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NEW HAMPSHIRE

Wetlands

PRIORITY CONSERVATION PLAN



1989

An addendum to the New Hampshire State Comprehensive Outdoor Recreation Plan

NEW HAMPSHIRE OFFICE OF STATE PLANNING

New Hampshire

***Wetlands Priority
Conservation Plan***

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State Comprehensive Outdoor Recreation Plan***



**State of New Hampshire
Judd Gregg, Governor**

**Office of State Planning
Jeffrey H. Taylor, Director**

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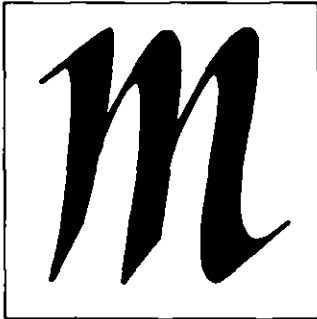
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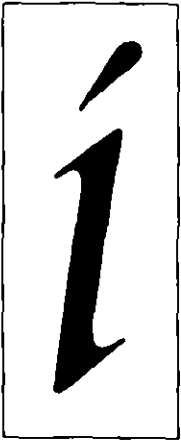
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Introduction



In the past, coastal and inland wetlands were seen as worthless wastelands that could only become "productive" through human intervention. Colonists in America routinely drained marshes and swamps in order to transform these "marginal" lands into highly productive farmlands. This legacy of human-induced changes continues today with the alteration of wetlands for agriculture, residences, transportation, industry, and recreation. In New Hampshire, wetlands adjacent to water bodies are particularly susceptible to developmental pressures due to the ever increasing demand for shorefront property.

In recent decades, public awareness of wetland benefits and public concern over wetland losses have prompted state and federal governments to assume a greater role in coastal and inland wetland protection. Almost all 30 coastal states (including those bordering the Great Lakes) have some form of regulatory control over their coastal wetlands. Nine states--including New Hampshire--have laws which address inland freshwater wetlands.¹

On the federal level, the primary laws relative to wetland protection include Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Both are regulatory permitting programs and both were expanded and reinforced by President Carter's two executive orders (Executive Orders 11988 and 11990) which made wetland protection and floodplain management the official policy of all federal agencies. The recent "Emergency Wetlands Resources Act of 1986" (Public Law 99-645) was enacted "to promote, in concert with other federal and state statutes and programs, the conservation of the wetlands of the Nation . . ."²

Under the requirements of the Emergency Wetlands Resources Act (see Appendix A), each State Comprehensive Outdoor Recreation Plan (SCORP) must specifically address wetlands within that state as an important outdoor recreation resource. New Hampshire Outdoors 1988 - 1993 is New Hampshire's most current SCORP. This wetlands component of New Hampshire's SCORP, New Hampshire Wetlands Priority Conservation Plan, was developed with assistance from state agencies and a private non-profit organization involved in state wetlands planning. Initially, a coordinating panel composed of representatives from the NH Association of Conservation Commissions, NH Fish and Game Department, Wetlands Bureau, the Department of Resources and Economic Development, and the Office of State Planning met to identify and coordinate existing informational resources. A second and final meeting was then held to seek recommendations for establishing wetlands acquisition priorities. This Report--using panel input where appropriate--was developed by the Office of State Planning to meet the requirements of the Emergency Wetlands Resources Act. Every effort has been made to address all of New Hampshire's wetlands within this report. However, an overall imbalance does exist between freshwater and saltwater wetlands discussions (in favor of saltwater wetlands), simply because more detailed information and documentation concerning saltwater wetlands is currently available.

Defining Wetlands



s a first step in discussing New Hampshire's wetland resources, one must first understand what wetlands are and what ecological role they play.

Various systems of wetland classification have been employed by different agencies at all government levels. Such a diversified approach to defining wetlands results from the need of state and federal regulatory agencies to arrive at a wetland definition that suits their individual administrative purposes (Table 1). Therefore, there is no single definition of a wetland. However, no matter what approach an agency has taken, the principal factors relied upon to determine wetland borders have

been hydrology (the degree of flooding or soil saturation), vegetation, and soils.

One definition that utilizes all three wetland attributes and which deserves special mention is the US Fish and Wildlife Service's Classification of Wetlands and Deepwater Habitats of the United States. This detailed classification system (Figure 1 and Appendix B) is used by federal, state, local, and other agencies involved with identifying and classifying wetlands. This system has been used by the National Wetlands Inventory Project (NWI) since its establishment in 1975.³ Likewise, the recent National Wetlands Priority Conservation Plan--developed in accordance with Section 301 of the Emergency Wetlands Resources Act of 1986--also utilizes this wetland classification system.⁴

Table 1
WETLAND DEFINITIONS

US Fish and Wildlife Service (Cowardin, et al. 1979):

Wetlands Definition: "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year."

Comments: This is the official Fish and Wildlife Service definition and is being used for conducting an inventory of the Nation's wetlands. It replaces the Circular 39 definition which is also outlined in this table. It emphasizes flooding and/or soil saturation, hydric soils, and vegetation. Shallow lakes and ponds are included as wetlands. Comprehensive lists of wetland plants and soils are available to further clarify this definition.

US Fish and Wildlife Service and USDA Soil Conservation Service (Shaw and Fredline 1956; commonly referred to as "Circular 39"):

Wetlands Definition: Wetlands are "lowlands covered with shallow and sometimes temporary or intermittent waters." They include marshes, swamps, bogs, wet meadows, potholes, sloughs, river overflow lands, and shallow lakes and ponds.

Comments: Former Fish and Wildlife Service definition. Although this definition is generally weak, 20 individual wetland types were described in terms of water permanence and depth, salinity and vegetation. Wetland definition includes shallow lakes and ponds, but not permanent waters of streams, reservoirs, and deep lakes. This is the official definition of the Soil Conservation Service.

Environmental Protection Agency and US Army Corps of Engineers (Federal Register, July 19, 1977):

Wetlands Definition: Wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

Comments: Regulatory definition in response to Section 404 of the Clean Water Act of 1977. Excludes similar areas lacking vegetation, such as tidal flats, and does not define lakes, ponds and rivers as wetland.

State of New Hampshire (FRI and Dredge in Wetlands, Chapter 483-A:1-a):

Wetlands Definition: I. "Wherever the tide ebbs and flows, this Chapter shall apply to all lands submerged or flowed by mean high tide as locally determined, and, in addition, to those areas within 100 feet of the highest observable tide line which border on tidal waters, such as, but not limited to, banks, upland areas, bogs, salt marsh, swamps, meadows, flats or other lowlands subject to tidal action."

Comments: Statutory definition. Authorizes the Wetlands Board to manage any activity within state coastal waters, submerged lands, fresh and tidal wetlands within 100 feet of the highest observable tide line. Changes in this statutory definition which occurred due to passage of Chapter 225 (Laws of 1989) are reflected in this definition. RSA 483-A is the state's most important law protecting inland and coastal wetlands.

II. "Wherever fresh water flows or stands and in all areas above tidal waters not included in paragraph I of this section, it [Chapter 483-A:1] shall apply (in addition to great ponds or lakes of 10 acres or more in natural area...) to those portions of great ponds or lakes created by the raising of the water level of the same, whether by public or private structure, and to all surface waters of the state as defined in RSA 149:1 (streams, lakes, ponds, and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state, marshes, water courses and other bodies of water, natural or artificial) which contain fresh water, including the

portion of any bank or shore which borders such surface waters, and to any swamp or bog subject to periodical flooding by fresh water including the surrounding shore."

III. " 'Mean high tide' as used in this section shall be determined according to the published tables and standards of the United States Coast and Geodetic Survey, adjusted to the locality from such tables."

IV. " 'Sand Dune' as used in this chapter, shall mean a hill or ridge of sand piled up by the wind and commonly found on the seacoast."

**Rules of the Wetlands Board
(Wt 101.01, 601.01):**

Wetlands Definition: " 'Freshwater wetlands' means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal conditions do support a prevalence of vegetation typically adapted for life in saturated soil conditions."

" 'Coastal wetlands' means lands that are transitional between upland areas and tidally influenced water bodies, as well as tidally influenced water bodies and the lands submerged by them, and areas that normally support, or are capable of supporting certain hydrophytic vegetation.

Saltwater wetlands are further divided into categories with varying characteristics:

- (a) Areas with hydrophytes and hydric soils, such as high and low saltmarsh, swamps, and swales.
- (b) Areas without hydrophytes but with hydric soils, such as flats and tidal drainage channels.
- (c) Areas with hydrophytes but nonhydric soils, which are areas where hydrophytic vegetation is establishing or re-establishing itself.
- (d) Areas without soils but with hydrophytes, such as rocky shores and cobble beaches where algae grows.
- (e) Areas without soils and without hydrophytes, such as rocky shores and cobble beaches where algae does not grow.
- (f) Areas with soils and vegetation influenced by irregular or occasional flooding or flowing, such as dunes and swales.
- (g) Areas normally submerged, such as ocean bottom, shoals, vegetated shallows, tidal rivers and creeks, reefs, pools, coastal bars, salt ponds, and stream bars."

Sources: USFWS, USDA, and USACE descriptions were excerpted from Wetlands of Delaware (Tiner, R.W. Jr., 1985). State of New Hampshire description was excerpted from New Hampshire Revised Statutes Annotated.

Figure 1. THE US FISH AND WILDLIFE CLASSIFICATION SYSTEM

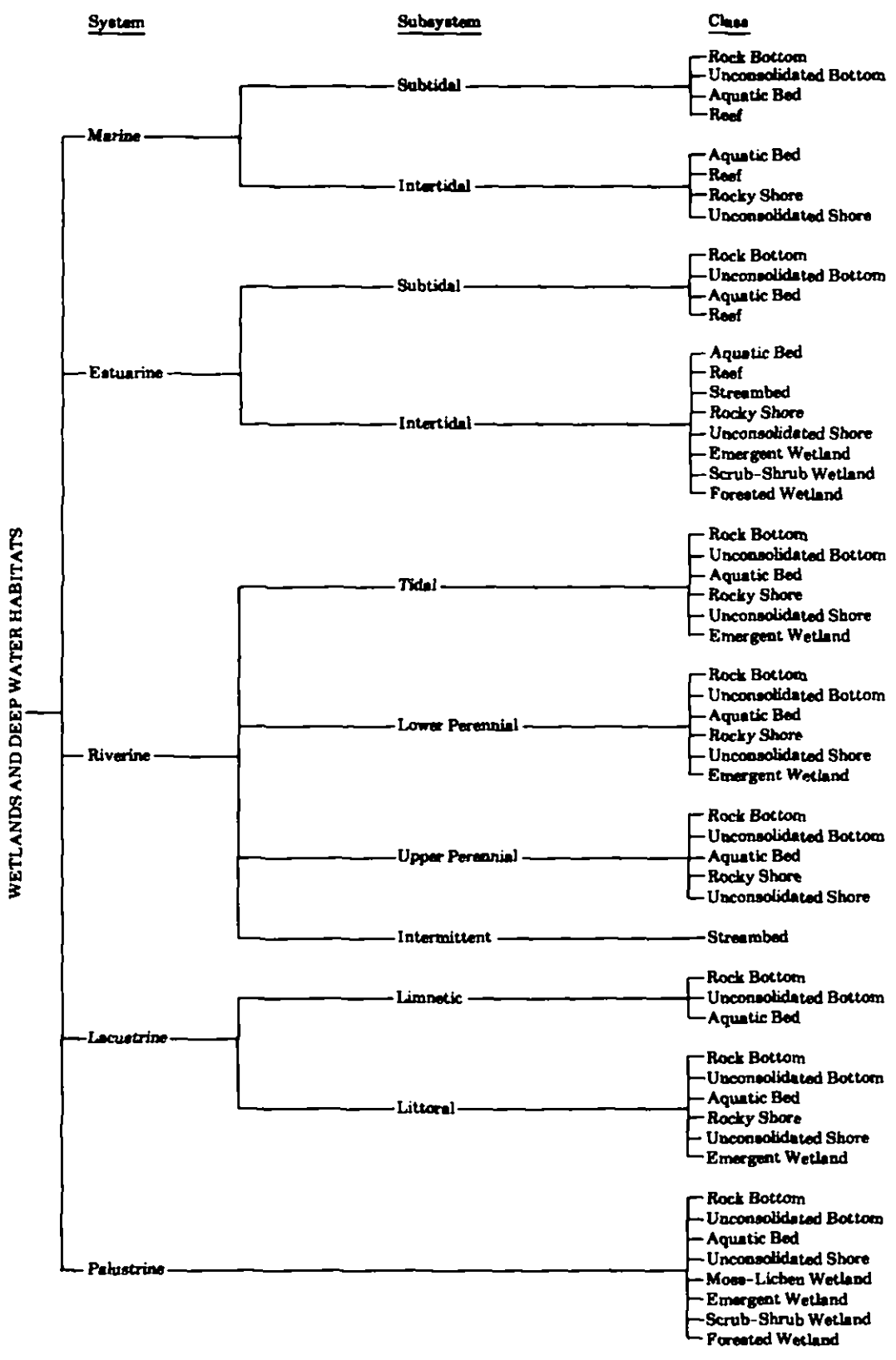
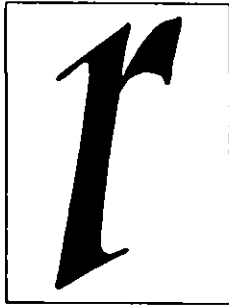


Fig. 1. Classification hierarchy of wetlands and deepwater habitats, showing systems, subsystems, and classes. The Palustrine System does not include deepwater habitats.

Wetland Values



Regardless of the variety or length of wetland definitions, all consider water the dominant factor. Terms commonly used to distinguish different coastal and inland wetlands include tidal flat, salt marsh, freshwater marsh, swamp, wet meadow, and bog. The inherent values of these wetlands are many. However, only recently has it been recognized that wetlands provide other public benefits besides wildlife habitat and recreational opportunities. It is important that the functional roles of wetlands be taken into consideration when potential impacts from dredge, drain, fill, and construction activities are being evaluated.

The following description of wetland functions taken from the Guide to the Designation of Prime Wetlands in New Hampshire⁵ provides a good overview of the contribution wetlands make to maintaining environmental quality.

Flood Control

Many wetlands act as natural regulators of storm water run-off. Poorly drained wetland soils are usually saturated with water, limiting their capacity to absorb additional moisture. However, some wetlands act as natural floodwater retention areas during peak

precipitation periods. Flat valley wetlands adjacent to rivers and lakes (riverine and lacustrine [Figure 1 and Appendix B]) can slow run-off from upland areas. The inflow is discharged at a constant but slower rate, reducing the maximum flood level of surface waters by releasing the storm water over a longer period of time. Wetlands are particularly effective in controlling run-off in "flashy" or flood-prone watersheds which are usually characterized by steep slopes, shallow or highly compacted soils, sparse vegetation or development with extensive paving. Storm water runs off quickly because less water infiltrates the soil or is taken up by vegetation.

Pollution Control

The ability of wetlands to filter pollutants has earned them a reputation as nature's free water treatment facility. By intercepting road salts, sediments and other pollutants carried by run-off, wetlands can reduce contamination of surface waters. Nitrates and phosphates from wastewater effluent and agricultural chemicals are absorbed and used by some wetland vascular plants and algae. Thick, organic wetland soils can trap and hold harmful chemicals and heavy metals. When wetland soils are disturbed by excavation or construction, they may release contaminants to area ground and surface water. (This is not to say that it is acceptable for wetlands to be subjected to the above mentioned types of run-off.

On the contrary, the constant onslaught of sediments and pollutants will cause severe problems. As an example, the Federal Refuge System is experiencing severe wetland degradation due to agricultural chemical and fertilizer seepage into wetlands.)

Shoreline Stabilization

Vegetated coastal (marine and estuarine [Figure 1 and Appendix B]) wetlands not only provide flood control, but also serve as natural buffers from storm damage. Thick mats of spartina grasses absorb the impacts of natural wave energy, limit potential wave generation, and protect against shoreline erosion. Vegetated wetlands adjacent to rivers and streams (riverine) and lakes (lacustrine) also serve as bank stabilizers, preventing erosion and resulting sedimentation. Man-made stabilization efforts to achieve the same result may cost thousands of dollars per linear meter if an elaborate seawall is constructed.

Water Supply Augmentation

A wetland's potential to augment surface water supplies is related to its ability to delay storm water run-off. By releasing storm water slowly, wetlands extend the period of time over which these waters are available to surface water supplies.

Most wetlands are underlain by relatively impermeable soils that do not transmit water well and, therefore, do not recharge groundwater. However, depending upon the hydrology of the area, some wetlands do augment groundwater supplies.

Sediment Retention and Erosion Control

As precipitation falls or snow melts, water either infiltrates the ground or flows over land towards a surface water drainage system. Especially at peak flow periods, run-off may cause erosion and additional particulate matter in surface water increasing the turbidity and color of the water. When water velocity decreases, soil particles settle out, forming sediment. If sedimentary particles are very fine, their accumulation can effectively seal the bottom of a body of water, eliminating any interaction between it and an underlying aquifer. Sedimentation may also smother aquatic vegetation and the eggs and larvae of aquatic insects.

Wetland soils and vegetation retard this process by trapping soil particles from storm water run-off, thereby reducing the sediment load. The same ability of a wetland to slow storm water run-off and, therefore, aiding in flood control also helps to reduce erosion downstream.

Food Web Productivity

Estuarine and coastal marshes are among the most productive areas in the world. Energy from sunlight is utilized by vascular plants which produce hundreds of pounds of primary nutrients per acre of salt marsh annually. Marsh grasses die and decay, combining with other wastes to form a rich particulate mixture called detritus. Microorganisms convert detritus into basic elements and nutrient sources for vascular plants, microalgae or phytoplankton (minute, floating plant life). Phytoplankton are consumed by zooplankton (microscopic floating animals), an important food source for shellfish such as softshell

clams and quahogs, oysters, blue mussels, crabs and shrimp, and for many species of finfish.

Estuaries are spawning, nursery, feeding or wintering areas for many species important to sport and commercial fishing. Finfish using the estuary during postlarval and juvenile stages include eels, striped bass, winter flounder and menhaden. Year-round species include smelt and smooth flounder. American shad, Atlantic salmon and alewives are species of anadromous fish that travel through estuarine waters on their way to spawn in freshwater upstream. NH Fish and Game restoration projects have emphasized the importance of American shad and Atlantic salmon fisheries. Coho Salmon, stocked by NH Fish and Game as smolts in Great Bay tributaries, also provide sport fishing when they return to the Bay as adults.

Wildlife Habitat

Coastal and estuarine wetlands are important wintering areas for waterfowl because tidal action keeps the creeks and rivers relatively free of ice. Species that winter on New Hampshire's coast include black duck, mallard, common goldeneye, bufflehead, red-breasted merganser, greater scaup and Canada goose. New Hampshire's coastal and estuarine wetlands are also significant breeding areas for the black duck, as well as a stop-over for many species of migratory waterfowl. Other shore birds of the NH coast include sandpipers, yellowlegs, plovers, herons, egrets and terns.

Inland freshwater wetlands adjacent to rivers and lakes (riverine and lacustrine) are valuable nesting and brood habitat for waterfowl. They are also prime habitat for many furbearers,

such as beaver, muskrat, otter and mink, and provide browse for white-tailed deer and moose. Wooded and shrub/scrub wetlands provide nesting habitat for wood ducks, hooded mergansers, mallards and black ducks.

Cordwood Harvest

Wooded swamps dominated by such species as red maple can be a source of cordwood. With sound management practices, wooded swamps can be harvested without significantly altering their other wetland values. Certain silvicultural practices can render a wetland more valuable as wildlife habitat. A red maple swamp, for example, can be harvested in scattered one acre plots on a rotating basis to stimulate growth of vegetation to serve as browse for white-tailed deer. (It should be remembered that dead trees provide nest and food sites for wildlife. Removal of all standing dead timber should, therefore, be discouraged.)

Recreation and Education

The recreational and educational values of wetlands need special mention since this plan (as mandated by the Emergency Wetlands Resources Act of 1986) must address wetlands as an important outdoor recreation resource. Whether tidal or inland, wetlands are natural areas for community open space. Their diversity and beauty provide visual relief in urban areas, and support such recreational activities as fishing, shellfishing, hunting, nature observation/study, birdwatching, hiking, and photography. Wetlands associated with open waterbodies also support recreational activities such as boating and swimming.

Quite often, it is these activities which contribute an economic value to wetlands. The recreational value of wetlands may be further increased when culturally significant sites containing historic or archaeological values are located within their boundaries. The proximity of quality wetlands to highly populated areas also contribute to their recreational and perceived values.

While recreational use can be a favored attribute of wetlands, careful management guidelines are essential in order to prevent unwanted negative impacts due to human activity. Such wildlife species as loons, eagles, and ospreys are vulnerable to human distur-

bance as are rare plant habitats and natural communities.

Due to their often unique and multifaceted environmental characteristics, wetlands are well-suited for use as environmental classrooms and research laboratories. They provide opportunities to observe a variety of plants and animals and to conduct long-term research into the structure and functions of wetland ecosystems. As research efforts identify the overall values associated with wetlands, the costs and benefits associated with the conversion of wetlands to other uses will become more readily identifiable.

New Hampshire's Wetlands



Almost all of New Hampshire's lakes, ponds, rivers, and wetlands are the result of the most recent period of glaciation which ended with the disappearance of glacial ice approximately 12,000 years ago. The cooler and most likely wetter climate of about 75,000 years ago caused centuries of accumulated snow to change into a large sheet of ice. This ice sheet, originating in the Hudson Bay area of central Canada, eventually flowed southward across New England and terminated in the area of Martha's Vineyard, Nantucket, and the other islands south of Cape Cod.⁶

Unsorted debris, ranging in size from clay to boulders, was frozen into the flowing ice and transported to the margins of the glacier. At the glacial margins, meltwater streams selectively transported clay, sand, and gravel-sized materials away from the glacier resulting in the thick sand and gravel outwash deposits found throughout the state. Some of the clay material settled out in ice-dammed lakes forming the thin impervious clay layers found in many locations.

As the climate changed and the rate of melting exceeded the winter's ac-

cumulation of snow, the margin of the glacier retreated. This retreat left behind large quantities of unsorted debris. Since this material was deposited by ice rather than flowing water, its distribution was independent of pre-existing water courses. In many areas of the state, surface drainage has not yet re-established itself and areas of marsh and swamp are the result.

Large blocks of ice broke away from the glacial margin and were buried in the outwash deposits in front of the retreating glacier. These blocks were insulated by overlying sediments for many centuries, but when they eventually melted, they left depressions known as kettle holes. These kettle holes go through a natural progression from pond to wetland to upland vegetation.

Large wetland areas are found mostly in the northern and the coastal regions of the state where the relatively level topography permits their development.

Estimating Wetland Loss

The following discussion of the historical loss of natural wetlands is based on several sources including review of literature, and personal communications with university faculty, other researchers, and soil scientists.⁷

Coastal and estuarine tidal marshes, which are found in 17 municipalities along the Atlantic coastline and around the Great Bay/Little Bay estuarine system, comprise approximately 7,500 acres. The study that determined this acreage, The Soil Survey of New Hampshire Tidal Marshes (Breeding and Richardson, 1974), also concluded that many more acres of tidal wetlands existed in the past. Field study and aerial photographs revealed evidence of tidal wetland disturbance via filling of salt marshes and road, tidal dam, and tidegate construction.

It is apparent from current aerial photographs that road construction--especially along the coastline--has truncated the original extent of tidal wetlands. By tracing the extent of the original marsh system through topographic observation, it is estimated that approximately 15,000 acres of tidal marshes existed at the time of European settlement. Of the approximately 7,500 acres of tidal marsh lost since that time, only a portion was filled. The remaining wetland areas have been "cut-off" from their tidal source by roads and other construction, and have become freshwater wetlands. These wetlands are less valuable than salt marshes because they have lost much of their productivity. Nevertheless, these areas do provide wetland/wildlife habitat values and other wetland functions such as flood control. Soil borings in these wetlands confirm their progression from tidal to freshwater systems.

Tidal marsh development over the past 3,000-6,000 years has paralleled the general rise in sea level. There are cases where salt marshes have developed over Atlantic White Cedar freshwater coastal swamps. Situations also exist today where a freshwater wetland has

developed over a salt marsh which in turn overlays an ancient cedar swamp. As noted in the recent Office of State Planning report Wetlands Mitigation/Restoration Issues (January 1988), relative sea level is and will continue rising, bringing with it shoreline changes and wetlands alteration. Most scientists agree that wetlands will respond to sea level rise by migrating landward. This becomes a problem when, due to development and existing physical barriers, there are no open upland areas to accommodate wetland migration. This State Planning report--which examines issues important to developing state regulations governing restoration and creation of tidal wetlands--suggests that the permitting process should include an option that would set aside buffer areas as a condition of the permit.

Currently, substantial acreages of salt marsh are undergoing a transformation to lesser productive freshwater systems due to inadequate tidal flushing resulting from undersized culverts, tidegates, and blocked drainage ways. Three major salt marsh areas in New Hampshire, the Bass Beach and Little River Salt Marshes in North Hampton and Parson's Creek Salt Marsh in Rye, provide dramatic examples of salt marsh degradation due to these factors. Further loss of habitat value is also occurring due to the encroachment of alien plant species such as Purple Loosestrife (*Lythrum salicaria*). Studies on these marshes to determine problems and propose solutions have been done. As of yet, however, none of the proposed solutions have been implemented. Some seacoast communities are presently reviewing new marsh management and marsh restoration proposals. Hopefully, the result will be funding and actual on-site restoration work programs.

Estimating inland freshwater wetlands loss is more difficult since no pertinent documentation concerning this subject is available. Local planning documents, conservation commission annual reports, and extant Wetlands Board files may provide scattered bits of information; however, compiling this data would be an enormously time consuming task. There are, nevertheless, some publications available that provide a perspective on nationwide wetlands assessment. The US Department of Interior Fish and Wildlife Service National Wetlands Inventory publications Wetlands of the United States: Current Status of Recent Trends (March 1984), and Wetlands of New Jersey (July 1985) are valuable sources. The 1984 study actually cites several references of wetland losses in various states. However, New Hampshire is not listed. Although seven of the state's coastal towns have mapped both fresh and tidal wetlands by aerial photography, statewide maps identifying, documenting, and mapping wetlands are only slowly becoming available.

Nationwide, agriculture has been the major factor contributing to wetland losses. In New Hampshire, agriculture has also been a contributing factor to inland freshwater wetland losses. Wetlands have been drained for timber cutting, and ditched and drained for hay, grain, forage, and vegetable crops. Moreover, inland wetlands have been lost to road and highway construction, building construction, and peat and mineral/gravel mining. In addition to the high altitude aerial photography being carried out by the US Fish and Wildlife Service under its National Wetlands Inventory program, low altitude, high resolution aerial photography would be of significant help in assessing wetland loss due to these

factors. Unfortunately, low altitude photographs are not available statewide.

