

Central Pine Barrens Comprehensive Land Use Plan

Volume 2: Existing Conditions

Plan Volume 2: Version of 6/28/95 (Reprinted 8/96)

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April 12 and 26, 1995: Amended by Commission resolutions following comments from towns.

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June 28, 1995: Approved in final form by the Commission, and signed into law by the Commission and the Governor.

May 1, 1996: Plan Volume 1 was amended by resolution of the Commission pursuant to ECL Article 57 provisions for Plan amendments. Plan Volume 2 was not altered.

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Central Pine Barrens Comprehensive Land Use Plan

Volume 2: Existing Conditions

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Riverhead Town Police
Southampton Town Police
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Suffolk County Park Police
Suffolk County Police
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Central Pine Barrens Comprehensive Land Use Plan

Volume 2: Existing Conditions

Contents

Preamble to Volume 2	23
1. Evolution and History of the Central Pine Barrens	24
1.1 Introduction	24
1.2 The Pleistocene Age	24
1.3 From 12,000 years ago to the time of European Colonization	25
1.4 From European Colonization through the 1800s	28
1.5 The Twentieth Century	29
1.6 Bibliography: Evolution and History of the Pine Barrens	30
2. Geologic Overview	33
2.1 Introduction	33
2.2 Surficial Geology	34
2.2.1 Unconsolidated Deposits	34
2.2.2 Bedrock	34
2.2.3 Lloyd Sand Member of the Raritan Formation	34
2.2.4 Clay Member of the Raritan Formation	38
2.2.5 Magothy Formation - Matawan Group Undifferentiated	38
2.2.6 Monmouth Group	38
2.2.7 Gardiners Clay	38
2.3 Glacial Deposits	39
2.4 Recent Deposits	39
2.5 Topographic Relief	39
2.5.1 Slopes	40
2.5.2 Land Forms	40
2.6 Bibliography: Geologic Overview	40
3. Soils Overview	41
3.1 Introduction	41
3.2 Description of General Soils Associations	41
3.2.1 Haven-Riverhead Association	41
3.2.2 Plymouth-Carver Association, Rolling and Hilly	43
3.2.3 Riverhead-Plymouth-Carver Association	44
3.2.4 Plymouth-Carver Association, Nearly Level and Undulating	45
3.3 Soil Resources Associated with Environmentally Significant Resources	45
3.3.1 Prime Agricultural Soils	46
3.3.2 Soils Associated with Environmentally Sensitive Areas	46

4. Hydrology and Water Quality Overview	47
4.1 Introduction	47
4.2 Hydrogeology	47
4.2.1 Ronkonkoma Moraine and Outwash Plains	47
4.2.2 Surficial Silt and Clay Deposits	47
4.2.3 Glacial Clay Units	49
4.2.4 Upper Glacial Aquifer	49
4.2.5 Gardiners Clay Unit	49
4.2.6 Magothy Aquifer	51
4.3 Ground and Surface Water Hydrology	51
4.3.1 Precipitation	51
4.3.2 Recharge	51
4.3.3 Hydrogeologic Zones	51
4.3.4 Water Table and Depth to Water	52
4.3.5 Upper Glacial Aquifer Flow	52
4.3.6 Magothy Aquifer Flow	52
4.3.7 Water Supply Pumpage	54
4.3.8 Streamflow	56
4.4 Pond and Wetland Hydrology	56
4.5 Ground and Surface Water Quality	57
4.5.1 Precipitation	57
4.5.2 Groundwater Quality	57
4.5.3 Pond and Wetland Water Quality	58
4.5.4 River and Underflow Water Quality	58
4.6 Bibliography: Hydrology and Water Quality Overview	59
5. Ecosystems Overview	61
5.1 Introduction	61
5.2 Description of the Ecosystem	61
5.3 Ecological Processes	62
5.3.1 Vegetation	62
5.3.2 Wildlife	67
5.3.2.1 Vegetative Cover Type	67
5.3.2.2 Soil Moisture Content	68
5.3.2.3 Habitat Availability	68
5.4 Description of Ecological Communities	69
5.5 Natural Pine Barrens communities	72
5.6 Upland Communities	72
5.6.1 Pitch Pine-oak forest G4G5 S4	72
5.6.2 Chestnut oak forest G3G4 S4	73
5.6.3 Dwarf pine plains G1G2 S1	73
5.6.4 Pitch pine-oak-heath woodland G3G4 S2S3	75
5.7 Wetland Communities	75
5.7.1 Coastal plain ponds G3G4 S2; Coastal plain pond shores G3G4 S2	76
5.7.2 Pine Barrens shrub swamps G5 S3	77

5.7.3	Coastal plain Atlantic white cedar swamp G3G4 S1	77
5.7.4	Red maple-hardwood swamps G5 S4S5	78
5.7.5	Coastal plain poor fen G3? S1	78
5.7.6	Coastal plain stream G3G4 S1	79
5.7.7	Low salt marsh G4 S3S4; High salt marsh G4 S3S4	79
5.7.8	Salt panne G3G4 S3	79
5.7.9	Salt shrub G5 S4	79
5.7.10	Pine Barrens vernal pond (G3G4 S2 elsewhere in New York); Vernal pool (G4 S3S4 elsewhere in New York)	80
5.8	Human-created Communities	80
5.8.1	Successional old field G4 S4; Successional Shrubland G4 S4	80
5.8.2	Cropland/row crops G5 S5	81
5.8.3	Mowed lawn G5 S5; mowed lawn with trees G5 S5	81
5.8.4	Mowed roadside/pathway G5 S5	81
5.9	Occurrences of Rare Pine Barrens Natural Communities and Species	81
5.9.1	Communities	81
5.9.2	Plants	82
5.9.3	Animals	82
5.9.4	Upland species	84
5.9.5	Dwarf Pine Plains Species	84
5.9.6	Wetland species	84
5.10	Ecological Principles of Conservation Reserve Design	85
5.11	Bibliography: Ecosystems Overview	87
6.	Status of Ecosystem Research in the Central Pine Barrens	91
6.1	Completed Research	91
6.2	Ongoing Research	91
6.2.1	The Nature Conservancy's NorthEast Pine Barrens Ecosystem Program	91
6.2.2	Fire behavior and fire ecology	92
6.2.3	Fire facilitation hypothesis	92
6.2.4	Historic vegetation reconstruction in the Long Island pine barrens	92
6.2.5	Pitch Pine Community relationships in New York State and Long Island	92
6.2.6	Interactions between climate and radial growth of pitch pine	92
6.2.7	Genetics of dwarf pitch pine	92
6.2.8	Community dynamics in ridge top pine barrens of the Shawangunk Mountains of New York	93
6.2.9	Water quality of wetlands in the Long Island Central Pine Barrens	93
6.2.10	Wetland hydrology and ecology	93
6.2.11	Lepidoptera in the Long Island dwarf pine barrens	93
6.2.12	Survey of fens of New York State	93
6.3	Future Research Needs	93
6.3.1	Biological Inventory	94
6.3.2	Biological and environmental monitoring	94

6.3.3	Land use history and fire history	95
6.3.4	Conceptual ecological models of upland natural communities	96
6.3.5	Wetland ecology	97
6.3.6	Wetland hydrology	97
6.3.7	Species ecology	98
6.3.8	Oldfields/Grasslands	98
6.3.9	Roadsides/Firebreaks	98
6.3.10	Food Plots	98
6.4	Bibliography: Status of Ecosystem Research in the Central Pine Barrens	98
7.	Cultural Resources: Historic and Archaeological	101
7.1	Definitions of Terms	101
7.2	Overview of Cultural Resources in the Central Pine Barrens	102
7.2.1	Prehistoric and Native American Resources	103
7.2.2	Historic and Cultural Resources	105
7.2.3	List of Historic Resources within Brookhaven	106
7.2.4	List of Historic Resources within Riverhead	108
7.2.5	List of Historic Resources within Southampton	109
7.2.6	Central Pine Barrens Sites Listed on the National Register	109
7.2.7	Existing Public and Private Programs	109
8.	Scenic Resources	117
8.1	Environmental Conservation Law Provisions Regarding Scenic Resources	117
8.2	Definition and Identification of Scenic Resources	117
8.3	Functions of Scenic Resources	118
8.4	Inventory Methodology	118
8.5	Scenic Resource Inventory for the Central Pine Barrens	118
8.6	Scenic Resources Issues Analysis	122
9.	Physical Data	125
9.1	Introduction	125
9.2	Historic and Current Population	125
9.2.1	1990 Population Estimates	125
9.2.2	1993 Population Estimates	126
9.3	Population Density	126
9.4	Housing	127
9.4.1	Multi-Unit Housing	128
9.4.2	Seasonal Housing	128
9.4.3	Housing Value	128
9.5	Income	129
9.6	Public Administrative Boundaries - Municipal, School District and other boundaries	129
9.7	Land Use within the Central Pine Barrens	131
9.7.1	Core and Compatible Growth Areas	131
9.7.2	Vacant Land Analysis	133
9.8	Infrastructure	135

