Conservation Plan for the Piscataquog Watershed 2005

Prepared by the

Piscataquog Watershed Association

Deering, Dunbarton, Francestown, Goffstown, Greenfield, Henniker, Lyndeborough, Manchester, Mont Vernon, New Boston, Weare

Table of Contents

Hennker, New Hampshire, Natural Resources Inventory, a report by the Henniker Conservation Commission. October 2002
Town of Weare New Hampshire Open Space Plan. June 2002
A Management Plan for the South Branch of the Piscataquog River, Southern New Hampshire Regional Planning Commission, Manchester, NH. 1982
Piscataquog River Management Plan, Southern New Hampshire Regional Planning Commission, Manchester, NH. 1999.

1. Introduction

This Plan was developed by the Piscataquog Watershed Association (PWA) with financial support from the U.S.D.A. Forest Service and the New Hampshire Charitable Foundation. The Plan was authored by Dr. Carol R. Foss and Margaret Watkins. The approach, major concepts, and drafts were reviewed by a Steering Committee including: Karen Bennett, Lisa Brooks, Ken Lombard, Frank Mitchell, Jon Nute, Graham Pendlebury, Gordon Russell, Amanda Stone, and Dr. Barry Wicklow. The first of what we hope will be many well-researched appendices on specific species was authored by Pam Hunt. Over the years St. Anselm College biology professor Dr. Barry Wicklow has provided invaluable data on watershed species, again, the beginnings for what we hope will be a comprehensive database to guide conservation action. Lauren Warner has volunteered time identifying potential saddle wetlands and other aquatic features of particular interest – again, the first of many such volunteer efforts in support of Plan goals. Emily Hague and others have provided inventories for specific focus areas, establishing a model for future such research.

While developed under auspices of the PWA and adopted by the Board of the PWA as an integral part of the PWA's conservation work in the watershed, it is our hope that conservation commissions, open space committees, and land use boards throughout the watershed, along with other land conservation organizations active in this watershed will embrace the Plan's general principles and assist with its implementation. The Plan is designed as a living blueprint for conservation action, to which new information will be added over time. The PWA is developing what we hope will be a comprehensive data base of information to be used in further refining the data and site-specific recommendations presented in this Plan.

April 2005

2. THE PISCATAQUOG RIVER WATERSHED

A. An Overview – Past and Present

The Piscataquog River Watershed encompasses 220 square miles on the western side of the Merrimack River Watershed in south-central New Hampshire. The watershed contains portions of 14 municipalities. It includes more than 90% of 3 towns (Francestown, New Boston, Weare), 79% of Goffstown, 64% of Deering, 50% of Dunbarton, nearly 25% of Greenfield and Lyndeborough, and less than 15% of the remaining towns – Mont Vernon, Henniker, Manchester, Hopkinton, Bennington, and Bedford.[1] Topography within the watershed consists primarily of gently rolling hills, with elevations ranging from 130' (confluence with the Merrimack River) to 1,917' (summit of Crotched Mountain). Oak-pine-hemlock and transition hardwood forests dominate upland vegetation within the watershed.

This is the watershed about which it was written in early colonial times, "Cut no tree upon whose stump a yoke of oxen cannot be driven [C.E. Potter, Manchester Town History 1751-1810]." Trees along the Piscataquog supplied the masts for British ships and the Royal Navy. Indeed, "more lumber has been boated and rafted from the Piscataquog River than upon all the rivers north of Boston," quotes Potter in the early Manchester history. The availability of wood and water led to the founding of early settlements at what are now Francestown, Weare, Manchester, Goffstown, and New Boston. By the 1830s there were some 30 mills on the North Branch of the Piscataquog. On the South Branch more than a dozen mills were in operation, and along the Middle Branch, at least eight. Permanent settlements, supported by the region's natural resources, expanded throughout the 1800s.

Today the watershed reflects the pressures of development, Manchester being the most heavily developed municipality in the watershed with the highest population of any city in the state. The growth is steady and inexorable. New Hampshire's population doubled between 1950 and 2000 and is projected to add another 350,000 residents between 2000 and 2025, an increase of more than 28% (SPNHF 2005). If current trends continue, the Piscataquog watershed will absorb a disproportionate share of this growth. Between 1990 and 2003 (the latest dates for which such data are available) four watershed towns, Manchester, Bedford, Goffstown, and Weare, were among the 20 fastest growing towns in the state as ranked by numeric growth. During the same period, Bedford, New Boston, Dunbarton, and Weare were among the fastest growing towns by percent growth.

Throughout the watershed, changes in the landscape are apparent. Planners anticipate that current trends will be intensified when the I-93 expansion from a 4-lane to an 8-lane highway is completed. The window of opportunity for protecting key habitats and landscape-level conservation work is closing, and that is genesis of and inspiration for this Plan.

[1] The Piscataquog Watershed Association serves 11 of these towns: Deering, Dunbarton, Francestown, Goffstown, Greenfield, Henniker, Lyndeborough, Manchester, Mont Vernon, New Boston, and Weare. Bedford, with 493 acres in the watershed, Bennington, with 221 acres, and Hopkinton, with 45 acres in the watershed, have never been focal communities for the PWA.

B. The Piscataquog Watershed Association

The Piscataquog Watershed Association (PWA) is a 501(c)(3) membership organization founded in 1970. The PWA's mission is to conserve the natural and scenic environment of the Piscataquog River watershed communities. This work is accomplished in the 11 watershed towns through direct land conservation action; on-going water quality, wildlife, and invasive species monitoring programs; collaborative research projects with local colleges and student interns; and workshops, newspaper articles, and other outreach activities to watershed landowners and residents encouraging their stewardship of land and water resources. The PWA owns 490 acres outright and holds 36 conservation easements.

The PWA has two paid staff, a full-time executive director and a part-time Director of Operations, and a 10-member Board of Directors. More than 70 volunteers participate in PWA programs. The watershed towns served are Deering, Dunbarton, Francestown, Goffstown, Greenfield, Henniker, Lyndeborough, Manchester, Mont Vernon, New Boston, and Weare. The Piscataquog River flows into the Merrimack in Manchester.

C. Plan Organization: Watersheds and Subwatersheds

This Plan looks at the entire Piscataquog River Watershed, which is defined to include all the land and waterbodies that drain via the Piscataquog River into the Merrimack River in Manchester. The direction of flow is determined by topography, just like the water that flows from the crest of a roof, some in one direction, some in another. The watershed includes upland or terrestrial areas, land along ponds, streams, and other wetland areas, also referred to as "riparian" land, and waterbodies – rivers, streams, ponds, lakes, and other wetlands. Watershed hydrology is influenced by an array of relationships among such diverse features as vegetation, precipitation, temperature, time of year, soils, topography, and the amount of impervious surfaces and developed areas. Groundwater, invisible to the observer except where it bubbles up to the surface at seeps, percolates into and through the soil. It also influences stream flow and waterbody levels.

Each stream in the watershed has its own small watershed. For analytical purposes, this Plan looks at the seven HUC 12 subwatersheds: Weare Reservoir/Lake Horace Marsh; Rand Brook/South Branch; South Branch; Everett Lake; Middle Branch; Lower North Branch/Upper Piscataquog; and Lower Piscataquog. HUC stands for Hydrologic Unit Code, a national nested coding system for watersheds. The higher the number, the smaller the watershed. HUC 14 is the highest code in the system, for the smallest watersheds. Each of these subwatersheds crosses town lines, encouraging projects between and among towns but alien to traditional town-focused plans and actions. For each subwatershed, the Plan looks at both aquatic and terrestrial features of conservation importance. See Water Resources Map for a delineation of the subwatersheds.

D. Aquatic Resources

Rivers and streams can be characterized by their size. Convention identifies the smallest streams as first order streams. Second order streams are created by two first order streams joining. Third order streams are created when two second order streams converge. Fourth and fifth order streams are created by the confluence of two third and two fourth order streams, respectively. The North Branch becomes a fourth order stream at its outlet from Lake Horace. The South Branch becomes a fourth order stream at its confluence with the Middle Branch in New Boston. The Piscataquog becomes a fifth order stream at the confluence of the South and North Branches. It remains a fifth order stream to its confluence with the Merrimack River.

Although the larger streams are more visible and may offer more recreational opportunities, from a conservation perspective, the first and second order, "headwater" streams are critically important to aquatic life, nutrient flows throughout the river system, and water quality. They provide cool, moist habitats of special value to breeding amphibians and a close interface between terrestrial and aquatic systems of importance to wildlife generally. In some instances, headwater streams support relict populations of indigenous species that may be vulnerable to land use changes. According to State GIS[2] analyses, there are approximately 63 miles of 2nd order streams in the watershed, and as yet undetermined but significant miles of 1st order streams. There are 54 miles of 3rd order streams, which share habitat attributes of the 1st and 2nd order streams.

In addition to streams, this Plan includes ponds larger than 10 acres (great ponds), wetlands of all types, and unusual features like hillside seeps among the aquatic resources of potential conservation interest. The largest great ponds in the watershed, Lake Horace, Everett Lake, and Deering Reservoir, are artificially impounded. According to data maintained by the NH Department of Environmental Services, the three largest naturally occurring ponds are Haunted Lake, a.k.a Scobie Pond (Francestown), at 170.7 ac, Gorham Pond (Dunbarton) at 102.6 ac, and Long Pond (Dunbarton) at 32.1 ac. There are 10,350 acres of wetland (as determined by the National Wetland Inventory), some 7 percent of the watershed.

Each of these categories of aquatic resources: rivers and streams, lakes and ponds, and wetlands, is captured in the National Wetlands Inventory classification system. This system uses a hierarchy of characteristics. *Ecological Systems* comprise the top level of the hierarchy. Those that occur in the Piscataquog Watershed include:

- Lacustrine (wetlands located in a topographic depression or a dammed river channel, essentially lacking emergent vegetation, and exceeding 20 acres),
- Palustrine (non-tidal wetlands dominated by emergent vegetation or freshwater wetlands less than 20 acres in area, less than 2 meters deep, and lacking a wave-formed or bedrock shoreline), and
- Riverine (wetlands contained within a channel).

[2] GIS stands for Geographic Information System. Most data in this Plan is from the New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT), a cooperative project to create, maintain, and make available a statewide geographic data base. A collaborative effort of the UNH and NH Office of Energy and Planning, the core GRANIT system is housed at UNH.

Within these systems, wetlands belong to various *Classes*, which, in the Watershed, include:

- Unconsolidated Bottom, or Lake (open water with sand, gravel, mud, or organic matter bottom),
- Aquatic Bed, or Pond (open water with floating or submerged plants),
- Emergent Wetland (rooted herbaceous plants that extend above the water's surface),
- Scrub-Shrub Wetland (dominated by woody vegetation less than 6 meters tall), and
- Forested Wetland (dominated by live or dead woody vegetation at least 6 meters tall).

Wetlands can be further characterized by water regime (e.g., permanent, seasonal, saturated) and special modifiers (e.g., beaver, impounded, excavated, partially drained/ditched).

The various combinations of these characteristics result in a wide diversity of unique wetland types. In addition, some wetlands are classified as combinations of two types. Including combined types, the Piscataquog Watershed includes more than 100 unique kinds of wetlands. For analytical purposes, this Plan considers wetlands in a few broad categories, rather than the many individual types. Lake, emergent marsh, forested wetland, and scrub-shrub wetlands occur in roughly equal proportions by area (21-22%) and open water ponds follow at 12%. Beavers have influenced 20% of the watershed's wetlands. Humans have influenced another 11.3% by impoundment, excavation (0.2%), or ditching (0.1%).

Deciduous vegetation dominates most forested wetlands, but the South Branch and Weare Reservoir subwatersheds include small areas of coniferous forested wetland.