On the other hand, beaver impoundments and those impoundments created by dams for water supply and hydroelectric power may have resulted in wetland development. Local changes in drainage patterns due to various terrain alterations may have also caused some sites to become wetter. Gravel excavations, abandoned when the water table was reached, are examples. Still, the general consensus is that there has been a net loss of wetlands in New Hampshire, and that the quality of many existing wetlands has been reduced by adverse environmental impacts, development pressures, and improper land use management practices. Most recent estimates, based on New Hampshire wetlands permit data, indicate that the permitting process allows the filling of up to 50 acres of wetland, both freshwater and saltwater, per year. This does not mean, however, that some type of yearly limit of fill is associated with the permitting process. Wetlands Board permit review procedures are, by statutory requirement, done on a case-by-case approach. A very small portion of wetland acreage filled (estimated to be less than 1 acre in 1987) involved saltwater wetlands. An earlier estimate by the Wetlands Board calculated the annual rate of wetlands loss statewide as 1/40 of 1% per year.⁸ Applying this rate of loss to the 1973 USGS wetlands estimate of approximately 95,000 acres for the state (see Table 2) yields an annual wetland loss of roughly 24 acres per year. This loss has occurred primarily in small isolated areas, and not in larger wetland areas.

Estimating Current Wetland Acreage

New Hampshire encompasses a total area of 9,304 square miles, including 280 square miles of inland water. Its Atlantic shoreline is only 18 miles long; its tidal coastline totals 131 miles.⁹ Until recently the focus of most detailed wetland inventories has centered around the state's ponds, lakes, and coast. In the late 1970's, the US Fish and Wildlife Service (USFWS), as part of its National Wetlands Inventory (NWI), began inventorying wetlands state-wide via color infra-red aerial photography. Approximately 25-30% of the state was photographed using existing USGS topographic maps. These maps, however, lacked consistency since they varied in scale. Aerial photography was suspended when the NWI determined that using larger scale maps would provide more detailed, compatible, and, therefore, more usable wetlands data. In 1986 aerial photography of the state--at the revised 1:24,000 scale--began anew. Through NWI mapping, wetlands as small as 1/2 to 1 acre will be identified.¹⁰

NWI mapping of New Hampshire involves the following stages:¹¹

1. *Photo Interpretation and First Round Quality Control* - As of June 1989, photo interpretation and first round quality control of interpreted photos have been completed for the entire state.
2. *Regional Quality Control* - The USFWS Northeast Office in Newton, MA is currently conducting regional quality control of interpreted photos covering southeastern New Hampshire. Regional Quality Control work will then shift to the south-

western part of the state, and then northward.

3. *National Quality Control* - Photos that have passed regional quality control are sent to NWI Headquarters in St. Petersburg, FL for further quality control inspection.
4. *Draft Map Production* - Draft maps are developed from photos that have passed all quality control stages. It is expected that some draft maps (which are usable) for southeastern New Hampshire will become available in the next few months.
5. *Final Maps* - Draft maps are reviewed for corrections and final maps are then printed.

A map report briefly outlining NWI procedures and findings (e.g. list of wetland plant communities, photo interpretation problems) will also be developed. In addition, a more comprehensive state wetland report will follow. This state report will include wetland statistics and detailed discussions of NWI techniques, wetland plant communities, hydric soils, and wetland values.¹²

Because NWI wetland maps for New Hampshire are not yet available, and because no other detailed, current data concerning existing inland wetland resources exists, discussion of inland wetlands will for now have to rely on earlier, less comprehensive studies. Coastal wetlands, on the other hand, have been the subject of study by the State's Coastal Resources Management Program and relatively detailed information is available in this area.

The only source of information available to estimate acreage of wetlands

statewide is the USGS Land Use and Land Cover Classification System. This system classifies land use and land cover into 9 separate categories including a separate category for wetlands of 40 acres or more in size. Using 1973 USGS Land Use and Land Cover Maps, all areas classified as "wetland" were totaled and wetland acreage was estimated by county and by river basin (Table 2). Figure 2, entitled "New Hampshire's Wetlands," shows the distribution of these wetlands statewide. This map was generated by the GRANIT (Geographically Referenced ANalysis and Information Transfer) System. This computerized geographic information system is being developed to apply computer mapping to land use planning and resource management.

Swamps, Marshes, and Bogs

The freshwater wetland communities of New Hampshire (graded from driest to wettest) are swamps, marshes, and bogs. Swamps contain predominantly woody vegetation and are divided into shrub swamps (woody plants less than 15 feet tall) and wooded swamps (woody plants greater than 15 feet tall).

Marshes are characterized by herbaceous (soft-stemmed) vegetation, and are divided into shallow marshes (containing cattails, sedge, and grasses) or deep marshes (containing water lilies, pondweeds, pickerelweed, and arrowheads).¹³

Bogs are highly acidic wetlands where the woody vegetation forms a floating root mat which rises and falls with the water level. The most prevalent vegetation is sphagnum moss which acidifies the water and forms a thick sponge among the roots of the woody plants.¹⁴ Bogs contain unique plant com-

munities specifically adapted to survive on little or no nutrients. Due to their uniqueness and their extreme sensitivity to disturbances, bogs are given the highest priority for protection under state law RSA 483-A, Fill and Dredge in Wetlands--New Hampshire's most important law protecting both inland and coastal wetlands.

Swamps, Marshes, and Bogs of Particular Value

A number of freshwater wetlands in the state have been recognized as natural areas of national significance and thus, worthy of being designated Registered Natural Landmarks. The National Natural Landmarks Program, which is administered by the National Park Service, was established in 1963 to identify and protect areas of national ecologic or geologic significance. An area's significance is determined by regional inventories and comparative analysis. Once identified, sites are listed in the National Registry of Natural Landmarks. Designation and listing do not affect ownership, nor do they afford permanent protection. An owner of a National Natural Landmark is invited to enter into a voluntary, nonbinding agreement with the National Park Service to help protect the nationally significant values of the property by adopting basic conservation practices. An owner who chooses to make this commitment is eligible for a bronze plaque and certificate that formally recognize the significance of the site. Among those wetlands possessing this distinction are the following:¹⁵

Heath Pond Bog: Located in Carroll County, this 110-acre site is a prime example of bog succession from open water to sphagnum heath-black spruce

Table 2**ESTIMATED ACREAGE PER COUNTY AND RIVER BASIN OF
WETLANDS 40 ACRES OR MORE IN SIZE**

County	Wetland Acreage
Belknap	4,425.58
Carroll	12,649.30
Cheshire	15,773.58
Coos	25,113.65
Grafton	2,578.44
Hillsborough	5,022.37
Merrimack	8,817.56
Rockingham	15,885.91
Strafford	4,711.65
Sullivan	463.36

 95,441.40

River Basin	Wetland Acreage
Androscoggin	10,762.88
Lower Connecticut	14,713.39
Middle Connecticut	4,181.48
Upper Connecticut	11,834.84
Lower Merrimack	6,333.49
Middle Merrimack	12,654.87
Pemigewasset	1,611.98
Piscataqua	18,199.96
Saco	9,593.35
Winnipisaukee	5,555.17

 95,441.41

Source: 1973 USGS Land Use and Land Cover Maps.

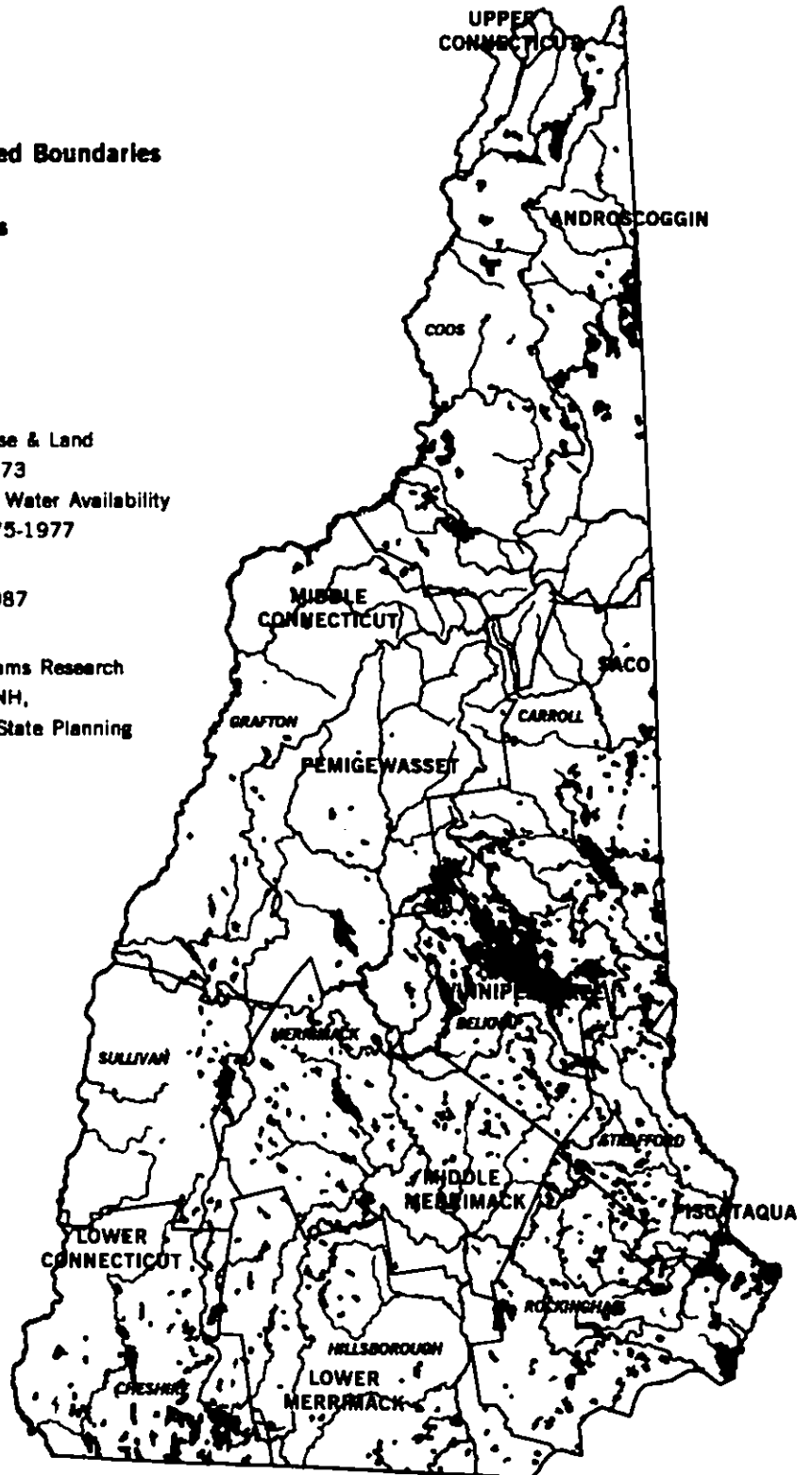
Figure 2
NEW HAMPSHIRE'S WETLANDS

- Wetlands and Watershed Boundaries
- Waterbodies and Rivers
- County Borders

SOURCE(S): USGS Land Use & Land Cover, 1973
 USGS Ground Water Availability Maps, 1975-1977

DATE PRODUCED: December, 1987

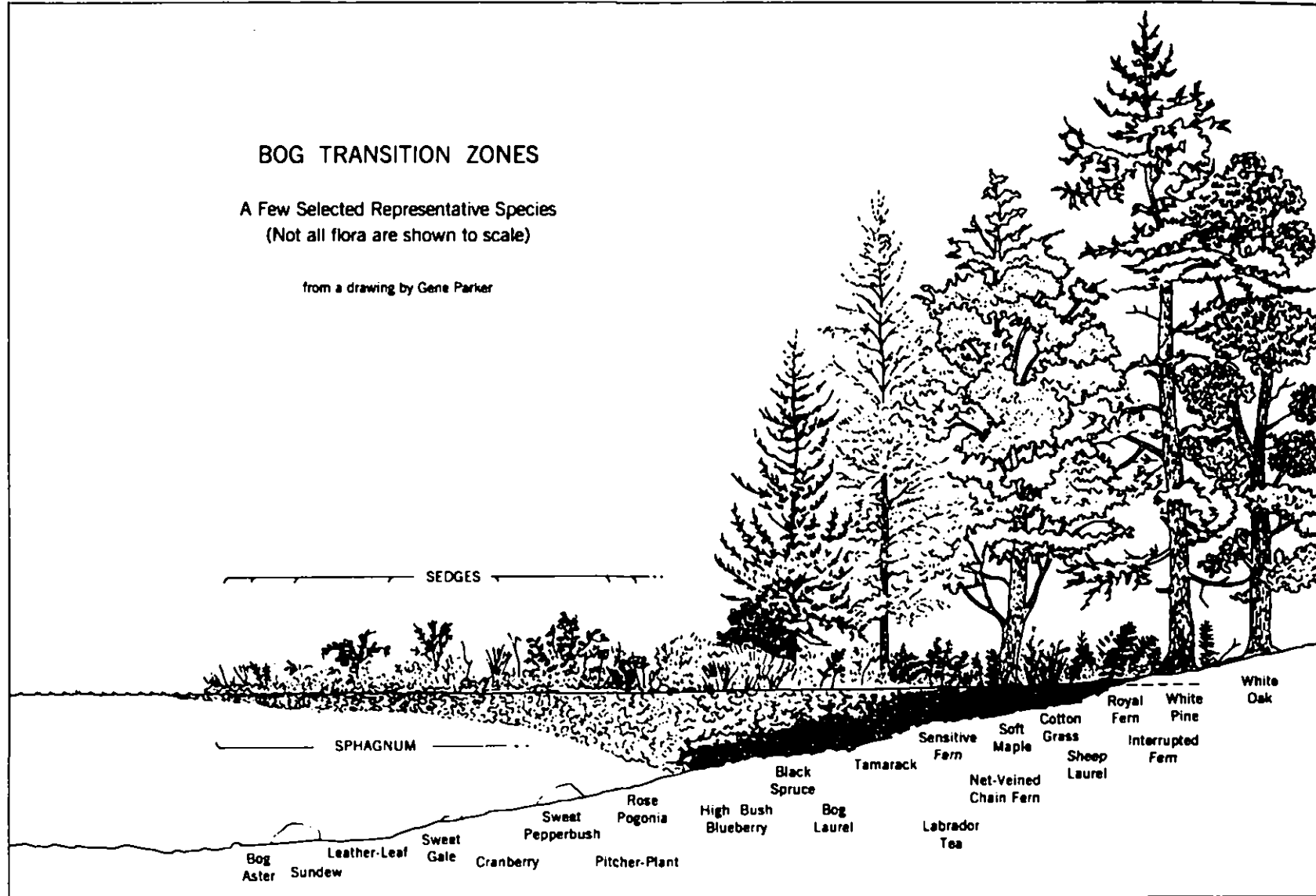
PRODUCED BY: Complex Systems Research Center, UNH,
 NH Office of State Planning



BOG TRANSITION ZONES

A Few Selected Representative Species
(Not all flora are shown to scale)

from a drawing by Gene Parker



Source: New England Wetlands - Plant Identification and Protective Laws, EPA, May 1981.

bog. It is said to contain more variety of plant species than any other peat bog in the state, thus offering an outstanding opportunity for study. This state-owned site is administered by the Division of Parks.

Spruce Hole Bog: Located in Strafford County, this bog is an excellent example of a complete ecological community occupying a true kettle hole. The site contains a pond surrounded by a floating mat of predominantly sphagnum and leatherleaf followed by a high shrub zone. The wooded slopes of the kettle hole rise steadily on all sides to a rim averaging 50 feet above the bog.

Floating Island: Located in Coos County, this 750-acre wetland includes a 260-acre northern heath bog surrounded on three sides by a mixed bog swamp forest, and an intricate water complex of meandering river, oxbows, and ponds. The area is one of the finest wildlife habitats in northern New England supporting moose, the endangered osprey, American bald eagle, and common loon.

Additional significant New Hampshire wetlands identified by New England Natural Areas Project, including other Registered Natural Landmarks, appear in Table 3.

Lake-Related Inland Freshwater Wetlands

In general, wetlands are recognized as being transitional lands between ter-

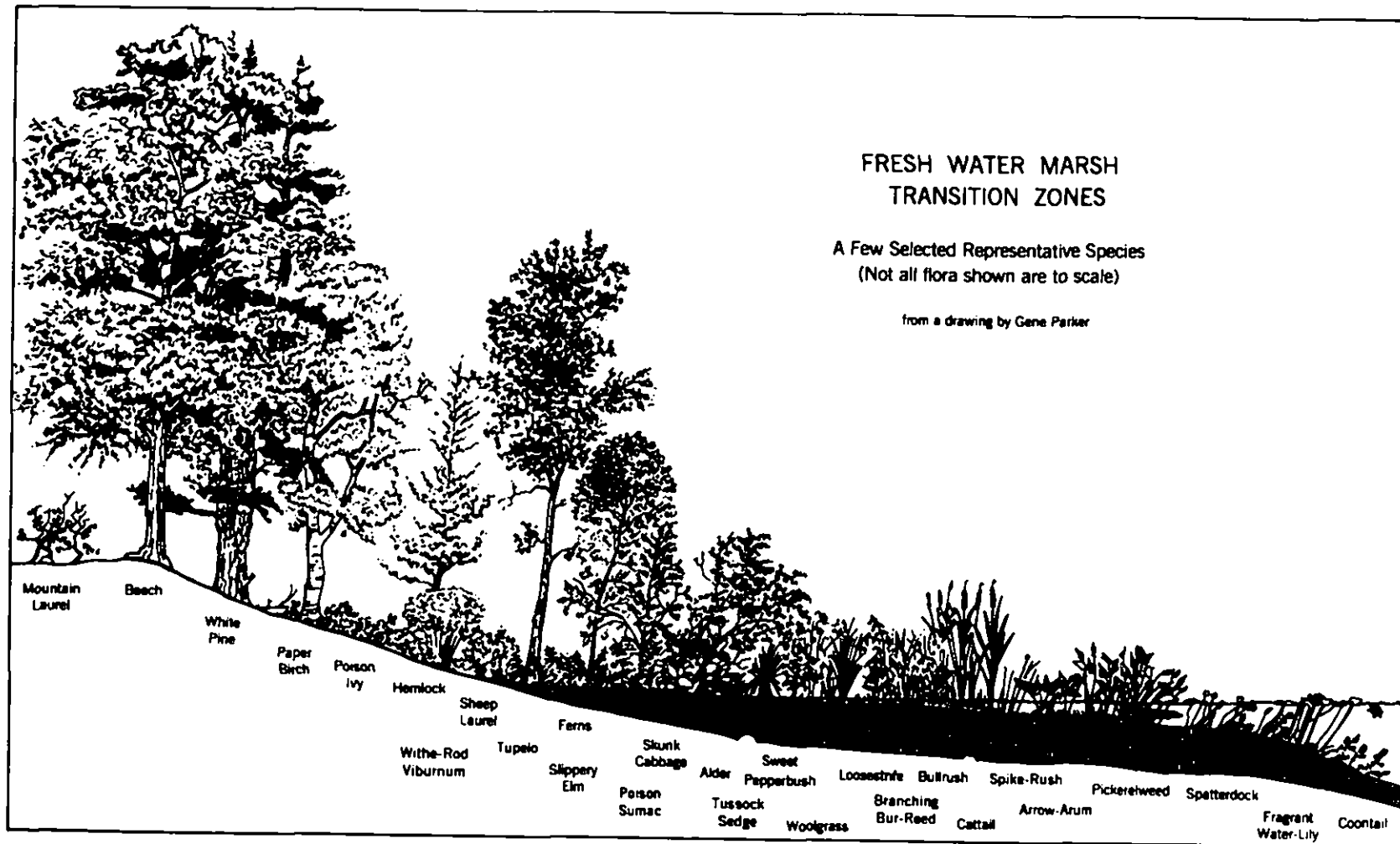
restrial and aquatic systems. The water table is usually at or near the surface or the land may be covered by shallow water. With respect to lakes and ponds, this transitional zone is limited to shorelines and to shallow waterbodies. The data available with respect to the state's great ponds (natural water bodies over 10 acres) has, up till now, concentrated on the surface area of these waterbodies. For this reason, the following discussion of lake-related wetlands focuses primarily on water surface acreage--most of which does not fall into the "transitional zone" definition of a wetland. Determining shoreline length of the state's great ponds is an approach more compatible with the "transitional zone" wetland definition. It is estimated that the total shoreline of the state's 780 great ponds is 1737.3 miles.¹⁶

According to the State Planning Project's 1964 Water Body Inventory, there are approximately 1400 standing fresh water bodies in New Hampshire. This figure includes all natural water bodies, natural water bodies controlled by dams, artificial impoundments, and the larger river impoundments. Of this total, approximately 983 water bodies are over ten acres in size¹⁷ and approximately 417 water bodies are less than ten acres in size. By statute, all of New Hampshire's natural fresh water bodies of ten acres or more are known as great ponds and are owned by the state (RSA 271).

Table 3
OTHER SIGNIFICANT INLAND FRESHWATER WETLANDS IN NEW HAMPSHIRE

Name	County	Acres	Value
Hulbert Swamp	Coos	500	Boreal swamp forest associated with a stream rather than a bog.
Black Gum Swamp	Hillsborough	5	Red maple-black gum swamp containing several gum trees of great age. (A potential Registered National Landmark)
Moose Pasture	Coos	185	Black spruce-tamarack bog containing habitat of unusual significance to bird life. (Part of 310-acre East Inlet Nature Preserve having Registered Natural Land-mark designation)
Pondicherry Wildlife Refuge	Coos	300	Pond-marsh-bog forest community containing important nest and resting areas for bird-life. (A Registered Natural Landmark)
Ossipee Lake Natural Area	Carroll	484	Classic delta marsh and one of the few remaining undisturbed beaches in the state.

Source: 1977 New Hampshire Outdoor Recreation Plan, New Hampshire Department of Resources and Economic Development and New Hampshire Office of Comprehensive Planning.



Source: New England Wetlands - Plant Identification and Protective Laws, EPA, May 1981.

In 1934, the total acreage listed for all standing fresh water bodies was 149,344.5 acres.¹⁸ In 1964, the acreage for only those bodies over ten acres was computed to be 160,971 acres--excluding acreages extending into bordering states.¹⁹ The increase may be due to the fact that US Geological Survey Maps were used as a base for measurement in 1934. In 1964, aerial photographs flown in 1963 were used to determine the size of a large number of water bodies for which the 1934 figures did not appear accurate. Several man-made impoundments which were either inadvertently omitted from the 1934 survey or had not yet been constructed were included in the 1964 total.

In size, New Hampshire's lakes and ponds range from the large Lake Winnepesaukee at 44,586 acres to the small Unnamed Pond #3 in Wentworth at .15 acres.²⁰ Lake of the Clouds, located in the Presidential Range, is the state's highest, while several ponds along the coast are only 10 feet above sea level.

Regardless of their size or elevation, lakes and ponds contribute greatly to the quality of our environment. Many of the state's lakes and ponds play an important role in regulating storm water run-off (e.g. Surry Mountain Lake, Drew Lake, Gunnerson Lake), and in providing quality water supplies (e.g. Little Masabesic, Waukewan Lake, Loon Pond). Lakes and ponds provide important wildlife and plantlife habitat. Shorelines are used for travel, banks for dens and nesting. Aquatic species such as fish, crayfish, and frogs are important food sources for mink, otter, osprey, and other aquatic feeders. Water bodies provide breeding grounds for the insects upon which songbirds and waterfowl feed. Pondweeds, burreeds, pickerelweed, and arrowhead--commonly associated with

inland fresh water ponds--rate very highly as waterfowl food in New Hampshire.²¹ Smaller pond-type waterways, 10 acres or less in area, have proven to be significant breeding areas as well as important feeding and nesting sites during migration.²² Likewise, many water bodies over 10 acres are also significant to waterfowl (Table 4).

Lake-Related Inland Freshwater Wetlands of Particular Value

As previously stated, all of New Hampshire's natural fresh water bodies ten acres or more in size are known, by statute, as great ponds. Of the approximately 780 lakes and ponds which fall into this category, 105 of them harbor endangered, threatened or rare plant and animal species.²³ Plant species are particularly susceptible to water pollution and habitat modification. Appendix C contains a listing of New Hampshire's rare wetland plants categorized by habitat type, including ponds.

Some specific examples of water bodies of particular value are as follows:

- **Lake Umbagog Region:** Located in Coos County, this region is probably the finest overall wildlife area in New Hampshire. This complex land/water ecosystem consists primarily of the dam controlled 8,000 acre Lake Umbagog which straddles New Hampshire and Maine. The entire area contains high quality fresh-water marshes and swamps, floating bogs, and an open lake--all supporting an abundance of wildlife including: moose, black bear, beaver, bobcat, fisher, rare

Table 4
PERMANENT WATER AREAS OF SIGNIFICANT VALUE
TO WATERFOWL IN NEW HAMPSHIRE

County	Inland Fresh Lakes		Inland Fresh Coves and Bays	
	No.	Acres	No.	Acres
Belknap	10	500	4	25
Carroll	26	3,065	3	65
Cheshire	34	2,180	1	75
Coos	41	2,240	2	360
Grafton	17	1,070	2	140
Hillsborough	6	300		
Merrimack	14	370		
Rockingham	10	1,265		
Strafford	11	1,560		
Sullivan	4	610		
TOTAL	173	13,160	12	665

Source: Inventory of Permanent Water Areas of Significant Value to Waterfowl in the State of New Hampshire. Boston: US Department of Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Branch of River Basins, 1958.

canada lynx and pine marten, loon and the endangered bald eagle and osprey. In April of this year, a pair of bald eagles was discovered nesting at Lake Umbagog, the first such nesting of bald eagles in New Hampshire in 40 years. In addition, this region provides nesting habitat for a variety of waterfowl species including Canada geese, ring-necked ducks, and black ducks. It is

also a significant warm water fishery, and habitat to unique lowland stands of jack pine, northern white pine and white cedar, spruce-fir and deciduous forest.²⁴

- **Lakes of the Clouds:** Located in Coos County, these two small lakes of glacial origin are on the southwest shoulder of Mount Washington. The larger, southernmost lake is one of the few truly

alpine lakes in the eastern United States and offers excellent research opportunity for alpine aquatic ecosystems. This water body is also the highest lake east of the Rocky Mountains.²⁵

- **Profile, Echo, and Lonesome Lakes:** Are located in the White Mountain's Franconia Notch--a Registered Natural Landmark. Profile Lake, a 13 acre eutrophic lake of glacial origin, derives its name from the view over it toward the "Old-Man-of-the-Mountain" profile. Echo and Lonesome Lakes are also of glacial origin.

River-Related Inland Freshwater Wetlands

With respect to rivers and streams, the transitional lands between terrestrial and aquatic systems (i.e. wetlands) are, in general, limited to river and stream shoreline. With the total length of the state's rivers and streams being approximately 12,000 linear miles, it can be estimated that the total length of river/stream shoreline is roughly 24,000 linear miles. This interface between aquatic and terrestrial environments creates a variety of habitat types along river corridors. Riparian edges, freshwater marshes, riverside seeps, and flood plains provide productive fisheries, wildlife, and plantlife habitat. Oxbow--abandoned river channels--provide additional wetland habitat.