9.8.1	Transportation	135
9.8.2	Survey of Existing Thoroughfares	136
9.8.3	Traffic Analysis	136
9.8.4	Currently Proposed Suffolk County Department of Public Works Road Improvements (SCDPW)	138
9.8.5	Potential Areas of Traffic Concern	138
9.8.6	Sewage Treatment Facilities in the Central Pine Barrens	138
9.9	Bibliography: Physical Data	139
10.	Land Protection Strategies	141
10.1	Land Protection Mechanisms	141
10.2	Land Protection Actions	141
10.2.1	Voluntary Actions	141
10.2.2	Direct Acquisition Mechanisms	141
10.2.3	Tax Incentives for Conservation	141
10.2.4	Land Use and Regulatory Techniques	142
10.2.5	Financing Land Acquisition	142
10.3	Land Acquisitions Programs of New York State and Suffolk County	142
10.3.1	New York State	142
10.3.2	Suffolk County	143
11.	Field Management Status	145
11.1	Introduction	145
11.2	Town of Brookhaven	145
11.3	Town of Riverhead	145
11.4	Town of Southampton	145
11.5	Suffolk County	146
11.5.1	Suffolk County Nature Preserve	146
11.5.2	Identified Concerns of the Parks Department	147
11.5.3	Cooperative Agreements	147
11.6	New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP)	147
11.7	New York State Department of Environmental Conservation (NYSDEC)	148
11.8	United States Department of Defense	149
11.9	United States Department of Energy	149
12.	Selected Laws Pertinent to the Central Pine Barrens	151
12.1	Introduction	151
12.2	Federal Laws	151
12.3	New York State Laws	155
12.4	Land Use Regulations: Local Land Use Controls	158
12.4.1	History of the Suffolk County Pine Barrens Review Commission	159
12.4.2	Suffolk County Laws	161
12.5	Town Laws Summarized	164
12.5.1	Brookhaven Town	164
12.5.2	Riverhead	165

12.5.3	Southampton Town	166
12.6	Bibliography: Selected Laws Pertinent to the Central Pine Barrens	167
13.	Public Participation and Community Outreach	169
13.1	Overview	169
13.2	Introduction	169
13.3	Review of Meetings	170
13.3.1	Core Preservation Area Landowners	170
13.3.2	Community Meetings	172
13.3.3	Public Briefing Sessions	172
13.3.4	Community Design Workshops	172
13.3.5	Expert Panel Meetings	175
13.3.6	Meeting Summary	176
14.	Suggested Design Guidelines for Pine Barrens Credit Use Areas	177
14.1	Introduction	177
14.2	Residential Overlay Districts/Designated Receiving Districts	177
14.2.1	Roads	177
14.2.2	Open Space	177
14.2.3	Common Drives/Utility Corridors	178
14.2.4	Drainage/Recharge Areas	178
14.2.5	Siting of Buildings/Setbacks	178
14.3	Planned Development Districts	178
14.3.1	Land Use/Permitted Uses	178
14.3.2	Community Participation	179
14.3.3	Fiscal Impacts	179
14.3.4	Streets	179
14.3.5	Parking	179
14.3.6	Open space	179
14.3.7	Buildings/Setbacks	180
14.3.8	General Factors	180
14.3.8.1	Architecture	180
14.3.8.2	Signage	181
14.3.8.3	Lighting	181
14.3.8.4	Landscape	181
Appendix 1.	Soils Overview	183
Appendix 2.	Ecosystems Overview	189
Appendix 3.	Cultural Resources: Historic and Archaeological	193
Appendix 4.	Scenic Resources	194
Appendix 5.	Physical Data	199

List of Figures

Figure 2-1: Surficial Geology, Hydrogeology of Suffolk County, New York 35

Figure 2-2: Suffolk County Stratigraphy and Hydrogeologic Units 36

Figure 2-3: Geologic Cross Sections Through the Central Pine Barrens 37

Figure 3-1: General Soil Map, Suffolk County, New York 42

Figure 4-1: Hydrogeologic Cross Section D-D' 48

Figure 4-2: Glacial Moraines and Basins 50

Figure 4-3: Hydrogeologic Zones and Groundwater Divides 53

Figure 4-4: Public Water Supply Wellfields 55

Figure 5-1: Ecological model of the Central Pine Barrens, Long Island, New York 63

Figure 5-2: Global and State Ranking for Elements of Rare Communities and Species 70

Figure 5-3: Pine Barrens Ecological Communities 71

Figure 5-4: Natural Pine Barrens Communities in Descending Order of State Rarity 72

Figure 5-5: Occurrences of Rare (S1-S3) Natural Communities in the Central Pine Barrens 82

Figure 7-1: Prehistoric Chronology for Long Island 105

Figure 9-1: Central Pine Barrens Population by Town, 1960-1990 125

Figure 9-2: Central Pine Barrens Population by Town, Percent Increase by Decade, 1960-1990 126

Figure 9-3: Population in the Core Preservation Area, Compatible Growth Area and the Total Central Pine Barrens by Town, 1990 126

Figure 9-4: Population Density in the Core Preservation Area, the Compatible Growth Area and the Total Central Pine Barrens by Town, 1990 (*Persons Per Square Mile*) 127

Figure 9-5: Central Pine Barrens Housing Units by Town, 1960-1990 127

Figure 9-6: Housing Units in the Core Preservation Area, Compatible Growth Area and the Total Central Pine Barrens by Town, 1990 128

Figure 9-7: Public Administrative Bodies in the Central Pine Barrens 130

Figure 9-8: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in the Central Pine Barrens 131

Figure 9-9: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in the Core Preservation Area 132

Figure 9-10: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in the Compatible Growth Area 132

Figure 9-11: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in Both the Compatible Growth Area and Core Preservation Area 133

Figure 9-12: All Land Use Categories: Acreage and Percent of Total Land Area in the Central Pine Barrens for the Core, Compatible Growth Area and Areas in Both the Core and Compatible Growth Areas 133

Figure 9-13: Acreage of Vacant, Privately Owned Land in the Central Pine Barrens

by General Zoning Category	134
Figure 9-14: Potential Additional Housing Units Under Existing Residential Zoning of Privately Owned Vacant Land	135
Figure 10-1: Land Acquisitions in Suffolk County by Cumulative Acres & Cumulative Expenditures,	144
Figure 12-1: Summary of Applications Received by the Suffolk County Pine Barrens Review Commission through 1992	160
Figure 13-1: Landowner Survey Summary: Breakdown By Location of Owner	171

Preamble to Volume 2

This volume, VOLUME 2: EXISTING CONDITIONS, provides inventory, research, background, and factual information regarding the Central Pine Barrens region.

The chapters contained herein address a range of natural and human aspects of this three town area by describing both its current state and its historical evolution.

1. Evolution and History of the Central Pine Barrens

1.1 Introduction

Ecosystems are dynamic. Organisms live and die, gene frequencies shift, populations migrate and plant and animal communities change. (Falk 1990). It is inevitable that the area known today as the Central Pine Barrens has undergone many changes over the past centuries and millennia. At various times in the past the Central Pine Barrens may have been much smaller or larger than it is today, or may have had a different distribution of natural communities and species. These fluctuations should in no way detract from the goal to "protect, preserve and enhance the functional integrity of the Pine Barrens ecosystem and the significant natural resources, including plant and animal populations and communities thereof." (E.C.L. Section 57-0121(2)(a)) .

The intent of delving into the history of the Central Pine Barrens is not to try to turn back the ecological clock to some arbitrary time in the past (if that could be done). Rather, an understanding the geologic, climatic, ecologic and historic forces that have created the present day Central Pine Barrens assists in efforts to fully appreciate, protect and preserve the pine barrens ecosystem and its natural resources. Such an understanding will guide the formulation of ecological goals, and guide ecologically sound pine barrens management practices.