E. Terrestrial Resources

Coupled with aquatic features are thousands of acres of upland. Data from LandSat imagery obtained during 1996-2001 identify the following land uses:

- 5 percent of the watershed is currently urbanized or highly suburbanized.
- 79 percent is forested (including scattered housing).
- 6 percent is in agriculture.
- 5 percent is wetland/open water.
- 5 percent is "other."

See Table 1 for current land use conditions by subwatershed.

The analyses of terrestrial resources in this Plan focus on large, unfragmented blocks of upland habitat and the need to maintain connectivity among them, together with unique or specialized habitats. Virtually all the information for the Watershed on uncommon plants and plant communities is from the NH Natural Heritage Bureau. Additional natural resource inventories and research in areas of high potential for supporting plants and plant communities that are rare or unusual for this watershed or in a broader statewide context are needed to expand on present documentation. It is the PWA's hope and expectation that such documentation will occur, and results will be integrated into this Plan to further refine areas for focused land conservation action.

F. Native Fish & Wildlife

The watershed's high quality streams and rivers likely support some 16-20 native fish, together with introduced species like brown and rainbow trout and large and small mouth bass. There are 16 species of native amphibians in the watershed, 8 species of salamanders, and 8 of frogs and toads. All 6 of the state's native turtle species are found here. There are 9 species of snakes.

Of the 47 native mammal species that occur in the watershed, many (e.g., raccoon, striped skunk, red fox) survive readily in human-altered habitats, including suburban and even some urban settings. The mammals of conservation interest in the watershed include species with specific habitat requirements, especially those requiring high quality wetlands and riparian areas, and those that need large areas of undeveloped land. Watershed birds exhibit the greatest diversity, with some125 species that breed in the watershed and additional species that stop to feed during migration. Of particular conservation interest are the 25 bird species that require wetlands and riparian habitats for breeding and the 26 that require extensive forests.

(1) Maps of Wildlife Habitat

The Plan's analysis of wildlife habitat is based on eight features[3] that are considered important indicators of significant wildlife habitat – their occurrence singly, and co-occurrences of more than one indicator, as mapped using available GRANIT data. These indicators are:

1) Unfragmented forest blocks of >500 acres (areas are >250' from any road)
2) Open, nonforested lands of > 40 acres
3) Riparian and shoreline buffers of at least 300'
4) Wetlands of >20 acres (with data from both the National Wetlands Inventory and hydric soils)
5) Emergent Wetlands (a wetlands classification distinguished from other wetlands because of their habitat value)
6) Alluvial soils (available only for Hillsborough County towns)
7) Steep slopes > 35%
8) South facing slopes >10% (providing more exposure to sun and warmth)

Additional information from knowledgeable individuals, future Watershed studies, the PWA's wildlife tracking program, and other PWA/partner inventories will be used in selection and protection of individual conservation focus areas. One example of PWA-sponsored studies is included as an appendix to this Plan. It illustrates the kind of work that the PWA, on its own and in concert with others, intends to carry out in future years. The findings from such studies will be integrated into the Plan and used to refine recommendations in this Plan and to substantiate the need to protect specific parcels. See Co-occurrence Model Map, for areas of high habitat value.

[3]In developing its conservation plan for the State (released after mapping for this Plan was completed), the NH Fish & Game Department used unfragmented blocks scaled from 25 acres up as a key criterion and the following habitats: south facing slopes >10%, riparian areas (300'), palustrine emergent wetlands, wetland clusters, wetlands > 5 acres, saltmarsh, pine barrens, disturbed sites, cleared sites, bedrock/vegetated sites (ledges), alpine areas, and agriculture. Given PWA Plan goals and the habitats represented in this watershed, the data sets differ somewhat.

Table 1: Land Uses, by Subwatershed, LandSat imagery, 1996-2001

	Weare Resvr		*Rand Brook*		*South Branch*		*Everett Lake*		*Lower North Br*		*Middle Branch*		*Lower Pisc*	
Residential	20		83		197		289		211		190		1494	
Roads/highways	293		391		578		704		334		670		1643	
Total Developed	313	2%	474	2%	775	4%	993	5%	545	6%	860	3%	3137	13%
Crops			12		64		58		3		860		50	
Hay	1039		1030		881		1318		521		1713		1459	
Orchards	9		38		42		3		22		117		74	
Total in Agriculture	1048	6%	1080	5%	987	5%	1379	6%	546	6%	1910	7%	1583	7%
Beech/oak	4513		5217		3048		4274		1817		6889		4475	
Birch/aspen	165		217		124		93		52		102		131	
Other hardwood	484		610		337		697		368		590		891	
White/red pine	1745		2270		4757		3930		950		3115		2679	
Spruce/fir	127		234		266		224		102		186		449	
Hemlock	1473		1443		1875		1281		305		1324		989	
Mixed	6644		7066		6257		6157		3217		9070		6166	
Total Forested	15151	82%	17057	86%	16664	83%	16656	79%	6811	74%	21276	80%	15780	66%
Open water	1016		292		175		338		163		600		658	
Forested wetland	60		74		135		145		91		105		82	
Open wetland	516		506		346		633		344		741		499	
Total Wetland	1592	9%	872	4%	656	3%	1116	5%	598	6%	1446	5%	1239	5%
Disturbed	5		9		139		64		15		55		47	
Other Cleared	350	2%	451	2%	847	5%	898	5%	708	8%	929	4%	2132	9%
Total acreage	18459		19943		20068		21107		9223		26476		23918	

G. Current Status of Land Conservation

As of February 2004, 16.4 percent of the Watershed (some 22,771 acres) have been reported and mapped into the GRANIT system as permanently protected lands by nonprofit organizations, federal, state, and local governments, and other public entities.

Table 2: Conserved Acreage by Type of Protection and Entity

Type	Municipal	State	Federal	Other Public	Private	TOTAL
Ag. Pres. Restriction		91.3				91.3
Conservation Easement	812.1	70.2			4,145.6	5,027.9
Deed Restriction	5.2				424.9	430.1
Flowage Rights/Easemnt			936.1			936.1
Fee Ownership	5,125.8	1,406.7	3,602.2	721.5	4,783.2	15,639.4
"Set Aside" in Dvlpmts.	554.6					554.6
Scenic Easement	47.9	43.9				91.8
TOTAL	6,545.6	1,612.1	4,538.3	721.5	9,353.7	22,771.2

While some of these conserved lands occur in blocks, few blocks total more than 1,000 acres, and many conserved parcels are isolated. (See Conservation and Public Lands Map.)

3. GOALS AND TASKS OF THE PISCATAQUOG WATERSHED CONSERVATION PLAN

A. Goals

This Conservation Plan is designed to guide the work of the PWA, in partnership with other conservation partners and community groups, toward achievement of four major goals:

- **to maintain the integrity of aquatic systems within the watershed;**
- **to maintain the integrity of forest matrix within the watershed;**
- **to maintain native biodiversity within the watershed; and**
- **to restore degraded systems.**

Developed and permanently protected lands in the watershed are committed to a particular land use. What remains of the landscape constitutes land whose future is yet to be determined and provides the canvas for conservation planning. If current market conditions prevail, opportunities to generate income directly from the land through forestry or agriculture will continue to be limited at best. If recent population trends continue, municipalities within the watershed will experience a growth in population of from 10%-20% to 50%-60% over the next 15 years (SPNHF 1999). This situation suggests limited but dramatically different alternatives for the future of currently undeveloped lands – protection as conservation land or development at some density.

B. Tasks

Our tasks in this Plan are to:

- **establish conservation principles and priorities;**
- **identify focal species;**
- **evaluate subwatersheds and identify core habitat conservation goals for each subwatershed;**
- **establish conservation targets;**
- **recommend land use guidelines for areas of connectivity;**
- **develop an implementation strategy, including the following components:**
    - **land conservation action;**
    - **Inventory, monitoring, and research;**
    - **land use planning;**
    - **education and outreach to town governments, landowners, and the general public;**
    - **restoration; and**
    - **funding;**
- **develop a timetable and identify capacity needs for conservation action.**

4. LAND PROTECTION PRINCIPLES AND PRIORITIES

Land protection by means of conservation easements or outright fee ownership by a conservation entity will be a critically important tool in working toward this Plan's stated goals. The PWA has identified land protection priorities for aquatic and terrestrial components that are critical to maintaining the watershed's biological diversity and ecological functioning.

A. Principles

Our land protection priorities reflect the following principles of landscape ecology[4]:

- Maintain large, unfragmented blocks that contain a mosaic of vegetation types and aquatic resources;
- Maintain large, compact unfragmented areas;
- Maintain important wildlife movement corridors (e.g., ridges, riparian areas);
- Maintain opportunities for wildlife movement between large unfragmented areas; and
- Maintain landscapes with sufficient proportions of undeveloped land to sustain ecological processes and native biodiversity;

and the following additional principles of watershed ecology:

- Maintain storage capacity of wetland systems;
- Protect water quality and capacity of stratified drift aquifers;
- Provide for natural erosion and deposition by flowing waters;
- Protect aquatic systems from anthropogenic inputs of nutrients, sediment, and pollutants;
- Avoid activities that result in the transfer of water from its smallest aquatic system;
- Maintain habitat connectivity for aquatic organisms;
- Maintain natural hydrology and temperature regimes of aquatic systems; and
- Maintain integrity of riparian systems.

B. Priorities

Targeted land protection efforts will be directed towards aquatic and terrestrial focus areas, as described below.

1) Aquatic Focus Areas

The watershed's aquatic system includes lakes and ponds, rivers and streams, and wetlands of numerous types.

[4] Adapted from Gutzwiller, K.J. 2002.

a) System-wide criteria

Throughout this system, high conservation priority will be given to aquatic resources that:

- are identified as aquatic reference areas; OR
- support focal wildlife species; OR
- provide habitat for rare aquatic plants or invertebrates; OR
- harbor exemplary natural communities as identified by the NH Natural Heritage Bureau; AND
- are free of invasive species.

b) Lakes and ponds within each subwatershed will be targeted for protection based on system-wide criteria and/or some combination of the following:

- essentially undeveloped shoreline;
- high water quality;
- high biological integrity, as indicated by the presence of indicator fish; macroinvertebrates, or other species, using one or more existing evaluative systems; and
- absence of water control structure(s).

c) Rivers and streams within each subwatershed will be targeted for protection based on system-wide criteria and/or some combination of the following:

- high water quality;
- naturalness;
- high biological integrity, as indicated by the presence of indicator fish; macroinvertebrates, or other species, using one or more existing evaluative systems;
- absence of water control structure(s); and
- undeveloped shoreline:
    - First and second order (headwater) streams in large unfragmented blocks, especially where their entire watershed is included.
    - Third order streams with no development within a minimum of 300 m from shore on either side, especially where wide vegetated buffers exist.
    - Undeveloped shoreline on either side of fourth and fifth order streams.

d) Wetlands within each of the subwatersheds will be targeted for protection based on system-wide criteria or some combination of the following:

- Representation of all wetland types (e.g., vernal pool, bog, emergent marsh, scrub-shrub swamp),
- Special, high-value wetlands:
    - Clusters of isolated wetlands in large, unfragmented forest blocks;
    - Large, diverse wetland complexes;
    - Stream-associated wetlands;
    - Saddle wetlands (i.e., wetlands at a watershed divide that drain in two directions); and

- undeveloped shoreline.

Each of the criteria listed above is described in more detail below.

(1) Definitions and Rationale

Aquatic reference areas

A reference area is a relatively pristine aquatic feature against which changes to similar features elsewhere in the watershed can be measured. For the watershed as a whole, protect one reference area for each aquatic component (lakes and ponds, wetland types), except streams. For 1st and 2nd order streams, identify those that are most productive, looking at indicators such as biodiversity, temperature, and conductivity and/or, baring sufficient documentation, protect those in relatively undeveloped watersheds**.** Reference reaches will serve as permanent monitoring stations for water quality, habitat characteristics, and wildlife use, and will be protected to the maximum extent practicable. The reference reaches will help gauge impacts of development on other similarly sized streams in the watershed. Such reaches will be part of the PWA's annual water quality monitoring program and will also be subject to additional monitoring to advance understanding of water quality trends and changes.