New Hampshire's rivers and streams add approximately 32,000 acres of fresh water surface to the area of the state.²⁶ The state is drained by five major rivers: the Merrimack, Connecticut, Saco, Piscataqua, and Androscoggin. Only the

Piscataqua reaches the sea within New Hampshire's borders. Each brook, stream, and river in the state belongs to one of five major river systems that originate in a corresponding number of drainage basins. A drainage basin is a geographic entity surrounded by a height of land from which runoff is collected to feed the numerous brooks that flow together to form a river.²⁷ The five major drainage basins in the state are named after the rivers that flow out of them toward the sea (Table 5).

The following descriptions of New Hampshire's five major watersheds are taken from A Guide to the Physical Environment of New Hampshire.²⁸

Merrimack Basin: This large basin lies mostly in New Hampshire and drains the entire central region of the state. The Pemigewasset and Winnepesaukee Rivers come together in Franklin to form the Merrimack River. From Franklin, the Merrimack River then flows southward into Massachusetts. Along its 116 mile course, it drops rather uniformly at a rate of approximately three feet per mile. The last 22 miles of the river are tidal.

The Pemigewasset River, the basin's northernmost tributary, begins in Profile Lake in Franconia Notch, where it flows out of the White Mountains and continues through the hills and valleys of the New England Upland near Plymouth. Other significant rivers within this basin include the Contoocook, Warner, Blackwater, Suncook, Soucook, Souhegan, and Piscataquog Rivers.

Lake Winnepesaukee, the state's largest lake, and numerous other lakes including Newfound Lake and Squam Lakes are located in this basin. The northern reaches of this basin continue to be a forest and agricultural region.

Table 5
MAJOR WATERSHEDS IN NEW HAMPSHIRE

	% of the Total Area of NH	Square Miles
Merrimack Drainage Basin	40	3,770
Connecticut Drainage Basin	33	3,058
Saco Drainage Basin	9	862
Piscataqua Drainage Basin	9	848
Androscoggin Drainage Basin	8	743

Source: Lee, James A. Waterways of New Hampshire. Concord, NH: New Hampshire Fish and Game Department, 1956.

However, the southern portion of this basin has undergone considerable urbanization and continues to be under strong developmental pressures.

Connecticut Basin: This basin occupies a total of 11,265 square miles of which 3,059 square miles are within the state's borders. The Connecticut River originates near the Canadian border at the mouth of the Third Connecticut Lake and flows entirely within the state for its first 29 miles. The river's west bank becomes the New Hampshire-Vermont border for 238 miles. After flowing another 138 miles through Massachusetts and Connecticut, it empties into Long Island Sound.

For the first 30 miles, the headwaters of the Connecticut drop some 30 feet per mile. The river descends another 400 feet over a 30 mile stretch centered on Moore Reservoir. Below this region, the river descends more gradually--approximately 2 feet per mile. The Am-

monoosuc and Ashuelot Rivers are the Connecticut's major New Hampshire tributaries. Other rivers found in this basin include the Sugar, Mascoma, Cold, Upper Ammonoosuc, and Israel Rivers.

Saco Basin: Approximately half of the Saco watershed lies in New Hampshire, the remainder in Maine. The upper reaches of the New Hampshire section drain the eastern slope of the White Mountains. The basin then becomes a broad plain encased by mountain ridges (Mount Washington Valley). In its southwestern reaches, the watershed consists of flat, open land.

The glacially formed Saco Lake gives rise to the Saco River which, in turn, flows 124 miles to its ocean outlet in Maine. The river's first 14 miles drop at a rate of approximately 90 feet per mile; thereafter, the slope decreases to about 6 feet per mile. The Swift and the Ossipee Rivers are the Saco's two major New Hampshire tributaries.

Piscataqua Basin: Approximately 75% of this basin lies within New Hampshire's boundaries with the remaining 25% lying in Maine. The Piscataqua River is only 13 miles long, originating at the confluence of the Cocheco and Salmon Falls Rivers and terminating at Odiorne Point south of Portsmouth. Together with the Salmon Falls River, the Piscataqua forms part of the Maine-New Hampshire border. The Piscataqua River is tidal throughout its length. Nine miles from its mouth, two large tidal bays, Great and Little Bays, connect with the river to form large inland tidal pools. The Great and Little Bay estuarine system covers approximately 17 square miles of tide waters. Eight percent of the estuarine's total area (838 acres) is salt marsh. The Lamprey, Exeter, and Oyster Rivers are also located within this Basin.

Androscoggin Basin: Most of this watershed lies in Maine. The 20% of the basin which lies within New Hampshire is generally a forested region containing numerous mountains and lakes. Its headwaters are in Umbagog Lake--a lake fed by several lakes and streams in Maine. The river, 161 miles long, drops approximately 1.5 feet per mile, except for a rapid stretch near Berlin where it drops 100 feet per mile, for a distance of approximately 2.5 miles.

River-Related Inland Freshwater Wetlands of Particular Value

New Hampshire's history and economy have been heavily influenced by its rivers. The state's major rivers have long been an important resource for transportation, industry, and recreation. Up to the mid 1800's, the rivers were used for transportation, log driving, small

scale water power, water supply, fish and wildlife habitat, and recreation. With the coming of large scale industrialization, conflicts developed over the use of the state's rivers. By the close of the 19th century, the primary role of the rivers was to produce power and receive wastes. It was not until the 1960's that increased environmental awareness led to renewed attention to the other values of New Hampshire's rivers--recreation, fish habitat, and water supply.

Today, improvements in water quality together with rapid population growth have greatly increased river use conflicts. The problem lies in determining which river benefits will outweigh others. Demands for residential, commercial and industrial development, water supply, natural area protection, and recreational opportunities will have to be reconciled. The challenge will be determining which river benefits will outweigh others.

New Hampshire's rivers and lakes continue to receive much legislative and administrative attention. The Rivers and Lakes Protection Program (Chapter 190, Laws of 1986) was the start toward establishing a comprehensive policy to guide decisions affecting the state's rivers and lakes. Under Chapter 190, the Upper Merrimack River which stretches from Franklin to Concord is being studied for designation. The riparian edges, freshwater wetlands, and flood plain intervals of the Upper Merrimack are valuable habitat to migratory birds which use the Merrimack as a central flyway, and to over 135 waterfowl, shore and song birds, and raptors which make the River their home. In addition, the Upper Merrimack was nominated in 1986 by the Fish and Game Commission "as a unique and important fish and wildlife unit area deserving of protection." The 1988

Legislature passed a law creating the New Hampshire Rivers Management and Protection Program, placing it within the Department of Environmental Services. The legislation, RSA 227-F, established a process whereby New Hampshire organizations and residents may nominate any river or river segment for special designation and protection by the state legislature. Rivers or river segments which will be considered for protection under RSA 227-F include but are not limited to the following: Pemigewasset, Saco, Swift, Contoocook, Merrimack, Connecticut, Isinglass, Lamprey, Smith, Ashuelot, Nashua, Nissitissit, and Piscataquog Rivers. Any River Corridor Management Plans developed for designated rivers must address wetland and flood plain protection. More detailed descriptions of Chapter 190 and RSA 227-F are found under the "State Wetland Programs" section.

Numerous New Hampshire rivers and river segments have been identified as meeting the minimum criteria for further study and/or potential inclusion into the National Wild and Scenic Rivers System. In order to meet this criteria, a river must:²⁹

1. Be five miles or more in length
2. Be a free-flowing river or stream
3. Be generally undeveloped
4. Be adjacent to or within a related land area that possesses an outstandingly remarkable geologic, ecologic, cultural, historic, scenic, botanical, recreational or other similar value (interpreted to mean an area of multi-state or national significance)

A listing of some of New Hampshire's river and river segments meeting the above criteria appear in Table 6. This

partial listing is taken from the National Rivers Inventory: Final List of Rivers.

Tidal and Coastal Saltwater Wetlands

New Hampshire's Atlantic shoreline is 18 miles long, while its tidal coastline totals 131 miles. The state's waters, marshes, beaches, sand dunes, rocky shores, and other natural resources are important local, state, and national resources. Coastal waters are commercially and recreationally important, and provide habitat for a wide variety of fish, shellfish, birds, and plants. Salt marshes are valuable fish and wildlife habitat, are an integral part of the coastal and estuarine food chain, and serve as a "natural treatment" for runoff. New Hampshire's beaches are some of the state's primary tourist attractions. In addition, undeveloped beaches are a good first line defense against storms.

Coastal and Estuarine Waters

Tidal waters of the state include the offshore waters to the limits of territorial sea, and the Great Bay and Hampton-Seabrook estuaries and associated tributary rivers. The Great and Little Bay estuarine system (Figure 3) covers approximately 17 square miles (11,000 acres) of tide-waters making it one of the largest estuarine systems on the eastern seaboard of the United States.³⁰ It is formed by the convergence of seven rivers: the Salmon Falls, Cocheco, Bellamy, Oyster, Lamprey, Squamscott, and Winnicut with a combined watershed of approximately 930 square miles. The system has 838 acres of salt marsh or 8% of its total area.³¹ The Hampton Harbor estuarine system includes the Taylor, Hampton, and Blackwater Rivers and

Table 6
SAMPLING OF NEW HAMPSHIRE RIVERS MEETING NATIONAL
WILD AND SCENIC RIVER MINIMUM CRITERIA

River Name	County	Segment Reach Description	Length (Miles)	Narrative Description of Values
✓ Androscoggin River	Coos	Above Berlin to Pontook Reservoir	10	<i>Fish:</i> River is an historic Atlantic Salmon fishery. <i>Hydrologic:</i> One of two remaining sparsely developed free-flowing segments of a unique high order river.
✓ Androscoggin River	Coos	Above Errol to Umbagog Lake	3	<i>Fish:</i> Historic Atlantic Salmon fishery. <i>Botanic:</i> Flows from Umbagog Lake, the finest wildlife area in the state. Contains open tamarack-black spruce bog, northern bog plants, and is breeding habitat for Lincoln Sparrow.
Saco River	Carroll Coos	North Conway to headwaters	276	<i>Recreation:</i> One of the most significant white water runs in central New England.
Connecticut River	Coos Essex	North Strafford to Beecher Falls	22	<i>Hydrologic:</i> Unique sparsely developed high order river. <i>Scenic:</i> Segment possesses one of the highest ranges of view in the entire northeast.
Contoocook River	Merrimack	West Hopkinton Dam to Bennington	26	<i>Recreation:</i> Segment includes some of the most significant white water canoeing in all of New England.
Nash Stream	Coos	Confluence with Ammonoosuc River to headwaters	14	<i>Wild:</i> Corridor and surrounding watersheds are virtually undeveloped and remote. <i>Hydrologic:</i> An excellent example of an undeveloped, free-flowing low order river.

Tide Mill Creek, as well as the relatively small but well protected harbor, which remains open during the winter.

Coastal and Estuarine Waters of Particular Value

The Great Bay is a classic example of an estuarine system and represents one of the finest remaining, relatively unspoiled systems on the Atlantic coast. The diverse environments within the estuary (shallow bays, exposed mud flats, rivers, rocky islands, and tidal wetlands) provide varied habitat for many plants, fish, and wildlife.

Marine algae, seaweeds, salt grasses, and fresh water marsh grasses are the driving force behind estuarine productivity providing oxygen to the water, stabilizing the estuary bottom, and providing food and habitat for fish, shellfish, birds, and other wildlife. Rare and endangered plants are also found within the Great Bay area and include:³²

Prolific Knotweed (*Polygonum prolificum*) - found at 3 sites in New Hampshire, all in the estuary.

Eastern Lilaeopsis (*Lilaeopsis chinensis*) - found at 2 sites in New Hampshire, 1 in the estuary.

Turks-cap Lily (*Lilium superbum*) - found at only one site in New Hampshire.

Marsh Elder (*Iva frutescens*) - found at 6 sites in New Hampshire, 5 in the estuary.

Stout Bulrush (*Scirpus robustus*) - found at 4 sites in New Hampshire, all in the estuary.

Exserted Knotweed (*Polygonum exsertum*) - found at 2 sites in New Hampshire, both in the estuary.

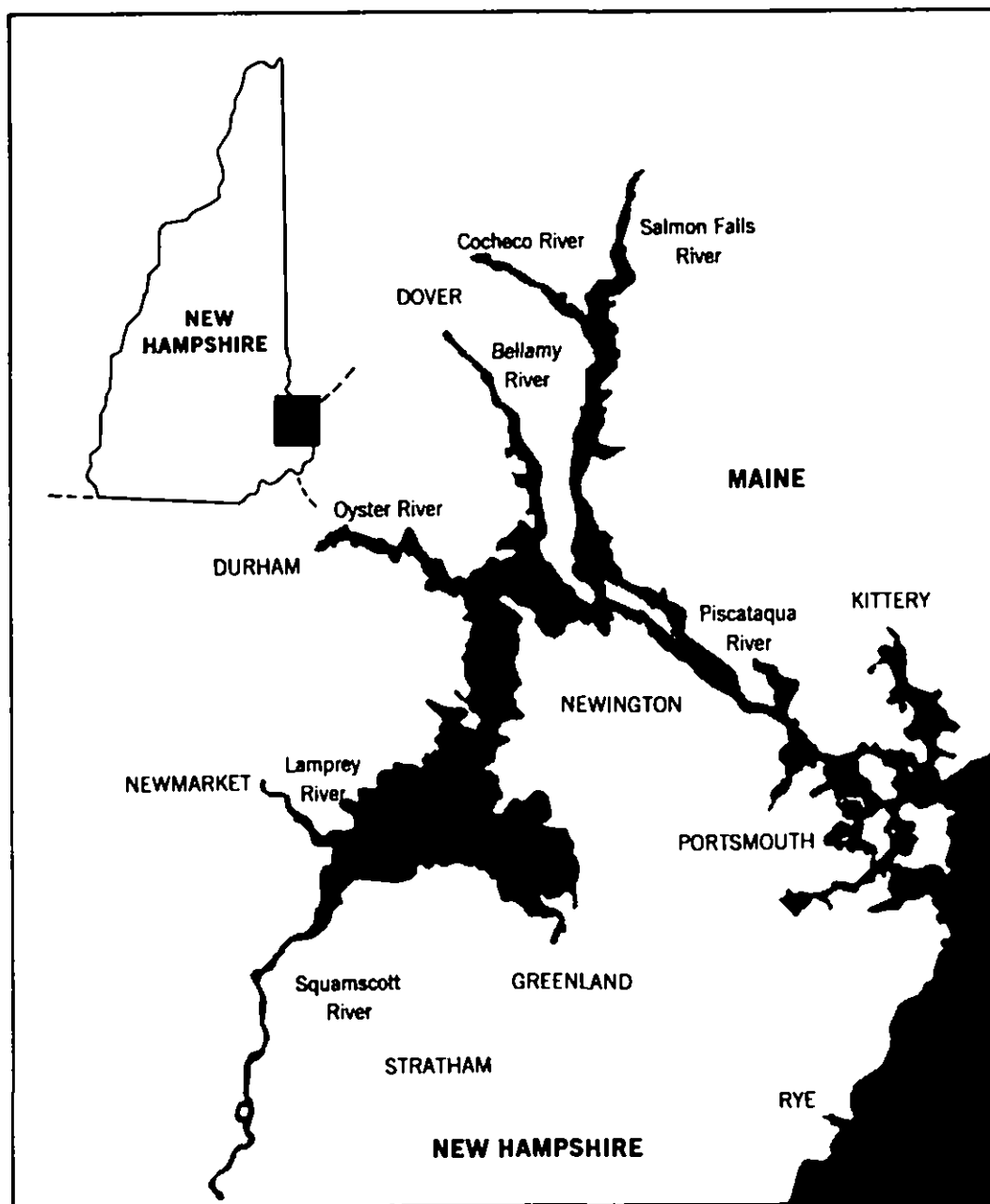
Large Salt Marsh Aster (*Aster tenuifolius*) - found at only 1 site in New Hampshire.

The estuary is also an important breeding ground for many species of finfish. An inventory of the natural resources of Great Bay, conducted by the Fish and Game Department, identified 52 different finfish species, some resident, some anadromous, and some migrant.³³

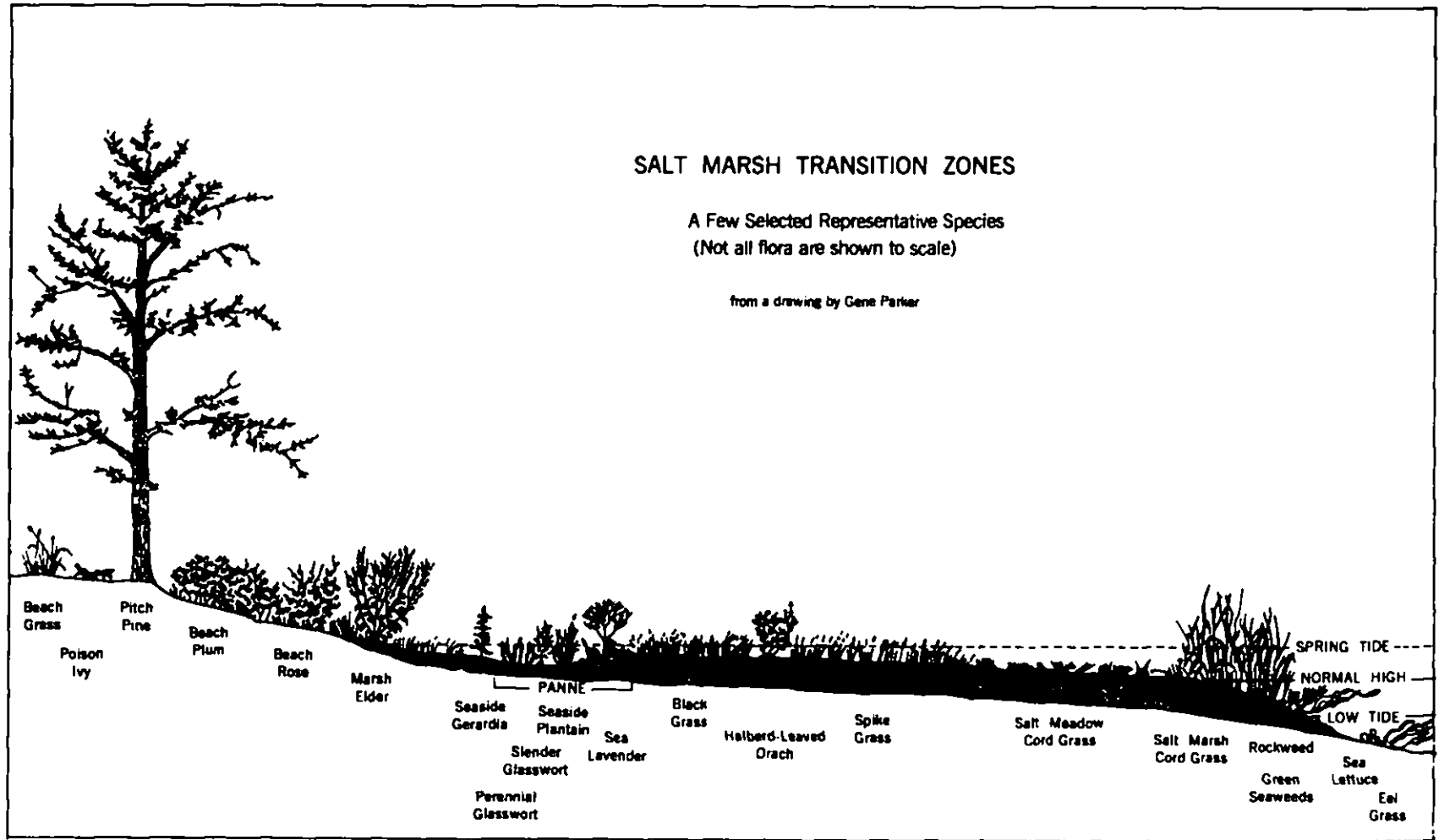
This same resource inventory sighted over 90,000 birds representing 71 different species during the two year period. Five endangered or threatened species were also sighted--the bald eagle, osprey, marsh hawk, common tern, and common loon. With respect to the bald eagle, the Great Bay estuary has a long history of winter eagle use. This estuary has accounted for 27% of all winter eagle sightings reported to the Audubon Society of New Hampshire between 1949 and 1981.³⁴ The estuary is also home to many species of mammals including: harbor seals, raccoons, white-tail deer, red fox, cotton-tail rabbits, and muskrats.

In recognition of the importance of Great Bay as a vital natural resource of national significance, the state has designated Great Bay and selected sites in the Towns of Durham, Newmarket, Newfields, Newington and Stratham as a National Estuarine Research Reserve under the National Estuarine Research Reserve Program.³⁵ More information on this national program is provided under the "Federal Wetland Programs" section.

Figure 3
GREAT BAY ESTUARY SYSTEM



Great Bay Estuary System.
Great Bay Estuary Inventory Survey,
1980-1981.



Source: New England Wetlands - Plant Identification and Protective Laws, EPA, May 1981.

Tidal Marshes

The tidal marshes of New Hampshire lie in the southeastern corner of the state and occupy an area of approximately 7,500 acres. The bulk of these marshes is found in the coastal communities of Seabrook, Hampton, Hampton Falls, North Hampton, and Rye, having formed along the seacoast in embayments protected from the direct force of the sea. The remaining tidal marshes are strung in coves and shallows along the margins of Great Bay and the complex of tidal streams and rivers flowing into it.

New Hampshire's tidal marshes are typical of what has been called the "New England type."³⁶ That is, the development of the state's marshes has been dependent upon the post-glacial submergence of the land or the concurrent rise in sea level, or both. Studies of the Hampton-Seabrook marsh peat show it to be between 2,700 and 6,800 years old.³⁷

From the European settlement of the New England coast up to the early 19th century, tidal marshes provided valuable hay and pasture land to seacoast farms. During this time, efforts were made to improve the production of marshes mainly through diking. Diking efforts were not successful in New Hampshire, however, leaving marshes essentially in their original condition.³⁸

New Hampshire's coastal marshes have experienced degradation and loss due to the altering of their hydrology. Earlier in this century, mosquito ditches were excavated to promote more drainage of standing water. Levees created by the excavated peat have created enclosed areas that are flooded in the higher spring tides and then are prevented from draining. The restriction of tidal flow and the retention of water

on high marsh surfaces are two conditions that most severely affect salt marsh viability.³⁹

According to a 1986 study of three salt marshes in North Hampton and Rye, clogged and slow running channels resulting in inadequate flushing of the marshes were a major problem.⁴⁰ The study found that development projects abutting the salt marshes were affecting the amount and quality of water entering the marshes, increasing roadway run-off into the marshes, and in some instances clogging and narrowing marsh channels. With the rapid development of New Hampshire's coastal communities, pressures on tidal wetlands in the state will undoubtedly continue.

Tidal Marshes of Particular Value

As discussed above, the salt marshes of Great Bay, approximately 838 acres, are a vital resource. They act as a natural secondary treatment plant and are critical to the estuarine food chain. They absorb wave and storm action and are habitat to many plant and animal species. According to NH Fish and Game assessments, the monetary value of this resource is estimated at \$68 million per year.⁴¹

The tidal marshes of the Hampton River Estuary are also vital. Salt marshes found in the Towns of North Hampton, Hampton, Hampton Falls, Seabrook, and Rye make up the largest expanse of salt marsh in the State. All contain plant and animal communities of unusual diversity and productivity. Of particular interest is the 160-acre Seabrook Salt Marsh which borders the last, unspoiled dunes in the state.

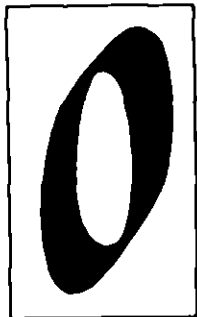
Beaches, Rocky Shores, and Sand Dunes

New Hampshire has 10.2 miles of Atlantic beachfront. All wet sand beach is owned by the state and open to the public as recreation areas.⁴² Great Boars Head and Odiome Point are the state's two largest rocky shore outcroppings. Many smaller outcroppings also exist within Great Bay, at the upper part of the tidally influenced section of the Bellamy River, and the Piscataqua River along the Portsmouth/Newington line. Most of these areas are as yet undeveloped. These rocky shores serve as storm protection for the land forms behind them, and are considered high in aesthetic value.⁴³

Sand Dunes are rare in New Hampshire. Only three sand dune areas remain on the seacoast: the state owned and managed Hampton Beach State Park dunes and the town owned Seabrook fore-dunes and back-dunes. In 1985, state legislation was enacted prohibiting any alteration of sand dunes including the removal of vegetation and use of off-highway vehicles. Subsequent to these actions, the Town of Seabrook purchased the 53 acres of back dunes.⁴⁴ These dunes represented the last unspoiled dune formation in the state and are habitat for a number of rare and endangered plant species.

Wetland Protection

Federal Wetland Programs



ver the years, federal programs and policies have had both positive and negative effects on this country's wetland resources. For almost 200 years the federal government provided encouragement and, at times, strong financial inducement to projects involving wetland destruction. Under the Agricultural Conservation Program--a cost sharing and technical assistance program for wetland drainage--approximately 57 million acres of wet farmlands and some wetlands were drained.⁴⁵ Today, the federal government plays a leading role in wetland protection through various policies and programs.

Federal Policy

Executive Orders 11988 and 11990

Both orders were issued in May 1977 by President Carter. Executive Order 11988 requires each federal agency to avoid direct or indirect support of floodplain development wherever there is a practical alternative. Executive Order 11990 requires all federal agencies to minimize the destruction, degradation or loss of wetlands. More specifically,

agencies are directed to avoid assisting or undertaking new construction in wetlands unless no practical alternative is available. Proposed actions must contain measures to minimize harm to wetlands.

Regulatory Programs

Rivers and Harbors Act of 1899

Section 9 of this statute forbids the construction of dams or dikes across any navigable waters of the United States unless approval is granted by the Army Corps of Engineers. Under Section 10, a permit from the Corps is also required for any construction involving dredging, filling, or obstruction of navigable waters.

Clean Water Act - Section 404

The 404 permit program, enacted as part of the 1972 Federal Water Pollution Control Act and amended during reauthorization of the Clean Water Act of 1977, regulates the discharge of dredge or fill material into the "waters of the United States," including wetlands.

The Environmental Protection Agency (EPA) and the Army Corps of Engineers share program responsibilities under Section 404. The Corps administers the program on a day-to-day basis and issues, denies, or modifies permits. EPA writes and interprets the 404(b)(1) Guidelines, the regulations

which the Corps must apply in their evaluation of permit applications. Moreover, EPA has authority under Section 404(c) to "veto" Corps issued permits based on a determination or "unacceptable adverse impact." Congress also assigned EPA the responsibility for delegating the program to qualified states in accordance with the Agency's State Program Regulations. EPA and the Corps have parallel authority to enforce against unauthorized discharges and violators of permit conditions. As a matter of practice, the Corps takes the lead in taking action against permit violators while EPA focuses its limited resources on significant unpermitted discharges.