The following discussion is divided into four time periods: The Pleistocene, the period from 12,000 years ago until European colonization, the period from European colonization through the 1800's, and the twentieth century.

1.2 The Pleistocene Age

Long Island is composed of deposits of sand, gravel and clay many hundreds of feet thick, lying upon bedrock of early Paleozoic to Precambrian age. Most of these sediments were deposited during the

late Cretaceous Epoch, 60-100 million years ago, as discussed in the Geologic Overview. An arbitrarily selected starting point for this discussion of the evolution of the Central Pine Barrens ecosystem is the Pleistocene, which began about 1.8 million years ago.

During the Pleistocene there were repeated episodes of glaciation, in which vast, mile-thick sheets of ice scoured New England. Throughout the Pleistocene, periods of glacial advance alternated with warmer interglacial periods during which the ice retreated. The most recent period of glacial advance, the Wisconsin, ended about 12,000 years ago. Limits of the last two advances of glacial ice are marked by the hilly Ronkonkoma moraine which runs through the Central Pine Barrens, and by the Harbor Hill moraine along the north shore of Long Island. (Figure 2-1). Erosion of these morainal deposits as the glaciers melted away produced extensive outwash plains of sand and gravel. Pleistocene-age morainal and outwash sediments overlie the deeper Cretaceous-age sediments across most of Long Island. Sediments in the Central Pine Barrens area are especially coarse, and have given rise to the well-drained, droughty, nutrient-poor soils which favor the assemblage of plant species associated with the pine barrens. (*see Pine Barrens Ecosystem Overview*).

At the time of maximum Wisconsin glaciation, isostatic compensation owing to the weight of the ice apparently raised the portion of the earth's crust now submerged south of Long Island. (Conard 1935). As a result, sea level was approximately 100 meters lower than at present, and the coastline extended almost 150 km (93 miles) east of its present position. (Heusser 1979). Vegetation displaced by advancing glacial ice could have migrated to extensive offshore lands, as well as to the south.

Based on pollen and megafossils from New Jersey coastal plain deposits, it appears that the plant taxa associated with pine barrens, including pine, oak, and heath, have been present in the northeast since the early Cretaceous age. (Dorf 1952, Groot et al. 1961). Pine, spruce, fir and birch have been found in Pleistocene deposits from western Long Island (Sirkin and Stuckenrath 1975), and from sites just west of the New Jersey Pine Barrens. (Sirkin et al.

1970). Species are believed to be those found in the modern boreal forest.

1.3 From 12,000 years ago to the time of European Colonization

As the Wisconsin glacial ice retreated from Long Island at the end of the Pleistocene 12,000 years ago, plants and animals migrated northward following the melting ice. Coastal lands exposed by the lowered sea level would have provided a greatly enlarged migratory path. Tundra and spruce-fir boreal forest would have been the earliest vegetation established on the exposed sediments, followed by mixtures of hemlock, pines and hardwoods. The cool, moist climate that followed the end of glaciation was interrupted by a warm, dry period between 4,000 and 8,000 years ago; the climate then turned colder again. These climatic fluctuations, interacting with different soil types, topography, exposure to marine influences, and other disturbances would have created complex, shifting patterns of plant and animal distributions. Migration of species was not hindered by artificial barriers or human destruction of habitats.

Pitch pine has been present in the northeast for at least 10,000 years (Patterson, personal communication) and, as noted, pines, oaks and heath since the Upper Cretaceous. However, the assemblage of species associated with pine barrens plant communities may first have come together on Long Island during the warm, dry period 4,000-8,000 years ago, which would have favored drought tolerant vegetation. Pine barrens terrestrial plant species are adapted to coarse, droughty, nutrient-poor soils such as those found in central Long Island and southern coastal New Jersey. Pine barrens species also are favored by frequent fire, which eliminates competitors and maintains droughty, nutrient-poor (and flammable) conditions. (see Pine Barrens Ecosystem Overview). In order to create and maintain pine barrens vegetation, both droughty soil and fire are required. Thus, the discussion that follows examines the frequency and importance of fire in some detail.

The composition of pre-settlement vegetation may never be known with certainty. Post-settlement land use has so drastically altered the vegetation of

Long Island that reliance must be placed on historical records and the limited archaeological and palynological (fossil pollen) evidence for vegetation reconstruction. In his archival 1983 manuscript, Turano pieced together historical information from a variety of sources. He concluded that much of the present Long Island Central Pine Barrens were oak forests prior to European settlement. Although this may be true, historical, palynological and ecological evidence suggest that at least part of today's Central Pine Barrens area supported pine barrens vegetation prior to settlement, as discussed below.

Pollen from sediments of Deep Pond, at the northern edge of the Central Pine Barrens, indicates that both pine and oak were abundant for the last 2,000 years; a general trend towards increasing importance of pitch pine, and a decline in white pine and beech, was apparent well before settlement. (Backman 1984). Additional palynological studies from other ponds in the Central Pine Barrens would be very valuable for reconstructing the extent and chronology of pine barrens vegetation.

The earliest known vegetation map of Long Island is the 1838 U.S. Coast Survey map. Sheet 77 of the Survey covers the Central Pine Barrens. The map appears to depict forest composition by using symbols for pitch pine, tree oak, dwarf pine, and scrub oak. (Windisch, personal communication). If Windisch's interpretation is correct, a vegetation pattern emerges which is similar to that found today, rather than the pre-settlement oak forests suggested by Turano. (Turano 1983). Windisch proposes that since the locations of pitch pine-scrub oak woodlands and dwarf pine plains (core pine barrens vegetation types) have remained stable since 1838 on the most xeric, fire-prone portions of the landscape, these vegetation types may predate European influence. Specifically, on the large Westhampton glacial outwash fan (site of the present-day dwarf pine plains), dwarf pines and scrub oak are indicated on the 1838 map, bordered by pitch pine-scrub oak woodlands to the south and east, surrounded by pine-oak forest. Similarly, the large outwash fan in the Horse Block Road area of Yaphank supported an extensive area of pitch pine-scrub oak woodland, surrounded by pine-oak forest. The smaller Center Moriches outwash fan

supported pine-oak forest. On all three outwash fans, forest composition graded to oak or oak-pine dominance near the coast. Pitch pine-scrub oak vegetation also was noted near Rocky Point. Windisch has proposed the "fired" concept, in which vegetation patterns are related to fire-influencing landscape features in both the New Jersey and Long Island Pine Barrens. He suggests that pitch pine-scrub oak woodland types of vegetation may be naturally restricted to discrete, especially fire-prone portions of the regional landscape, presumably including the outwash fan areas. Such areas would be the most likely locations of pine barrens vegetation prior to European settlement.

The earliest written reference to the dwarf pine plains, located on the Westhampton outwash fan, is from 1804. (Dwight 1822). It is possible that the Long Island dwarf pines, with mostly serotinous cones, are a genetic ecotype adapted to frequent fire, as are the dwarf pines in New Jersey. (Givnish 1980, Good and Good 1975). Environmental selection of a genetic ecotype takes time; the evolution of a dwarf pine community covering thousands of acres would likely have required at least a hundred years, if not several centuries. The dwarf pine plains were well-established at the time of Dwight's travels in 1804. Thus if the Long Island dwarf pines are a distinct genetic ecotype, the pine plains probably pre-dated European settlement. Results of an analysis of the DNA of dwarf and tall pitch pines from Long Island, New Jersey and the Shawangunks are expected early in 1995, and may clarify the genetic status of the Long Island dwarf pines. (Colosi, personal communication).

The existence of at least some areas of fire-dependent pine barrens vegetation prior to settlement seems plausible since another fire-dependent plant community, the Hempstead Plains of Nassau County, apparently predated European settlement. The earliest references to "the plain" describe land where cattle grazed and corn was planted, and state that the grassland covered an area 4 miles by 16 miles, or 40,000 acres. (Denton 1670, Valentine 1976). This fertile plain was described as a ". . . broad upland meadow [like] a Western Prairie...with scarcely a bush or tree . . ." (Watson 1860). In the moist climate of the

northeast, on rich soils, such a grassland could only have been created, and maintained free from trees and shrubs, by repeated, frequent fires over a long period of time. Harper pointed out additional botanical evidence that fire had long been a "natural" occurrence on the Plains (predating European settlement), including the presence of species that resprout from subterranean rootstocks, and the absence of plants with barbed fruits which are most effective if held on to the plant for months at a time. (Harper 1918). If such a fire regime could have existed on fertile soils in Nassau County, could it not also have existed on much droughtier soils just to the east, in Suffolk County? Prime describes a brushy plain of scrub oak adjoining the Hempstead Plains on the east, extending into a pine barrens area. It seems plausible that grassland fires could have swept into the adjoining forest, creating the oak brush plains (pitch pine scrub oak barrens) vegetation that Prime described. (Prime 1845).