Habitat for focal wildlife species

Focal wildlife species include vertebrates that are rare or endangered in New Hampshire, are uncommon in areas of the state outside the Piscataquog Watershed, or are particularly dependent on aquatic systems during some or all of their life cycle. Species meeting one of the first two criteria contribute to biodiversity at the landscape scale, and those meeting the last criterion play important roles in transferring nutrients and energy between aquatic and terrestrial systems.

Habitat for rare aquatic plants or invertebrates

Rare aquatic organisms may require a unique set of physical and chemical conditions to survive, and have limited opportunity or ability to disperse and colonize new areas. They contribute significantly to biodiversity at the landscape scale.

Exemplary natural communities

Exemplary natural communities include rare ecosystem types (such as Atlantic white cedar swamp) and outstanding examples of common natural communities identified by the New Hampshire Natural Heritage Bureau. These communities contribute significantly to biodiversity at the landscape scale.

Absence of non-native, invasive species

As the name suggests, non-native, invasive species compete, generally successfully, with native species. In the case of aquatic plants, their presence likely signals changes not only to the plants found in a waterbody but also to the fauna that depend on wetland plants or on wetland-plant-dependent wildlife for food.[5]

[5] The PWA has an ongoing invasive [plant] species program to: educate the general public about invasive plants and their control, inventory locations, and control, as feasible.

Undeveloped shoreline

Undeveloped shoreline helps to maintain water quality and prevent erosion, and provides important habitat for riparian plants and for animals that require both aquatic and terrestrial resources. Undeveloped streamside areas also provide important travel corridors for many wildlife species.

High water quality

Water quality is determined by a variety of measurable characteristics, including pH, salinity, temperature, sediment concentration, odor, color, light penetration, nitrogen and phosphorous levels, and presence of pollutants. These characteristics determine the ability of various aquatic organisms to survive in a given water body and the human uses for which it is suitable.[6]

High biological integrity

Biological integrity is the capacity to support and maintain a balanced, integrated, and adaptive biological system that has the full range of elements and processes expected in the natural environment of a region (Karr and Dudley 1981, Angermeier and Karr 1994, Karr 1996). Biological integrity is determined by the presence and abundance of various aquatic organisms in a given water body, particularly of species that are unique to conditions of extremely high or low water quality. Maintaining high biological integrity promotes survival of species most sensitive to habitat degradation.

Absence of water control structures

Water control structures can alter movement of sediment, resulting in upstream deposition and downstream scouring; increase upstream water temperatures; and change a stream's seasonal flow distribution, both by increasing the duration and frequency of extreme low flow conditions and by reducing the incidence and severity of flooding. A pond maintained by a dam which is not used to manipulate water levels and has been in existence long enough for a stable plant community to have become established in and around the pond may rank as a high conservation priority if it meets other criteria.

Naturalness

"Naturalness" will be evaluated based on criteria modified from Macmillan 1986, in Gordon, McMahon, and Finlayson 1992, as follows:

- Pristine: The entire watershed area represents an unmodified ecosystem which can act as a baseline reference area.
- Slightly modified: Watershed processes are largely intact. The flow regime has been modified to only a minor extent, and the only input of pollution is sediment. There are no barriers to the movement of instream biota.
- Moderately modified: Watershed processes, hydrology, and instream biota have been noticeably altered. There may be direct manipulation of the flow regime by impoundment, and sediment input may have altered the stream substrate. Levels of biostimulants may be elevated but not other toxic inputs.

[6] The PWA has an ongoing water quality monitoring program, with approximately 24 permanent monitoring stations around the watershed.

- Heavily modified: Watershed processes, riparian, and instream biota have been substantially modified. The flow regime may be highly manipulated, sediment input may be substantial and levels of biostimulants are substantially elevated. Toxic substances may be present at significant levels.
- Severely degraded: Major modification of the stream has taken place, leading to severe degradation of riparian and instream biota. Examples would be streams grossly affected by elevated levels of salinity, heavy metal pollution and/or enclosure within a concrete channel.

Wetland type representation
Different wetland types (e.g., open water, emergent marsh, forested wetland) play different roles in the watershed's hydrology and support different communities of plants and animals.

Clusters of isolated wetlands in large, unfragmented forest blocks
Clustered wetlands in unfragmented forests provide important habitat for semi-aquatic wildlife species that depend on a wetlands for some part of their life cycle. The different wetlands within a cluster provide a range of vegetation types and hydrologic conditions, and increase the probability that suitable habitat will be available during periods of drought. These wetlands also provide important foraging habitat for species that prey on aquatic organisms.

Large, diverse wetland complexes
Large, diverse wetland complexes include a number of different wetland types, support more plant and animal species than similar-sized wetlands of a single type, play an important role in the hydrology of the watershed, and provide extensive riparian habitat.

Stream-associated wetlands
Wetlands associated with streams help to regulate down-stream flow during extreme conditions of flood and drought.

Saddle wetlands
Saddle wetlands are unique because their waters influence two separate drainage systems. Lying high on watershed divides, they provide an important link between watersheds for wide-ranging mammals.

2) Terrestrial Focus Areas
The Watershed's terrestrial system includes all the upland area with its various land uses, including managed and unmanaged forests, agricultural lands, and developed areas. Because forests constitute New Hampshire's natural upland vegetation in the absence of human influence, PWA's terrestrial conservation efforts will focus on forested lands.[7]

[7] Note that grassland habitats are significant, and educational efforts will include information on mowing regimes and other management practices that help protect fields for grassland-dependent species, e.g., meadowlarks, bobolinks. Because this watershed is not among the most productive in the state for grassland species and given the rapidity with which large upland blocks are succumbing to development, the Plan's terrestrial focus is on protecting large, unfragmented blocks of upland.

a) System-wide criteria

High conservation priority will be given to:

- Large blocks of unfragmented land that provide core wildlife habitat;
- Late successional forests;
- Connections between protected areas (existing and future);
- Significant plant and wildlife habitat; and
- Special surficial topographic features (e.g., eskers, ravines).

(1) Definitions and Rationale

Large blocks of unfragmented land (>500 ac) that provide core wildlife habitat

Blocks of 500-5,000 acres can be expected to support medium-sized predators, such as fisher, bobcat, long-tailed weasel, barred owl, and northern goshawk. Analysis of data from Connecticut suggests that bear, bobcat, and fisher are most likely to occur in towns with >20% of their land area >250 m (820 ft) from the nearest road. Blocks that include the entire watershed of one or more low order streams are extremely important for maintaining water quality and aquatic habitat quality downstream. The less edge between protected and developed lands (i.e., the less complex the shape of the protected block) the less the influence of development.

Late successional forest

Late successional forests are characterized by: shade-tolerant tree species that can regenerate under a closed canopy, complex vertical structure with many layers of foliage, and relatively abundant woody debris and standing dead trees. These conditions are relatively rare on the landscape because of New Hampshire's extensive history of agriculture and timber harvesting, and can take more than a hundred years to develop. Given their rarity, opportunities to create such late successional forest conditions also constitute a high conservation priority.

Connections between protected areas

Connections between protected areas are important to enable animals to travel safely between habitat patches and to provide safe dispersal routes for juveniles. Isolation of habitat patches by inhospitable land uses can lead to local extinctions of vulnerable species.

Significant plant and wildlife habitat

Significant plant habitat includes sites that support rare and endangered plants identified by the New Hampshire Natural Heritage Bureau. Significant wildlife habitat includes areas that support rare species, provide a particularly abundant source of an important wildlife food, or support several different habitat types as described in the New Hampshire Fish & Game Department publication, *Identifying and Protecting New Hampshire's Significant Wildlife Habitat: A Guide for Towns and Conservation Groups*.

Special surficial topographic features

Special surficial topographic features include eskers, drumlins, ravines, kettle holes, gorges, ledge outcrops, and other unusual landscape features. These features contribute to the uniqueness of local landscapes.

5. FOCAL WILDLIFE SPECIES

The Watershed current supports a wide diversity of wildlife both great and small. This Plan focuses on protection of fish, amphibians, reptiles, birds, and mammals, particularly those species within each broad category that are most threatened by loss of habitat, unique habitat requirements, pollution, and other changes. These special species are characterized as "focal species."

A. Fish

The waters of the Piscataquog Watershed likely support 16-20 native species of fish as well as a number of introduced species, including brown and rainbow trout and large- and small-mouthed bass. While the majority of native fish present have extensive distributions in New Hampshire, several species are worthy of note.

Focal fish species for the Conservation Plan include bridle shiner, creek chub, banded sunfish, swamp darter, slimy sculpin, and brook trout. The distributions of these species within the Piscataquog Watershed are not well documented.

The *bridle shiner* inhabits beds of aquatic vegetation in shallows of lakes, ponds, backwaters, and sluggish streams with muddy bottoms. Its New Hampshire distribution includes the Merrimack and Coastal watersheds and a chain of lakes in the Saco watershed. Bridle shiners are known to occur in the watershed.

The *creek chub* inhabits small streams and brooks with rubble or gravel bottoms. It is rare in the Merrimack and Androscoggin watersheds, but abundant in the Connecticut Watershed. There are no records in the watershed for the creek chub, but there is suitable habitat. The most recent records for this species in the entire Merrimack Watershed are from the Souhegan River watershed, in 1987.

The *banded sunfish* inhabits weedy lakes and backwaters in lowlands of the Coastal watershed and the southern Merrimack and Connecticut watersheds, and is tracked by the New Hampshire Natural Heritage Bureau. Banded sunfish are found in the Souhegan watershed and have access to lower reaches of the Piscataquog via the Merrimack. There is appropriate habitat upstream of the dams, and they may occur elsewhere in the watershed in populations that preceded dam construction.

The *swamp darter* inhabits areas of dense aquatic vegetation in shallow, protected coves of lakes and ponds and fast waters of streams. It occurs in the lower Merrimack watershed and in the coastal watershed, and habitat in the Piscataquog watershed is suitable.

The *slimy sculpin* lives under stones in clear, cold streams and cool lakes. It occurs throughout much of New Hampshire and is an indicator of high quality, well-oxygenated waters and has been documented in watershed streams.

Eastern brook trout once thrived in many of the watershed's streams, measuring 12" to 15". The brook trout seeks cool waters, river banks thick with roots providing hiding places, cobbles and riffles for nesting, slow, soft bottoms for insect hatches, and active tributaries that bring minerals to the river system. Today, native brook trout are known from only a few streams.

B. Amphibians

The lands, waters, and wetlands of the Piscataquog Watershed support 16 native amphibian species: 8 salamanders and 8 frogs and toads. Half of these species are widespread and relatively abundant. The other 8 are of some conservation interest because of their habitat requirements.

Focal species for this conservation Plan include: spotted, blue-spotted, northern dusky, spring, four-toed, and two-lined salamanders, and northern leopard and wood frogs.

Wood frogs and spotted and blue-spotted salamanders breed in vernal pools and spend the remainder of the year foraging in adjacent forested uplands.

Northern dusky, spring, and northern two-lined salamanders inhabit forest streams, streamsides, springs, and seeps. Of the three species, two-lined salamanders tolerate the widest range of water quality and temperature. Spring and dusky salamanders require cold, well-oxygenated water, and are most common in high-gradient headwater streams.

Four-toed salamanders inhabit damp, mossy forests and hummocky forested wetlands with abundant moss. Females lay their eggs on mossy banks adjacent to slow-moving streams and small ponds, and the larvae develop in the water.

Leopard frogs breed and overwinter in permanent water bodies, but spend the summer in damp meadows or woods well away from water. Its distribution in New England is patchy, and it is listed as a Species of Special Concern in Maine.