The three categories of permits that the Corps may issue for the placement of dredged or fill material in waters of the United States are as follows:⁴⁶

Nationwide Permits - Issued by Corps for discharges into minor waterways and for certain types of activities in all waters of the United States. In New England, projects in headwater areas and isolated wetlands are permitted by nationwide authorization. No written notification or authorization is required for activities under nationwide permit.

General Permits - Issued by Corps for certain types of activities in specific, relatively small geographic areas within their jurisdiction. The activities must cause only minimal environmental harm, both individually and cumulatively. Authorization for activities under general permit consists of a "letter of authorization" from the appropriate Corps Office.

Individual Permit - Issued by Corps for projects that do not qualify for a general or nationwide permit. Application for a 404 permit must be

submitted to the appropriate Corps Office. After a completed application is received, a public notice is issued which grants 30 days for comments from the public and review agencies (both state and federal). After comments are received, a decision is made.

The activities over which the Corps has jurisdiction are the same as those over which the New Hampshire Wetlands Board has jurisdiction under RSA 483-A (refer to "State Wetlands Program" section for detailed discussion of Wetlands Board responsibilities). RSA 483-A allows no exceptions; any activity/project in or on coastal or inland wetlands of the state must receive an individual permit from the NH Wetlands Board. On the other hand, federal law exempts certain activities and regulates only the placing of fill in waters of the US under Section 404. In addition the Corps, through its Nationwide and General Permits, allows certain negligible impact projects to proceed without a federal Individual Permit.

One of the problems that developers and conservation commissions have with this federal permit system is the uncertainty concerning which projects need a federal Individual Permit. Some New Hampshire projects that have proceeded without an Individual Permit have been stopped, with fines and restoration ordered.⁴⁷

To address the inconsistency between the federal and state permitting processes, and the confusion over when a federal Individual Permit is needed, the Corps has proposed issuing two new permits: a NH General Permit and a General Permit/General Denial for Federal Aid Highway Projects. The proposed NH General Permit would be for projects in

New Hampshire that are classified as "minor" and "minimum impact" by the NH Wetlands Board. Provided they complied with the Conditions of the NH General Permit, these projects would be exempt from the need to obtain federal Individual Permits unless an applicant was notified of such a need within 21 days of approval of their NH Wetlands Board permit. For projects classified as "major" by the NH Wetlands Board, "discretionary authority to require an Individual Permit may be invoked by the NH Corps of Engineers at any time." Therefore, if a NH General Permit were to be issued, a federal Individual Permit could still be required for projects classified as "minor" or "minimum impact" by the NH Wetlands Board. However, notification of this requirement would occur sooner than at present.⁴⁸

The proposed General Permit/General Denial for Federal Aid Highway Projects would require that the state Federal Highway Administration submit the data required to obtain a Corps permit as part of the National Environmental Policy Act (NEPA) documentation. The environmental information and any proposed mitigation would be developed during the preliminary engineering design stage, rather than in the final design stage. At this point, the Corps would issue a General Permit or General Denial for the proposed project.⁴⁹

It should also be noted that the EPA has begun a national effort to identify priority wetlands and waterbodies across the country. In 1985, Region I of EPA developed a listing of Priority Wetlands in New England. This listing, updated in 1986, identifies wetlands and other aquatic resources in New England which EPA considers to be of high quality or which are vulnerable to environmental degradation. This list (Table 7) is not a

comprehensive inventory or ranking system, but serves as a basis for choosing areas that merit additional protection via the EPA's "Advanced Identification of Sites" process or its use of veto authority over the Corps.

Federal Assistance Programs - Technical

US Fish and Wildlife Service (USFWS)

Under authority of the Fish and Wildlife Coordination Act, the USFWS assesses the impacts on fish and wildlife of all water and related land resource development projects which are federally funded or are constructed under a federal permit or license, and provides reports to federal construction or regulatory agencies and to permit applicants. The USFWS reviews permit applications to encourage avoidance of adverse impacts on fish and wildlife and their habitat, particularly in wetland areas.

The USFWS also spearheads the National Wetlands Inventory Project. The aim of this project is to generate and disseminate scientific information on the characteristics and extent of the nation's wetlands. In addition, the USFWS Region Office in Concord is currently developing State Concept Plans as part of the National Wetland Priority Conservation Plan. This listing of wetlands will be used to determine USFWS acquisition priorities.

US Department of Agriculture (USDA)

Between 1942 and 1980, almost 57 million acres of wet farmland, including some wetlands, were drained under the USDA's Agricultural Conservation Program. A major policy shift concerning

Table 7

**EPA REGION I LISTING OF PRIORITY WETLANDS IN
NEW HAMPSHIRE (INCLUDES WATERBODIES)****GENERAL LISTING**

1. **Tidal Wetlands in Hampton, Rye and North Hampton**
Highly productive areas; provide important fish and wildlife habitat.
2. **Wetlands and Waterbodies of Southeast New Hampshire**
Important to fish and wildlife, flood control, water quality maintenance, and recreation.
3. **Wetlands Identified as Important on State Breeding Bird Censuses**
This site-specific information is not yet available.

SPECIFIC LISTING

1. Copsps Pond and Copsps Pond Marsh - Tuftonboro
2. North Mill Pond - Portsmouth
3. Great Bay, Little Bay Estuaries
4. Lake Umbagog - Errol
5. Lake Winnepesaukee Area Wetlands
6. Sugar River (Including Adjacent Wetlands and Their Direct Tributaries)
7. Exeter River
8. Merrimack River (From Lowell, MA to Franklin, NH Including Adjacent Wetlands and Direct Tributaries)
9. Connecticut River (Including the River Proper and Special Aquatic Sites within the Floodplain)
10. Lamprey River
11. Piscataqua River

Source: EPA, Region I, September 1987.

the use of wetlands for agriculture began with a wetland memorandum from the USDA's Soil Conservation Service (SCS) in 1975. The "Conservation Planning Memorandum" stated that in regard to 18 of the 20 types of wetlands described in the 1954 Fish and Wildlife Service Survey, the SCS would no longer provide technical and financial assistance for draining and otherwise altering these wetlands.⁵⁰ More recently, the passage of the Food Security Act of 1985 (Farm Bill) has provided new avenues to deal with wetland loss problems. Under the "Swampbuster" provision of this bill, any person who produces an agricultural commodity on wetlands converted to such agricultural production after December 23, 1985, becomes ineligible for most agricultural subsidies. A second major provision of the Farm Bill that indirectly benefits wetlands is the Conservation Reserve Program. Under this program, approximately 45 million acres of predominantly highly erodible croplands (many of which contain interspersed wetlands) are to be placed in a not-less-than-10-year set-aside status. Once in the program, an annual payment is made to the landowner and 50% Federal cost-sharing of vegetative cover establishment is provided.⁵¹ In the Northeast United States, an estimated 200,000 acres of farmed wetlands are now eligible for protection under the Program.⁵²

The USDA and SCS provide technical assistance in several aspects of resource conservation. In New Hampshire, the SCS provides technical assistance to individual land owners and municipal governments through ten County Conservation Districts. The SCS staff have been very helpful in training people in wetland identification and inventorying techniques for prime wetland designation

purposes. The Town of Derry utilized SCS soil and wildlife specialists to train its prime wetlands study volunteers.

Army Corps of Engineers

In addition to its regulatory functions under the Rivers and Harbors Act of 1899 and the Clean Water Act--Section 404, the Corps provides floodplain management technical services to states and localities. The program includes non-structural approaches to controlling flood loss and, therefore, may be important to wetlands protection and management.⁵³

Federal Assistance Programs - Financial

Subsidised Flood Insurance

Established by the National Flood Insurance Act of 1968, the National Flood Insurance Program (NFIP) is part of a comprehensive approach to reduce flood damage and to cope with the disastrous effects of floods. The program emphasizes the importance of managing floodplains in order to reduce flood hazards and the ever rising cost of flood damage.

All flood-prone communities within United States' jurisdiction can participate in the NFIP. As of July 1989, 224 of New Hampshire's 234 communities had been identified by the federal government as having flood-prone areas within their boundaries. Of the 224, 59 had flood hazards identified, 25 were in the emergency program, and 140 were in the regular program.⁵⁴ To come under the program, state and local governments must establish land use controls over floodplain development by zoning, subdivision regulations, building codes, or other means.

Federal Income Tax Incentives

The federal tax law contains certain provisions which make charitable gifts of land financially attractive. A landowner owning a unique natural area of wetland may give all or certain partial interests in the land to a qualified charitable organization or government entity. Subject to certain limits, such a land gift can be deducted from federal income taxes. In most cases, the amount of the deduction is determined by the current appraised value of the gift. For a qualified easement, the value of the gift is the difference in the property's value before and after the easement is conveyed.⁵⁵

Grants-in-Aid

Pittman-Robertson Funds

The Federal Aid to Wildlife Restoration Act, often referred to as the Pittman-Robertson Act, provides funds for wildlife habitat acquisition. Grants are administered by the Fish and Wildlife Service and the grant's funding source comes from the excise tax on ammunition and firearms sales.

Over the past five years, the amount of Pittman-Robertson funds allotted to New Hampshire's Fish and Game Department has varied from \$466,450 to \$637,343 per year. Most of this money is used for existing wildlife management projects. A very small portion of these funds are in fact available for use in land acquisition. When available they are used as follows: 25% state match and 75% Pittman-Robertson match.⁵⁶

Dingell-Johnson Funds

The Federal Aid in Fish Restoration Act, commonly referred to as the Dingell-Johnson Act, provides funding for the acquisition of fish habitat, and fish res-

toration and management projects. The amount of Dingell-Johnson funds budgeted by the Department over the past five years has varied from \$313,800 to \$1,401,007 per year. Most of these funds are used for existing fisheries research and management projects. As with Pittman-Robertson, a very small portion of these funds are available for land acquisition. When available they are used as follows: 25% state match, and 75% Dingell-Johnson match.⁵⁷

Land and Water Conservation Fund (LWCF) Act of 1965

The LWCF program provides matching grants to states, and through the states to local governments, for the acquisition and development of public outdoor recreation areas and facilities. Administered by the National Park Service, LWCF assistance may be used to acquire lands and waters or interests in lands and waters for public outdoor recreation, and development of basic outdoor recreation facilities for the general public. More recently, the Emergency Wetlands Resources Act of 1986 amends the LWCF Act by specifically authorizing state and federal wetlands acquisition with LWCF monies.

In order to qualify for continued participation in the LWCF program, the State's Comprehensive Outdoor Recreation Plan (SCORP) must first receive National Park Service approval. New Hampshire Outdoors 1988 - 1993 is the state's most current SCORP. Of utmost importance in administering the LWCF grants program is the Open Project Selection Process (OPSP)--a procedure which ensures public involvement and an equitable, competitive selection process. Under the OPSP, LWCF grant applications are reviewed and rated according to specific selection criteria. A separate

question in the state OPSP selection criteria is asked specifically to rate projects which help protect critical natural resources such as wetlands. Most wetland related projects have scored very well in the OPSP evaluation. Of the approximately 525 LWCF projects funded to date, 20 involved significant wetland acreages and more than 100 projects involved wetland areas or were physically located on open bodies of water.

Coastal Zone Management Act (CZMA)

Administered by the National Oceanic and Atmospheric Administration's Office of Coastal Zone Management, this federal grant-in-aid program provides assistance and encouragement to coastal states (and US territories) to voluntarily develop and implement management programs for their coastal areas. Financial assistance grants are available for program development and program implementation.⁵⁸

The New Hampshire Coastal Program relies exclusively on existing state laws and policies. The purpose of the program is to improve the administration of existing state laws in order to provide for the optimal use of New Hampshire's coastal resources. While many state agencies have been operating within the coast, this program is the first to coordinate activities among agencies. The Office of State Planning receives and distributes coastal program funds and coordinates all local, state, and federal involvement in the program. Among other things, these funds are used to pay for the staffing of 2 Wetlands Board inspectors for 17 Coastal Program communities.⁵⁹

The CZMA, under the National Estuarine Research Reserve Program, also provides federal matching grants to

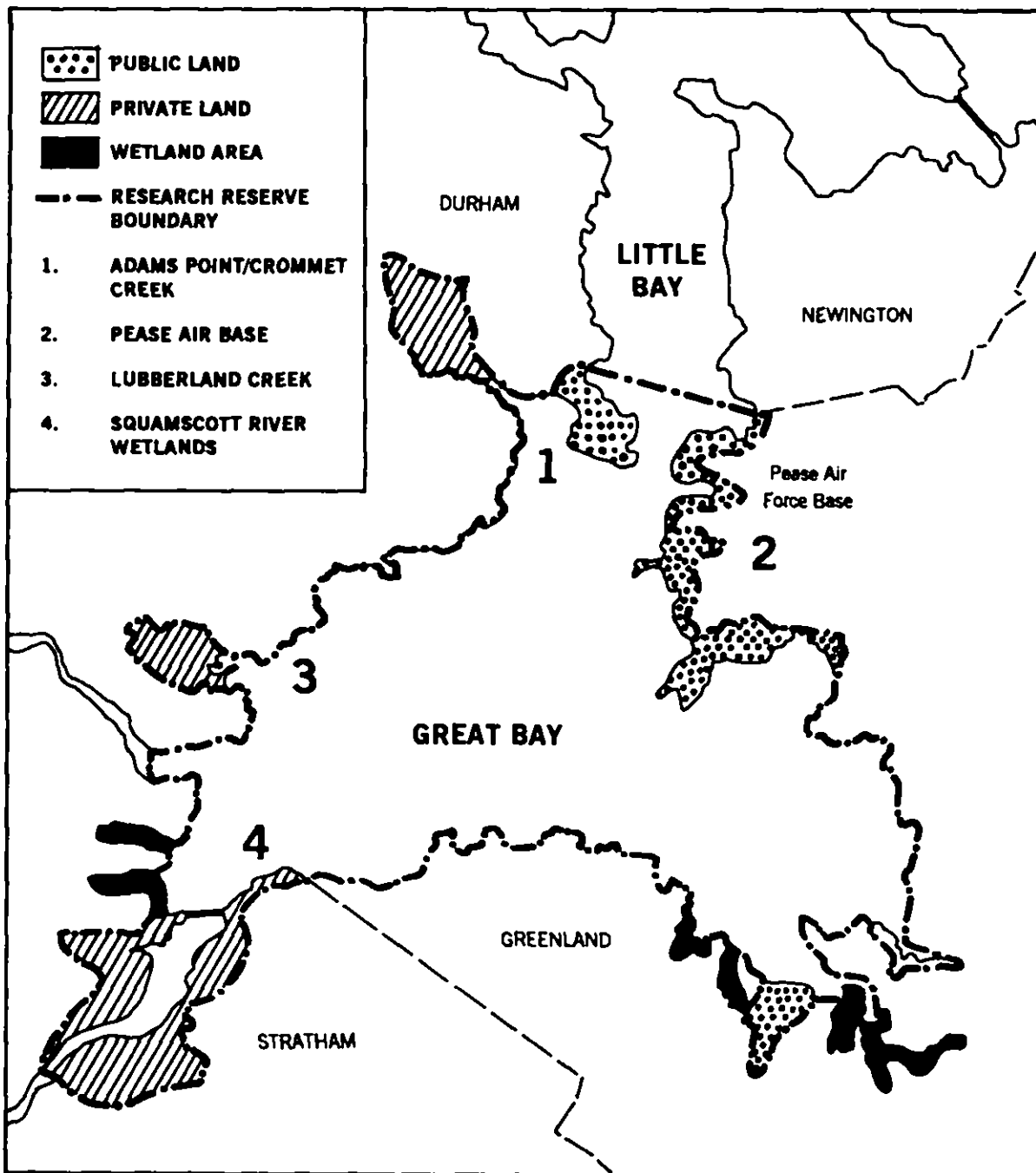
states for developing and managing a national system of estuarine reserves which are representative of the various regions and estuarine types in the United States. The State of New Hampshire has designated Great Bay and selected sites in the Towns of Durham, Newmarket, Newfields, Stratham, and Newington as a National Estuarine Research Reserve. The Great Bay National Estuarine Research Reserve (Figure 4) will include approximately 4,471 acres of tidal water, 800 acres of key upland areas, 502 acres of tidal wetlands, and 456 acres of freshwater wetlands.⁶⁰ Federal funds, accompanied by the required 50% match by the state, will be used for the following: acquisition of privately owned lands via conservation easements of identified key land and water area sites within the proposed boundary for Great Bay; construction and development of a visitor's center at Hilton Park and related interpretive/educational programs and activities within the proposed boundary; and the final preparation of a management plan for the Great Bay National Estuarine Research Reserve.⁶¹

To date, there are 17 established Reserves representing 14 different states and Puerto Rico. The Great Bay Reserve is the 18th reserve under the Reserve Program.

State Wetland Programs

The first attempt by the state to regulate wetlands dates back to 1955 when the legislature made it illegal to create land by filling in great ponds (natural fresh water bodies of 10 acres or more) without permission of the Governor and Council (RSA 482:41-a to d). This legislation dealt with public inland waters, not wetlands as such.

Figure 4
GREAT BAY NATIONAL ESTUARINE RESEARCH RESERVE
KEY LAND AND WATER AREAS



Source: Great Bay National Estuarine Research Reserve Management Plan, 1989.

In 1965, an act regulating sewage disposal systems on islands provided that no marshes bordering on or adjacent to a great pond could be filled in without prior approval of the sewage disposal system in accordance with municipal zoning ordinances or, in the absence of such ordinances, the Water Supply and Pollution Control Commission (RSA 149-C:4). Under this act, pollution prevention was the main goal--not wetland preservation.

New Hampshire's first full-fledged wetland regulations came into existence in 1967 in the form of three dredge and fill laws.

(RSA 488-A) prohibited any person, firm, or corporation from excavating or dredging any bank, flat, marsh, swamp, or lake bed that lies below the natural mean high water mark of any fresh public waters of the state without petitioning the Water Resources Board.

(RSA 482:41-e to i) replaced the original 1955 law regarding placing fill in great ponds without permission of the Governor and Council.

(RSA 483-A) prohibited persons from excavating, removing, filling, or dredging any bank, flat, marsh, or swamp in and adjacent to tidal waters without approval of the New Hampshire Port Authority.

These laws have been reviewed and revised during subsequent sessions of the legislature. Over time, RSA 483-A has become the most important law protecting New Hampshire wetlands.

Direct State Regulatory Measures

Fill and Dredge in Wetlands (RSA 483-A)

Gives the state direct authority over both coastal and inland wetlands. The state's lead agency, the New Hampshire Wetlands Board, is authorized to promulgate rules and to issue permits for activities that excavate, remove, fill, dredge, or construct any structure in or on any bank, upland area, flat, marsh, bog or swamp as well as in any surface fresh or tidal waters within or bordering the state. The statute also defines the limits of the Wetlands Board's jurisdiction over tidal wetlands and gives the Board jurisdiction over all sand dunes in the Town of Seabrook.⁶² Violations of the law can result in both Wetlands Board imposed administrative fines and Court levied civil penalties. The Board consists of the Commissioners of a number of state agencies, as well as persons representing municipalities, soil and water conservation districts, and local conservation commissions.

During the 1989 Legislative Session, RSA 483-A was amended in several ways. Chapter 99 gave the Wetlands Board authority to issue emergency cessation orders and administrative restoration/removal orders. Chapter 225 extended Wetlands Board jurisdiction adjacent to tidal areas to include everything within 100 feet of the highest observable tide line. It also amended RSA 483-A in various other ways including increasing civil penalties for wetlands violations from a \$5,000 maximum to \$10,000 per day of continued violation, and making violators liable for the "removal of any fill, spoil or structure placed pursuant to such a violation and the restoration of any wetlands disturbed in connection with the violation."

Table 8
WETLANDS BOARD ACTIONS 1988

CATEGORY	APPROVE	DENY	PENDING	TOTAL
Applications				
Major Projects				
Waive Public Hearing	107			107
Public Hearing Held	55	43	8	106
Denied Without Hearing		40		40
Minor Projects				
Public Hearing Held	15	6		21
Without Hearing	970	344	65	1,379
Minimum Impact Projects	711			711
Reaction				
Public Hearing	24	14	4	42
Other	222	111		333
Time Extension	129	6		135
Name Change	34			34
Fine Actions				
Fines Considered				226
Fine Hearings Held				80
Removal Actions Initiated				155
Approvals Sent to Governor & Council				18
TOTAL	2,267	564	77	3,387

Source: "Report of the Wetlands Review Committee." February, 1989.

The Wetlands Bureau, within the Department of Environmental Services' Water Resources Division, is principally responsible for providing administrative support to the New Hampshire Wetlands Board. This support includes but is not limited to: application review; permit tracking; field investigation of proposed projects and reported violations; preparation of weekly agenda and staff recommendations; development of permits, fine consideration and removal action notices/orders; and development of enforcement actions through the Attorney General's Office. The Bureau also represents the Wetlands Board before Governor and Council, during the rule making process, on proposed legislation, and in court.⁶³

The review of applications, response to reports of violations, and field investigations are handled by technical staff located at the Bureau's Concord and Portsmouth offices. Two Coastal Wetlands Inspectors are federally funded through the New Hampshire Coastal Zone Program, resulting in their operations being limited to the towns within the Coastal Zone Management area. These coastal communities produced 7% (202) of the new files (applications and violations) created during 1988. The rest of the state, with 93% (2,666 files) of the permitting and enforcement activity, is the responsibility of five inland wetland inspectors (two permanent and three temporary).⁶⁴

During the last five years, the number of new files (applications and violations) opened and processed has climbed at an average rate of 26% per year for an overall increase of 146%, while staffing has remained at the 1984 level. During just the last two calendar years, the annual number of public hearings held by the Wetlands Board increased from 88 to 249

(264 for FY 1988), and the frequency of Board meetings increased from biweekly to weekly. Many of the additional hearings held during the last two years concerned administrative fines being considered by the Board. Table 8 shows the actual Board actions taken during calendar year 1988. Of the 3,387 actions taken, 2,364 were first-time applications. Eleven percent (253) of those first-time applications were for major projects, 59% (1,149) minor projects, and 30% (711) were minimum impact projects.⁶⁵

Prime Wetlands (RSA 483-A:7)

The designation of prime wetlands involves the local adoption of something resembling a zoning overlay district but places the authority to regulate certain activities within that district in the hands of a state body, the New Hampshire Wetlands Board. By statute, a municipality (through its Conservation Commission) choosing to designate prime wetlands is required to base its designation and mapping upon the criteria established by the Wetlands Board.⁶⁶

The process used to select prime wetlands involves inventorying and evaluating wetlands (using criteria provided under Chapter 700, Rules of the Wetlands Board), and selecting those wetlands worthy of prime wetland designation. The designation proposal submitted to the Wetlands Board must carefully follow the criteria, report, and map format established by the Board.

The effects of local designation of prime wetlands include:

- The identification of those wetlands of greatest importance to the municipality which are deemed worthy of extra protection due to their size, unspoiled character, uniqueness, fragility

Table 9

**MUNICIPALITIES WITH OFFICIALLY DESIGNATED
PRIME WETLANDS AS OF JULY 1989**

Town	No. of Wetlands	Approximate Total Acreage
Weare	2	350
Exeter	5	975
Gilford	18	379
Meredith	7	859
Sandwich	8	861
New London	3	130
Wolfeboro	6	462
Tamworth	8	487
Derry	29	1,015
Holderness	18	272
Pelham	7	344
Sanbornton	12	249
Salem	25	1,250
State Total	148	7,633

Source: New Hampshire Wetlands Board

and/or other special characteristics.

- The notification to owners, potential developers, and the New Hampshire Wetlands Board that the municipality feels strongly that those wetlands designated as "prime wetlands" should remain in their natural state.
- The assurance that applications for dredge and fill permits in prime wetlands will receive special consideration from the Wetlands Board (provided that the Conservation Commission notifies the Board that the permit application is for a proposed project in a prime wetland).

For towns which have officially designated prime wetlands (Table 9) the approaches taken and costs involved in adopting prime wetland designation have varied. The prime motivation for initiating the designation process has been protecting wetlands from encroaching development. The needed wetland studies under the provisions of RSA 483-A:7 are extensive. However, conducting the studies and obtaining the data need not be a difficult or costly task. A creative approach to conducting a prime wetland study can yield solid information at a minimal cost. The towns of Sandwich and Derry exemplify two different but effective approaches.

The Sandwich Conservation Commission began its prime wetlands study in March 1983. Over 40 Sandwich town citizens, summer residents, and organizations raised over \$4,500 to finance the study. The study utilized one consultant and a Wetlands Evaluation Team (WET Team) composed of 25 volunteers. WET Team members did extensive public education work, attending meetings and publishing numerous writings to inform the public about the project. WET Team members--under consultant training and supervision--developed field survey forms, journal entry plans, and methods for mapping, photographing, and observing the wetlands. The final report and final drafts of the prime wetlands maps were produced by the consultant, incorporating WET Team collected data and suggestions.⁶⁷

As a result of the prime wetlands study, maps which accurately delineate the location or edge of wetlands are now available. This information makes it easier for the Town of Sandwich to require specified setbacks, to enforce its wetlands ordinance, and to advise the Wetlands Board on any applications for dredge and fill permits.⁶⁸

The Derry Conservation Commission, regularly finding itself in a crisis management situation regarding wetlands, initiated a prime wetlands study of the town. Their successful public awareness campaign attracted 30+ talented volunteers, including some with backgrounds in botany, hydrology, and photography. Utilizing Soil Conservation Service (SCS) maps and US Fish and Wildlife National Wetlands Inventory (NWI) maps, 87 wetlands were located and classified by type. Volunteer team members, trained by SCS soil and wildlife specialists, performed the needed fieldwork and data collection. In one summer, fieldwork was completed

on 70 of the 87 wetlands. Eventually, the Derry study concluded that 29 wetlands (out of the original 87) merited prime wetland designation.⁶⁹

By relying on volunteers, by using existing soil and wetland maps, and by using available services of the Soil Conservation Service and Rockingham Regional Planning Commission, the cost of Derry's prime wetland study totaled \$500, \$200 of which was spent on mylar for maps. The 29 wetlands in Derry receiving prime wetland status have added protection, since it is now up to the dredge and fill permit applicant to prove that the intended project will have no negative effects on a prime wetland. Two applications for dredge and fill in Derry have already been denied by the Wetlands Board due to prime wetland considerations.⁷⁰ Most recently (January 5, 1988), Derry successfully passed a wetlands ordinance establishing a 150 foot buffer zone around each of its 29 officially designated prime wetlands. In the outer-most 75% of the buffer, some activities may be allowed by special exception.