Prior to European settlement, could fire have occurred often enough to create fire-dependent plant communities? Lightning ignitions are rare in the northeast, since most coastal thunderstorms are accompanied by heavy rain. (Pyne 1984). However, in the New Jersey Pinelands of more than one million acres, a few lightning ignitions occur each year, on average, smouldering until weather conditions dry out enough to permit open flames. (Windisch, personal communication). In the smaller Long Island Pine Barrens, a few lightning ignitions per decade might be expected. Once started, a fire in pre-settlement times could have burned for great distances through the unbroken, continuous forests. Perhaps in areas of droughty soils, just a few lightning-caused fires per century could have been sufficient to favor pine barrens species. In any case, lightning probably was not the only cause of fires; it seems likely that Native Americans set fires and altered the landscape in ways that also could have contributed to the development of pine barrens.

About 3,000 years ago, at the start of the "Early Horticulture" (or Woodland) period, changes in settlement and subsistence patterns resulted in a shift to increased utilization of coastal habitats. (Snow 1980; Patterson and Sassaman 1988). Horticulture (the maintenance of garden plots)

apparently began at this time, and developed into agriculture (cultivation of fields) during the last millennium. Cape Cod supported relatively dense populations (Mulholland 1984), and Long Island may have also, although data are lacking. (Patterson and Sassaman 1988). Sedimentary charcoal studies which indicate the frequency of forest fires throughout New England suggest that "prior to European settlement, fires were most common in areas where, on the basis of archaeological site distributions, Indian populations were greatest...and their land-use practices most intensive." (Patterson and Sassaman 1988). The greatest amounts of charcoal were found in central-coastal Massachusetts, Cape Cod (Duck Pond) and Long Island ((Deep Pond) the only Long Island site reported by Patterson and Sassaman 1988). At Duck Pond, "abundant charcoal throughout the stratigraphic column suggests that fire has played an important role in maintaining pine-oak forests throughout the Holocene." (Winkler 1982).

Some increase in fire frequency associated with Native American habitation could have been due to accidental escape of campfires. However, there is evidence that many fires were deliberately set. For clearing fields, Native American women set fire to piles of wood set around the base of standing trees. (Cronon 1983). Crops of corn, beans and squash were planted among the standing dead trees; the same site could be used for eight to ten years before the soil lost its fertility. (Cronon 1983). Fire also was used to make travel easier by removing underbrush, and as a hunting aid. (Day 1953). Cronon believes that Native Americans used fire not merely to drive game, or attract game to specific areas for hunting, but to intentionally create a mosaic of successional forest types, open the canopy, and improve the growth of grasses and berries that provided food for game. (Cronon 1983). They would thereby have increased the food supply available for game, and supported the great abundance of elk, deer, beaver, hare, bears, turkey, grouse, and other species that impressed English colonists. Burning also may have been used to destroy plant diseases and the "fleas which inevitably became abundant around Indian settlements." (Cronon 1983).

Reports of fire are common from the time of the very earliest explorers, although the purpose or use

of specific fires was rarely noted. Later, settlers were more specific in their observations. Thomas Morton wrote "[t]he Savages are accustomed to set fire of the Country in all places where they come, and to burne it twize a yeare, viz: at the Spring, and the fall of the leafe." (Morton 1632). This frequent burning was the cause of the open, park-like forest remarked upon by early settlers in southern New England. As William Wood observed, the fire "consumes all the underwood and rubbish which otherwise would overgrow the country, making it unpassable, and spoil their much affected hunting." (William Wood 1634).

Although Native Americans moved their villages seasonally, they reoccupied the same fixed sites for many years. Thus the area around the villages and planting sites would have been heavily impacted by intensive food gathering and cultivation, garbage accumulation, and cutting of firewood. Native Americans burned huge fires all night long, both during the summer and during the winter. (Cronon 1983). They needed to move to winter camps because the summer sites were stripped of fuel. (Cronon 1983, Day 1953). Such heavy use of firewood, combined with wildfires, could explain the "open plains 25 or 30 leagues in extent, entirely free from trees" reported by Verrazzano on his visit to Narragansett Bay in 1524. (Brevoort 1874, Wroth 1970). William Wood described similar treeless expanses a century later for Massachusetts Bay. (W. Wood 1634).

Thus it seems likely that Native American land use practices had a major impact on the vegetation of at least the localized coastal sites that they inhabited. Fires, land-clearing and fuelwood cutting would have opened up the forests and disturbed the soil, creating conditions favorable to the growth of Pine Barrens and grassland species. The landscape in the vicinity of settlements may have been a mosaic of forests and fields in varying stages of succession, created by shifting patterns of settlement and cultivation. (Patterson and Sassaman 1988).

Considering all the evidence, it seems plausible that at least some areas of pine barrens predated European settlement, possibly located on small, discrete areas of especially coarse, droughty soil, such as the Westhampton and Yaphank outwash fans. Intervening areas may have been oak forest

or pine-oak forest, later converted to pine barrens by European land use practices such as fuelwood cutting, and increased fire frequencies. However, in the absence of conclusive evidence, the antiquity of the Long Island Central Pine Barrens remains unknown.

1.4 From European Colonization through the 1800s

Some of the earliest colonists cultivated the Hempstead Plains, where colonists were granted rights to the plains for grazing cattle and planting corn. (Munsell 1983). Cattle were imported for breeding as early as 1625. In Suffolk County, colonial development proceeded from east to west, especially along the shoreline near sheltered harbors where ships could safely moor. These harbors were the areas of concentrated development, and had economies based upon marine-dependent industries such as whaling and boat building, as well as agrarian industry that needed transportation access to distribute their agricultural products to New York City.

Central Suffolk County appears to have been sparsely settled. In 1691 a colonial governor described the middle of the island as "altogether barren." (Gabriel 1960). The name "barrens" was applied by settlers to any land that was not good for agriculture. The Carver-Plymouth soils are too droughty and nutrient-poor to support crops, but settlers may well have tried nevertheless. Successful agriculture is most likely to have occurred on the Haven and Riverhead soils (Figure 3-1), probably in the areas still being farmed today. Harvesting of cranberries and blueberries has long been important in the Pine Barrens.

The earliest specific references to extensive areas of pine barrens date from the late 1700's. George Washington noted the existence of an oak brush plains type:

April 22nd. The first five miles of the road is too poor to admit inhabitants or cultivation, being a low, scrubby oak, not more than two feet high, intermixed with small and ill-thriving pines. Within two miles of Coram there

are farms, but the land is of indifferent quality, much mixed with sand. Coram contains but few houses. From thence to Setauket the soil improves, especially as you approach the sound, but it is far from being of the first quality, still a good deal being mixed with sand. (Munsell 1882).

Alexander Hamilton noted similar vegetation south and east of Setauket. (Hart 1907). In his travels of 1804 Dwight portrayed the south shore of Long Island as a:

vast level [plain], which extends from Canoe Place [Shinnecock Canal] to Jamaica: about eighty miles; and occupies throughout this distance the southern half of the Island. It is not interrupted by a single hill. About twenty miles from its eastern limit it is covered with yellow pines; then a mixture of pines and oaks; then with oaks only; until within a few miles of Hempstead the pines make their appearance again. (Dwight 1822).

Other writers in the early 1800's also refer to yellow pine. (Dwight 1822, Dyson 1969). Bayles reported that:

[a]t the time this [rail]road was opened, about thirty years ago, this immense tract of unoccupied land was covered with a heavy growth of timber - yellow pine along the neighborhood of the railroad, and oak and chestnut among the hills, and varieties of oak on the southern borders. (Bayles 1873).

Yellow pine (*Pinus echinata*) is a southern species not found today on Long Island. It is unclear if these early writers were referring to yellow pine or to pitch pine (*Pinus rigida*), or to a mixture of both. Windisch and Patterson (personal communication) both believe these references were to pitch pine;

"yellow pine" is a generic term used to refer to "hard" pines, as opposed to white pines. (Patterson, personal communication). Turano speculated that if indeed yellow pine had been present on Long Island 150 years ago, it is possible that it was eliminated by the frequent and intense wildfires of the mid 1800's. (Turano 1983). This seems unlikely, since *P. echinata* is today a major component of western and southern portions of the New Jersey Pinelands that were burned repeatedly in the 1700's and 1800's. (Windisch, personal communication).