C. Reptiles

Fifteen native reptile species occur in the Piscataquog Watershed: 6 turtle species and 9 snake species. A number of these species, such as painted and snapping turtles and brown and garter snakes, are common and widespread. Species of conservation interest in the Piscataquog Watershed include three turtles on the New Hampshire list of Special Concern species and three snakes that inhabit wetlands and riparian areas.

Focal species for this conservation Plan include: Spotted, Blandings, and Wood turtles and Hognose, Ribbon, and Northern Water snakes.

Spotted and Blanding's turtles are restricted to southeastern New Hampshire, while *wood turtles* occur at lower elevations throughout the state. These turtles use a combination of wetland and upland areas, including slow-moving streams, vernal pools, swamps, and forests. They may travel more than a mile between wetlands. Spotted, wood, and Blanding's turtles do not breed until they are 7-10, 11-12, and 12-15 years old, respectively. Because of their large home ranges and delayed maturity, populations of these turtles are particularly susceptible to habitat fragmentation and road mortality.

Ribbon and northern water snakes require wetland habitats. Ribbon snakes inhabit brushy wetland edges where they forage for small amphibians. Northern water snakes inhabit riparian areas within 20 feet (6 meters) of the water's edge, and need a scattering of open areas for basking.

The *hognose snake* inhabits fields and woodlands with dry, sandy or loamy soils. Their current range in New Hampshire is limited to the lower Merrimack Valley in Hillsborough and Merrimack counties. Adults prey largely on toads, while young snakes capture salamanders and spring peepers.

D. Birds

Birds are by far the most diverse vertebrate group in New Hampshire, and some 125 species are likely to breed in the watershed, with additional species occurring during spring and fall migrations and in the winter. Of the breeding species, 25 are inhabitants of wetlands or riparian areas and 26 require extensive forests.

Focal species for this Conservation Plan include most of the breeding birds that rely on wetlands or extensive forests, as well as species of interest, whether due to declining populations or for their specialized habitat needs.

Wetland-associated species	Forest species
Common Loon	Sharp-shined Hawk
Pied-billed Grebe	Cooper's Hawk
Great Blue Heron	Northern Goshawk
American Bittern	Red-shouldered Hawk
Green Heron	Broad-winged Hawk
Wood Duck	Ruffed Grouse
American Black Duck	American Woodcock
Hooded Merganser	Barred Owl
Common Merganser	Northern Saw-whet Owl
Virginia Rail	Whip-poor-will
Sora	Eastern Wood-Pewee
Red-shouldered Hawk	Least Flycatcher
Spotted Sandpiper	Brown Creeper
Belted Kingfisher	Winter Wren

Olive-sided Flycatcher
Alder Flycatcher
Willow Flycatcher
Marsh Wren
Nashville Warbler
Northern Waterthrush
Louisiana Waterthrush
Swamp Sparrow

Blue-gray Gnatcatcher
Wood Thrush
Veery
Hermit Thrush
Blue-headed Vireo
Yellow-throated Vireo
Scarlet Tanager
Black-throated Blue Warbler
Black-throated Green Warbler
Blackburnian Warbler
Pine Warbler
Black-and-white Warbler
Ovenbird
Canada Warbler
Rose-breasted Grosbeak
Rufous-sided Towhee
Dark-eyed Junco

E. Mammals

Beaver and *muskrat* are common, wetland-dependent furbearers. Beavers play an important role in altering wetland and riparian habitats by constructing dams and harvesting young trees for food. They require extensive areas of low-gradient streams and wetlands with adjacent hardwood forest to maintain a food supply over the long term. Muskrats inhabit marshes and riparian areas with abundant herbaceous vegetation, on which they feed.

Mink and *river otter* are predators that spend most of their time in and along watercourses, but will travel considerable distances overland from one drainage to another. Mink home ranges may cover up to three miles of shoreline. Home ranges of otters have been estimated at 15 to 30 linear miles.

The *black bear* inhabits large habitat mosaics that include mixed deciduous-coniferous forests and various kinds of wetlands. Home range size varies with age, sex, season, population density and food availability, and home ranges of different individuals overlap. Adult males have the largest home ranges, which may include more than 100 square miles; female home ranges typically cover 6-19 square miles.

Moose also use large habitat mosaics that vary with age, sex, season, density, and food. Fall home ranges are the largest and cover about 30 square miles. Moose require extensive areas of deciduous shrubs and saplings, which provide their primary source of food, wetlands with aquatic plants or roadside licks to provide sodium, abundant water, and areas of softwood cover for shelter.

The *New England cottontail*[8] inhabits early successional habitats with dense forb and shrub growth in southern New Hampshire. Populations have become fragmented by development and are most likely to survive in habitat patches of at least 12 acres.

Bobcat and *fisher* are medium sized predators (sometimes called "mesocarnivores") that inhabit forests throughout New Hampshire and den in hollow trees, rocky ledges, and brush piles. Bobcat home ranges in the northeast may include 9 to 14 square miles, and those for fishers average about 4,750 acres.

8 **Included in** NH Fish & Game Department***, Identifying and Protecting New Hampshire's Significant Wildlife Habitat: A Guide for Towns and Conservation Groups.***

6. SUBWATERSHED CHARACTERISTICS AND CORE HABITAT GOALS

As indicated above, the Watershed has seven HUC 12 subwatersheds, designated as such for water resource management and planning purposes. In the following pages each subwatershed is described, major natural features are identified, and a minimum acreage for conservation focus areas is established. The focus area size is based on existing opportunities to conserve large blocks of land – the less developed a subwatershed, the higher the expectation that larger blocks can be conserved. The subwatersheds are delineated on the Water Resources map that accompanies this report (see Water Resources Map). The first name listed for subwatersheds is that used by the NH Department of Environmental Services. Any additional names were added by PWA for further clarification. USGS topographic maps are useful for more refined analyses of a particular area. The names of streams, lakes, ponds, hills, and mountains are from the USGS topographic maps. The map of Potential Focus Areas based on Block Size and Habitat Features shows the blocks of unfragmented lands referenced in the discussions below.

A. Weare Reservoir/Lake Horace Subwatershed (18,459 acres, 13% of watershed)

This subwatershed comprises the uppermost basin of the North Branch of the Piscataquog, stretching from the headwaters to the mouth of Weare Reservoir, a.k.a Lake Horace. It drains 18,405 acres in the northwestern-most corner of the Piscataquog Watershed and includes 57.6% of Deering (11,507 ac), 11.1% of Weare (4,271 ac), 8.6% of Henniker (2,460 ac), and 1.1% of Francestown (219 ac).

Aquatic Resources

The North Branch of the Piscataquog River originates at Deering Reservoir, which is fed by Lyons Brook and a second, unnamed tributary. The North Branch and Dudley Brook are the only third order streams in this subwatershed. The North Branch becomes a fourth order stream at its confluence with Dudley Brook at the Weare Reservoir. All other brooks and streams are first and second order.

The subwatershed includes five great ponds, including four impoundments, Deering and Weare reservoirs at 315.4 acres and 323 acres, respectively, Deering Wildlife Sanctuary and Dudley ponds (naturally occurring with water levels raised by dams at 32.5 acres and 33.3 acres, respectively) in Deering, and one natural pond, Pleasant Pond at 92.1 acres, in Henniker. The highest elevation great pond in the watershed is a small, 20-acre unnamed pond in Deering at 1,030', west of the Deering Reservoir.

Named brooks include Dudley Brook, Smith Brook, and Patten Brook. Unnamed brooks may be equally important as named brooks and are not listed in the text for reasons of simplicity. Site-specific field work and small scale maps will identify these generally

smaller streams and their importance. Locally named and not identified on the USGS map but of known conservation significance, Bartlett Brook flows to the North Branch between Bartlett Hill and Boars Head.

Mapped wetlands (National Wetlands Inventory) comprise 1,907 acres (10% of the subwatershed), and include the following wetland classifications:

Wetland category	Area (acres)	Percent by area
Lake	744	39.0
Pond	231	12.1
Emergent marsh	422	22.1
Scrub-shrub wetland	315	16.5
Forested wetland	194	10.2

Terrestrial Resources

This subwatershed is largely forested, with a small proportion of agricultural land. Large areas of unfragmented land range from a 373-acre block to a 2,297-acre block, of which just under half lies in westernmost portions of the Piscataquog Watershed. The most remote location is 3,380' (1,030 m) from the nearest road. The total area of land in unfragmented blocks >500 acres is 10,140 acres, or 55% of the subwatershed.

Topographic relief at named areas is highest at Clark Summit (1,560'), Cove Hill (el. 1,195'), Goodale Hill (el. 1,180'), Bartlett Hill (1,100'), Toby Hill (el. 1,060'), Locke Hill (el. 1,000'), and Collins Ledges (920').

GRANIT Land Cover Mapping for New Hampshire (2001) (based on satellite imagery data from 1996 to 2001) provides the following distribution of land use categories for the subwatershed:

Upland Forest	82.08%
Water/Wetland	8.63%
Agricultural	5.67%
Other	1.93%
Developed	1.70%

Protected Land as of 2/04

Some 3,300 acres (17.9%) of the subwatershed are currently protected in 15 separate blocks, with concentrations west of Deering Reservoir, around the Deering Wildlife Sanctuary of NH Audubon, and northwest of Weare Reservoir around Vincent State Forest.

Terrestrial Focus Area Goal

To protect unfragmented blocks > 500 acres.

B. RAND BROOK - SOUTH BRANCH SUBWATERSHED (19,943 acres, 14% of Watershed)

This subwatershed comprises the uppermost basin of the South Branch of the Piscataquog and includes 19,934.5 acres, divided among three towns. With 13,489.3 acres (64.9% of the town), Francestown is the central town. All of Greenfield that lies in the watershed is in the Rand Brook – South Branch subwatershed, some 3,842 acres (22.2% of the town). Deering has 1,305.5 acres (6.5% of the town), Lyndeborough has 1,076.5 acres (5.6% of the town), and Bennington has 221 acres (3% of Bennington, and the only part of Bennington in the watershed).

Aquatic Features

The South Branch of the Piscataquog River originates in this subwatershed at Pleasant Pond, which is fed by a small unnamed stream and wetlands. Virtually all of the streams are first and second order streams, save a small portion of the South Branch, which becomes a third order stream at its confluence with Rand Brook.

There are three Great Ponds: Shattuck Pond (naturally occurring at 24.7 acres, 925' elevation), Pleasant Pond (a.k.a., Pleasant Lake), a dammed pond of 187 acres at 817' elevation, and Collins Brook, a dammed pond of 80 acres.

Named brooks include Rand Brook, Brennan Brook, Collins Brook, and Dinsmore Brook.

Mapped wetlands (National Wetlands Inventory) comprise 1,426 acres (7% of the subwatershed), and include the following wetland classifications:

Wetland category	Area (acres)	Percent by area
Lake	244	17.1
Pond	165	11.6
Emergent marsh	403	28.2
Scrub-shrub wetland	294	20.6
Forested wetland	321	22.5

Terrestrial Features

The largest roadless block of land in the Watershed lies in this subwatershed and includes portions of the upper watersheds associated with Brennan Brook and Rand Brook. Of the 5,133 acres, more than half is in the watershed. Another large block totaling 1,156 acres lies partly in this subwatershed and partly in the Weare Reservoir and Middle Branch subwatersheds and includes Candlewood Hill. Other large blocks of 1,198 acres and 1,156 acres are shared between Francestown and Deering, entirely within the Piscataquog Watershed. A 2,203-acre block lies in Lyndeborough, Greenfield, and Francestown, of which approximately 1,100 acres are in the Piscataquog Watershed. Total acreage of unfragmented lands in blocks > 500 acres is 9,276 acres, some 47% of the subwatershed.