Indirect State Regulatory Measures

Dredging (RSA 149:8-a)

Requires a permit from the Water Supply and Pollution Control Division (WSPCD) "to dredge, excavate, place, fill, mine, transport forest products or undertake construction in or on the border of the surface waters of the state." A permit is also required from the WSPCD for projects which significantly alter the characteristic of the terrain in such a manner as to impede the natural runoff or create an unnatural runoff. The WSPCD has authority to establish the terms and conditions under which a

project must be carried out but cannot prohibit a project.

**Wildlife Emblems;
Wildlife Protection Fund
(RSA 206:41)**

States that the Fish and Game Commission may authorize the executive director of said department to print and to sell wildlife emblems (e.g. wildlife stamps, decals, buttons, medallions, etc). This law also authorizes the establishment of an account within the Fish and Game Department--known as the Wildlife Protection Account--where all revenues received from the sale of wildlife emblems are deposited. Disbursements from the Wildlife Protection Account are used to defray the expenses of producing and selling wildlife emblems and to fund wildlife habitat protection, restoration, and enhancement programs.

**Waterfowl Conservation
Program (RSA 214:1-d)**

The State Migratory Waterfowl Stamp and Print Law requires persons who intend to hunt, shoot, pursue, kill, or take migratory waterfowl (ducks, mergansers, coots, geese, and brant) to first procure a state migratory waterfowl stamp--in addition to obtaining the applicable hunting license and the federal duck stamp. This statute also authorizes the state treasurer to establish a Waterfowl Conservation Account, within the Fish and Game Fund, where proceeds from the sale of state migratory waterfowl stamps are credited. The law allows the acceptance of donations into the Waterfowl Conservation Account from sources other than stamp sale proceeds, and provides for the reproduction, sale, licensing, and other disposal of art created for the stamp on condition that

all money derived from the art be added to the Account.

Funds from the Waterfowl Conservation Account are used for the following purposes:

1. The development, management, preservation, conservation, restoration, acquisition, and maintenance of migratory waterfowl habitat--including the development of state wetlands, shores, and designated waterfowl management marshes for maximum migratory waterfowl production, access to such areas, and acquisition of necessary barriers.
2. The protection, conservation, and propagation of migratory waterfowl.
3. Up to 25% of the prior year's gross waterfowl receipts can be expended for the promotion of the state migratory waterfowl stamp and print.

Since the Waterfowl Conservation Program began in 1983 (within the New Hampshire Fish and Game Department), some 65,000 stamps and 7,100 prints have been sold generating more than \$565,000 for waterfowl projects.⁷¹ These funds are placed in the nonlapsing Waterfowl Conservation Account and yearly unspent revenues are allowed to build from year to year, with interest. Program funds can cover 100% of acquisition costs or be used as a 25% match to Pittman-Robertson/Dingell-Johnson funds.

The primary objectives of the Waterfowl Conservation Program are to acquire wetlands at established Fish and Game Waterfowl Management Areas and

to investigate additional marshlands throughout the state for their acquisition potential. Up till now, program emphasis has been on acquiring wetlands and protective upland buffer zones at established Management Areas. To date, waterfowl conservation funds have helped purchase 13 wetlands totaling 309 acres. In the beginning, work concentrated on the Department's Waterfowl Management Area at Cascade Marsh in Sutton which has grown to 326 acres. Of that total, 190 acres of marsh and upland habitat were bought with waterfowl funds. The history of wetland acquisitions has continued to grow and includes: Hoit Road Marsh in Loudon, Hirst Marsh in Boscawen, Little Cohas Marsh in Londonderry, Gallop Marsh in Unity and Lempster, Woodman Marsh in Northwood, Danbury Bog in Danbury, Chapman's Landing in Stratham, and a section of the Piscassic River wetlands in Epping. In 1987, five parcels consisting of 107 acres were obtained at Hirst Marsh, Cascade Marsh, Danbury Bog, Gallop Marsh and the section of the Piscassic River wetlands.

The Waterfowl Conservation Program also affords the Fish and Game Department the opportunity to participate in several cooperative waterfowl projects. A much welcomed and long-termed effort between Ducks Unlimited and the Department is the Ducks Unlimited MARSH Program which was initiated in 1985. MARSH is an acronym for Matching Aid to Restore States Habitat. Ducks Unlimited (DU) is providing to state fish and wildlife agencies 7.5% of revenues generated in each state by DU volunteers. The MARSH Program has provided New Hampshire with over \$26,000 for waterfowl habitat acquisition and management projects thus far. These monies are available on a

50/50 matching basis, with state waterfowl conservation revenues being used for matching purposes to finance two marsh projects (Hirst Marsh Project - 25 acres; Gallop Marsh Project - 50 acres). The Piscassic River project was a cooperative effort with the New Hampshire Waterfowl Association.

In addition, the Fish and Game Department and the Forest Service are presently evaluating several small marshes within the White Mountain National Forest for ways to more intensively manage these sites for waterfowl. Investigations have been made on five potential project sites--all of which will include water control structures to reflood inactive beaver impoundments.

Finally, the Waterfowl Conservation Program, in addition to land acquisition, is providing an opportunity to increase management efforts on some 4,000 acres of wetland habitat at the Department's Waterfowl Management Areas. These management activities primarily focus on providing conditions for optimum growth of wetland vegetation. Moist Soil Management is one such technique which stimulates the growth of important aquatic vegetation by simulating those optimum conditions found in beaver impoundments during their first five to seven years after flooding. Water control structures which manipulate water levels are prescribed for impoundments which exhibit substantial declines in waterfowl usage. Since 1985, the Moist Soil Management technique has been utilized at seven Fish and Game waterfowl impoundments. In addition to applying techniques which mimic beaver activity, the maintenance of healthy beaver populations is also paramount to breeding waterfowl within the state. Through the Waterfowl Conservation Program, the acquisition and manage-

ment of quality wetlands has benefited both waterfowl and native wetland wildlife species.

***Endangered Species
Conservation Act of 1979
(RSA 212-A)***

Establishes the Endangered Species Program (ESP) which is administered by the NH Fish and Game Department with key contractual services provided by the Audubon Society of New Hampshire. The Program was established to protect threatened and endangered species of wildlife, and addresses the problems of declining wildlife species in the state through research, status surveys, public information, and management. The Executive Director of the Fish and Game Department is charged with determining which species of animals are in need of conservation and adopting rules setting up conservation programs. The establishment of such programs can include ". . . acquisition of land or aquatic habitat or interests therein . . . deemed necessary for the conservation of species threatened with extinction."

The NH Endangered Species Conservation Act also authorizes the publishing of the NH Threatened and Endangered Species List. Official listing of the state's threatened and endangered wildlife affords each species listed protection under the Act, and makes them eligible for monitoring and management activities through the ESP. The newly revised list (see Appendix D) designates 21 animals as endangered and 13 as threatened. Among those species listed as endangered are: the dwarf wedge and swollen wedge mussel; common tern; piping plover; Sunapee trout; shortnose sturgeon; and bald eagle. Among those species listed as threatened are: the common loon; osprey; least tern; arctic tern;

and roseate tern. An endangered species is one that is in danger of extinction throughout all or a significant part of its range within the state, or any species determined to be endangered under the federal Endangered Species Act of 1973. A species is threatened if it is likely to become endangered in the foreseeable future throughout all or a significant part of its range within the state, or any species determined to be threatened under the federal Endangered Species Act of 1973.

***Nongame Species
Management Act of 1988
(RSA 212-B):***

Establishes a nonlapsing, Nongame Species Account within the Fish and Game Fund, which is used solely for nongame species management. Monies received from the federal Nongame Act, private donations and matched General Fund money fund the account. The state may match donations up to and including a total of \$50,000 annually.

More than 300 vertebrates (fish, birds, mammals, reptiles, and amphibians) live in New Hampshire year round; another 120 species pass through the state as migrants. Of these 420 species, approximately 60 are listed as sport fish, game birds, or game animals. The rest (85%) are nongame. To better understand these species, the NH Fish and Game Department is developing and implementing a comprehensive nongame wildlife program which includes research, management, and information/education. The Nongame Program will also work closely with the Endangered Species Program and the Loon Preservation Committee.

***New Hampshire
Native Plant Protection Act of 1987
(RSA 217-A)***

Directs the Department of Resources and Economic Development (DRED) to establish a list of endangered and threatened plant species found in New Hampshire. This list is to be developed through a program of biological research and investigation with the assistance of other state and federal agencies and interested persons. With input from the Natural Areas Council, a Native Plant Technical Advisory Committee was established and, using New Hampshire Natural Heritage Inventory (NHNHI) data, draft lists of eligible species were prepared. On April 16, 1988 a rare plant conference/public hearing was cosponsored by the NHNHI and The Nature Conservancy to allow the public to comment on the draft lists of protected plants. The lists were finalized and have been in effect since December, 1988. Administrative Rules for the Native Plant Protection Act were passed on December 16, 1988. The NHNHI will have an active role in implementing the Act by reviewing state projects, applications for permits, and additions and/or deletions to the lists. DRED is also directed to develop conservation programs for the protection of endangered and threatened plants. These programs can include acquiring land, by purchase or gift, to protect such plants. This law also requires all state agencies and departments to cooperate in preserving and protecting endangered and threatened plants, and requires that none of their programs threaten the existence of such plants.

Wetlands may indirectly benefit from the Native Plant Protection Act since the state's bogs and coastal wetlands harbor unique native plants. The findings of one University of New Hampshire study

(Crow and Storks, 1980) concluded that 9% of the state's rare flora were chiefly restricted to the coastal area, including the Great Bay estuarine system.

***New Hampshire Rivers
Management and Protection
Program (RSA 227-F)***

Passed in 1988, this law establishes within the Department of Environmental Services (DES) a New Hampshire Rivers Management Program. The Program, administered by a State Rivers Coordinator, establishes a process whereby state residents and organizations may nominate any river or river segment for special designation and protection by the state legislature. RSA 227-F is designed to complement and reinforce existing state and federal water quality laws and to maintain instream flows along protected rivers "in a manner that will enhance and not diminish the enjoyment of outstanding river characteristics." The Program is also charged with restoring and maintaining "the scenic beauty and recreational potential" of protected rivers. Any river/river segment nomination must include an assessment of fisheries; geologic and hydrologic features; vegetation; wildlife; historical and archaeological features; open space and recreation features and potential; water quality and quantity; man-made structures; and riparian interests. Any river nomination approved by the Commissioner of DES must be reviewed and approved by the general court prior to its inclusion into the Program.

***Designating Rivers and Lakes
Deserving Protection
(Chapter 190, Laws of 1986)***

Authorizes the Council on Resources and Development (CORD) to establish criteria and procedures for designating lakes, sub-areas of lakes, or river

stretches as water areas deserving protection. The designation process set up by CORD allows for any New Hampshire organization or resident to nominate a water area (river or lake) for designation. In June 1987, Governor John H. Sununu asked CORD to undertake the task of nominating the Franklin to Concord segment of the Merrimack River for designation as a protected river under Chapter 190.

The Office of State Planning initiated work in response to this request on behalf of CORD, developed a work outline, and hired a staff person. The first year of the planning effort has focused on collecting and mapping information about the River. This information will be bound as Volume I - Background Information and Findings: Upper Merrimack Corridor Plan. This initial report will demonstrate the outstanding significance of Upper Merrimack River resources and provides the foundation for planning recommendations.

The advisory River Area Planning Committee built on this foundation by analyzing issues and developing draft goals and objectives which will represent the start of Volume II - Goals, Recommendations, and Action Plan: Upper Merrimack Corridor Plan, anticipated for completion this fall.

Conservation Restrictions (RSA 477:45-48)

Gives landowners the right to require, prohibit, or limit activities on or uses of a land or water area through conservation restrictions held by another party. Conservation easements are appropriate for outstanding conservation land whose protection will significantly benefit the general public. They provide long term protection for the land while allowing the landowner to retain owner-

ship and control. The terms of an easement can be obtained to suit a particular property and/or situation. Once they are in place, restrictions in the easement are permanent, binding all future owners of the property. Conservation easements are most commonly given, but they can also be sold. The organization or agency to whom an easement is given provides long-term enforcement of the restrictions.

Current Use Taxation (RSA 79-A)

The legislature, recognizing the importance of the state's recreational, scenic, and ecologically important open spaces, enacted this law to prevent the development of such lands due to the pressure of high tax assessments. The means for encouraging preservation of open space under this statute are the assessment of land value for property taxation on the basis of current use and the acquisition of discretionary easements of development rights by town or city governments. The law authorizes a property tax abatement program which provides for reduced property assessments on certain parcels of land. Tracts of land qualifying for current use assessment (Table 10) must meet the criteria in one of a combination of the following categories of open space: Farm Land, Forest Land, Wild Land, Recreation Land, Wet Land, and Flood Plains. Current use acreage criteria requirements (set forth in Department of Revenue Administration Administrative Rules) for land categories are as follows:⁷²

Farm Land -At least ten acres in size or any farmland acreage which generates more than \$2,500 annually.

Forest Land -At least ten contiguous acres.

Wild Land -At least ten contiguous acres. Includes "Unproductive" and "Productive" Wild Land. Inactive farm land of less than 10 acres can qualify under current use if authorization to maintain it as open land comes from a Conservation Commission or other appropriate authorized town body designated by the Board of Selectmen. No minimum acreage requirements exist for "Natural Preserve Land."

Recreation Land -At least ten contiguous acres or undeveloped land of any size open to public access which possesses unusual public recreational value.

Wet Land -Any size.

Flood Plains -Any land lower in elevation than the land-water boundary along a water course flowing at its 100-year flood level which meets the criteria for any of the above land categories.

Land which has been classified as open space land on or after April 1, 1974 is subject to a land use change tax when it is changed to a use which does not qualify for open space assessment. In 1988, Chapter 120 was passed which allows a municipality to vote to allocate all or a portion of the receipts from the use change tax to the conservation fund.

Table 10

**ACREAGE OF WET LAND AND FLOOD PLAIN UNDER CURRENT USE ASSESSMENT
AS OF DECEMBER 1988**

County	Wet Land	Flood Plain
Belknap	2,759.87	415.12
Carroll	3,416.05	536.00
Cheshire	5,327.84	462.09
Coos	8,031.30	4,319.73
Grafton	4,730.85	2,370.77
Hillsborough	11,475.28	330.30
Merrimack	10,431.12	551.60
Rockingham	11,917.83	155.10
Strafford	4,470.24	27.00
Sullivan	2,129.04	584.90
Totals	64,689.42	9,752.61

Source: Department of Revenue Administration

Local and Regional Programs

Local governments can only exercise those powers delegated to them by the state. The basic source of authority for elected officials to govern and regulate land use is the police power--the authority to regulate for the health, safety, and general welfare of the community. Local exercise of police power can assert itself in several ways. Some approaches municipalities can take to aid them in regulating activities that can adversely affect wetlands are discussed below.

Conservation Commissions

RSA 36-A authorizes towns to establish conservation commissions and lists the commission's specific responsibilities. The statute directs every conservation commission to conduct research into the land and water resources within its boundaries; coordinate the activities of unofficial bodies organized for similar purposes; and index all open space and natural, aesthetic, or ecological areas within its boundaries. The statute also states that conservation commissions may recommend programs for the protection, development, or better use of such areas; may recommend the purchase of, or receive gifts of, unique lands; and may provide environmental education through a variety of communications media.

Although conservation commissions are advisory bodies, they can be very effective in motivating and strengthening environmental activity at the local level. A commission's scope and influence may be increased further by other statutes which give conservation commissions additional powers. In particular, Fill and Dredge in Wetlands (RSA 483-A)--the principal NH statute protecting wet-

lands--allows conservation commissions to request time to investigate an application for a dredge and fill permit filed with the New Hampshire Wetlands Board. The conservation commission is the only municipal body with authority to request such a delay. Under RSA 483-A:7, a conservation commission may also prepare the report and maps for the local designation of prime wetlands.

Since the passage of Chapter 36-A in 1963, the number of towns and cities creating commissions has steadily increased. As of July 1989, 198 communities (84%) had established conservation commissions.⁷³

Planning Boards

RSA 673:1 authorizes towns to establish local land use boards, while local land use planning and regulatory powers are specified under RSA 674. Planning boards are permitted to undertake a variety of duties. One responsibility that every planning board must carry out is the preparation and periodic revision of the municipality's master plan. In general, a master plan is comprised of a report or set of statements and land use/development proposals which are designed to show the planning board's recommendations for desirable municipal development. These recommendations may address up to nine specific areas, depending on the town's special requirements. Three of the areas where wetland protection recommendations might be incorporated include land use, recreation, and conservation and preservation. The master plan acts only as a guide for the future development of the municipality. In order to be effective, it should be implemented by the adoption or modification of zoning ordinances and other municipal regulations. A total of 234 communities (100%) have estab-

lished planning boards; 211 communities (90%) have completed master plans; and 13 communities (5%) have master plans pending.⁷⁴

In a municipality where the planning board has adopted a master plan, the local legislative body may authorize the planning board to prepare and amend a recommended capital improvement program covering a minimum of six years to assist with the preparation of the annual municipal budget. If the master plan includes recommendations for municipal acquisition of specific conservation areas such as wetlands, the capital improvements plan could include the cost of acquiring such land. Statewide, 78 communities (33%) have implemented a capital improvements program.⁷⁵

Another responsibility of the planning board is recommending additions and amendments to zoning ordinances/maps to the local legislative body. However, the local legislative body can only adopt a zoning ordinance after the planning board has adopted the general statement of objectives and the land use section of the master plan. Thus, the master plan acts as the foundation for zoning. Zoning is the principal tool for local regulation of land use. It establishes land use districts within a municipality in order to separate incompatible uses and provide for orderly development. In each district, some uses are permitted, some are prohibited, and some are allowed only under certain conditions. A zoning ordinance may also impose requirements on a specific use--such as the size and position of signs. Eighty-eight percent of New Hampshire's communities have zoning ordinances in place.⁷⁶

Protecting natural resources like wetlands, flood plains, rivers, and lakes via

conventional zoning districts poses special problems. Because these resources often occur in several locations within a municipality, using conventional use districts to protect them can result in a complicated ordinance and a less accurate zoning map. For this reason, overlay districts are often used to protect natural features that occur in several locations throughout a municipality.

An overlay district is one that is superimposed on existing use zoning districts. Development must comply with the requirements of both the underlying and overlay districts. In this way, uses normally allowed by the underlying district can be prohibited, thus providing some added protection to natural resource features. Approximately 118 communities (50%) have wetland regulations which use the overlay district approach.⁷⁷ A good example of such an approach to resource protection is the "Pemi River Overlay Plan" developed by the Pemigewasset River Council. Six towns bordering the river voted in 1987 to include the Plan in their town zoning ordinances. The Plan encourages and the zoning will protect the naturalness and integrity of river frontage in a corridor 500 feet wide on each shore.

Finally, a planning board may be authorized by town meeting or city council to regulate the subdivision of land (RSA 674:35). Subdivision regulations may contain provisions that can effectively manage local wetland development. The areas that subdivision regulations may cover which have potential for wetland protection include: the provision for open spaces of adequate proportions; the provision for parks of reasonable size for neighborhood playgrounds or other recreational uses; and the provision that land be of such character that it can be used for building

purposes without endangering health. Since septic systems built in poorly drained soils may result in groundwater or surface water pollution, subdivision regulations may exclude wetlands from minimum lot size calculations due to their unsuitability for buildings and septic systems. Subdivision regulations may also provide for clustering buildings in upland areas while maintaining overall density by leaving low-lying wetland or flood plain areas free from structural development. In New Hampshire, 230 communities (98%) have established subdivision regulations. In addition, 192 communities (82 %) have building codes in place.⁷⁸ Building codes can also be used to guide development to ensure it is consistent with maintaining wetland area values. Such codes can require that structures be elevated above flood hazard levels and that suitable foundation materials be used to locate them.

Regional Planning Commissions

The purpose of a regional planning commission (RPC) is ". . . to prepare a coordinated plan for the development of a region, taking into account present and future needs with a view toward encouraging the most appropriate use of land . . ." (RSA 36:45). Planning region delineation is such that each municipality falls within a specific region. A city or town may either join the existing commission for its particular planning region, or, if no commission exists, join with one or more municipalities to form a new RPC. Membership in an RPC is optional and the commission's role is strictly advisory.

RPC's provide assistance on local planning problems and make recommendations to local governments as a means of implementing regional plans. With respect to wetlands, RPC's can: assist

planning boards or conservation commissions in writing a wetland protection ordinance or writing amendments to an existing ordinance; assist a community with selecting a consultant to perform a wetland inventory and make recommendations for wetland protection; and become directly involved in mapping wetlands based on soils. RPC's are also active in terms of helping communities protect wetlands through water resource plans, local conservation plans, subdivision regulations, and setbacks from wetlands. Some specific examples of recent RPC involvement include:

1. Six out of nine RPC's prepared guidebooks for assisting towns in developing water resource protection plans.
2. Rockingham Planning Commission prepared an update to a 1978 study of shoreline change along New Hampshire's 18-mile coast, including recommendations and cost estimates associated with mitigating the changes described.
3. Rockingham Planning Commission assisted the Town of Derry with its prime wetland study by helping the town prepare the needed wetland maps.

As of July 1989, 216 communities (92%) were members of a regional planning commission.

Conservation Districts

RSA 430-B provides for the "establishment of conservation districts . . . composed of landowners and land occupiers within the districts . . ." The boundaries of the state's 10 conservation districts are delineated by the 10 counties within the state. The purpose of conservation districts is to facilitate the joint

effort of landowners, land occupiers, and government in carrying out measures for the conservation and development of soil, water, and related natural resources and preventing soil erosion, floodwater, and sediment damages.

The Strafford County Conservation District (SCCD) in the southeastern part of the state near the Maine border, is just one example of a rapidly growing region. Currently, the SCCD is involved in several projects which are adapted to meet the needs of this growing region. The District has provided Dover city planners with an extensive preliminary evaluation of some 1,750 acres--primarily wetland. This acreage is being considered for possible rezoning to commercial use. The land evaluation done by the SCCD will aid city planners

in preserving important watersheds, groundwater, flood control lands, and wildlife habitat. In addition, the District's on-site soil testing revealed areas where high intensity soil mapping would be necessary to demonstrate that a proposed land use would not harm public health.

Other examples of SCCD involvement include: retaining the services of a consulting soil scientist to further the technical expertise required by projects such as the one described above; evaluating dredge and fill applications at the request of the Wetlands Board by providing on-site evaluation of existing wetland conditions; and encouraging the reclamation of gravel pits through reclamation project demonstrations.

Current Plans for Wetland Protection



rotection of New Hampshire's wetlands is a high priority issue among many agencies, organizations, and individuals. The general public, for example, is becoming increasingly aware of the value of wetlands and is becoming increasingly concerned about negative impacts of such actions as filling a swamp for development purposes. Natural resource scientists and experts are knowledgeable of the abundance of life in wetlands and of the key role played by wetlands as habitat for unusual plant and animal species as well as entire plant communities. Sportspersons are keenly aware of the role dry land, water, and wetlands play in supporting fish and wildlife resources.

Several New Hampshire programs that, in part, have developed priorities for wetlands protection are discussed in the following paragraphs. Some programs are long-established while others are new and just getting underway. Aspects of protection include planning, acquisition, and regulation.

Several New Hampshire programs that, in part, have developed priorities for wetlands protection are discussed in the following paragraphs. Some programs are long-established while others are new and just getting underway. Aspects of protection include planning, acquisition, and regulation.

State Comprehensive Outdoor Recreation Plan (SCORP)

New Hampshire Outdoors 1988 - 1993 is New Hampshire's State Comprehensive Outdoor Recreation Plan (SCORP), and serves as the state's official policy plan for outdoor recreation and natural resource conservation. The 1988 - 1993 SCORP is the ninth such plan issued by the state since the passage of the Federal Land and Water Conservation Fund (LWCF) Act of 1965, which dictates that each state must have an approved SCORP on file with the National Park Service in order to participate in the LWCF program. New Hampshire Outdoors 1988 - 1993 assesses the quantity and quality of resources and determines their adequacy in meeting current and future demands. The plan tries to determine what will happen to these resources given certain conditions and use patterns. Finally, it identifies major issues and options which address these concerns. Wetlands are one such major issue discussed in the 1988 - 1993 SCORP. The source of SCORP recommendations for wetland protection was the 1988 DRAFT New Hampshire Wetlands Priority Conservation Plan. Three other issues in the 1988 - 1993 SCORP (Natural Resource Protection, Rivers and Lakes, and State Park Resources) contain recommendations that indirectly address wetlands. Included among these recommendations

are the following:

- The state legislature should make additional funding available to the Land Conservation Investment Program (LCIP) in order that the LCIP may successfully carry out its mission of protecting land with exceptional conservation and recreational value.
- State agencies should develop their priority lists for use with the Land Conservation Investment Program in acquiring the best and most needed protection lands and development rights. These lists should reflect individual agency's past efforts to name priorities including, for example, the Division of Parks and Recreation's 6-year development plan and the State Parks Policy Plan.
- The State Land Forest Management Program should adopt rules for designation of Natural Reserve Areas on state properties and work with the NH Natural Heritage Inventory and the NH Natural Areas Council to implement these policies.
- New Hampshire state agencies, in cooperation with the NH Natural Areas Council, should examine their land holdings to determine the presence of unique natural areas and take adequate measures for their long-term protection.
- The Department of Resources and Economic Development should continue to place priority on the acquisition of additional resources of either statewide or national significance, while providing increased opportunities which are compatible with local agency responsibilities.
- The Legislature should consider redefining the goals of the state park system to assure the recreational opportunities and natural area protection values receive the highest priority within the system. As RSA 216-A stands now, equal priority is given to "unusual scenic, scientific, historical, recreational and natural areas."
- The state should continue to maintain the Current Use Law (RSA 79-A), which, in part, rewards private landowners for keeping lands in an undeveloped state through local property tax reductions.
- The Fish and Game Department should develop long-range goals and objectives to meet the needs of New Hampshire's residents and should increase its emphasis on nongame and endangered species.
- The Lakes and Great Ponds Report should serve as an interagency guide for lake management, and agencies should continue to take steps to implement its recommendations.
- The New Hampshire Rivers Management and Protection Program should be fully staffed and should aggressively pursue the objectives of the program as specified by law.
- When setting priorities for acquiring open space, municipalities should consider parcels that include streams and ponds, or that protect lake shore and river corridors.
- Communities should continue to encourage private land conservation practices through existing enabling legislation, such as the current use assessment, sub-

division requirements for dedicated open space, and through conservation easements.

- The state's major private conservation organizations, including the Audubon Society of New Hampshire, The Nature Conservancy, the Society for the Protection of New Hampshire Forests, and the Appalachian Mountain Club should continue their efforts to protect valuable natural resources and to promote the same through such means as volunteer naturalist programs.
- Private landowners should voluntarily protect unique natural resources which occur on their properties, seeking the advice of knowledgeable people such as the New Hampshire Natural Heritage Inventory staff.
- The National Park Service should increase its efforts to implement the National Natural Landmarks Program by providing, for example, state grants for inventory work and adequate federal staffing levels to review recommendations for landmark designation.