Wood products were an economic resource from earliest times. The forests of pine, oak and hickory were used for cordwood, shingles, post and rail fences, and boat-building, while tar was produced from pine trees and barrel staves from oak trees. (Valentine 1976). The forests were cut over at least twice: once by the colonists and again by the British. (Valentine 1976, Prime 1845). Several towns became so concerned with the depletion of timber supplies that they prohibited tree cutting without permission from the trustees, and non-townsmen were specifically prohibited from harvesting forests. (S. Wood 1828, Valentine 1976).

From colonial times through the 1830's cordwood was an important source of fuel. It took an average of 40 cords of wood per year to heat a house. Wood was harvested and brought to coastal landings where it was shipped to New York City by water. In 1798 cordwood was two shillings [14 cents in 1994 dollars] per cord. By 1842 the wholesale price was \$.50 per cord, bringing \$2.50 retail. Later, in 1900, cordwood was sent to brick yards to fire the kilns. (Valentine 1976). According to Prime the woods were recut every 20-25 years.

The decades from 1840 to 1860 saw great changes in the agrarian and marine economies of Suffolk County. By 1840 coal was in general use and the cordwood industry badly hurt. (Valentine 1976). In 1844, the Long Island Railroad (LIRR) completed its New York City to Greenport line through the center of the Pine Barrens. From Greenport, travelers began the seaward leg of their voyage with the ultimate destination being Boston. The construction of the rail line forever changed

Long Islanders' access to New York City. The once thriving whaling industry suffered serious setbacks with the discovery of gold in California in 1849 and petroleum in Pennsylvania in 1859.

Severe and extensive wild fires burned through the Central Pine Barrens repeatedly during the 1800s. These fires caused devastating economic losses. Tredwell's in 1912 reveals the following observation offered in 1853 that

. . . since the [rail]road was opened...there has scarcely been a day, from May to November, in which some portion of these forests have not been burned. Many of these fires destroy thousands of cords of cut cured wood awaiting transportation, and this local commerce has about ceased. (Tredwell 1912).

As noted by Tredwell, many of these fires may have been caused by sparks from the wood-burning engines of the Long Island Railroad. (Tredwell 1912). However, arson fires also were frequently set, apparently motivated by the New York State mandated wages for fire-fighters. (1895). By 1911 much of the Central Pine Barrens had been burned so badly that the middle of the island was untaxed because the land was unproductive.

It appears likely that post-settlement land use practices, including timbering, land clearing for agriculture and settlements, increased fire frequencies, introduction of exotic species, draining of wetlands, and construction of roads and railroads, caused regional vegetation change on Long Island. It is quite likely that the area occupied by pine barrens could have expanded during the 1700's and 1800's due to the combined effects of timbering, land clearing and repeated fire. As noted above, the extent of pre-colonial pine barrens vegetation on Long Island remains unknown.

1.5 The Twentieth Century

The New York City to Boston link of the Long Island Railroad was in use for less than a decade

when a faster route was built along the coast of Connecticut. The Long Island Railroad then became a transportation link from New York City to Long Island. This change in transportation access changed the population settlement pattern of Suffolk County. The most dense populations were now found in western Suffolk County, the area closest to New York City. The LIRR enabled residential development to house people who worked in New York City. It also provided transportation for tourists who wanted to enjoy the marine sports and cool summers of Long Island's shore. The popularization of the automobile continued this residential development pattern, concentrating residential development in western Suffolk County while the agrarian economy continued in eastern Suffolk.

During World War One, Camp Upton was created for the training of soldiers. The 40,000 men at Camp Upton in 1917 doubled Suffolk's population. Camp Upton later became the campus for the Brookhaven National Laboratory. In parts of the Central Pine Barrens, towers were erected to transmit wireless communications to Europe.

The development of the Long Island Expressway from 1955 to 1972 impacted development in the Central Pine Barrens to a great extent. Until this time, general access to the Central Pine Barrens was limited due to lack of transportation links. The construction of the 70 mile, 4 lane, limited access expressway through the center of the Island decreased travel time to westerly employment destinations in Nassau County and New York City. This made the relatively cheap vacant land in the middle of Long Island attractive for residential development.

The population in the Central Pine Barrens almost doubled in each decade from 1960 to 1980, from 12,500 in 1960 to 43,000 in 1980 and by 1990 an estimated 57,000 people resided in the Central Pine Barrens.

The increased development of the Central Pine Barrens mirrored the development that was occurring throughout Suffolk County. A greater awareness of the impact of population growth and development on natural habitats and ecologic processes occurred as the population of the county

grew and matured.

Increased residential developments in conjunction with the advent of modern fire suppression techniques, have greatly reduced the extent of fire in the Pine Barrens. Arsonists still cause many fires in the Pine Barrens, as apparently has been the case for more than 100 years. (Bayles 1873). However, these fires are aggressively controlled so that the extent of the areas burned is kept quite limited. With the removal of fire as a widespread ecological process, the vegetation of the Pine Barrens may be changing through natural succession into more oak-dominated forests in many areas.

In 1978 New York State formed a group to plan for preservation of 40,000 acres of woodlands between Yaphank and Riverhead, the Suffolk County Pine Barrens (SPLIA, 1978). Between 1978 and 1993 popular demand for a 40,000 acre preserve grew to support a 100,000 acre preserve approved by the State Legislature. On July 14, 1993, Governor Cuomo signed the Long Island Pine Barrens Protection Act into law. (For a more informative discussion of the events leading to and including the passage of the Long Island Pine Barrens Preservation Act see Volume 1).

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2. Geologic Overview

2.1 Introduction

This section contains a description of the surficial and subsurface geology of the Central Pine Barrens. It contains a description of the different geologic time periods and events that shaped the Central Pine Barrens from bedrock to land surface. It utilized data collected for preparation of the *Suffolk County Comprehensive Water Resources Management Plan*.

The geologic formations of Suffolk County, including the Central Pine Barrens Area, consist of thick deposits of unconsolidated, water-bearing sediments resting upon a relatively impermeable, crystalline bedrock surface. The sequence of events that shaped Suffolk County's geology is not known with certainty, but it probably began with the formation of the original basement rocks in early Paleozoic to Precambrian time more than 400 million years ago. These were heated and compressed (metamorphosed) by folding and faulting to produce a rugged, mountainous topography. During the subsequent period ending with the Late Cretaceous Epoch, 100 million years ago, erosion reduced the land to a nearly planar surface that gently tilted to the southeast.

During the Late Cretaceous Epoch (60-100 million years ago), streams brought sediments from the north and west to the Long Island area on the continental margin, forming a permeable sand layer (Lloyd Sand Member of the Raritan Formation) and overlying clay layer (clay member of the Raritan Formation) upon the bedrock surface. After a short period of erosion or non-deposition, thick, permeable beds of river-delta clay, sand, and gravel were deposited on the Raritan Formation; these deposits comprise the Magothy aquifer. Toward the close of late Cretaceous time (approximately 60 million years ago), a sand and clay unit (Monmouth Group) of low permeability was deposited in shallow marine waters in the area that now constitutes Suffolk's south shore.

A long period of non-deposition, or possibly

deposition followed by erosion, occurred after Cretaceous time. Geologic activities during this time left few sedimentary traces, but streams flowing across Long Island cut some deep valleys into the Magothy. It was not until late Pleistocene (Wisconsinan) glaciation (some 20-200 thousand years ago) that there were any significant additions to Long Island's geologic record. At that time, valleys were filled, and the older deposits were almost completely buried by glacial deposits.

Prior to the southward movement of the Pleistocene ice sheets to Long Island, an extensive clay unit (Gardiners Clay) was deposited in shallow marine and brackish waters along the shores of what is now Suffolk County. This unit rested upon the Magothy and Monmouth Group, and acted as a confining layer. The northern portions of the Gardiners Clay were subsequently eroded by advancing ice and glacial meltwaters. Consequently, Gardiners Clay beds are now found only in the south shore area.