Prominent mountains include Rose Mountain (1,720') and Crotched Mountain (1,917'). Smaller hills include Blanchard Hill (1,126) and Campbell Hill (1,280).

GRANIT Land Cover Mapping for New Hampshire (2001) (based on satellite imagery data from 1996 to 2001) provides the following distribution of land use categories for the subwatershed:

Upland Forest	85.53%
Agricultural	5.41%
Water/Wetland	4.37%
Developed	2.38%
Other	2.31%

Protected Land as of 2/04
Some 1,623.4 acres have been permanently protected, representing 10.6% of the subwatershed. They are concentrated on the top and flanks of Crotched Mountain and around the Rand Brook Forest.

Terrestrial Focus Area Goal
To protect unfragmented blocks > 1,000 acres.

C. SOUTH BRANCH SUBWATERSHED (20,068 acres, 14% of Watershed)

Although the South Branch originates in Pleasant Pond, the nomenclature designates this subwatershed the South Branch subwatershed. It is 19,067.9 acres and includes portions of New Boston, 13,505 acres (48.8% of the town), Lyndeborough, 2,533 acres (18.2% of the town), Mont Vernon, 1,581 acres (14.6%of the town) and the only lands in the town in the Piscataquog watershed), Francestown, 1,285 acres (6.6% of the town's acreage), and Goffstown, 164 acres (0.7% of the town).

Aquatic Features
The South Branch is a dominant natural feature of the South Branch subwatershed flowing through New Boston center and along Rte. 13. It becomes a fourth order stream, more visible and recreationally attractive, at its confluence with the Middle Branch.

The only Great Pond in this subwatershed is Bailey Pond at 14.2 acres, 735' elevation.

All brooks are first and second order except the South Branch, which is third order to its confluence with the Middle Branch. Cold Brook, Lord's Brook, and Meadow Brook are named South Branch tributaries in this reach.

Mapped wetlands (National Wetlands Inventory) comprise 1,138 acres (6% of the subwatershed), and include the following wetland classifications:

Wetland category	Area (acres)	Percent by area
Lake	24.3	2.1
Pond	161	14.1
Emergent marsh	143	12.6
Scrub-shrub wetland	304	26.7
Forested wetland	505	44.4

Terrestrial Features

The largest roadless area contained entirely within the subwatershed is 2,006 acres. There are four other large blocks ranging from 1,074 acres to 2,311 acres. Two of these lie in both this and the Lower Piscataquog River subwatershed. The smallest block of any size is 113 acres. The total acreage of unfragmented lands in blocks of >500 acres is 6,462, or 32% of the subwatershed.

Prominent hilltop summits are Piscataquog Mountain (1,250'), The Pinnacle (1,703'), South Hill (1,041'), and Joe English Hill (1,270') (only the western flank of this prominence lies in the watershed).

GRANIT Land Cover Mapping for New Hampshire (2001) (based on satellite imagery data from 1996 to 2001) provides the following distribution of land use categories for the subwatershed:

Upland Forest	83.40%
Agricultural	4.92%
Other[9]	4.92%
Developed	3.86%
Water/Wetland	3.27%

Protected Land as of 2/04

The South Branch subwatershed has 4,953.8 acres in conservation, or 24.7% of the subwatershed. Many of these lands are along the river. Particularly south of New Boston center, the protected riverfront lands are larger parcels, often contiguous. North of the center, more than 3 miles along the river have a slim buffer of permanently protected land. Most of the west side of Piscataquog Mountain lying in the watershed has been protected.

Terrestrial Focus Area Goal

To protect unfragmented blocks > 1,000 acres.

[9] Mining of sand and gravel deposits along the river and along Piscataquog Mountain likely accounts for some of the "disturbed" and "other" land.

D. EVERETT LAKE SUBWATERSHED (21,107 acres, 15% of Watershed)

The Everett Lake subwatershed drains the northeastern portion of the Piscataquog Watershed. It has 21,106.9 acres, partitioned among four towns. Weare has 14,901.7 acres (38.7% of the town), Dunbarton has 5,321.1 acres (26.5% of the town), Henniker has 838.8 acres (2.9% of the town), and Hopkinton has 45.3 acres (0.2% of the town and the only Piscataquog watershed land in Hopkinton).

Aquatic Features
This subwatershed is dominated by the Everett Lake Flood Control project and Everett Lake, managed by the Army Corps of Engineers to control flooding in both the Piscataquog and Contoocook watersheds. The permanent lake and land around it subject to a flood easement cover more than 3,000 acres.

There are two Great Ponds associated with the flood control area, Everett Lake (140 acres, 340' elevation) and Stark Pond (10.3 acres, 370' elevation), also dammed. The other Great Pond is Mount William Pond, a natural pond with a dam controlling water levels to a pool of 33.1 acres at 830' elevation.

All of the streams in this subwatershed are first and second order except the North Branch, which is a fourth order stream throughout. Named brooks include Stark Brook, Peaslee Meadow Brook, Center Brook, Breed Brook, Choate Brook, and Barnard Brook. Locally named brooks of conservation importance include Dustin Brook, draining into the North Branch west of Rte. 114 and including Chipmunk Falls, and Bog Brook in North Weare north of Rte. 77.

Mapped wetlands (National Wetlands Inventory) comprise 1,471 acres (7% of the subwatershed), and include the following wetland classifications:

Wetland category	Area (acres)	Percent by area
Lake	261	17.7
Pond	192	13.0
Emergent marsh	359	24.4
Scrub-shrub wetland	346	23.6
Forested wetland	312	24.4

Terrestrial Features
The largest roadless area wholly within the watershed and partially in the Everett Lake subwatershed is 2,894 acres, all located in Weare. Large acreages lying partially in the watershed and north into Hopkinton and Henniker and the Contoocook watershed are 3,126 (with portions in Weare) and 2,129 acres (with portions in Dunbarton). Total area of unfragmented land in blocks >500 acres is 11,242, 53% of the subwatershed.

The highest hill is Mt. William at 1,107' elevation. Green Hill is 860' elevation, and Sugar Hill is 650'.
GRANIT Land Cover Mapping for New Hampshire (2001) (based on satellite imagery data from 1996 to 2001) provides the following distribution of land use categories for the subwatershed:

Upland Forest	78.91%
Agricultural	6.54%
Water/Wetland	5.29%
Developed	4.71%
Other	4.56%

Protected Land as of 2/04
5,593 acres, or 26.5% of the subwatershed, is presently classified as protected; of this acreage, more than half lies in the Hopkinton-Everett flood control area. Its primary purpose is flood control, and this focus severely compromises habitat within the flood control area. Since flooding typically, but not always, occurs in the spring, flood waters destroyed both adult and young animals.

Terrestrial Focus Area Goal
To protect unfragmented blocks > 1,000 acres.

E. UPPER PISCATAQUOG RIVER/LOWER NORTH BRANCH SUBWATERSHED (9,223 acres, 7% of Watershed)

This 9,222.7-acre area takes in the North Branch of the Piscataquog River from the Everett Dam to its confluence with the South Branch. It includes portions of Weare, 3,943.1 acres (10.3% of the town), Dunbarton, 3,008.6 acres (15% of the town), Goffstown, 1,783 acres (17.4% of the town), and New Boston, 488 acres (1.8% of the town).

Aquatic Features
The North Branch is the dominant aquatic feature. Flows in the river are controlled by the Army Corps of Engineers' releases at the dam at Everett Lake. The releases are governed by flood control concerns. Unnatural flows have degraded stream habitat along this lower stretch of the North Branch.

There is one Great Pond, Gorham Pond, a 102.6-acre natural pond at 425' elevation associated with a series of large former mill ponds and beaver ponds to the north.

All the brooks are first and second order streams, with the exception of the North Branch, which is a fourth order stream. Named brooks include Gorham Pond brook with its impressive associated wetland system and Huse Brook.

Mapped wetlands (National Wetlands Inventory) comprise 711 acres (8% of the subwatershed), and include the following wetland classifications:

Wetland category	Area (acres)	Percent by area
Lake	116	16.4
Pond	95	13.3
Emergent marsh	116	16.4
Scrub-shrub wetland	151	21.3
Forested wetland	232	32.6

Terrestrial Features
Roads run parallel the North Branch and largely north south. The largest block of unfragmented land is 3,146 acres, also running north south through three towns, Dunbarton, Goffstown, and Weare. Other large blocks are 1,088 acres (Dunbarton and Goffstown) and 1,040 acres entirely in Weare. Total acreage in unfragmented blocks of >500 acres is 5,535 acres, 60% of the subwatershed.

The highest elevation is Barnard Hill at 876'. The Kuncanowet Hills create a north-south running ridge at elevations from 500' to 600'. Raymond Cliff is an impressive rocky face known for its nesting ravens.

GRANIT Land Cover Mapping for New Hampshire (2001) (based on satellite imagery data from 1996 to 2001) provides the following distribution of land use categories for the subwatershed:

Upland Forest	73.85%
Other	7.84%
Water/Wetland	6.48%
Agricultural	5.93%
Developed	5.90%

Protected Land as of 2/04
Protected lands in this subwatershed are relatively concentrated in the Dunbarton portion of the Kuncanowet Hills and associated wetlands. The Army Corps holds flood easements on lands along the length of the river. Piscataquog (a.k.a. Clough) State Forest is at the north end of the subwatershed. Total protected acres is 1,715.7, or 18.6% of the subwatershed.

Terrestrial Focus Area Goal
To protect unfragmented blocks > 900 acres.

F. MIDDLE BRANCH SUBWATERSHED (26,476 acres, 19% of Watershed)

This subwatershed lies in the center of the watershed. At 26,476.9 acres it is the largest of the subwatersheds and includes 14,241.3 acres in Weare (37% of the town); 7,913.8

acres in New Boston (28.6% of the town); and 4,321.8 acres in Francestown (22.2% of the town). All the water that drains into the Middle Branch comes from this subwatershed.

Aquatic Features
The Middle Branch originates in Haunted Lake, also known as Scobie Pond, in Francestown. From there it flows 10.6 miles to its juncture with the South Branch in New Boston. The Middle Branch becomes a third order stream at its confluence with Buxton Brook.

In addition to Haunted Lake (a natural lake of 170.7 acres, 636' elevation), Great Ponds in this subwatershed include Ferrin Pond, a natural pond of 14.7 acres at 945' elevation; Perkins Pond Marsh (55 acres, 650' elevation); Daniels Lake (100 acres, 372' elevation); Beard Pond (a natural lake of 12 acres at 465' elevation; Still Pond (a natural lake of 12 acres at 550' elevation; Dodge Pond (also a natural lake of 12.5 acres, 495' elevation); and Dennison Pond (also naturally occurring, 12 acres, 750' elevation).

Named first and second order streams include Otter Brook, Hillside Brook, Meadow Brook, Peacock Brook on USGS maps, locally known as Hodgdon Brook, Buxton Brook, Currier Brook, and Whiting Brook. Lily Pond Brook flows into both Buxton Brook and the North Branch system. A significant tributary to Otter Brook west of Otter Brook is locally known as Eastman Brook.

There are 2,222 acres of wetlands (8% of the subwatershed), in the following NWI classifications:

Wetland category	Area (acres)	Percent by area
Lake	404	18.2
Pond	313	14.1
Emergent marsh	534	24.0
Scrub-shrub wetland	582	26.2
Forested wetland	388	17.4

Terrestrial Features
Though large in acreage, the Middle Branch watershed is traversed by roads. The largest block of unfragmented land, at the western edge of this subwatershed and overlapping with the Rand Brook and Weare Reservoir subwatersheds, is 4,283 acres, involving Weare, Francestown, and Deering. (Note that here, as in other discussions of terrestrial features, the reference to a block's lying in more than one subwatershed does not imply that waters flow between the two subwatersheds.) The next two largest, at 2,894 acres (an area known locally as Melvin Valley) and 1,040 acres, overlap into the Everett Lake and Lower North Branch/Upper Piscataquog subwatersheds and lie entirely within Weare. The largest unfragmented block in the subwatershed is 605 acres and includes the Perkins Pond Marsh Wildlife Management Area. There are 7,839 acres in unfragmented blocks >500 acres, some 30% of the subwatershed.