New Hampshire Outdoor Recreation Action Program (NHORAP)

Recreation in Action 1987 - 1989 also encompasses issues of importance concerning outdoor recreation, environmental protection, and natural resource conservation. The NHORAP focuses on activities that were actually implemented in response to those issues identified in the SCORP, and on actual activities to be undertaken during the upcoming biennium. Accomplishments related to natural resource and wetlands protection

at the state and regional levels during 1986 - 1987 include the following:

- The Trust for New Hampshire Lands aided in developing priorities, inventory information, and a formal program for the major land protection/acquisition effort.
- The Office of State Planning, using digitized mapped layers, prepared maps and analyses for the Squam Lake watershed as a basis for developing a management plan for this watershed, its wetlands, water bodies, and related boundaries.
- The Office of State Planning established draft criteria and a procedure for designating lakes, sub-areas of lakes and river stretches as water areas deserving protection (this study responds directly to the requirements of Chapter 190, Laws of the 1986 Session of the General Court).

Actions on the state level taken during the biennium (July 1987 - June 1989) include the following:

- With the \$20 million budget appropriated to the Land Conservation Investment Program, acquired lands and interest in lands of statewide, and local conservation and recreation importance.
- Pursued opportunities for the acquisition of critical and prime wildlife habitat, in order to preserve the quality and quantity of such vital resources.
- Provided assistance to local communities in the acquisition of parcels identified by the New Hampshire Natural Heritage Inventory.

It should be noted that wetlands are also a priority on the local level. With development pressures on the rise, a number of towns, working through their Conservation Commissions, are involved in acquiring wetland acreage, obtaining conservation easements on parcels abutting wetlands, and developing wetland overlay maps for wetland zoning district purposes. Some wetland related actions implemented on the local level during 1986-1987 include:

- *Concord City Council* - Adopted a modified version of a wetlands zoning overlay district developed by the Concord Conservation Commission in conjunction with the city's Economic Development Advisory Council.
- *Dublin Conservation Commission* - Developed a shallow "shoreline conservation district," based on a model created by the Lakes Region Planning Commission, to preserve water quality and prevent indiscriminate development around 6 major lakes in the community.
- *Town of Hampton Falls* - Utilizing a dike and a water control structure, restored a wetlands area in Hampton Falls to its original state as a prime wetland habitat.
- *City of Nashua* - Conducted a program which identified and assessed the city's prime wetlands and which resulted in recommendations for improving local land use regulations for wetland areas.
- *Strafford Conservation Commission* - With assistance from the Strafford Regional Planning Commission, prepared a wetlands inventory and maps for use in the master plan.

- *Cheshire County Conservation District* - Identified, mapped, and evaluated the City of Keene's wetlands to determine which wetlands should be included in the open space portion of this City's master plan.
- *Pemigewasset River Council* - An organization established by representatives from 9 communities to promote the coordination of river corridor management along the Pemigewasset River. With assistance from the Belknap County Conservation District and the Lakes Region Planning Commission, the Council developed and subsequently proposed to each community an overlay zoning district to help protect and preserve water quality and the river's shoreline. To date, 6 of the 9 towns have adopted this overlay plan.

In addition, numerous towns were successful in designating certain wetlands in their communities as "prime" under RSA 483-A:7.

New Hampshire Fish and Game Department Waterfowl Management Plan

This Management Plan provides general recommendations and objectives for the management of waterfowl and their habitat in New Hampshire. The plan outlines general recommendations and utilizes these recommendations to develop management plans specific to each Waterfowl Management Area regulated by the Fish and Game Department. Components of the plan associated with waterfowl habitat management include:⁷⁹

- **Waterfowl Habitat Conservation** - The acquisition of quality wetland habitat (marshlands, beaver ponds, beaver flowages, wooded or shrub swamps) is a high priority. All wetland acquisitions should include, where possible, a 300-foot wide upland buffer zone around the wetland. A listing of Fish and Game Waterfowl Management Areas Requiring Habitat Acquisitions is found in Table 11.
- **Waterfowl Habitat Management and Restoration** - Focus is put on those factors considered to be limiting waterfowl utilization of an area. Habitat management and restoration practices addressed in the plan include water depth contour map and vegetation cover type map development, water level manipulation, food and cover enhancement, and protection of upland areas within 300 feet of wetland edge.
- **Beaver Pipe Program** - Approximately 300-400 acres of wetlands are maintained through this program annually. The program maintains beaver impoundments on public/publicly managed land while preventing undesirable flooding and retains wetlands that otherwise would be drained.
- **Technical Assistance** - When requested, technical assistance is provided to federal, state, and town conservation agencies as well as to sportsperson's groups for wetland acquisition and any management/restoration projects involving waterfowl habitat.

Within the New Hampshire Fish and Game Department, the major source of funds for waterfowl habitat conserva-

tion, management, and restoration is the New Hampshire Migratory Waterfowl Stamp and Print Program (RSA 214:1-d). These funds are placed in the nonlapsing Waterfowl Conservation Account. With the tightening of matching federal Pittman-Robertson Funds, the Waterfowl Conservation Account will continue to be the primary funding source for acquiring wetlands and protective upland buffer zones at established Fish and Game Waterfowl Management Areas.

Water Resources Management Plan

Recognizing the interdependence between different water uses and users within the state, the 1983 Legislative Session passed Chapter 402. This legislation directed the Water Resources Board to work with a special legislative subcommittee and other agencies to develop preliminary priority water use policies and an allocation plan. The resulting Water Resources Management Plan is an evaluation of specific issues, objectives, authority, programs, and actions related to conserving, protecting, allocating, and otherwise managing water resources.

Under this plan, water use is divided into seven specific sections: wetlands; fish and wildlife; agriculture and forestry; land use; energy production; recreation; and domestic, industrial and commercial use. With respect to wetlands, the plan stresses the desirability for wetland protection to start with educating property owners on the functional roles of wetlands and the public benefits associated with these functions. The plan also recommends that landowners and local government bodies be encouraged to develop and to implement their own guidelines and measures to protect significant wetlands. In addition,

Table 11

**FISH AND GAME WATERFOWL MANAGEMENT AREAS
REQUIRING HABITAT ACQUISITION**

Airport Marsh	Whitefield
Cascade Marsh	Sutton
Danbury Bog	Danbury
Farrar Marsh	Hillsborough
Hoit Road Marsh	Concord/Loudon
Knights Meadow Marsh	Webster
Little Cohas Marsh	Londonderry
McDaniels Marsh	Springfield/Grafton
Merrymeeting Marsh	Alton/New Durham
Perkins Marsh	Weare
Rowbartwood Marsh	Campton
Gallop Marsh	Unity/Lempster
Goodrich Marsh	Epping

Source: "Waterfowl Management Plan." Concord, NH: New Hampshire Fish and Game Department, March 1987.

it is recommended that the state, through the Wetlands Board, develop stronger, clearer, and timelier enforcement methods to ensure adequate wetland protection.⁸⁰

Water Protection Assistance Program

The Water Protection Assistance Program was established by Chapter 167 of the Laws of 1986. The purpose of this program is to encourage and assist municipalities individually and, where appropriate, collectively to evaluate their water resources and to develop local and

regional measures for protection of both groundwater and surface water.

During the program's first year, The Office of State Planning (OSP) developed draft criteria for local water resource management and protection plans with the input of regional planning agencies, the legislators who sponsored the original bill, and other state agencies with water related interests. Through Chapter 283 of the Laws of 1987, the legislature consolidated the statutes relating to OSP into a single statute, RSA 4-C. Amendments were made to RSA 4-C:19-22 at that time which resulted in a number of changes within the Water

Protection Assistance Program. Among these changes was the requirement that OSP adopt rules relative to criteria for water protection to guide municipalities in the development of local water resource management and protection plans. OSP was also required to review all such plans and zoning ordinances proposed to implement the plans for consistency with these rules.

The rules for local water plans became effective January 20, 1988. During 1988 and 1989, with funding through OSP, the nine established regional planning agencies assisted member municipalities in the preparation of twenty local water resource management and protection plans. OSP reviewed a total of twenty-one local water plans for consistency with the rules, prior to their adoption. Forty-seven zoning ordinances intended to protect water resources were also reviewed by OSP during that time period. This review was to determine if the proposed ordinance was consistent with the municipality's local water plan. Where a community did not have a distinct local water plan, OSP reviewed the ordinance for consistency with the municipality's current master plan. When a proposed ordinance was found to not be consistent with the plan, OSP was able to provide guidance to the municipality relative to amendments that could be made to the master plan to include the basis for the ordinance prior to its adoption. A total of 47 water related zoning ordinances were reviewed prior to March 1989 town meeting. This included 20 wetlands protection ordinances as well as 15 aquifer protection ordinances, 3 shoreland protection ordinances, and 9 other ordinances intended to somehow manage or protect water resources.

Chapter 346 of the Laws of 1989 made further amendments to the Water Protection Assistance Program. The most significant was to change the requirement that OSP adopt administrative rules "relative to criteria for water protection and suggested model language" to rules "to serve as a guide to municipalities." Another change was to remove the requirement for an OSP consistency review of water related zoning ordinances prior to their local adoption. OSP will revise the rules for local water plans to reflect these changes. The Water Protection Assistance Program will continue to offer technical planning assistance to municipalities throughout the fiscal year 1990 and 1991 biennium. This will be done primarily through the regional planning agencies, with funds appropriated for that purpose, under the administration of OSP.

New Hampshire Natural Heritage Inventory

Under Chapter 195 of the 1986 Session of the General Court, a New Hampshire Natural Heritage Inventory (NHNHI) was established within the Department of Resources and Economic Development (DRED). The NHNHI's main purpose is to "identify, designate, and preserve unique and rare plant and animal species and geologic formations which constitute the natural heritage of the state." The program focuses on protecting the best examples of the state's natural diversity, using the natural heritage inventory system developed by The Nature Conservancy.

Under the program, information collected through intensive studies of New Hampshire's rare plant and animal species, and exemplary natural communities are transferred to a computer

data base. This data base stores information on the state's 400 threatened, endangered, or special interest plant and animal species and 70 types of significant habitats. This information may be retrieved by geographic area (town, park), ecological community (bogs, watersheds), species name, legal status (state or federal endangered status), or date of information. The inventory data is important in helping to determine whether proposed projects may affect rare species or exceptional communities. Data is also available for conservationists to use to help focus preservation efforts on those species or habitats most critically threatened. Researchers may also take advantage of the existing knowledge on inventoried elements. The process of data compilation and verification is an ongoing one, with the data bank being continuously updated and improved.

The NHNHI along with The Nature Conservancy, a national nonprofit conservation organization, have the necessary expertise to identify wetlands with ecologically significant attributes but lack the staff resources to carry out this type of research at the present time. Contingent upon procuring new funding sources that would support additional staff, NHNHI and The Nature Conservancy propose to undertake a three-phase statewide wetlands inventory for the presence of rare species and exemplary natural communities. Although work on identifying wetlands in New Hampshire continues under the National Wetlands Inventory Project, there is little information presently available on measuring their comparative ecological value. Under the proposal, the Natural Heritage Inventory staff would supply data and expertise and The Nature Conservancy staff and interns would carry out the field surveys and report preparation. Infor-

mation from this inventory could also be made available to communities as an aid to potential prime wetlands designation.

Using existing Heritage Inventory data, the NHNHI has identified several wetlands which meet acquisition criteria set forth in the US Fish and Wildlife Service's National Wetlands Priority Conservation Plan (developed in accordance with Section 301 of the Emergency Wetlands Resources Act of 1986). These priority wetlands are:

Manchester Cedar Swamp (30 acres)	Manchester
Deerfield Black Gum Swamp (25 acres)	Deerfield
Route 145 Fen (10 acres)	Stewartstown
Lancaster Bog (20 acres)	Lancaster
Hampton Marsh (1,770 acres)	Hampton/ Hampton Falls
Fremont Spruce Swamp (500 acres)	Fremont
Avery's Northern White Cedar Swamp (20 acres)	Clarksville
Hurlbert Swamp (400 acres)	Stewartstown /Clarksville
Pine River Area (1,670 acres)	Effingham/ Ossipee
Rochester Heath Bog (200 acres)	Rochester
Durham Point Sedge Meadow (15 acres)	Newmarket

Governor's Conference on Outdoor Recreation

In April 1986, Governor Sununu challenged the Conference on New Hampshire's Outdoor Recreation Future

"to find creative ways to build on New Hampshire's legacy of outdoor successes and to ensure for future generations quality of life for its residents, quality of service to its visitors, and quality of environment for all." The report No Accidental Successes summarizes the one-day conference and is analyzed relative to wetlands priorities in this section.

The Conference assembled 124 participants from around the state to discuss issues and come up with solutions to problems relating to the general subject of outdoor recreation. Participants included recreationists, historic preservationists, educators, legislators, private industry persons, and public agency representatives. The resource conservation community was well represented.

Although the Conference focused primarily on the active use of resources for recreational purposes, four of the fifteen issues addressed areas concerning the general well being of the state's natural resources, including wetlands. The issue of resource protection generated recommendations to counter resource deterioration, mismanagement, vandalism, pollution, and encroachment.

The quality of New Hampshire's outdoors was an issue which drew recommendations for an increased promotion, presumably at all levels of government and in private industry, of a land protection ethic. People should become more aware of the inherent value of our prized natural resources, including wetlands.

Water for recreation and for fish and wildlife habitat were two interdependent issues which linked the resource base and people use. Wetlands support the growth and health of both game and nongame species of wildlife and should be recognized for that quality.

The findings and recommendations contained in No Accidental Successes were also utilized in the updating of the state's outdoor recreation plan, New Hampshire Outdoors 1988 - 1993. The plan should advance some of the ideas which as Governor Sununu observed at the Conference, "may not guarantee success, but will certainly improve the odds" of attaining an overall quality of life.

New Hampshire State Development Plan

The Office of State Planning is charged with writing New Hampshire's State Development Plan. This document is an extension of the policy development work undertaken by the Council on Resources and Development in 1985 at the Governor's request. An analysis of the "Issues, Goals, Policies, and Implementing Actions" section of the Plan show the priority of wetland protection relative to other statewide planning needs. The Plan drew upon several previous planning efforts, including the State's Comprehensive Outdoor Recreation Plan, New Hampshire Outdoors 1983.

The lead-off issue in the Plan addresses the need for a clean environment and for open space. It talks of, among other things, the many acres of wetlands and flood plain lost annually. Traditional land use practices are identified as having potential for degrading environmental quality. The Plan identifies the potential culprits of this degradation including pesticides, fertilizer, road salt, fuel storage tanks, and solvents from normal household use.

Wetlands are addressed by two policy statements in the Plan under the goal to preserve, protect and improve New

Hampshire's natural, recreational and scenic resources. The first policy is to wisely manage agricultural, forest, water, and other natural resources within the state to ensure their long-term availability. Here, the Plan stresses the need to expand information and education programs (which address the quality of New Hampshire's wetlands, streams, and lakes) to resource users such as loggers, woodlot owners, industry, and others.

The second policy under this section of the Plan is to protect and preserve unique natural resources such as valuable wetlands and features of botanical, zoological, and geological significance. To help in this effort, the Plan recommends compiling data pertaining to wetlands and incorporating it into a geographic based information system (GRANIT) for future use. The plan specifies the need to develop funding strategies and other innovative techniques to acquire or protect environmentally sensitive lands such as wetlands.

New Hampshire Rivers and Lakes Protection Program

The 1986 session of the New Hampshire legislature passed a law authorizing the Council on Resources and Development to set up a process by which certain rivers and lakes could be designated as water areas deserving protection. The Office of State Planning provided the staff to develop the June, 1988 Rivers and Lakes Protection Program. This proposed designation process outline serves as the basis for this report.

The Rivers and Lakes Protection Program's planning process measures the value of these water areas using a wide variety of parameters. One natural

resource value is presence of wetlands. Almost any river or lake possesses wetland edges or more extensive wetland areas away from the water's edge. Depending on its extent, diversity, or habitat type, wetlands can be the most important reason for a river or lake being designated by this program. River flood plains and bog-pond systems are examples of this value.

Currently, the workability of the Rivers and Lakes Protection Program is being tested by the nomination for protected status of a stretch of the Merrimack River from Franklin to Concord. This nomination, which the Office of State Planning is studying at the request of the Governor, will address wetland resources and make recommendations for their protection.

New Hampshire Rivers Management and Protection Program

The 1988 legislature passed a law (RSA 227-F) which established a New Hampshire Rivers Management and Protection Program within the Department of Environmental Services. This legislation establishes a process whereby New Hampshire organizations and residents may nominate any river or river segment for special designation and protection by the state legislature.

Under this law, the Rivers Coordinator, with assistance from the Office of State Planning, must develop detailed guidelines for river corridor management plans. Protection of wetlands and flood plains must be included in these management plans. Groups that nominate rivers will be encouraged, as part of the designation process, to adopt river corridor management plans. The New Hampshire

Rivers Management and Protection-Program is also designed to complement and reinforce existing state and federal water quality laws, including the Fill and Dredge in Wetlands Law (RSA 483-A).

New Hampshire Coastal Program

As an integrated, multidisciplinary approach to coastal management, the New Hampshire Coastal Program reviews the issues which have emerged since its inception in 1983.

Discussion of wetland priorities for the New Hampshire Coastal Program is drawn from the recently published "Final Emerging Coastal Issues Paper." This paper describes the Coastal Program. In practice, the Coastal Program staff offers expertise in wetlands ecology and works closely with municipal planning boards, conservation commissions, developers, and others in helping to protect the public interest in wetlands. The staff works with the Wetlands Board in promoting the wise use and regulation of coastal wetlands.

Four of the nine identified issues listed in the paper directly involve wetlands: 1) wetlands mitigation and replication procedures related to dredge and fill activities; 2) saltmarsh restoration; 3) identification of ecologically sensitive areas; and 4) wetlands mapping. One instance of saltmarsh restoration involved illegal filling of about one-eighth acre of marshland with a subsequent court-ordered removal of the fill and restoration of the marsh.

Mitigation measures may be associated with the Wetlands Board permitting process and may involve restoration of wetlands and creation of new wetlands areas as conditions attached to the per-

mit. Rules changes in the area of mitigation continue to be considered which would realistically help to further wetlands protection.

The Coastal Program has already identified those areas which it considers most ecologically sensitive, and will continue to encourage cooperative efforts to protect these areas. Such cooperative efforts will involve the state's Natural Heritage Inventory, the private Trust for New Hampshire Lands and its public counterpart the Land Conservation Investment Program, the Society for the Protection of New Hampshire Forests, and the Audubon Society of New Hampshire.

Wetlands mapping has been expanded from the original seven municipalities to seventeen. The additional 10 municipalities are those associated with Great and Little Bays. These maps will continue to provide baseline information for planning purposes.

Great Bay National Estuarine Research Reserve

The purpose of the Great Bay Estuarine Research Reserve is to establish a coordinated program of research, education, and resource protection for the Great Bay estuarine system. The land and water boundary of the Research Reserve encompasses a system of five identified key land and water areas around the estuary: Adams Point in Durham; Crommet Creek in Durham; Lubberland Creek in Newmarket; salt marshes abutting the Squamscott River in Stratham, Newfields, and Newmarket; and Pease Air Force Base lands abutting Great Bay, principally in Newington. The water portion consists of all of Great

Bay, the small channel from the Winnicut River and the larger channels from the Squamscott and Lamprey Rivers. The Great Bay Research Reserve encompasses 4,471 acres of tidal water, 800 acres of upland, 502 acres of tidal wetlands and 456 acres of freshwater wetlands. The Reserve has now acquired a total of four easements around Great Bay to date, setting aside 266 acres for research, education, and interpretation. Acquisition of an additional 6 easements is planned in the next year and a half.

Although the Reserve Program is not programmatically a part of the Coastal Program at the federal level, the Office of State Planning has closely linked the program administratively and coordinated and integrated the Coastal and Estuarine Research Reserve Program policies and objectives. Federal funds are being utilized by OSP to finalize the planning phases of the Program and to acquire conservation easements on privately owned lands which were identified as key land and water sites within Great Bay. Approximately \$1,000,000 in federal funds has been committed for acquisition of key land and water area easements. In addition to acquisition funds, approximately \$50,000 per year in federal funds will be provided over the next 5 years to support the establishment and operation of the Great Bay Estuarine Research Reserve.

OSP has served as the lead agency for planning and acquisition phases and will maintain an active role in the implementation phases of the Program. However, because of the increasing emphasis on resource management as the Program develops, the Fish and Game Department will assume the role of lead agency to implement the research, education, and resource protection activities beginning July 1, 1989.

Land Conservation Investment Program

The LCIP was created by the New Hampshire General Court in its 1987 session. The law appropriated \$20 million over a two-year period to be used for, among other purposes, acquiring lands and interests in lands of statewide, regional and local importance. These lands as defined by statute "may include ... plant and wildlife habitat, wetlands, ... and other important open space and natural resource conservation areas." Legislation passed during the 1989 Legislative Session appropriated an additional \$18 million to fund the LCIP for an additional two years.

The draft rules for the Land Conservation Investment Program were adopted by the LCIP Board of Directors in early January, 1988. Final administrative rules governing the operation of the program were adopted and made effective on April 20, 1988. The LCIP rules set up a detailed criteria point system to rank properties according to their land quality attributes. The criteria ranking will be used with other decision making factors to determine which projects are funded through the LCIP. The criteria categories for both statewide and local lands include: property size, water resource frontage, recreation, wildlife habitat, scenic/historic/natural area values, public water supply, prime agricultural soils, productive forests, scientific site, threat of development, and wetlands.

Recommendations



s directed by the Emergency Wetlands Resources Act of 1986, this report has investigated the status of wetlands and finds that, in addition to other valuable roles, wetlands serve as an important recreational resource for the State of New Hampshire. This report has defined wetlands, has quantified the state's wetlands resources and has looked at various programs which are involved in protecting those wetlands. Specific plans and programs which contain evidence of setting their own wetlands priorities have been reviewed. The following recommendations are made to address the wetlands protection issue:

- As recommended in the February 1989 "Report of the Wetlands Review Committee":
 - a) Legislative action should be considered that will modify the definition of wetland from one based on vegetation, to one that requires meeting two out of three criteria based on vegetation, soils, and hydrology. Such a change would reduce the confusion for applicants who are familiar with the federal definition.
 - b) Legislative action should be taken to increase staffing at the Wetlands Bureau.
 - c) The Wetlands Bureau should provide increased support to both applicants and conservation commissions in the form of published review criteria, industry/project specific informational meetings, and workshops on wetlands identification. The Wetlands Bureau should also increase its field presence throughout the State.
 - d) Because review criteria are based on approved rules, the Wetlands Board and the Wetlands Bureau should continue to work together to expand and refine the rules so that they are current and complete. Possible areas requiring new rules are criteria for streams and rivers, criteria for forestry operations, and treatment of aesthetic considerations.
 - e) The Wetlands Bureau's current efforts to computerize the application review process should be continued and expanded.

f) The Wetlands Bureau should continue its efforts to attain an ideal turn-around time for projects which have a complete application and in which the local conservation commission has not intervened.

- Legislative action should be taken to increase the Wetlands Board's capabilities in analyzing existing data to determine trends in wetlands loss/degradation.
- The Wetlands Bureau should expand its successful pre-application site review program (currently confined to seacoast communities) to include those projects in other parts of the state which are classified as major.
- The Wetlands Bureau should develop and adopt wetland mitigation guidelines for cases where alternatives to wetlands encroachment are not practicable. These guidelines would establish mitigation standards for the replacement of lost or degraded wetlands.
- The Department of Resources and Economic Development, through its New Hampshire Natural Heritage Inventory, should work closely with the Wetlands-Bureau staff to identify and protect those wetlands containing rare or declining native plant and animal species, and exemplary natural communities.
- The New Hampshire Natural Heritage Inventory should attempt to secure additional funding in order to hire sufficient personnel to conduct an inventory of wetlands in New Hampshire to determine which wetlands possess ecologically significant attributes. This inventory would include:
 - a) compilation of data already available on rare species and exemplary natural communities as they occur in wetlands of the state.
 - b) targeting wetlands that are potentially ecologically significant through the use of aerial photos and other available information.
 - c) measuring inventoried wetlands against the criteria listed in the National Wetlands Priority Conservation Plan with respect to rare species and communities.
 - d) preparation of a list of priority wetlands that meet the threshold criteria of the National Wetlands Priority Conservation Plan and possess ecologically significant attributes.
- The New Hampshire Coastal Program should investigate the cumulative impacts of development projects on coastal wetlands and develop recommendations for assessment and review.
- The New Hampshire Coastal Program should draft policy recommendations which respond to the projected rise in sea-level.
- The New Hampshire Fish and Game Department should work closely with the US Fish and Wildlife Service (USFWS) in the preparation of the USFWS's Wetlands Concept Plan for the Northeast Region.
- The New Hampshire Fish and Game Department should continue to make acquisition of wetlands for fish and wildlife habitat a high priority, and should continue to make use of available federal and state funding sources.

- The New Hampshire Fish and Game Department should conclude its two year effort to develop its wetland acquisition priority system as part of a priority system for all types of habitats.
- The Department of Environmental Services, through its New Hampshire Rivers Management and Protection Program, should strongly encourage groups that nominate rivers under this Program to adopt river corridor management plans which include wetlands and flood plain protection measures.
- The Department of Resources and Economic Development and the Office of State Planning should consider modifying the Land and Water Conservation Fund's Open Project Selection Process selection criteria to reflect the findings of this report. Consideration should be given to awarding selection criteria points to proposed acquisitions of prime wetlands designated by municipalities, and to proposed acquisitions of wetlands identified by state agencies as being of special importance to fish and wildlife or to the state's natural heritage.
- The Department of Resources and Economic Development's Division of Parks and Recreation should review the State Parks Development Plan, and should consider amending the Plan to enable the acquisition of certain priority wetland types. Amending the Plan will assure that representative wetlands of sufficient size will be protected.
- The Office of State Planning, when preparing the State Development Plan should incorporate, to the extent possible, the findings of this report in addressing the importance of wetlands to the state's natural resource base.
- The Office of State Planning should continue its role as the lead agency coordinating the development of the New Hampshire GRANIT geographic data base. This multi-state agency effort to develop a data base (which will include hydrography, wetlands, flood plain, Natural Heritage Inventory, and wildlife habitat data layers) is important to the development of a GIS-based wetland mapping system which would provide a basis for trend studies to determine accurately the rates of wetland loss or conversion, and to identify regions of critical concern.
- Through the Natural Areas Council, state agencies and conservation organizations should continue to coordinate their natural resource protection strategies and programs, including wetlands protection.
- Municipalities, through their Conservation Commissions, should continue to identify and map prime wetlands. Results from prime wetland studies can then benefit both local resource protection planning efforts and state wetlands protection programs.
- Municipalities that have not gone through the prime wetlands designation process should seek advice from those municipalities that have. Although the needed wetland studies under the provisions of RSA 483-A:7 are extensive, conducting the studies and obtaining the data need not be a difficult or costly task. Those communities that have successfully gone through the designation process are an invaluable source of information on how to conduct a prime wetland study at a minimal cost.