The Pleistocene glaciation created the hilly Ronkonkoma moraine along Suffolk's "spine" and South Fork, and the Harbor Hill moraine along the North Shore and North Fork (Figure 2-1). The Ronkonkoma moraine runs down the middle of the Central Pine Barrens Area in an east-west direction while the Harbor Hills moraine is located to the north. Erosion of these morainal deposits (as the glacier melted away from Long Island) created extensive outwash plains of sand and gravel in the intermorainal area and south to the Atlantic Ocean. These highly permeable deposits comprise the upper glacial aquifer and represent the majority of Suffolk's surficial sediments. Some local confining clay units (e.g., the Smithtown clay) were also formed from glacial materials in intermorainal lakes and tidal lagoons. Since the end of glaciation about 12,000 years ago, Holocene beach and marsh deposits have been formed along the marine edge, and within stream corridors and ponds, such as the Peconic River.

2.2 Surficial Geology

2.2.1 Unconsolidated Deposits

The sequence of stratigraphic units below Suffolk County and the Central Pine Barrens Area is presented in Figure 2-2 and can be summarized, in ascending order, as follows:

Early Paleozoic to Precambrian Bedrock: impermeable, crystalline basement rock more than 400 million years old.

Late Cretaceous Deposits: deltaic clays, sands, and gravels deposited by streams along the continental margin or as marine sediments comprising the Lloyd Sand (aquifer), Raritan clay (confining unit), Magothy Formation (aquifer), and Monmouth Group (confining unit); (60-100 million years old).

Pleistocene (Wisconsinan) Deposits: marine clays and various glacial materials (till, outwash sand and gravel, intermorainal clay) comprising the Gardiners Clay, upper glacial (aquifer), and Smithtown clay (20-200 thousand years old).

Holocene Deposits: recent beach and marsh deposits less than 12 thousand years old.

Several geologic cross sections through the Central Pine Barrens Area as contained in the *U.S. Geological Survey (USGS) Atlas HA-501, Hydrogeology of Suffolk County, Long Island, New York* are presented in Figure 2-3 (see Figure 2-3 for key). These figures are included to illustrate the areal extent and thickness of the various hydrogeologic units corresponding to the geologic units listed in Figure 2-2. A detailed description of each of the geologic units is presented in the following subsections.

2.2.2 Bedrock

Bedrock below Suffolk County is comprised of crystalline metamorphic rocks (gneisses and schists) that are similar to those found in Connecticut. The original basement rocks are believed to have been early Paleozoic (Cambro-Ordovician) to Precambrian granite or sandstone more than 400

million years old. These rocks were crystallized by heat and pressure during folding and faulting caused by tectonic forces during early Paleozoic time (200-300 million years ago).

The bedrock surface below Suffolk County is tilted southeast to south at a slope of approximately 50 to 70 feet per mile. It is, therefore, closest to land surface (within 500-600 feet) in northwest Huntington and at Orient, and deepest along the South Shore (over 2,000 feet deep at the western part of Fire Island). In many places, the upper surface of the bedrock is weathered to a residual clay. Since the water bearing capacity of the unit is extremely low, the bedrock surface is considered to be the bottom of the groundwater reservoir.

2.2.3 Lloyd Sand Member of the Raritan Formation

The sediments comprising the Raritan Formation lie on the bedrock surface and are believed to have been derived from stream erosion of areas to the north and west during late Cretaceous time (60-100 million years ago). The formation is made up of a lower sand and gravel member (Lloyd Sand) and upper clay member (Raritan clay).

The Lloyd Sand Member has a moderate overall hydraulic conductivity and consists of sand and gravel interbeds, with occasional lenses of clay and silt. The Lloyd's beds are about parallel to the bedrock surface below. Its upper surface lies about 400 feet below sea level in northwest Huntington and at Orient, and over 1,500 feet below sea level at western Fire Island. The unit is believed to terminate somewhere close to the North Shore beneath Long Island Sound, and is not found in Connecticut. The thickness of the Lloyd increases from north to south; it is about 200 feet thick in northwest Huntington, 100 feet thick at Orient, and over 500 feet thick at western Fire Island.

Figure 2-1: Surficial Geology, Hydrogeology of Suffolk County, New York

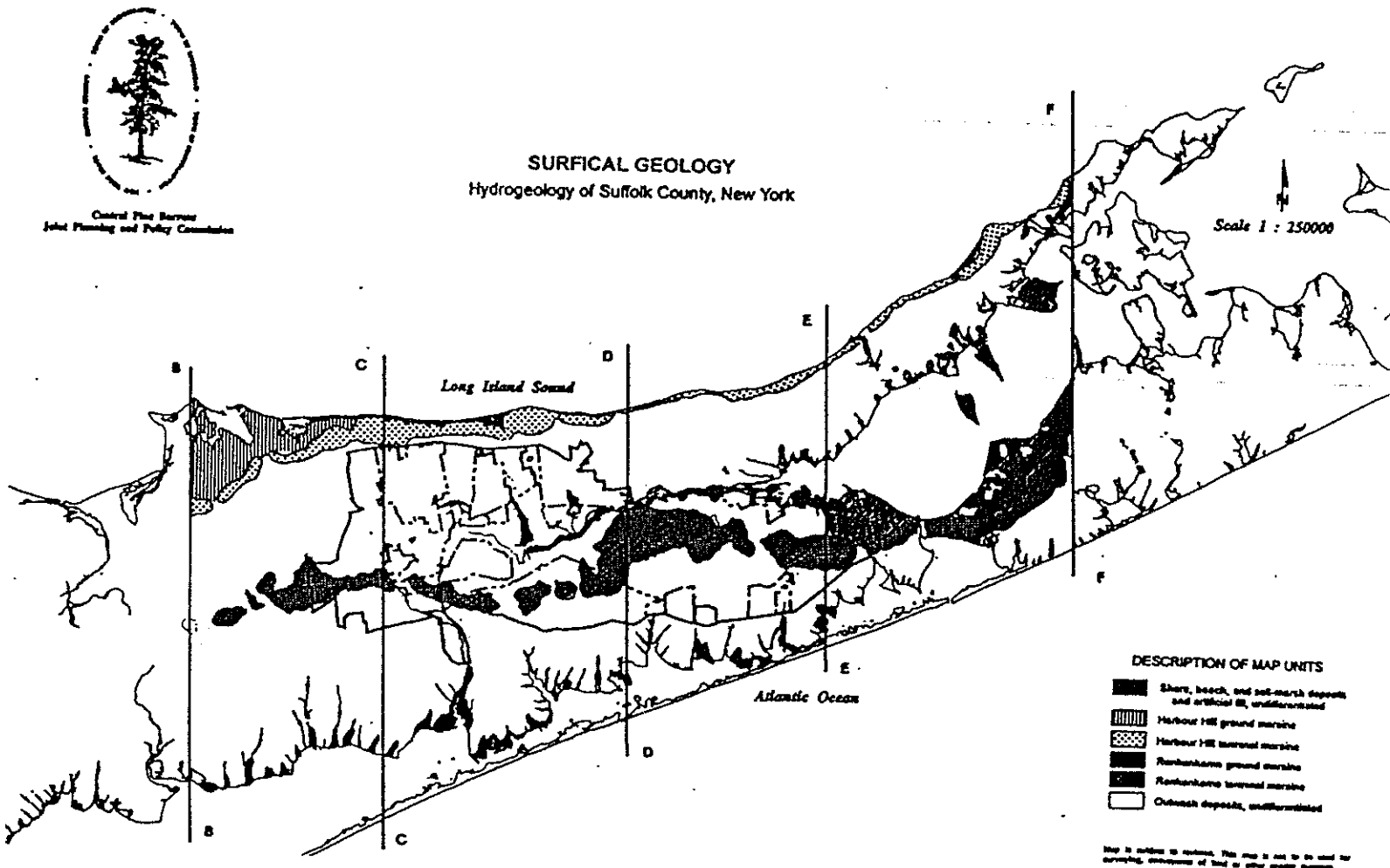
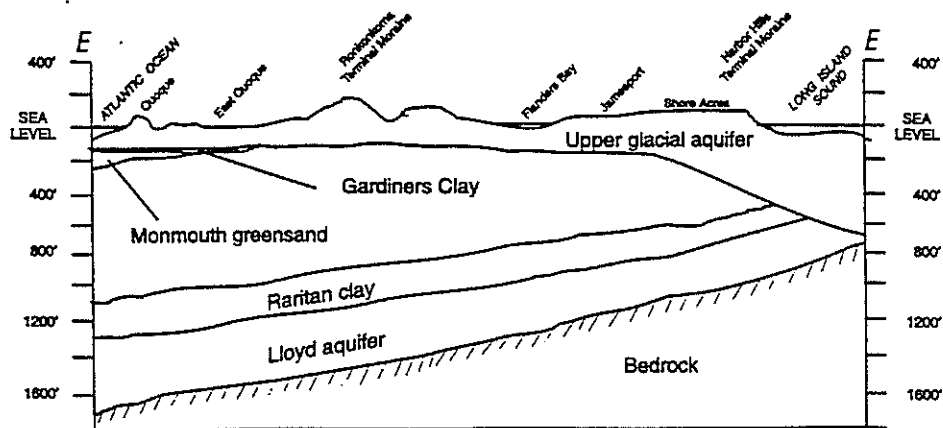
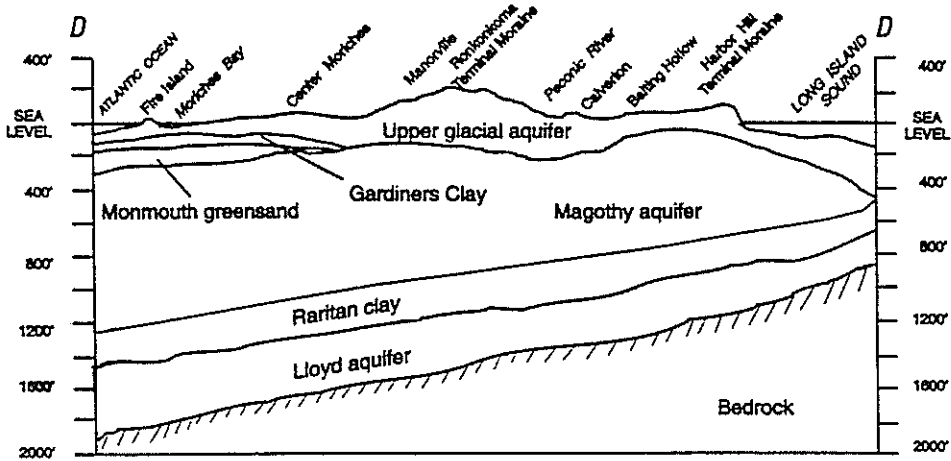
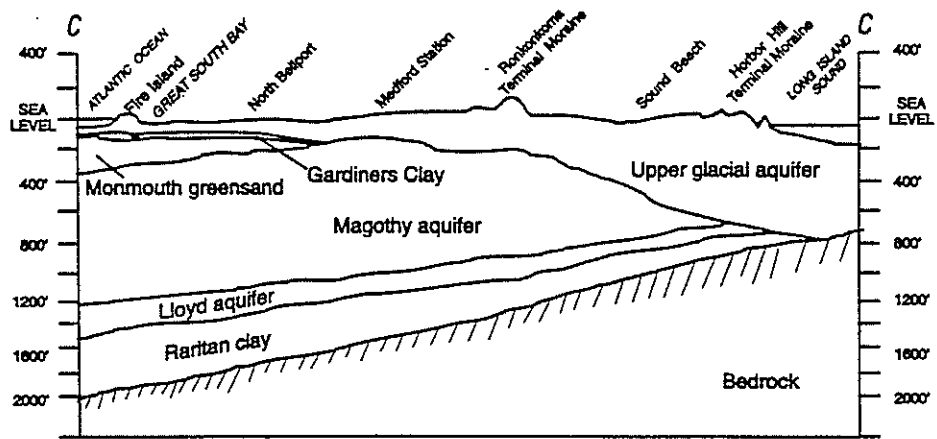