A string of mountains lies in this subwatershed. They are Mt. Wallingford (1,200'), Mine Hill (1,211'), Mt. Dearborn (1,211'), and Odiorne Hill (1,107'). Other hills include Boars Head (1,161') and Candlewood Hill (1,301').

GRANIT Land Cover Mapping for New Hampshire (2001) (based on satellite imagery data from 1996 to 2001) provides the following distribution of land use categories for the subwatershed:

Upland Forest	80.36%
Agricultural	7.22%
Water/Wetland	5.46%
Other	3.72%
Developed	3.25%

Protected Land as of 2/04
Protected lands are scattered, but most abut undeveloped land and offer potential for larger conservation areas. To date, some 2,111.3 acres have been permanently protected, or 6.1% of the subwatershed.

Terrestrial Focus Area Goal
To protect unfragmented blocks > 500 acres.

G. LOWER PISCATAQUOG RIVER/MAIN STEM PISCATAQUOG SUBWATERSHED (23,918 acres, 17% of Watershed)

This subwatershed lies in the lowest reaches of the watershed. It is 23,918.7 ac and includes 17,056 ac in Goffstown (70.9% of the town), 3,550.7 ac in New Boston (18.2% of the town) 1,695 ac in Dunbarton (8.5% of the town), 1,124.5 ac in Manchester (5% of the city), and 492.5 ac in Bedford (2.3% of the town).

Aquatic Features
The South and North Branches converge in the Lower Piscataquog River subwatershed to become the Piscataquog River. The mainstem supports populations of mussels that are sensitive to pollution. Their presence is indicative of the high quality stream conditions that mark the entire watershed.

Great Ponds in the subwatershed include Long Pond, a naturally occurring, undammed lake in Dunbarton, Uncanoonuc Lake at 24 acres, 655' elevation, and two impoundments on the river, Glen Lake and the impoundment behind Kelley Falls Dam. Hadley Falls Hydro in downtown Goffstown creates a dammed stretch of river that is not, however, classified as a Great Pond by the State.

All streams are first and second order except Bog Brook, a third order stream, and the mainstem, which is a fifth order stream. Named streams include Harry Brook and Bog Brook (the two longest systems), Catamount Brook, Whitney Brook, Dan Little Brook, and Whittle Brook.

Mapped wetlands (National Wetlands Inventory) comprise 1,476 acres (6% of the subwatershed, and include the following wetland classifications:

Wetland category	Area (acres)	Percent by area
Lake	412	28.0
Pond	99	6.8
Emergent marsh	260	17.6
Scrub-shrub wetland	286	19.4
Forested wetland	321	21.7

Terrestrial Features
North Mountain (1,324' elevation) and South Mountain (1,300') of the Uncanoonucs are dominant features. The largest unfragmented block lying wholly within this most-urbanized of the subwatersheds is along the Harry Brook corridor at 1,405 ac. Two large blocks on the Uncanoonucs separated by a road total 1,994 ac. In all, some 9,432 acres are in unfragmented blocks >500 acres, or 39% of the subwatershed.

GRANIT Land Cover Mapping for New Hampshire (2001) (based on satellite imagery data from 1996 to 2001) provides the following distribution of land use categories for the subwatershed:

Upland Forest	65.93%
Developed	13.11%
Other	9.11%
Agricultural	6.62%
Water/Wetland	5.22%

Protected Land as of 2/04
2,142.9 ac have been protected, representing 9.0% of the subwatershed. Most of this acreage is concentrated around the Uncanoonuc Mountains.

Terrestrial Focus Area Goal
To protect unfragmented blocks of >600 acres.

7. CONSERVATION TARGETS

In the previous discussion, a minimum size for focus areas was established for each of the subwatersheds. In this section conservation targets, or goals, are established for the entire watershed and for each subwatershed.

A. Watershed-wide Targets

- **Protect one reference area for each aquatic component, except streams. For 1st and 2nd order streams, protect key headwater stream watersheds.**
- **Protect at least five unfragmented blocks, each of which exceeds 1,000 acres.**

B. Subwatershed Level Targets

- **Protect 30% of each subwatershed within unfragmented blocks of >500 acres;**
- **Maintain as undeveloped land at least 25%[10] of each subwatershed at least 820 ft (250 m) from the nearest road;**
- **Protect at least one good (representative) example of each of the following pond and wetland types: forested wetland, scrub-shrub, emergent marsh, and unconsolidated bottom, with associated uplands;**
- **Protect at least one entire headwater watershed, ideally one with high native species diversity (fish or other taxa); and**
- **Protect at least two good (representative) examples of special, high-value wetlands.**

Parcels that include the entire watershed of one or more low order streams have a high priority for protection.

The Plan identifies key elements of an implementation strategy, including (1) land conservation, (2) inventory, monitoring, and research, (3) land use planning, (4) education and outreach, (5) restoration, and (6) funding. Given the development pressures on land in Piscataquog watershed towns, the PWA will work simultaneously on its own and in concert with conservation interests throughout the watershed to encourage, support, foster, and otherwise generate on the ground land conservation successes. The timing of specific focus area action will depend on landowner interest, goals and timetables of conservation partners, and availability of funding for geographic-specific areas.

[10] This target exceeds the 20% land mass identified in literature from Connecticut. It reflects is a conservative approach to habitat block size. It also goes further in protecting rural character, an attribute most watershed towns seek to maintain.

8. LAND USE PLANNING GUIDELINES

The conservation targets aim to protect core wildlife habitat and a diversity of plant and aquatic communities. Outright protection cannot, however, accomplish all the watershed conservation goals anticipated in this Plan, particularly in light of changing land uses and development pressures. There is a vital and necessary role for local land use boards and commissions in watershed protection. The principles below focus on maintaining connectivity for wildlife to pass through the community. They represent a different approach to watershed protection from more traditional regulations focused on water resource protection.

Typical are local regulations to protect surface water and groundwater from degradation, requiring building setbacks from wetlands, for example, and limiting the kinds of activities that can occur in groundwater protection areas. The state, in cooperation with New Hampshire Audubon and others, has developed regulatory guidelines for buffers around wetlands, geared towards municipalities and currently (2005) under revision. Some municipalities are working with developers to further water quality protection goals through open space development designs and subdivision layout. Increasingly, resources are available to communities, in both the public and private sectors, to assist local boards with proactive resource conservation, particularly basic water quality protection. Through its terrain alteration program, the State helps to control runoff from large developed sites, although piecemeal development in a watershed is typically not regulated for protection of natural flow regimes. As possible given its capacity, the PWA will help local boards connect with such technical assistance as is available.

Land Use and Development Principles for Maintaining Landscape Connectivity for Wildlife

Site (subdivision) scale

- Minimize destruction of natural vegetation: Concentrate development within the site and minimize areas that are disturbed during construction.
- Maximize contiguous undisturbed area: To the extent practical, create site designs in which undisturbed portions of individual lots are adjacent to one another, to undisturbed wetland or riparian buffers, or to other undisturbed land.
- Minimize developed/undeveloped edge: Concentrate developed areas and undisturbed areas to minimize the length of interface between them.

Landscape scale (at municipal level, accomplished through zoning)

- Maximize connectivity and permeability between protected areas: Use land use planning tools such as cluster development, wide and extended riparian buffers, long road frontage, and large lot size with development concentrated near road frontage to provide for wildlife movement between protected areas.

9. IMPLEMENTATION STRATEGIES

As indicated above, this Plan contemplates ongoing conservation action by a number of players and at several levels, from on-the-ground work with landowners to municipal planning, to watershed wide research and education. As of May 2005, the PWA Board has identified on-the-ground land protection as a top priority for the foreseeable future. The following activities reflect actions the PWA is taking or intends to take as lead player. It is our intent to collaborate with other organizations wherever possible.

A. Land Protection

- Select one or more project focus areas for 3- to 5-year land conservation efforts.[11]
- Work with key landowners to secure conservation easements and fee interests on high priority lands within focus areas.
- Work with landowners throughout watershed towns to protect strategically important parcels.
- Collaborate with municipalities and other land trusts to achieve Plan goals.

B. Inventory, Monitoring, and Research

- Recruit and train volunteers to assist with inventory, monitoring, and research projects.
- Collaborate with institutions of higher education, natural resource agencies, and the Russell Piscataquog River Watershed Foundation to accomplish inventory, monitoring, and research projects.
- Locate potential connections between protected areas.
- Complete detailed map-based analysis of priority wetlands, i.e., saddle wetlands, clusters of isolated wetlands in terrestrial blocks, large, diverse wetland complexes, and stream-associated wetlands; field check.
- Develop and maintain spatially explicit database of biodiversity and natural resources in the watershed to document features of important areas for protection and to aid in priority setting.
- Identify, inventory, and map specific threats to biodiversity and natural resources in the watershed.
- Inventory and map occupied habitat of selected focal species.
- Continue participation in DES Volunteer Rivers Assessment Program.
- Initiate participation in DES Volunteer Lakes Assessment Program or the UNH Cooperative Extension Lay Lakes Monitoring Program where no lay monitoring

[11] Focus area selection will be based on the proposed area's ability to meet conservation targets and priorities; on local and/or regional interest by additional entities; on anticipated cost - all things being equal, an area with multiple easement or fee interest donors will be a higher priority than an area where significant funds for acquisition must be raised; on likely fund-raising capacity; and on degree of threat.

programs exist and incorporate data from ongoing lake monitoring programs already underway in the watershed into watershed resources database.
- Identify and document attributes of reference reaches for streams and other aquatic components of the watershed.
- Document and map locations of invasive plants.
- Inventory and map undeveloped shorelines of wetlands and waterbodies.
- Evaluate biological integrity of lakes and streams.

Appendices to this Plan are examples of the kind of inventory work that we anticipate pursuing. The Plan is designed to be a living document, to which inventory and research findings will be added, shared with other conservation entities, and used to help direct conservation work.

C. Land Use Planning

- Work with local land use boards and commissions to encourage compatible land uses in areas connecting or adjacent to protected lands and provide information from inventories of connectivity needs to such boards.
- Monitor major land use proposals within the watershed with potential to impact hydrology and biodiversity (e.g., large-scale water withdrawals or discharges, large concentrated increases in impervious surface, extensive terrain alterations).
- Work with the Piscataquog River Local Advisory Committee to provide documentation of significant environmental values that are threatened by specific subdivision proposals.

D. Education and Outreach

- Meet with potential partners to share land conservation visions and discuss opportunities for collaboration, including
    - planning boards and conservation commissions in watershed municipalities,
    - pertinent regional planning commissions,
    - the Piscataquog River Local Advisory Committee established under RSA 483, the State Rivers Management and Protection Act,
    - regional and statewide land trusts (Francestown Land Trust, Monadnock Conservancy, NH Audubon, Society for the Protection of NH Forests, The Nature Conservancy), and
    - state natural resource agencies (Dept. of Environmental Services, NH Fish & Game, NH Division of Forests and Lands, UNH Cooperative Extension).
- Offer workshops on conservation easements, tax implications, and related issues to interested landowners.

    - Pursue opportunities to develop tools like the video produced in connection with the Headwaters Project 1 for use at workshops, and in other contexts, e.g., with individual landowners
- Partner with New Hampshire Audubon, The Jordan Institute, and the Piscataquog River Local Advisory Committee to bring Three Infrastructures analyses to watershed municipalities.
- Provide information to landowners and the general public regarding invasive species and their control.
- Work with UNH Cooperative Extension to encourage sustainable forest management by landowners within the watershed.
- Provide information to the general public regarding watershed threats and values and conservation opportunities through written, electronic, and broadcast media.
- Provide or otherwise support, as through publicity, workshops for landowners of large tracts or special resources regarding land management issues and conservation opportunities.
- Collaborate with Cooperative Extension Coverts Program volunteers and Manchester Tree Stewards to develop and disseminate landowner information.