- The US Fish and Wildlife Service Region Office should become more involved in *providing technical and financial assistance* to states with respect to wetlands protection, so both the state and federal wetland priority conservation plans can be more meaningful.
- The US Fish and Wildlife Service should develop a program of assistance (as scheduled in the National Wetlands Priority Conservation Plan) that will assist states, both financially and technically, in maintaining and further refining a comprehensive state wetlands planning component.

APPENDIX A

SECTION 303 OF THE EMERGENCY WETLANDS RESOURCES ACT OF 1986

SEC. 303 INCLUSION OF WETLANDS IN COMPREHENSIVE STATEWIDE OUTDOOR RECREATION PLANS.

Section 6 of the Land and Water Conservation Fund Act of 1965 (16 USC 4601-8) is amended -

1. in subsection (d), by adding at the end thereof the following new paragraph:

"For fiscal year 1988 and thereafter each comprehensive state-wide outdoor recreation plan shall specifically address wetlands within that State as an important outdoor recreation resource as a prerequisite to approval, except that a revised comprehensive statewide outdoor recreation plan shall not be required by the Secretary, if a State submits, and the Secretary, acting through the Director of the National Park Service, approves, as a part of and as an addendum to the existing comprehensive statewide outdoor recreation plan, a wetlands priority plan developed in consultation with the State agency with responsibility for fish and wildlife resources and consistent with the national wetlands priority conservation plan developed under section 301 of the Emergency Wetlands Resources Act or, if such national plan has not been completed, consistent with the provisions of that section";

2. in subsection (e)(i), by inserting, in the first sentence thereof, after "For the acquisition of land, waters, or interests in land or waters" the following: ", or wetland areas and interests therein as identified in the wetlands provisions of the comprehensive plan"; and
3. in subsection (f)(3), by adding at the end thereof the following: ":Provided, that wetland areas and interests therein as identified in the wetlands provisions of the comprehensive plan and proposed to be acquired as suitable replacement property within that same State that is otherwise acceptable to the Secretary, acting through the Director of the National Park Service, shall be considered to be of reasonably equivalent usefulness with the property proposed for conversion."

APPENDIX B

THE US FISH AND WILDLIFE SERVICE WETLANDS CLASSIFICATION SYSTEM SIMPLIFIED

I. MARINE SYSTEM/Coastal Saltwater Wetlands

The Marine system includes the open ocean, from the outer edge of the continental shelf to the landward limit of the extreme high water of spring tides and the splash zone of breaking waves.

A. SUBTIDAL SUBSYSTEM/Open Saltwater

Subtidal refers to areas continually covered by saltwater. The underlying strata could be any of the following classes:

Rock Bottom: Associated species: American lobster, tunicate, and sea urchin, encrusting sponge.

Unconsolidated Bottom: Associated species: brittle star, amphipods, and clam worm.

Aquatic Bed: Associated species: kelp, turtlegrass.

Reef: Associated species: oysters, tube-worms.

B. INTERTIDAL SUBSYSTEM/Tidal Flat and Low Salt Marsh

Intertidal refers to areas flooded and exposed twice daily with the tides, including the splash zone of breaking waves. The underlying strata could be any of the following classes:

Aquatic Bed: Associated species: oysters, tube-worm and reef worm.

Rocky Shore: Associated species: barnacle, blue mussel, peri-winkle, limpet.

Unconsolidated Shore: Associated species: soft shell clam, quahog, sea anemone, clam worm, false angel wing and blood worm.

II. ESTUARINE SYSTEM/Tidal Saltwater Wetlands

The estuarine system is the area where saltwater and freshwater meet, and is likely to be more sheltered from wave action than the marine system. It extends inland to the area of a stream, bay or sound where ocean salt measures less than 0.5 percent during annual low flow periods. The seaward limit of an estuary is determined by the mouth of the river, bay or sound, or by the seaward limit of emergent wetland plants, shrubs or trees. Off-shore areas where ocean waters are continually diluted by freshwater are also in the estuarine system.

A. SUBTIDAL SUBSYSTEM/Tidal Flat and Low Salt Marsh

These areas are continually covered by water. The underlying strata could be any of the following classes:

Rock Bottom: Associated species: seawhip, tunicate.

Unconsolidated Bottom: (Beaches and flats) Associated species: sand dollar, soft-shell clam, clam worm.

Aquatic Bed: Associated species: marine algae, rockweed and eelgrass.

Reef: Associated species: oysters, tube-worm and reefworm.

B. INTERTIDAL SUBSYSTEM/Tidal Flats, Low Salt Marsh and High Salt Marsh, Wooded Swamp

These areas are flooded and exposed twice daily by the tides. The underlying strata could be any of the following classes:

Aquatic Bed: Associated species: rockweed, eelgrass.

Reef: Associated species: oyster, tube-worm and reef worm.

Streambed: Associated species: mollusk, mussel, ghost shrimp, mud snail.

Rocky Shore: Associated species: barnacle and limpet.

Unconsolidated Shore: (Beaches, bars and flats) Associated species: soft-shell clam, quahog, blood worm, fiddler crab, clam worm, blue mussel, mud snail.

Emergent Wetland: (Salt marshes or meadows) Associated species: saltmarsh cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*Spartina patens*), needle rush, salicornia, narrow-leaved cattail, saltmarsh aster, bulrush. Vegetation in some estuarine emergent wetlands is destroyed by ice in winter.

Scrub-Shrub Wetland: Associated species: sea myrtle and marsh elder.

Forested Wetland/Wooded Swamp: Associated species: red maple, Atlantic Coast White cedar.

III. RIVERINE SYSTEM/River-Related Inland Freshwater Wetlands

The riverine system includes all channels that usually contain flowing water, or that connect two bodies or standing water. The limits of the system are: channel banks or levees; areas dominated by tree, shrubs or persistent emergents (plant species that usually remain standing at least until the beginning of the next growing season); areas where the stream flows into a lake; or where ocean-derived salt in the water reaches 0.5 percent during low flow periods.

A. TIDAL SUBSYSTEM/Tidal River Wetlands

This encompasses channels that are generally flat. The rate of stream flow fluctuates with tidal action. Streambeds are usually mud with some sand. Salinity due to ocean-derived salts is less than 0.5 percent. Underlying strata could be any of the following classes:

Rock Bottom: Associated species: freshwater sponge, brook leech.

Unconsolidated Bottom: Associated species: freshwater mollusk, sewage worm.

Aquatic Bed: Associated species: water lettuce, duckweed, watermeal, bladderwort.

Rocky Shore: Associated species: liverwort, lichen.

Unconsolidated Shore: Associated species: freshwater mollusk, crayfish.

Emergent Wetland: In the riverine system, only nonpersistent species occur (Species of which there is no evidence during some seasons of the year). Associated species: pickerel weed, arrow arum, arrowhead.

B. LOWER PERENNIAL SUBSYSTEM/Nontidal River Wetlands

Channels are generally flat. Slow-moving water flows year-round. There is no tidal influence. Streambeds are mostly sand and mud. Low oxygen levels occur. Underlying strata could be any of the following classes:

Rock Bottom: Associated species: brook leech.

Unconsolidated Bottom: Associated species: freshwater mollusk, sewage worm.

Aquatic Bed: Associated species: water lettuce, duckweed, watermeals, bladder-wort.

Rocky Shore: Associated species: liverwort, lichen.

Unconsolidated Shore: Associated species: freshwater mollusk, crayfish.

Emergent Wetland: In the riverine system, only nonpersistent emergent plants are found. Associated species: pickerel weed, arrow arum, arrowhead.

C. UPPER PERENNIAL SUBSYSTEM/Fast Moving River Wetlands

Channels are generally sloped. Fast-moving water flows year-round. There is no tidal influence. Streambeds are mostly rock, cobbles, or gravel with some sand. Oxygen levels are high. Underlying strata could be any of the following classes:

Rock Bottom: Associated species: water penny, caddis fly, stonefly, mayfly, blackfly, crayfish.

Unconsolidated Bottom: Associated species: stonefly, midge, caddis fly, pond snail, scud, freshwater mollusk, freshwater sponge.

Aquatic Bed: Vegetation is less likely to occur in the upper perennial subsystem because of fastmoving water. Associated species: moss, stonewort.

Rocky Shore: Associated species: liverwort, lichen.

Unconsolidated Shore: Associated species: freshwater mollusk, fingernail clam, leech, snails.

D. INTERMITTENT SUBSYSTEM/Seasonal or Irregularly Flooded Stream Inland Wetlands

Channels contain nontidal water which does not flow year-round. When water is not flowing there may be isolated pools, or the channel may have no water present. Underlying strata will be:

Streambed: Channels that are dry at times. Bottoms could be either bedrock, cobble-gravel, sand, mud or organic matter. Associated speices: snails, oligochaete worm, mayfly, midge, mosquito, fingernail clam.

IV. LACUSTRINE SYSTEM/Lake-Related Inland Freshwater Wetlands

The lacustrine system includes wetlands and deepwater habitats that occur either in a depression or a dammed river channel which contain only nonpersistent emergent plants. The system includes both freshwater lakes and tidal lakes with less than 0.5 percent ocean-derived salts. Generally, lacustrine systems are larger than 20 acres, including open water, and have considerable areas of deep water with wave action. The limits of the system are areas where the water body is bound by upland or persistently vegetated wetlands, the normal spillway level of a dammed river or the area where a river enters a lake.

A. LIMNETIC SUBSYSTEMS/Deepwater Lakes

All deepwater lakes. Some lacustrine systems do not have a limnetic area (limnetic refers to open water, generally deeper than 6.6 feet). Underlying strata could be any of the following classes:

Rock Bottom: Associated species: freshwater sponge, brook leech.

Unconsolidated Bottom: Associated species: freshwater mollusk, fingernail clam.

Aquatic Bed: Associated species: duckweed, stonewort, aquatic moss.

B. LITTORAL SUBSYSTEM/Shallow Lakes

This subsystem includes all lake-related wetlands in the lacustrine system from the upland limits of nonpersistent emergent plants to the deepest occurrence containing nonpersistent emergent plants, or water at a depth of 6.6 feet, whichever is shallower. Underlying strata could be any of the following classes:

Rock Bottom: Associated species: freshwater sponge, brook leech.

Unconsolidated Bottom: Associated species: freshwater mollusk, fingernail clam, sewage worm.

Aquatic Bed: Associated species: duckweed, aquatic moss, stonewort.

Rocky Shore: Associated species: caddis fly, freshwater mollusk, fingernail clam, liverwort, lichen.

Unconsolidated Shore: Associated species: leech, freshwater mollusk, midge, larvae, goosefoot.

Emergent Wetland: In the lacustrine system, only nonpersistent emergent plants are found. Associated species: arrow arum, pickerel weed, arrowheads.

V. PALUSTRINE SYSTEM/Marshes, Swamps, Bogs

The palustrine system includes all vegetated wetlands whose salinity is less than 0.5 percent. Also included are nonvegetated wetlands that are less than 20 acres; fresh bodies of water shallower than 2 meters (6.6 feet) without wave-formed or bedrock shore features. Underlying strata could be any of the following classes:

Rock Bottom: Associated species: freshwater sponge, pond snail, leech, midge.

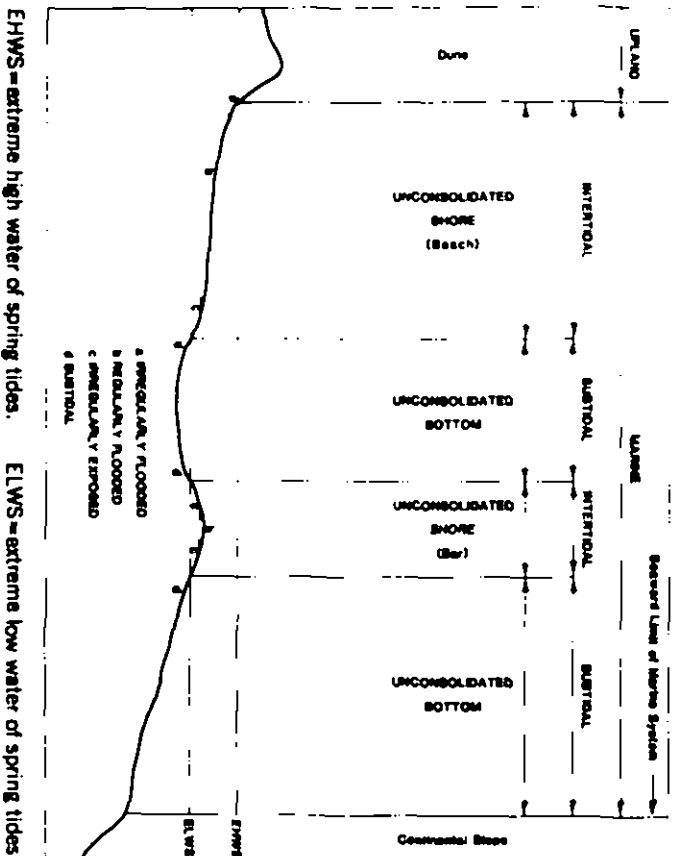
Unconsolidated Bottom: Associated species: freshwater sponge, freshwater mollusk, fingernail clam, oligochaete worm.

Aquatic Bed: Associated species: stonewort, aquatic moss, water lilies, pickerel weed.

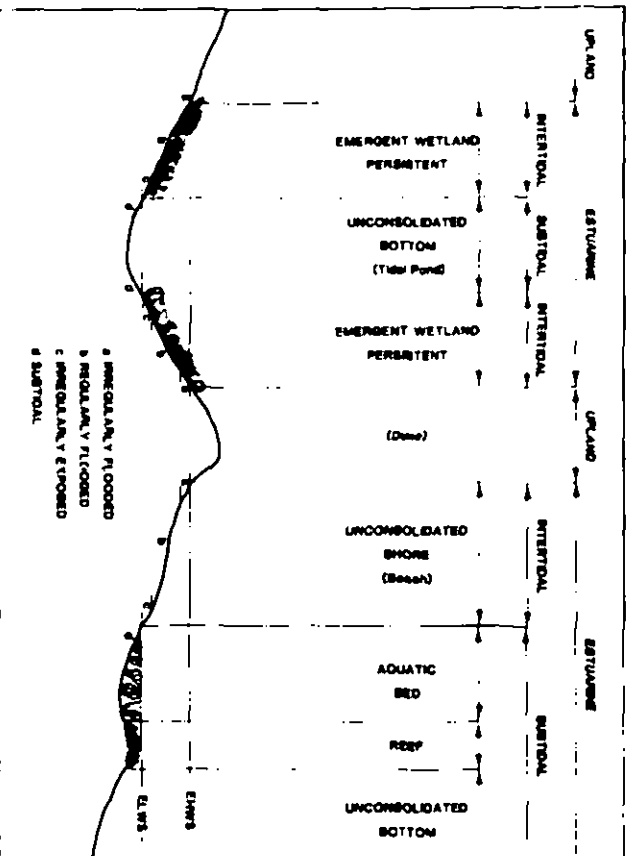
Unconsolidated Shore: Associated species: freshwater mollusk, crayfish, fingernail clam, leech.

Moss-Wetlands/Bogs: Associated species: Sphagnum moss, pitcher plants, sundew.

DISTINGUISHING FEATURES AND EXAMPLES OF HABITATS IN THE MARINE SYSTEM

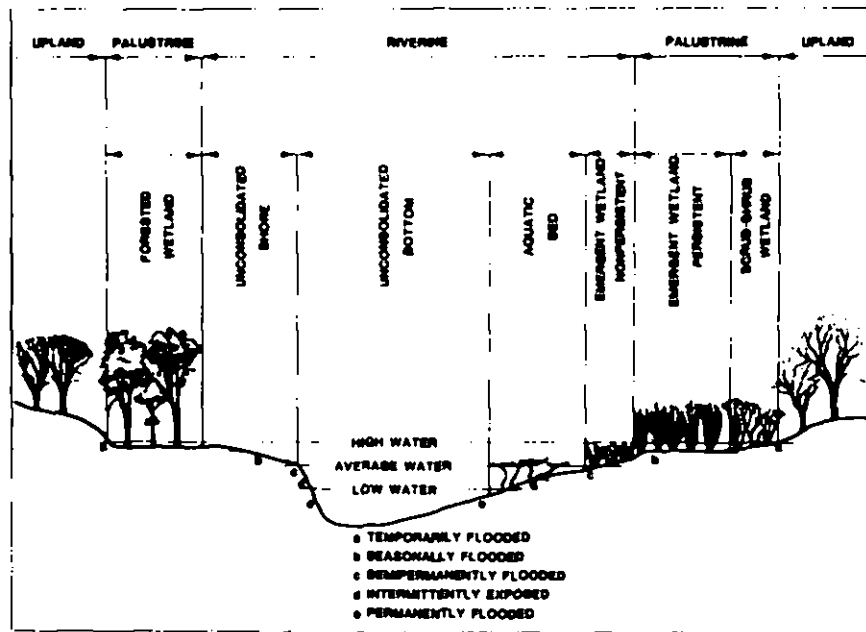


DISTINGUISHING FEATURES AND EXAMPLES OF HABITATS IN THE ESTUARINE SYSTEM

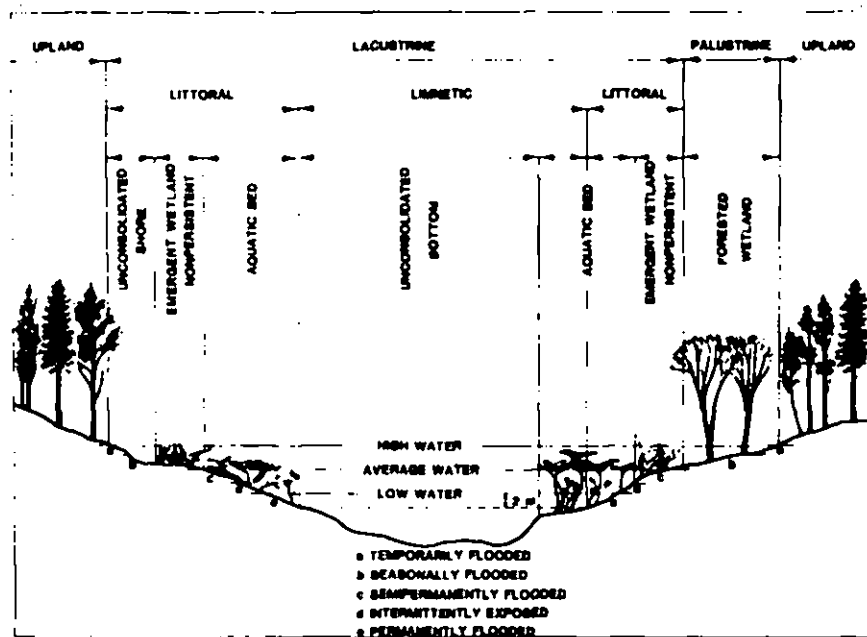


Source: Classification of Wetlands and Deepwater Habitats of the United States, USFWS, 1979.

DISTINGUISHING FEATURES AND EXAMPLES OF HABITATS IN THE RIVERINE SYSTEM

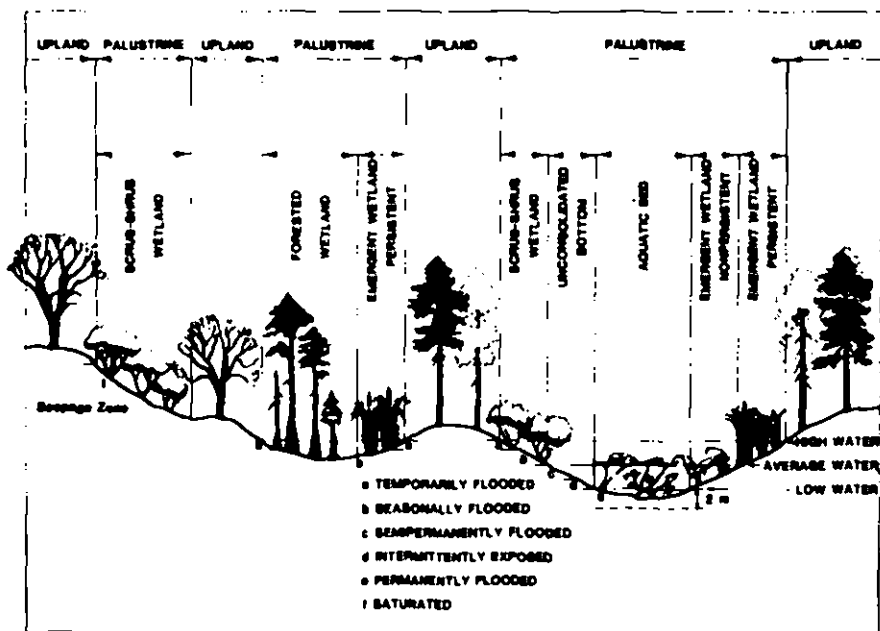


DISTINGUISHING FEATURES AND EXAMPLES OF HABITATS IN THE LACUSTRINE SYSTEM



Source: Classification of Wetlands and Deepwater Habitats of the United States, USFWS, 1979.

DISTINGUISHING FEATURES AND EXAMPLES OF HABITATS IN THE PALUSTRINE SYSTEM



Source: Classification of Wetlands and Deepwater Habitats of the United States, USFWS, 1979.

APPENDIX C

RARE WETLAND PLANTS LIST

This list categorizes New Hampshire's rare wetland plants by broad habitat type. It is meant as a general guide, to be used in conjunction with descriptive field guides and manuals. Note that the habitat types may intergrade, and some plants cited under one category may be found in other wetland habitats as well.

Arctic species are excluded from consideration here. Flood plain, riverine, and pond plant species are listed even though the habitat types do not qualify as "prime wetlands", since some of these plants may grow in wetland areas. Species that require calcareous soils will be found primarily in the Connecticut Valley.

Some of these species are difficult to identify without help from an experienced botanist. Local botanists, garden clubs, and the botany or environmental studies department of a local university may be able to help. Additional assistance may be available through the NH Natural Heritage Inventory.

Coastal Wetlands Including Inter-Tidal Areas

Quillworts:	Canadian River-bank Quillwort	<i>Isoetes riparia</i>
Pondweeds:	Leafy Pondweed	<i>Potamogeton foliosus</i>
Water-plantains:	Spongy Hooded-arrowroot	<i>Lophotocarpus spongiosus</i>
Grasses:	Salt-meadow Grass	<i>Diplachne maritima</i>
	Alaskan Goose-grass	<i>Puccinellia paupercula</i> var. <i>alaskana</i>
Sedges:	Stout Bulrush	<i>Scirpus robustus</i>
	Salt-loving Spike-rush	<i>Eleocharis halophila</i>
Iris:	Slender Blue Flag	<i>Iris prismatica</i>
Smartweeds:	Exserted Knotweed	<i>Polygonum exsertum</i>
	Prolific Knotweed	<i>Polygonum prolificum</i>
	White Dock	<i>Rumex pallidus</i>
Goosefoot:	Dwarf Glasswort	<i>Salicornia bigelovii</i>
	Perennial Glasswort	<i>Salicornia virginica</i>
	Coast-blight	<i>Chenopodium rubrum</i>
Orpines:	Pigmy Weed	<i>Tillaea aquatica</i>
Milkworts:	Cross Polygala	<i>Polygala cruciata</i> var. <i>aquilonia</i>
Parsley:	Eastern Lilaeopsis	<i>Lilaeopsis chinensis</i>
Primrose:	Water-pimpernel	<i>Samolus parviflorus</i>

Mints:	Hairy Germander	<i>Teucrium occidentale</i> var. <i>boreale</i>
Figworts:	Salt-marsh GerardiA Mudwort	<i>Agalinis maritima</i> <i>Limosella subulata</i>
Composites:	Large Salt Marsh Aster Marsh Elder	<i>Aster tenuifolius</i> <i>Iva frutescens</i> var. <i>oraria</i>

Northern White Cedar Swamps

Horsetails:	Marsh Horsetails	<i>Equisetum palustre</i>
Sedges:	Buxbaum's Sedge	<i>Carex buxbaumii</i>
Orchids:	Calypso, Fairy Slipper Ram's Head Lady's Slipper Small Yellow Lady's Slipper Showy Lady's Slipper Heart-leaved Twayblade Lily-leaved Twayblade White Adder's-mouth	<i>Calypso bulbosa</i> <i>Cypripedium arietinum</i> <i>Cypripedium parviflorum</i> <i>Cypripedium reginae</i> <i>Listera cordata</i> <i>Listera convallanioides</i> <i>Malaxis monophylla</i> var. <i>brachypoda</i>
Wintergreen	Bog Wintergreen	<i>Pyrola asarifolia</i>
Valerian:	Marsh Valerian	<i>Valeriana uliginosa</i>
Composites:	Sweet Coltsfoot	<i>Petasites frigidus</i> var. <i>pal- matus</i>

Other Swamps

Pines:	Atlantic White Cedar	<i>Chamaecyparis thyoides</i>
Bur-reeds:	Bur-reed	<i>Sparganium androcladum</i>
Sedges:	Bebb's Sedge	<i>Carex bebbii</i>
Orchids:	Small Yellow Lady's Slipper Showy Lady's Slipper Heart-leaved Twayblade Lily-leaved Twayblade	<i>Cypripedium parviflorum</i> <i>Cypripedium reginae</i> <i>Listera cordata</i> <i>Listera convallanioides</i>
Crowfoot:	Water-plantain Spearwort	<i>Ranunculus ambigens</i>
Heath:	Huckleberry Pinxter-flower Swamp Azalea	<i>Gaylussacia dumosa</i> var. <i>bigeloviana</i> <i>Rhododendron nudiflorum</i> <i>Rhododendron viscosum</i>

Primrose:	Tufted Loosestrife	<i>Lysimachia thyrsiflora</i>
Gentians:	Fringed Gentian	<i>Gentiana crinita</i>
Milkweeds:	Purple Milkweed	<i>Asclepias purpurascens</i>
Mints:	Gypsywort	<i>Lycopus rubellus</i>
	Canadian Germander	<i>Teucrium canadense</i> var. <i>svirginicum</i>
Madders:	Labrador Bedstraw	<i>Galium labradoricum</i>
	Large Marsh-bedstraw	<i>Galium obtusum</i> var. <i>obtusum</i>
Harebells:	Greater Marsh-bellflower	<i>Campanula uliginosa</i>
Composites:	Climbing Hempweed	<i>Mikania scandens</i>
	Pursh's Goldenrod	<i>Solidago purshii</i>