Figure 2-2: Suffolk County Stratigraphy and Hydrogeologic Units

System	Series	Geologic Unit	Hydro-geologic Unit	Approximate thickness in feet	Geologic Description	
QUATERNARY	Present HOLOCENE 12,000 years	Recent shore, beach, and salt-marsh deposits		0-60	Sand, gravel, clay, silt, organic mud, peat, loam, and shells. Colors: gray, brown, green, black, and yellow. Recent artificial-fill deposits of gravel, sand, clay and rubbish.	
	PLEISTOCENE 200,000 years	Morraine deposits Glaciofluvial deposits Smithtown clay (informal usage)	Upper glacial aquifer	0-700	Fill composed of clay, sand, gravel and boulders; forms Harbor Hill and Ronkonkoma terminal moraines. Outwash deposits consist of quartzose sand, fine to very coarse, and gravel, pebble to boulder sized. Glaciolacustrine deposits (Smithtown clay) consist of silt, clay, and some sand and gravel layers. Colors are mainly gray, brown, and yellow. Contains shells and plant remains generally in finer grained beds.	
		Unconformity			0-75	Marine deposits of clay and silt with some interbedded sand and gravel. Color, greenish-gray and gray. Foraminifera and lignite present, and also locally glauconite.
		Gardiners Clay	Gardiners Clay			
		Unconformity			0-140	Sand, fine to coarse. Color is brown. Identified as a distinct unit only on South Fork to date.
post-Cretaceous (?) deposits	Upper glacial aquifer					
CRETACEOUS	60 million years	Unconformity		0-200	Interbedded marine deposits of clay, silt, and sand. Color, dark greenish-gray to black. Contains much glauconite and lignite.	
		Monmouth Group	Monmouth greensand			
		Unconformity		0-1000	Sand, fine to coarse, clayey in part; interbedded with lenses and layers of light- to dark-gray clay. Basal 100-200 feet is generally composed of coarse sand and gravel beds. Sand and gravel are quartzose. Lignite and pyrite are common. Colors are gray, white, red, brown, and yellow.	
	Magothy Formation-Matawan Group undifferentiated	Magothy aquifer				
	UPPER CRETACEOUS 100 million years	Disconformity?		0-250	Clay, solid and silty; few lenses and layers of sand; little gravel. Lignite and pyrite common. Colors are gray, red and white, commonly variegated.	
		Clay Member	Raritan confining unit			
		Raritan Formation	Disconformity	0-550	Sand, fine to coarse, and gravel with intercalated beds and lenses of light- to dark-gray clay, silt, clayey and silty sand and some lignite and pyrite. Locally has gradational contact with overlying Raritan clay. Colors are yellow, gray, and white; clay is red locally.	
Lloyd Sand Member		Lloyd aquifer				
EARLY PALEOZOIC TO PRECAMBRIAN (?)	400 million years	Unconformity		not known	Crystalline metamorphic and igneous rocks; puscovite-biotite schist, gneiss, and granite. Surface of bedrock is commonly highly weathered to a greenish-white residual clay.	
	> 500 million years	Bedrock	Bedrock			

Figure 2-3: Geologic Cross Sections Through the Central Pine Barrens



2.2.4 Clay Member of the Raritan Formation

The clay member of the Raritan Formation (Raritan clay) overlies the Lloyd Sand Member throughout Suffolk County. In some locations, however, the clay has been eroded, and glacial deposits overlie the Lloyd, thus providing good hydraulic conductivity between the glacial deposits and the Lloyd aquifer. The Raritan clay, although composed mainly of clay and silt, does contain some sand and gravel beds and lenses; overall, however, the hydraulic conductivity of the clay member is low, and it confines the water in the Lloyd aquifer.

The Raritan clay parallels the Lloyd Sand Member and terminates just offshore in Long Island Sound. The surface of the clay member lies between 300 and 400 feet below sea level in northwest Huntington and at Orient, and about 1,100-1,300 feet below sea level at western Fire Island. Clay member thicknesses range between 50 and 100 feet in the northern areas, and reach nearly 300 feet in the western part of Fire Island.

2.2.5 Magothy Formation - Matawan Group Undifferentiated

The Magothy Formation - Matawan Group undifferentiated (informally "Magothy") is composed of river delta sediments that were deposited on top of the Raritan Formation during the late Cretaceous after a period of erosion. It consists of highly permeable quartzose sand and gravel deposits with interbeds and lenses of clay and silt that may have local hydrologic significance.

The Magothy was eroded during the time period between the end of Cretaceous and the Pleistocene. The surface was scoured by glaciers, particularly in northwest Huntington, where it is completely eroded. Glacial meltwaters also shaped the Magothy's surface, creating north-south valleys that are now buried below the areas of Huntington-Deer Park, Saint James-Ronkonkoma-Sayville, and Miller Place-Selden. In addition, the Connecticut River is believed to have created the buried valley that runs through the vicinity of Orient-Amagansett during a period of lowered sea level.