Restoration

- Undertake restoration projects, as feasible, considering natural resource value of the project, its capacity to serve as a model or otherwise promote restoration work in the watershed and elsewhere in the state, and availability of funding. Restoration projects might include such activities as modification or elimination of hydropower releases to create more natural conditions; reduction, control, or elimination of invasive species at sites; removal of inactive dams to restore free flowing water; modification of culverts to better allow for passage of fish and other aquatic species.
- Engage in hydro relicensing discussions and other activities that may result in significant restoration action, including, for example, assessment of culverts as they may promote or impinge upon aquatic movement through the system, flow, etc.

Funding

- Expand individual and corporate membership base to support on-going activities.
- Identify capacity that needs to be developed in-house, considering potential for collaborate work with other organizations and their respective capacities.
- Develop and implement a funding plan to build any additional in-house capacity for *Plan* implementation in as short a time period as is realistically feasible.
- Hire consultant to conduct a feasibility study for campaign purposes, when campaign needs are clear.

- Conduct special fund-raising campaigns for major acquisitions and entire focus areas.
- Pursue grants and individual donations to support Plan actions, including land and easement acquisition.

10. IMPLEMENTATION PLAN

To achieve the goals advanced in this Plan will take concerted work by not only the PWA but also other nonprofit conservation organizations, conservation commissions, planning boards, selectmen, and others in a decision-making position, down to – and particularly including – the individual landowner. Many plans create lists of activities each group with the potential to contribute to the plan's implementation should undertake. Because each organization and each of the watershed towns function differently and have different priorities at different times, we have not attempted to dictate the activities of other organizations as such. Instead, the Plan identifies potential partners and conservation goals, the realization of which may take on a variety of forms.

The first major project the PWA has undertaken under auspices of this Plan provides a model for future projects. In the Headwaters Project 1, initiated in spring 2005, PWA is working with Francestown Land Trust, Monadnock Conservancy, and the Russell Piscataquog River Watershed Foundation as key Partners, and with the Lyndeborough Land Preservation Society, Forest Society, and local conservation commissions in focus area towns, planning boards as necessary for the completion of individual conservation projects, and individual landowners. This project is focused on a goal for each of three subwatersheds within the Rand Brook/South Branch subwatershed. Reliance of the groups upon each other to achieve the common goal is strong.

The Plan alludes to various ways town land use boards can participate in Plan implementation. Between 2005-2007, the PWA will meet with land use boards to determine specific tasks and interest levels. PWA will also work with boards to identify shared needs and assist, as possible and appropriate, in addressing them. For example, the PWA is exploring the desirability of and demand for a forum for boards interested in improving open space plans and the regulations that shape them. Similarly, given interest, PWA could assist with design of and funding for a forum on developing regulations to maximize back yard habitat.

On an annual basis, the PWA will determine, through annual work plans, what its focus for Plan implementation will be. PWA land conservation priorities for 2005 are:

- the Headwaters Project 1;
- a neighborhood conservation project in Goffstown aimed at amassing a block of conserved land in a part of town identified as the Conservation Commission's highest conservation priority area and also identified in this Plan as a valuable block; and
- assistance to landowners, on request, with conserving their land, particularly where properties abut existing conservation land or contribute to the creation of significant habitat blocks.

Additional strategies identified in the 2005 annual work plan include research in the Headwaters project area (Rose Mountain) and a three-pronged fund raising focus.

Also annually, the PWA will assess what has been accomplished with respect to land and water conservation goals outlined in this Plan.

The total acreage goal for unfragmented blocks of habitat and core habitat is 41,440 acres. Even acknowledging that some of the land already protected will contribute towards the goal, this goal clearly reflects a multiyear undertaking. Assuming, for example, what experience suggests is an aggressive goal of 3,000 acres of targeted lands were permanently protected annually, the timeline for accomplishing Watershed Plan goals could be as long as 14 years. Annually, the PWA will meet with key conservation partners to discuss their priorities for the year and ways the organizations can collaborate. Regular communications will help engage other conservation organizations in Plan implementation and maximize collaboration. The successes that conservation partners achieve in the watershed are as central to the Plan's implementation as the PWA's successes.

The PWA's 2005 work plan identifies several Plan elements, as outlined in Appendix D.

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12. APPENDICES

A. Comparative Tables of Subwatersheds
   Land Use
   Conservation Lands

B. Potential Focus Areas by Subswatershed

C. Whip-poor-will Survey Results, 2004

D. PWA 2005 Work Plan

Appendix A

Land Use by Subwatershed
Based on GRANIT Land Cover Mapping for NH (2001)

As Percentages	**Weare Reservoir/ Lake Horace**	**Rand Br/ South Branch**	**South Branch**	**Everett Lake**	**Lower North Branch/Upper Piscataquog**	**Middle Branch**	**Lower Piscataquog River**
Upland Forest	82.08%	85.53%	83.0%	78.9%	73.85%	80.6%	65.93%
Water/Wetland	8.63%	4.37%	3.27%	5.29%	6.48%	5.46%	5.22%
Agriculture	5.67%	5.41%	4.92%	6.54%	5.92%	7.22%	6.62%
Other	1.93%	2.31%	4.92%	4.56%	7.84%	3.72%	9.11%
Developed	1.7%	2.38%	3.86%	4.71%	5.90%	3.25%	13.11%
% of watershed	13%	14%	14%	15%	7%	19%	17%

Conserved Lands By Subwatershed
As of February 2004

	Weare Res	Rand Br	South Br	Everett Lk	North Br	Middle Br	Lower Pisc
Acres	3,300	1,623.8	4,953.8	5,593[1]	1,715.7	2,111.3	2,142.0
As %	17.9	10.6	24.7	26.5	18.6	6.1	9

[1] Includes Everett Flood Control lands.

Appendix B

Potential Focus Areas by Subwatershed, As Determined from GRANIT Data and Map Analyses; Potential Aquatic Focus Areas

Weare Reservoir/Lake Horace

Potential Terrestrial Focus Areas

- Lands north and east of Pleasant Pond, including the Pond, itself largely undeveloped; no conservation lands to date (780 acres). Possibly NHNHB site.

  Henniker

- Northwesternmost portion of the Piscataquog watershed, including portions of Hillsborough; no conservation lands to date (2,300 acres total).

  Henniker/Deering

- Western block, including Deering Wildlife Sanctuary and Sanctuary Wildlife Pond (740 ac).

  Deering

- Dudley Pond and south, including Cove Hill; Shepherd's Crossing and portions of Copadis protected lands (635 ac). Directly east of this block is Vincent State Forest.

  Deering

- Lands west of Deering Reservoir, including King Forest, Hodgdon Pasture, Deering Preserve, and French protected lands (3,600 ac, of which a fraction lies in the Piscataquog watershed and Deering Reservoir watershed).

  Deering

- North Branch, south of Deering Reservoir to Pleasant Pond Road (518 ac). This block lies adjacent to large blocks to the south and east and includes extensive wetlands adjacent to the river, possibly NHNHB site.

  Deering

- A large, irregularly shaped block that crosses three subwatersheds draining lands to the South, Middle, and North branch rivers and includes in this subwatershed, the North River, significant wetlands, possibly NHNHB site, Thompson, Wasserman, and Weare T.F. protected lands (4,280 ac).

  Deering/Francestown/Weare

- North Branch south of the Weare Reservoir, including extensive river-related wetlands and a portion of Tobey Hill Road protected land (937 ac). Travel corridor.

  Weare/Deering

- Vincent State Forest and surrounding lands, northwest of Weare Reservoir (630 ac). Wildlife travel corridor; possibly NHNHB site.

  Weare

Potential Aquatic Focus Areas

Lakes and Ponds

- Pleasant Pond, Henniker, largely undeveloped Great Pond in an area of unfragmented lands. Connects with Dudley Pond to south.

- Dudley Pond, Deering, a natural pond with water levels raised by a dam, mostly within a block of unfragmented land

Rivers and Streams

- North Branch River from Deering Reservoir to Weare Reservoir, flowing through Deering and Weare. The North Branch becomes a third order stream at a beaver influenced, naturally occurring pond abutting/including portions of the Wasserman protected property. It flows through large areas of undeveloped land, with four major road crossings in **X** miles, a trout-rich segment; **X** dams. It is identified as an exemplary "upper perennial riparian system" and SNE floodplain forest by the NHNHB

- Dudley Brook from Dudley Pond to its confluence with the North Branch, flowing through Deering with a small portion in Weare. This third order stream has stream-associated aquifer, wetland resources, and includes a trout-rich stretch. It is currently afforded some protection by abutting conservation lands.

Priority Wetlands

- Large diverse wetland complex, both beaver and ledge-created, in Deering, between Rte. 149 and Pleasant Pond Road.

- Lake Horace Marsh on the North Branch, influenced by the dam controlling water levels in Lake Horace and one of only two designated prime wetlands in Weare.

Rand Brook/South Branch

Potential Terrestrial Focus Areas

- Dinsmore Brook/Collins Brook/Shattuck Pond watershed, two large blocks of land, with Old County Road bisecting the area, including NHNHB designated "upper perennial riparian system" community and two small conservation parcels, FL Hill Wetland on Collins Brook and Shattuck Pond FCC parcel (2,355 ac).
  Francestown/Deering

- Crotched Mountain block including Brennan Brook headwaters; Crotched Mountain Town Forest, SPNHF, Merrill, Schultz, and Crotched Mtn. CE protected lands. This is the largest roadless area involving watershed lands.
  Francestown/Bennington/Greenfield

- Rand Brook watershed including four blocks fragmented by Dodge Road, East Road, and Russell Station Road. Special features include Rose Mountain and Rand Brook; Greenfield T.F., Discoll Hill T.F., Rand Brook Forest, and Kunhardt are protected lands (4 parcels totaling 5,273 ac).
  Francestown/Greenfield/Lyndeborough

- A large, irregularly shaped block that crosses three subwatersheds draining lands to the South, Middle, and North branch rivers and includes in this segment, the North River, significant wetlands, and Thompson, Wasserman, and Weare T.F. protected lands (4,280 ac).
  Deering/Francestown/Weare

Potential Aquatic Focus Areas

Lakes and Ponds

- Dennison Pond, Francestown/New Boston. This 12 ac natural lake has an essentially undeveloped shoreline and lies within a block of unfragmented land of 567 ac. Rare wildlife are noted for the vicinity in NHNHB.

- Pleasant Pond (aka Pleasant Lake), Francestown, a large, relatively undeveloped Great Pond situated in one of the Piscataquog Watershed's largest upland blocks and headwaters of the South Branch.

- Shattuck Pond, Francestown, at 925' elevation, one of the highest ponds in the watershed, naturally occurring and undammed, with bog vegetation and other unusual features. It is in a hydrologically "dense" area of connected streams and associated wetlands in largely unfragmented lands.

Rivers and Streams

- Brennan Brook drainage, Francestown, connects the South Branch with Crotched Mountain; stream-associated wetlands, much of the upper reaches of the watershed are undeveloped – the largest undeveloped block in the Watershed is largely in the Brennan Brook watershed.

- South Branch from its origins in Pleasant Pond to intersection of Todd and Poor Farm roads, flowing through a finger of the irregularly shaped block of undeveloped land and including stream-associated wetlands; selected sections further downstream where documented rare turtle habitat occurs; from Rte. 136 south to its confluence with Rand Brook the river is considered rich in alluvial soils.

- Rand Brook, Francestown. This second order brook and its tributaries provide good trout spawning habitat (small streams) and wintering habitat (larger streams, Rand Brook). Much of its watershed is undeveloped.