Freshwater Marsh

Horsetails:	Marsh Horsetail	<i>Equisetum palustre</i>
	Variiegated Horsetail	<i>Equisetum variegatum</i>
Curly Grass:	Climbing Fern	<i>Lygodium palmatum</i>
Polypody:	Netted Chain-fern	<i>Woodwardia areolata</i>
Grasses:	Sharp Flowered Manna-grass	<i>Glyceria acutiflora</i>
Sedges:	Golden-fruited Sedge	<i>Carex aurea</i>
	Lesser Paniced Sedge	<i>Carex diandra</i>
	Inflated Sedge	<i>Carex bullata</i>
	Incurved Umbrella Sedge	<i>Cyperus aristatus</i>
	Wright's Spike-rush	<i>Eleocharis diandra</i>
	Bald Spike-rush	<i>Eleocharis erythropoda</i>
	Neat Spike-rush	<i>Eleocharis nitida</i>
	Ovate Spike-rush	<i>Eleocharis ovata</i> var. <i>heuseri</i>
	Small Spike-rush	<i>Eleocharis parvula</i>
	Few-flowered Spike-rush	<i>Eleocharis pauciflora</i> var. <i>fernaldii</i>
	Tuberclcd Spike-rush	<i>Eleocharis tuberculosa</i>
	Hair-like Beak-rush	<i>Rhynchospora capillacea</i>
	Lined Bulrush	<i>Scirpus pendulus</i> (<i>S. lineatus</i>)
	Many-leaved Bulrush	<i>Scirpus polyphyllus</i>

Duckweeds:	Star-duckweed	<i>Lemma trisulca</i>
	Duckweed	<i>Lemma valdiviana</i>
Rushes:	Short-fruited Rush	<i>Juncus brachycephalus</i>
Iris:	Slender Blue Flag (calcareous)	<i>Iris prismatica</i>
Orchids:	Small Yellow Lady's Slipper	<i>Cypripedium parviflorum</i>
Mustards:	Spring Cress (calcareous)	<i>Cardamine bulbosa</i>
Primrose:	Tufted Loosestrife	<i>Lysimachia thyrsoiflora</i>
Valerian:	March Valerian	<i>Valeriana uliginosa</i>
Harebells:	Brook Lobelia (calcareous)	<i>Lobelia kalmii</i>
Composites:	Small Bidens	<i>Bidens discoidea</i>
	Smooth Bidens	<i>Bidens laevis</i>
	Sweet Coltsfoot (calcareous)	<i>Petasites frigidus</i> var. <i>palmatum</i>

Bogs/Fens

Polypody:	Netted Chain-fern	<i>Woodwardia areolata</i>
Sedges:	Meagre Sedge	<i>Carex exilis</i>
	Inflated Sedge	<i>Carex bullata</i>
	Wiegand's Sedge	<i>Carex wiegandii</i>
	Hair-like Beak-rush (calcareous)	<i>Rhychospora capillacea</i>
Orchids:	Arethusa	<i>Arethusa bulbosa</i>
	Loesel's Twayblade	<i>Liparis Loeselii</i>
	Huckleberry	<i>Gaylussacia dumosa</i> var. <i>bigeloviana</i>

Ponds, Including Edges, Standing Water

Clubmoss:	Slender Bog Club-moss	<i>Lycopodium inundatum</i> var. <i>bigelovii</i>
Quillworts:	Eaton's Quillwort	<i>Isoetes eatoni</i>
	Engelmann's Quillwort	<i>Isoetes engelmanni</i>
	Large-spored Quillwort	<i>Isoetes macrospora</i>
	Canadian River-bank Quillwort	<i>Isoetes riparia</i>
Bur-reeds:	Bur-reed (calcareous)	<i>Sparganium androcladum</i>
	Broad-fruited Bur-reed (calcareous)	<i>Sparganium eurycarpum</i>

Pondweeds:	Thin-leaved Apline Pondweed (calcareous)	<i>Potamogeton alpinus</i>
	Northern Slender Pondweed	<i>Potamogeton filiformis</i> var. <i>alpinus</i>
	Leafy Pondweed (calcareous)	<i>Potamogeton foliosus</i>
	Budding Pondweed	<i>Potamogeton pusillus</i> var. <i>gemmiparus</i>
	One-sided Pondweed	<i>Potamogeton lateralis</i>
	Knotty Pondweed	<i>Potamogeton nodosus</i>
	Sago Pondweed	<i>Potamogeton pectinatus</i>
	Prolonged Pondweed (calcareous)	<i>Potamogeton praelongus</i>
	Vasey's Pondweed - (calcareous)	<i>Potamogeton vaseyi</i>
	Zostera-like Pondweed	<i>Potamogeton zosteraformis</i>
Water Plantains:	Wapato (calcareous)	<i>Sagittaria cuneata</i>
Grasses:	Sharp Flowered Manna-grass	<i>Glyceria acutiflora</i>
Sedges:	Buxbaum's Sedge (calcareous)	<i>Carex buxbaumii</i>
	Lesser Panicked Sedge	<i>Carex diandra</i>
	Wright's Spike-rush	<i>Eleocharis diandra</i>
	Bald Spike-rush	<i>Eleocharis erythropoda</i>
	Salt-loving Spike-rush	<i>Eleocharis halophila</i>
	Neat Spike-rush	<i>Eleocharis nitida</i>
	Ovate Spike-rush	<i>Eleocharis ovata</i> var. <i>heuseri</i>
	Small Spike-rush	<i>Eleocharis parvula</i>
	Few-flowered Spike-rush	<i>Eleocharis pauciflora</i> var. <i>fernaldii</i>
	Tuberclad Spike-rush	<i>Eleocharis tuberculosa</i>
	Small-flowered Hemicarpa	<i>Hemicarpa micrantha</i>
Pickeral-weeds:	Water-stargrass	<i>Heteranthera dubia</i>
Rushes:	Short-fruited Rush (calcareous)	<i>Juncus brachycephalus</i>
Birch:	River Birch	<i>Betula nigra</i>
Smartweeds:	Robust Knotweed	<i>Polygonum robustius</i>
Water-lilies:	Spatter-dock	<i>Nuphar advena</i>
	Tiny Cow-lily	<i>Nuphar microphyllum</i>
Crowfoot:	Water-plantain Spearwort	<i>Ranunculus ambigens</i>
	Stiff Water Crowfoot	<i>Ranunculus subrigidus</i>
Water Starwort:	Alpine Water-Starwort	<i>Callitriche anceps</i>

Water-Milfoils:	Alternate-flowered Milfoil	<i>Myriophyllum alter niflorum</i>
	Farwell's Milfoil	<i>Myriophyllum farwelli</i>
	Mermaid-Weed	<i>Proserpinaca pectinata</i>
Mare's tails:	Mare's-tail	<i>Hippuris vulgaris</i>
Figworts:	Mudwort	<i>Limosella subulata</i>
	False Pimpernel	<i>Lindernia anagallidea</i>
Harebells:	Brook Lobelia	<i>Lobelia kalmii</i>
Composites:	Small Bidens - <i>Bidens discoidea</i>	
	Smooth Bidens	<i>Bidens laevis</i>
	Water Marigold	<i>Megalodonta beckii</i>
	Sclerolepis	<i>Sclerolepis uniflora</i>

Flood Plains/Riverside Seeps

Horsetails:	Marsh Horsetail	<i>Equisetum palustre</i>
	Meadow Horsetail	<i>Equisetum pratense</i>
	Variegated Horsetail	<i>Equisetum variegatum</i>
Grasses:	Neglected Reed Bent-grass	<i>Calamagrostis neglecta</i>
Sedges:	Garber's Sedge	<i>Carex garberi</i> var. <i>bifaria</i>
	Slightly Hairy Sedge	<i>Carex hirsutella</i>
	Hair-like Beak-rush	<i>Rhynchospora capillacea</i>
Lilies:	Sticky False Asphodel	<i>Toliedia glutinosa</i>
Orchids:	Loesel's Twayblade	<i>Liparis Loeselii</i>
	Shining Lady's-tresses	<i>Spiranthes lucida</i>
Willows:	Heart Shaped Willow	<i>Salix cordata</i> var. <i>abrasa</i>
Saxifrage:	Grass-Of-Parnassus	<i>Parnassia glauca</i>
Harebells:	Brook Lobelia	<i>Lobelia kalmii</i>
Composites:	Dwarf Ragwort	<i>Senecio pauperculus</i>

Streams and Rivers, Including Edges

Quillworts:	Eaton's Quillwort	<i>Isoetes eatoni</i>
	Engelmann's Quillwort	<i>Isoetes engelmanni</i>
	Large-spored Quillwort	<i>Isoetes macrospora</i>
	Canadian River-bank Quillwort	<i>Isoetes riparia</i>

Pondweeds:	Thin-leaved Alpine Pondweed (calcareous)	<i>Potamogeton alpines</i>
	Knotty Pondweed	<i>Potamogeton nodosus</i>
	Sago Pondweed	<i>Potamogeton pectinatus</i>
	Prolonged Pondweed	<i>Potamogeton praelongus</i>
	Vasey's Pondweed (calcareous)	<i>Potamogeton vaseyi</i>
	Zoster-like Pondweed	<i>Potamogeton zosteriformis</i>
Duckweeds:	Star-duckweed	<i>Lemna trisulca</i>
	Duckweed	<i>Lemna valdiviana</i>
Lilies:	Siberian Chives (calcareous)	<i>Allium schoenprasum</i>
Orchids:	Tubercled Orchid	<i>Habenaria floara</i>
	Auricled Twayblade	<i>Listera auriculata</i>
Willows:	Sandbar Willow	<i>Salix interior</i>
Birch:	River Birch	<i>Betula nigra</i>
Water Lilies:	Spatter-dock	<i>Nuphar advena</i>
	Tiny Cow-lily	<i>Nuphar microphyllum</i>
Crowfoot:	Stiff Water Crowfoot	<i>Ranunculus subrigidus</i>
Oprines:	Pigmy Weed	<i>Tillaea aquatica</i>
Bean:	Robbins' Milk-vetch	<i>Astragalus robbinsii var. jesupi</i>
	Alpine Milk-vetch	<i>Astragalus alpinus var. brunetianus</i>
St. John's-wort:	Great St. John's-wort	<i>Hypericum pyramidatum</i>
Milfoils:	Alternate-flowered Milfoil	<i>Myriophyllum alterniflorum</i>
	Farwell's Milfoil	<i>Myriophyllum farwellii</i>
Mare's-tails:	Mare's tail	<i>Hippuris vulgaris</i>

Source: Prepared by the Office of State Planning with assistance from Frankie Brackley of The Nature Conservancy and Frederic L. Steele. 6/83.

APPENDIX D

ENDANGERED AND THREATENED SPECIES IN NEW HAMPSHIRE

Endangered

Common Name	Scientific Name
Dwarf Wedge Mussel	<i>Alasmidonta heterodon</i>
Swollen Wedge Mussel	<i>Alasmidonta varicosa</i>
Frosted Elfin Butterfly	<i>Incisalia irus</i>
Karner Blue Butterfly	<i>Lycaeides melissa samuelis</i>
Persius Dusky Wing Skipper	<i>Erynnis persius</i>
Banded Bog Skimmer	<i>Williamsonia lintneri</i>
Sunapee Trout	<i>Salvelinus aureolus</i>
Shortnose Sturgeon	<i>Acipenser brevirostrum</i>
Timber Rattlesnake	<i>Crotalus horridus</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>
Common Tern	<i>Sterna hirundo</i>
Piping Plover	<i>Charadrius melodus</i>
Upland Sandpiper	<i>Bartramia longicauda</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Golden Eagle	<i>Aquila chrysaetos</i>
Peregrine	<i>Falco peregrinus</i>
Sedge Wren	<i>Cistothorus platensis</i>
Loggerhead Shrike	<i>Lanius ludovicianus</i>
Henslow's Sparrow	<i>Ammodramus henslowii</i>
Canada Lynx	<i>Lynx canadensis</i>
Small Footed Bat	<i>Myotis leibii</i>

Threatened

Common Name	Scientific Name
Pine Pinion Moth	<i>Lithophane lepida lepida</i>
Pine Barrens Zanclognatha Moth	<i>Zanclognatha martha</i>
Cobbelstone Tiger Beetle	<i>Cicindela marginipennis</i>
Common Loon	<i>Gavia immer</i>
Least Tern	<i>Sterna albifrons</i>
Arctic Tern	<i>Sterna paradisaea</i>
Roseate Tern	<i>Sterna dougallii</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Northern Harrier	<i>Circus cyaneus</i>
Osprey	<i>Pandion haliaetus</i>
Common Nighthawk	<i>Chordeiles minor</i>
Purple Martin	<i>Progne subis</i>
Pine Martin	<i>Martes americana</i>

Source: NH Endangered Species Program, NH Fish and Game Department and The Audubon Society of New Hampshire, June, 1987.

BIBLIOGRAPHY

- Breeding, C., Richardson, F. and Pilgrim, S. 1974. Soil Survey of NH Tidal Marshes. NH Agricultural Experiment Station. Durham, NH: University of New Hampshire.
- Commerce, US Department of. 1987 Draft Environmental Impact Statement and Draft Management Plan: Great Bay National Estuarine Research Reserve. Washington, DC.
- Commerce, US Department of. 1987. NH Coastal Program and Draft Environmental Impact Statement. Office of Ocean and Coastal Zone Resource Management and New Hampshire Office of State Planning.
- Comprehensive Planning, Office of. 1977. 1977 New Hampshire Outdoor Recreation Plan. Concord, NH.
- Cowardin, L. et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Fish and Wildlife Service.
- Crow, G. and Dunlop D. 1983. Coastal Endangered Plant Inventory.
- Emergency Wetlands Resources Act of 1986, Public Law 99-645.
- Fish and Game, NH Department of. 1980-1982. Great Bay Estuary Monitoring Survey, Volumes I and II.
- Fish and Game, NH Department of. 1987. "Waterfowl Management Plan." Concord, NH.
- Fish and Game, NH Department of. 1975. Waterfowl and Their Management in New Hampshire. Concord, NH.
- Governor's Conference on New Hampshire's Outdoor Recreation Future. 1986. No Accidental Successes: Report of the 1986 Governor's Conference on NH's Outdoor Recreation Future.
- Guariglia, M. 1975. Wetlands - A Vital Natural Resource. Lakes Region Planning Commission. Meredith, NH.
- Horwitz, E. 1978. Our Nation's Wetlands. Council on Environmental Quality. Washington: US Government Printing Office.
- Interior, US Department of. 1958. Inventory of Permanent Water Areas of Significant Value to Waterfowl in the State of New Hampshire. Fish and Wildlife Services, Bureau of Sport Fisheries and Wildlife, Branch of River Basins. Boston: MA.
- Interior, US Department of. 1981. Nationwide Rivers Inventory: Final List of Rivers. Northeast Regional Office, Heritage Conservation and Recreation Service. Philadelphia, PA.
- Interior, US Department of. 1987. Opportunities to Protect Instream Flows and Wetland Uses of Water In New Hampshire and Connecticut. Fish and Wildlife Service, Biological Report 87(6). Washington, DC.
- Interior, US Department of. 1985. Wetlands of New Jersey. Fish and Wildlife Service. Washington, DC.
- Interior, US Department of. 1984. Wetlands of the United States: Current Status and Recent Trends. Fish and Wildlife Service. Washington, DC.
- Ivey, C. 1977. A Guide to the Protection of Wetlands in New Hampshire.

- Johnson, D. 1925. The New England-Acadian Shoreline. New York, NY: Hafner Publishing Company.
- Keene, H. 1970. Salt Marsh Evolution and Post Glacial Submergency in New Hampshire. Master of Science Thesis, University of New Hampshire.
- Kimball Chase Company, Inc. 1986. New Hampshire Coastline Erosion and Deposition Study for Rockingham Planning Commission. Final Report. Portsmouth, NH.
- Kundell, J. and Woolf, S. 1986. Georgia Wetlands - Trends and Policy Options. Carl Vinson Institute of Government. Athens, GA: University of Georgia.
- Lee J. 1956. Waterways of New Hampshire. NH Fish and Game Department. Concord, NH.
- McClure, J. 1987. Land Protection and the Tax Advantages for New Hampshire Landowners, 2nd Edition.
- Michener, M. et al. 1986. The Coastal Wetlands Mapping Program, New Hampshire. Phase 2 Report. Bedford, NH: Normandeau Associates.
- New Hampshire Association of Conservation Commissions. 1983. Guide to the Designation of Prime Wetlands in New Hampshire.
- New Hampshire Coastal Program. 1986. "Final Emerging Coastal Issues Paper."
- New Hampshire Code of Administrative Rules Annotated. Orford, NH: Equity Publishing Corporation.
- New Hampshire Revised Statutes Annotated. Orford, NH: Equity Publishing Corporation.
- New Hampshire State Planning Board. 1934. Water Bodies in New Hampshire. Concord, NH.
- New Hampshire State Planning Project. 1964. New Hampshire Water Bodies and Public Access Points. Report Number 4. Concord, NH.
- New Hampshire State Planning Project. 1964. New Hampshire Public Water Bodies and Public Access Points: Part II. Report No. 12. Concord, NH.
- New Hampshire Water Resources Board. 1984. "New Hampshire Water Resources Management Plan." Concord, NH.
- Normandeau Associates, Inc. 1986. The Coastal Wetlands Mapping Program, New Hampshire (Phase 2 Report).
- Richardson, F. 1982. Identification, Documentation and Mapping of Prime Tidal Wetlands in the Town of Hampton, New Hampshire.
- Richardson, F. February 2, 1988. NH Wetlands Board. Interdepartmental Communication.
- Robinson, E. 1987. "Waterfowl Habitat Acquisition and Management Update." Concord, NH: NH Fish and Game Department.
- Sandwich Conservation Commission. Sandwich Prime Wetlands Study, 1983-1985. Sandwich, NH.
- Short, F. 1984. North Hampton Salt Marsh Study.
- Simpson, M. 1986. Restoration of Parson's Creek Marsh, Rye, New Hampshire. Master's Project. Antioch New England Graduate School.
- Smith, C. and Evans, D. 1983 Study of Bald Eagle Use of New Hampshire Estuaries. Final Report.
- State Planning, NH Office of 1985. Lakes and Great Ponds Report 1984-1985, Volume 2.

- State Planning, NH Office of. 1987. Recreation in Action.
- State Planning, NH Office of. 1988. Rivers and Lakes Protection Program.
- State Planning, NH Office of. 1989. Status of Municipal Planning and Municipal Land Use Regulations in New Hampshire.
- State Planning, NH Office of. 1988. "Wetlands Mitigation/Restoration Issues."
- Swope, M. 1988. Handbook for Municipal Conservation Commissions in New Hampshire.
NH Association of Conservation Commissions.
- Taffe, W. and Ross, J. 1977. A Guide to the Physical Environment of New Hampshire.
Environmental Studies Center. Plymouth, NH: Plymouth State College.
- Tiner, R. and Wilen, B. 1982. The US Fish and Wildlife Service's National Wetlands Inventory Project. US Fish and Wildlife Service, Newton Corner, MA and National Wetlands Inventory Project, US Fish and Wildlife Service. Washington, DC: Cooperative Publication.
- Tiner, R. Jr. 1985. Wetlands of Delaware. US Fish and Wildlife Service, National Wetlands Inventory, Newton Corner, MA and Delaware Department of Natural Resources and Environmental Control, Wetlands Section. Dover, DE: Cooperative Publication.
- US Fish and Wildlife Service. 1989. National Wetlands Priority Conservation Plan.
Washington, DC.

FOOTNOTES

1. Kundell, James, E., and S. Wesley Woolf. Georgia Wetlands: Trends and Policy Options. Georgia: Carl Vinson Institute of Government, University of Georgia, 1986.
2. Emergency Wetlands Resources Act of 1986, P.L. 99-645.
3. Tiner, Ralph, W., and Bill O. Wilen. The US Fish and Wildlife Service's National Wetlands Inventory Project. US Fish and Wildlife Service, Newton Corner, MA and National Wetlands Inventory Project, US Fish and Wildlife Service, Washington, DC. Cooperative Publication, 1982.
4. National Wetlands Priority Conservation Plan. Washington, DC: US Fish and Wildlife Service, April 1989.
5. Guide to the Designation of Prime Wetlands in New Hampshire. Concord, NH: The New Hampshire Association of Conservation Commissions, 1983.
6. Taffe, William J., and John E. Ross. A Guide to the Physical Environment of New Hampshire. Plymouth State College Environmental Studies Center, 1977.
7. Richardson, Frank D., NH Wetlands Board. Interdepartmental Communication. Concord, NH: February 2, 1988.
8. Kettenring, Kenneth., Administrator of the Wetlands Board. Phone Interview. February 26, 1988.
9. New Hampshire Coastal Program and Draft Environmental Impact Statement. Office of Ocean and Coastal Resources Management, Washington, DC and the Office of State Planning, Concord, NH. Cooperative Publication, 1987.
10. Smith, Glenn. National Wetlands Inventory, US Fish and Wildlife Service, Newton, MA: Phone Interview. June, 1989.
11. Ibid.
12. The US Fish and Wildlife Service's National Wetlands Inventory Project, op. cit.
13. The Coastal Wetlands Mapping Program, New Hampshire. Phase 2 Report. Normandeau Associates, Inc. 1986.
14. Ibid.
15. 1977 New Hampshire Outdoor Recreation Plan. Concord, NH: New Hampshire Department of Resources and Economic Development and New Hampshire Office of Comprehensive Planning, 1977.
16. New Hampshire Public Water Bodies and Public Access Points: Part II. Report No. 12. Concord, NH: New Hampshire State Planning Project, 1964.
17. Inventory of Fresh Water Bodies in New Hampshire. Concord, NH: New Hampshire Division of Water Resources, 1988.

18. Water Bodies in New Hampshire. Concord, NH: New Hampshire State Planning Board, December 1934.
19. New Hampshire Water Bodies and Public Access Points. Report No. 12, op. cit.
20. New Hampshire Water Bodies and Public Access Points. Report No. 4, Concord, NH: New Hampshire State Planning Project, 1964.
21. Waterfowl and Their Management in New Hampshire. Concord, NH: New Hampshire Fish and Game Department, 1975.
22. Ibid.
23. Lakes and Great Ponds Report, 1984-1985. Volume 2. Concord, NH: New Hampshire Office of State Planning.
24. Natural Areas Inventory Data Sheet No. 112. "Umbagog Lake Region." New Hampshire Natural Areas Inventory, 1971.
25. 1977 New Hampshire Outdoor Recreation Plan, op. cit.
26. Guide to the Physical Environment of New Hampshire, op. cit.
27. Ibid.
28. A Guide to the Physical Environment of New Hampshire, op. cit.
29. National Rivers Inventory: Final List of Rivers. Philadelphia, PA: US Department of the Interior, Northeast Regional Office, Heritage Conservation and Recreation Service, 1981.
30. New Hampshire Coastal Program and Draft Environmental Impact Statement, op. cit.
31. Ibid.
32. Natural Heritage Inventory, New Hampshire Department of Resources and Economic Development, 1985.
33. Great Bay Estuary Monitoring Survey 1980-1982. Volumes I and II. Concord, NH: New Hampshire Department of Fish and Game.
34. Smith, Carol F., and Diane Evans. Study of Bald Eagle Use of New Hampshire Estuaries. Final Report. Concord, NH: Coastal Energy Impact Program, Office of State Planning, 1983.
35. Draft Environmental Impact Statement and Draft Management Plan: Great Bay National Estuarine Research Reserve. US Department of Commerce, National Oceanic and Atmospheric Administration, Washington, DC and Office of State Planning, Concord, NH. Cooperative Publication, 1987.
36. Johnson, D. W. The New England-Acadian Shoreline. New York: Hafner Publishing Company, 1925.
37. Keene, H. W. Salt Marsh Evolution and Post Glacial Submergence in New Hampshire. Durham, NH: University of New Hampshire, M. Sc. Thesis, 1970.

38. Breeding, Charles H. et al. Soil Survey of New Hampshire Tidal Marshes. Durham, NH: New Hampshire Agricultural Experiment Station; University of New Hampshire, 1974.
39. Michener, Martin C. et al. The Coastal Wetlands Mapping Program, New Hampshire. Phase 2 Report. Bedford, NH: Normandeau Associates, Inc. 1986.
40. New Hampshire Coastline Erosion and Deposition Study for Rockingham Planning Commission. Final Report. Portsmouth, NH: Kimball Chase Company, Inc., 1986.
41. Great Bay Estuary Monitoring Survey 1980-1982, op. cit.
42. New Hampshire Coastal Program and Draft Environmental Impact Statement, op. cit.
43. Ibid.
44. Ibid.
45. Georgia Wetlands: Trends and Policy Options, op. cit.
46. New England Wetlands - Plant Identification and Protective Laws. Boston, MA: Environmental Protection Agency, May 1981.
47. "Conservation Commission News." Concord, NH: New Hampshire Association of Conservation Commissions, Fall 1988.
48. Ibid.
49. Ibid.
50. Grant, Kenneth E. Conservation Memorandum - 15. Soil Conservation Service, May 5, 1987.
51. Increasing Our Wetland Resources: Conference Proceedings. Washington, DC: National Wildlife Federation - Corporate Conservation Council, April 1988.
52. "New Hampshire Wildlife." Concord, NH. NH Wildlife Federation. March-April 1989.
53. Georgia Wetlands: Trends and Policy Options. op. cit.
54. Status of Municipal Planning and Land Use Regulations in New Hampshire. Concord, NH: Office of State Planning, July 1989.
55. McClure, Jan, W. Land Protection and Tax Advantages for New Hampshire Landowners. Concord, NH: Office of State Planning and Society for the Protection of New Hampshire Forests, Cooperative Publication, 1984. Revised 1987.
56. Robinson, Edward., Wildlife Biologist, New Hampshire Fish and Game Department. Phone Interview, December 9, 1987.
57. Ibid.
58. New Hampshire Coastal Program and Draft Environmental Impact Statement. op. cit.

59. Ibid.
60. Draft Environmental Impact Statement and Management Plan: Great Bay National Estuarine Research Reserve, op. cit.
61. Ibid.
62. Guide to the Designation of Prime Wetlands in New Hampshire, op. cit.
63. "Report of the Wetlands Review Committee." Concord, NH: Wetlands Review Committee. February 8, 1989.
64. Ibid.
65. Ibid.
66. Guide to the Designation of Prime Wetlands in New Hampshire, op. cit.
67. Sandwich Prime Wetlands Study 1983-1985. Sandwich, NH: Sandwich Conservation Commission.
68. Ibid
69. Cormier, Fran. "Derry Prime Wetland Study." Lecture presented to the Londonderry Conservation Commission. October 27, 1987.
70. Ibid.
71. Robinson, Edward. "Of Wetland and Waterfowl." Discover Wild New Hampshire. Concord, NH: New Hampshire Fish and Game Department, September 1988.
72. "Criteria for Current Use Assessment." Concord, NH: Current Use Advisory Board, February 1987.
73. "Status of Municipal Planning and Land Use Regulations in New Hampshire." Concord, NH: Office of State Planning, July 1989.
74. Ibid.
75. Ibid.
76. Ibid.
77. Ibid.
78. Ibid.
79. "Waterfowl Management Plan." Concord, NH: New Hampshire Fish and Game Department, March 1987.
80. New Hampshire Water Resources Management Plan. Concord, NH: New Hampshire Water Resources Board, 1984.