- Dinsmore Brook, Francestown, relatively undeveloped and associated with large, wetland complex.

Priority Wetlands

- Wetlands complex associated with Collins Brook headwaters and Brook/Collins Brook/Shattuck Pond block.

- Wetlands at Rand Brook headwaters, as exceptionally rich and complex, excellent habitat.

South Branch

Potential Terrestrial Focus Areas

- Headwaters of Cold Brook, including the two headwater ponds and Kingsbury Timber, King-Hibbard Forest, and Roger D. Whittemore Reservation (1,348 ac).
  Lyndeborough

- North/south ranging Piscataquog Mountain, a 4-mile esker w/ glacial kettles along the base of its sinuous course, ponds, wetlands, and Cold Brook tributaries. The east side of this mountain has been heavily mined, with resulting sedimentation of brooks. Includes Kingsbury Timber-Fuller Lot, Olsen/Poirier+Zebuhr, and Piscataquog WMA protected lands (1,786 ac). Connects through 500+ ac block to 2,000 ac "Hildreth Townes" block.
  Lyndeborough

- "Hildreth Townes Forest" block, including Lord's Brook, South Branch, South Hill and Story Hill. Protected lands include Townes #1, FH Townes Forest, and Philippi (2006 ac).
  New Boston/Mont Vernon

- Block south of Bedford Road, north of McCurdy, includes a small pond and stream, hilly terrain, straddles this and Lower Piscataquog subwatersheds, north west of large block by tracking station and south of South Branch block, including Kingsbury Timber Co., Gallerani protected lands (1071 ac).
  New Boston

- Block that runs along the south side of the South Branch into Goffstown, straddling two subwatersheds, including King NFTI, Kingsbury Timber – Moore Lot, Kingsbury Timber – Butterfield protected lands (2311 ac).
  New Boston/Goffstown

Potential Aquatic Focus Areas

Lakes and Ponds

- Bailey Pond, New Boston. Essentially undeveloped shoreline abutting/in block of 469 ac including Marvin easement. Natural Pond, at 14.2 ac. Surrounded by hills.

Rivers and Streams

- Cold Brook, Lyndeborough/New Boston, along its entire length, including its confluence with the South Branch. This stream is very cold, supports Slimy Sculpin and Brook Trout, contains a cascading waterfall and gorge.

- Lords Brook, Mont Vernon/New Boston, entire length, much of this stream is protected, includes stream-associated wetlands.

Priority Wetlands

- Wetlands west of Francestown Turnpike, east of Salisbury Road (in 565 ac block) – large size, possible diversity.

- Sandhill, Mayberry, and Colby ponds and associated Cold Brook wetlands at confluence with the South Branch, New Boston, stream-associated wetlands, possibly affected by Mountain Road and Francestown Tpk.

Everett Lake

Potential Terrestrial Focus Areas

- Lands north of No. Weare between Rtes. 77,114 and Hatfield Road, including Rattlesnake Hill and adjacent to the block of land across Hatfield Road to the north east and to the "Craney Hill Pond" block. This area includes Town of Hopkinton, The Marshall Fund, and Wells protected land (3,126 ac).

  Weare/Henniker/Hopkinton

- Craney Hill Pond (so called) on town lines including King #3 and Buekler Parcel protected lands (2236 ac). This block provides a travel corridor to Vincent State Forest via intervening land.

  Henniker/Weare

- Weare Town Forest, south of Rte. 77, north of River Road, traversed by wildlife from Everett Lake and including Weare Town Forest (1,035 ac).

  Weare

- North Dunbarton, north of Rte. 77, beaver ponds, forested track, stream habitat; wildlife tracking data available, includes Old Fort Estates open space, Myron Chase Sanctuary, and Meadowsend Sawmill, Inc. protected lands (2,129 ac).

  Dunbarton/Hopkinton

- Mt. William (see Middle Branch Piscataquog River).

- Mt. Wallingford, 1200' elevation, Mt. Dearborn (1211' elevation), wildlife corridor, including Buxton Forest, Elizabeth Simons Preserve, and Walker CE (941 ac).

  Weare

Throughout the Everett Lake flood control are NHNHB sites, which bear further analysis with respect to protection requirements and their relation to unprotected lands.

Aquatic Focus Areas

<u>Lakes and Ponds</u>

- Unnamed pond, Craney Hill notation on topo maps, Henniker/ Weare, undeveloped with associated wetlands.

<u>Rivers and Streams</u>

- Stream draining unnamed pond, Craney Hill notation, in Weare, stream-associated wetlands, "chipmunk falls," and undeveloped land in at least half of the watershed.

- Breed Brook, Weare, together with associated beaver ponds, and significantly undeveloped watershed lands (>500 ac undeveloped); north/south wildlife corridor.

- Center Brook ?(trout)

Priority Wetlands

- String of brook-associated wetlands west of and along Thorndike Road, Weare.

- "Bogs" of Bog Brook, North Branch in weare – five marshes, varying wetland habitats. Not true bogs straddle railroad along 77 as one leaves No. Weare village towards concord. First wetland in Boisvert subdivision has been protected. Others not.

Lower North Branch/Upper Piscataquog

Potential Terrestrial Focus Areas

- Lands north and south of Gorham Pond along Gorham Brook and the Kuncanowet Hills, including Kuncanowet Town Forest and Conservation Area; active travel corridor (3,146 ac).

  Dunbarton/Goffstown/Weare

- Lands west of Rte. 13 and east of Gorham Pond Road south to Snook Road (1,088 ac), and south from Snook Road (955 ac).

  Dunbarton/Goffstown

- Upper Huse Brook, east/west travel corridor and adjacent to Melvin Valley block (1,040 ac).

  Weare

- Raymond Caves, denning and nesting habitat, partially contained within Piscataquog State Forest, part of a 357-ac block and likely NHNHB sites.

  Weare

Aquatic Focus Areas

Lakes and Ponds

- The string of undeveloped beaver ponds from the Everett Road Natural Area south to Gorham Pond lie in protected land and offer considerable diversity.

Rivers and Streams

- Gorham Brook from Gorham Pond to its confluence with the North Branch.

- Huse Brook, relatively undeveloped watershed to its confluence with the North Branch.

- North Branch flows are controlled during flood periods by the Everett Dam. The US Corps of Engineers holds flood control easements on floodplain land from the dam to the mouth of the river. The need for additional protection for brook floater mussels should be investigated.

Priority Wetlands

- Huse Marsh, off Colby Road, Weare, located in upper reaches of 509 ac unfragmented block, south of Upper Huse Brook block, including Hoit Mill protected land.

- Wetlands associated with Gorham Brook north and south of town/county line.

- Wetlands north of Gorham Pond and associated with it.

Middle Branch

Potential Terrestrial Focus Areas

- Candlewood Hill (also in Rand Brook/South Branch and Weare Reservoir subwatersheds), wildlife tracking data available, includes Whiting Brook headwaters.

  Francestown/Weare/Deering

- Melvin Valley (also in Everett Lake subwatershed), includes Mt. William - a highly productive low-mountain habitat and wind-thrown, grassy summit - extensive wildlife corridors, rare plant habitat, tracking data available (2,894 ac).

  Weare

- Mt. Misery and Perkins Pond WMA, unique habitat on the mountain, includes a portion of Peacock Brook (605 ac).

  Weare

- From Weare Town Forest on Poor Farm Road south west to Dennison Pond, including a portion of Buxton Brook, possible NHNHB site, Weare T.F. and Reeve protected lands (567 ac).

  Weare/New Boston/Francestown

- Block lies northeast of Francestown Tpk., east of Poor Farm Road and south of Bible Hill and includes a portion of the South Branch and headwaters of a tributary to Whiting Brook, Cilley protected land (600 ac).

  Francestown

- Block bounded by Rte. 136, Thornton Road, Dodge Hill Road, including upper reaches of the Middle Branch River, significant turtle habitat, St. Anselm College data available, Brooks family protected lands (598 ac).

  New Boston/Francestown

- Lower reaches of Peacock Brook, across Tucker Mill Road to include a second block east to Rte. 77. This area contains Middle Branch frontage, tracking data available, including Tuthill Woodlands and Thomas Lot protected lands (c. 900 ac).

  Weare/New Boston

- Block west of Rte. 114, east of Rte. 77, south of Twin Bridge Road, west of Riverdale Road, including lower reaches of the Middle Branch, New Boston T.F. and portion of Lang S.F. protected lands (741 ac).

  New Boston/Weare

Potential Aquatic Focus Areas

Lakes and Ponds

- Dennison Pond, Francestown/New Boston, undeveloped in large habitat block. Stream draining from it feeds Middle Branch headwaters.

- Perkins Pond Marsh, Weare, although artificially impounded at 55 acres, provides high quality habitat, 650' elevation.

- Beard Pond, New Boston, a small, 12-acre natural lake adjacent to Rte. 77 but associated with extensive wetlands, linked with Dodge Pond, a 12.5-acre natural pond west of Rte. 77, by Beard Brook.

- Still Pond, New Boston, a small, 11.4 acre natural lake east of Tucker Mill Road, surrounded by wetlands, round in shape.

Rivers and Streams

- Buxton Brook, Weare/New Boston, relatively undeveloped, large wetland associated with it at Great Meadow.

- That portion of Dudley Brook containing an uncharacteristically large cluster of floodplain forest ironwood (*Carpinus caroliniana*), along the brook and at its mouth at the Middle Branch.

- Unnamed stream originating in Dennison Pond.

- Middle Branch, particularly where it flows through large unfragmented blocks and where it supports rare mussels.

Priority Wetlands

- Squamscott Bog?

- Buxton Brook/west Peacock Brook headwater wetlands, saddle wetlands.

- Great Meadows, New Boston, known for wildlife diversity, used by Virginia Rail, Sora, American Bittern, Least Bittern, and Pied-billed Grebe.

Lower Piscataquog River

Potential Terrestrial Focus Areas

- Harry Brook corridor, running north-south and including several individual parcels of protected land: Story (connected by the brook), Burack, SKV Investment Associates, Paige Hill, Briar Court Open Space, Cobble Creek Open Space (1,405 ac).

  Goffstown/Dunbarton

- Long Pond watershed lands, partially in the Piscataquog Watershed and including protection of undeveloped shores of Long Pond (1,281 ac).

  Dunbarton

- Black Brook/Harry Brook divide lands including Mtn. View Estates beaver pond protected (940 ac).

  Goffstown

- Lands south of Snook Road, along in Lower North Branch subwatershed and possibly including NHNHB site, with beaver influenced wetlands, streams, forested land and open fields (955 ac).

  Goffstown

- Lands west of Paige Hill and east of Rte. 13 with clustered open space in the southern portion (654 ac).

  Goffstown

- Pine barren habitat in Manchester, fragmented parcels but potential butterfly habitat.

  Manchester

- North and South Uncanoonucs, building on protection efforts that have already occurred (1,994 ac total).

  Goffstown

- Block that runs along the south side of the South Branch into Goffstown, straddling two subwatersheds, including King NFTI, Kingsbury Timber – Moore Lot, Kingsbury Timber – Butterfield protected lands (2311 ac).

  New Boston/Goffstown

- Lands west and east of Pulpit Rock Open Space in Bedford, totaling 1,966 ac.

  Goffstown, New Boston, Bedford

Aquatic Focus Areas

<u>Lakes and Ponds</u>

- Long Pond, Dunbarton, an undeveloped Great Pond and headwaters of Harry Brook.

Rivers and Streams

- Mouth of the Piscataquog River and other NHNHB sites.

- Harry Brook, to its confluence with the Piscataquog River, largely undeveloped shorelines.

Priority Wetlands

- See Prime Wetlands publication by the Goffstown Conservation Commission 2005.

- Wetland corridors associated with tracking station lands.