Unlike the upper surfaces of bedrock and the

members of the Raritan Formation, the highly eroded upper surface of the Magothy does not exhibit any distinctive tilt to the southeast, although bedding planes within the formation have this orientation. Because the upper surface is so irregular, the thickness of the Magothy varies; however, the thickness generally increases from north to south, with the greatest thicknesses (around 1,000 feet) found along the South Shore.

2.2.6 Monmouth Group

The Monmouth Group is the youngest Cretaceous unit. It was deposited in a shallow marine environment and consists of interbedded clay, silt, and sand, giving the unit a low overall permeability. The Monmouth contains much of the mineral glauconite, which gives the unit a dark greenish color, and is the basis for the hydrogeologic unit's name--Monmouth greensand.

The Monmouth Group overlies the Magothy Formation along most of the South Shore, except for portions of the South Fork. Post Cretaceous erosion by glacial meltwater streams is evident on the surface of the unit, but it appears to have been spared the glacial scouring seen in other Cretaceous formations located further north. The upper surface ranges from about 70 to 165 feet below sea level, and has been found in thicknesses up to 200 feet.

2.2.7 Gardiners Clay

The Gardiners Clay is a shallow marine or brackish-water deposit of late Pleistocene age. It is typically grayish-green to gray; the variation in color is due to the content of minerals such as glauconite. The unit contains some beds and lenses of sand and silt, but its overall hydraulic conductivity is low, making it a confining layer for underlying aquifer formations, particularly the Magothy.

The Gardiners Clay is found along most of the South Shore. Its northern extent varies from 3 to 5 miles inland and is indented by long, narrow north-south channels, which indicate the effects of erosion by glacial meltwater streams and areas of nondeposition. The upper surface of the unit ranges in altitude from 40 to 120 feet below sea level. The thickness of the unit increases

southward toward the barrier island, reaching thicknesses of over 100 feet.

2.3 Glacial Deposits

Continental glaciers of Wisconsinan age (20 to 86 thousand years ago) brought to Long Island the materials that now comprise nearly all of its surficial sediments. Glacial material was deposited in two terminal moraines: the Ronkonkoma moraine, which forms Suffolk's "spine" and South Fork, and the Harbor Hill moraine, which runs along the North Shore and forms the North Fork. Some of the original glacial material (till) can still be seen along the north shore of the South Fork, at Montauk, and on Shelter Island, where it acts to retard the downward movement of recharge.

Most of the glacial material was reworked by meltwater to form large, sandy outwash plain deposits south of, and between, the two moraines. These highly permeable, stratified sand and gravel deposits filled in the valleys eroded on the surface of the Magothy (although some filling may have occurred prior to the ice sheet's advance to Long Island).

The glacial deposits can reach thicknesses of up to 700 feet (e.g., in the "Ronkonkoma Basin"). They generally overlie Magothy deposits, except in areas of the North Shore where the Magothy was scoured away by glaciers, and in areas of the South Shore where the Gardiners Clay or Monmouth Group intervene.

Clay materials were also eroded from the moraines and deposited in freshwater lakes or shallow marine lagoons. An example of such a clay is the Smithtown clay unit, located in northeast Huntington, northern Smithtown, and northeast Brookhaven. It occurs within the sequence of outwash deposits and ranges in depth from 90 feet above sea level to 150 feet below sea level. Its thickness ranges up to 170 feet. Because of its overall low conductivity, the clay acts as a local confining unit between upper and lower portions of the glacial aquifer.

2.4 Recent Deposits

Beach and marsh deposits of Holocene age are found primarily along the shoreline, and within stream corridors and ponds. Beach deposits consist primarily of sands eroded from the outwash plain or bluffs by wind, runoff, and wave action. Marsh deposits consist of mud and peat, which accumulate along streambeds, in ponds, and in tidal marshes and shoals. These deposits are generally thin, but may be of local hydrogeologic significance (e.g., on the barrier islands).

2.5 Topographic Relief

The elevations within the Central Pine Barrens area range from mean sea level where the study area borders Flanders Bay, to a high of 295 feet at Bald Hill, which is on the Ronkonkoma Moraine just southwest of the Eastern Campus of Suffolk County Community College (SCCC) south of Riverhead. Generally, elevations are lowest in the areas where recent geologic deposits are found and highest in the moraine areas as noted in Figure 2-3

Since the Peconic River is a drainage basin between the Harbor Hills Moraine to the north and the Ronkonkoma Moraine to the south, the river and its tributaries are the low points in the watershed area. The elevation of the river goes from mean sea level at Flanders Bay, rising in a westerly direction to a high of approximately 40 feet in the Peasys Pond area and approximately 80 feet in the wetland area west of William Floyd Parkway, which comprises the headwaters of the Peconic River. North and west of the Peconic River, elevations generally rise to the Harbor Hills Moraine where they can exceed over 200 feet above mean sea level in many places. South and west of the river, elevations generally rise to the Ronkonkoma Moraine where they exceed over 250 feet in many places. South of the Ronkonkoma Moraine elevations decrease along the outwash plains within the Central Pine Barrens area.

Similarly, the Carmans River originates in the western Pine Barrens area at Middle Island and cuts through the Ronkonkoma Moraine starting at an elevation of approximately 70 feet, and flows in a southerly direction through Southaven Park to

Bellport Bay, which is also at mean sea level.

2.5.1 Slopes

Slopes within the area of the Central Pine Barrens where outwash plains and recent deposits can be found are generally even to gently rolling, and range from 0 to 15%. The moraine areas are very hilly and uneven containing slopes that range from 15 to 35% in many areas.

2.5.2 Land Forms

In addition to common glacial features which include moraines, outwash plains and recent geologic deposits, kettle holes, kames and swale areas can be found in or adjacent to the moraine areas in the Central Pine Barrens. A kettle hole is a depression in glacial drift formed by the melting of a detached block of stagnant ice that was buried in the drift. It often contains a lake or swamp. Many of the ponds within the Central Pine Barrens area are kettle holes. A classic example of a kettle hole can be found directly north of the Eastern Campus of SCCC.

Kames are mounds, knobs or short irregular ridges left by the glaciers that consist of stratified, poorly sorted sand and gravel, and at some locations they are overlain by a thin ablation till. A representative example of a kame can be found south of County Road 111, Port Jefferson-Westhampton Road, approximately a half mile southeast of its intersection with the Long Island Expressway.

Swale areas occur when 2 steeply sided hill areas converge on one another leaving a steep sloped gully or ravine. Many of these are found throughout the moraine areas. A good example is found south of Birch Creek in the Flanders area at Sears Bellows County Park.

Kame-and-kettle topography, also known as knob-and-kettle topography, is an undulating landscape in which a disordered assemblage of knolls, mounds, or ridges of glacial drift is interspersed with irregular depressions, pits, or kettles that are commonly undrained and may contain swamps or ponds. A representative example of this type of topography can be found in the southeastern corner of the Central Pine Barrens area in a section known

as Henry's Hollow.

2.6 Bibliography: Geologic Overview

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3. Soils Overview

3.1 Introduction

This section provides a description of the soil associations found within the Central Pine Barrens area and includes a discussion of critical soil resources. This section was based on the *Suffolk County Soil Survey* prepared in 1975 by the United States Department of Agriculture Soil Conservation Service in cooperation with the Cornell Agricultural Experiment Station.

A soil association is a group of soils geographically associated in a characteristic repeating pattern. Associations allow the comparison of large tracts of land as to their suitability for certain kinds of land use and provide guidance for the management of large tracts such as watershed or wildlife areas. It is not suitable to use these general soils associations for specific parcel comparisons, since soils in any one association often differ in slope, depth, stoniness, drainage and other characteristics.

Information on the limitations of specific soil types within an association for certain uses are indicated in Appendix 1-1. The limitations of a soil for a certain use is due to it having a property not conducive for that use. For instance, areas that have soils with a high water table would not be suitable for cesspools.

Soil resources within the Central Pine Barrens area include prime agricultural soils that have already been cleared and soils with a high water table that are indicative of environmentally sensitive areas such as wetlands and tidal marshes.

3.2 Description of General Soils Associations

Four soil associations are located within the Central Pine Barrens area as identified from the general soils map in the Soil Survey. (Soil Survey 1975). These are shown on Figure 3-1 and are identified as: 2-Haven-Riverhead Association; 3-Plymouth-Carver Association, Rolling and Hilly; 4-Riverhead-Plymouth-Carver Association; and 10-Plymouth-

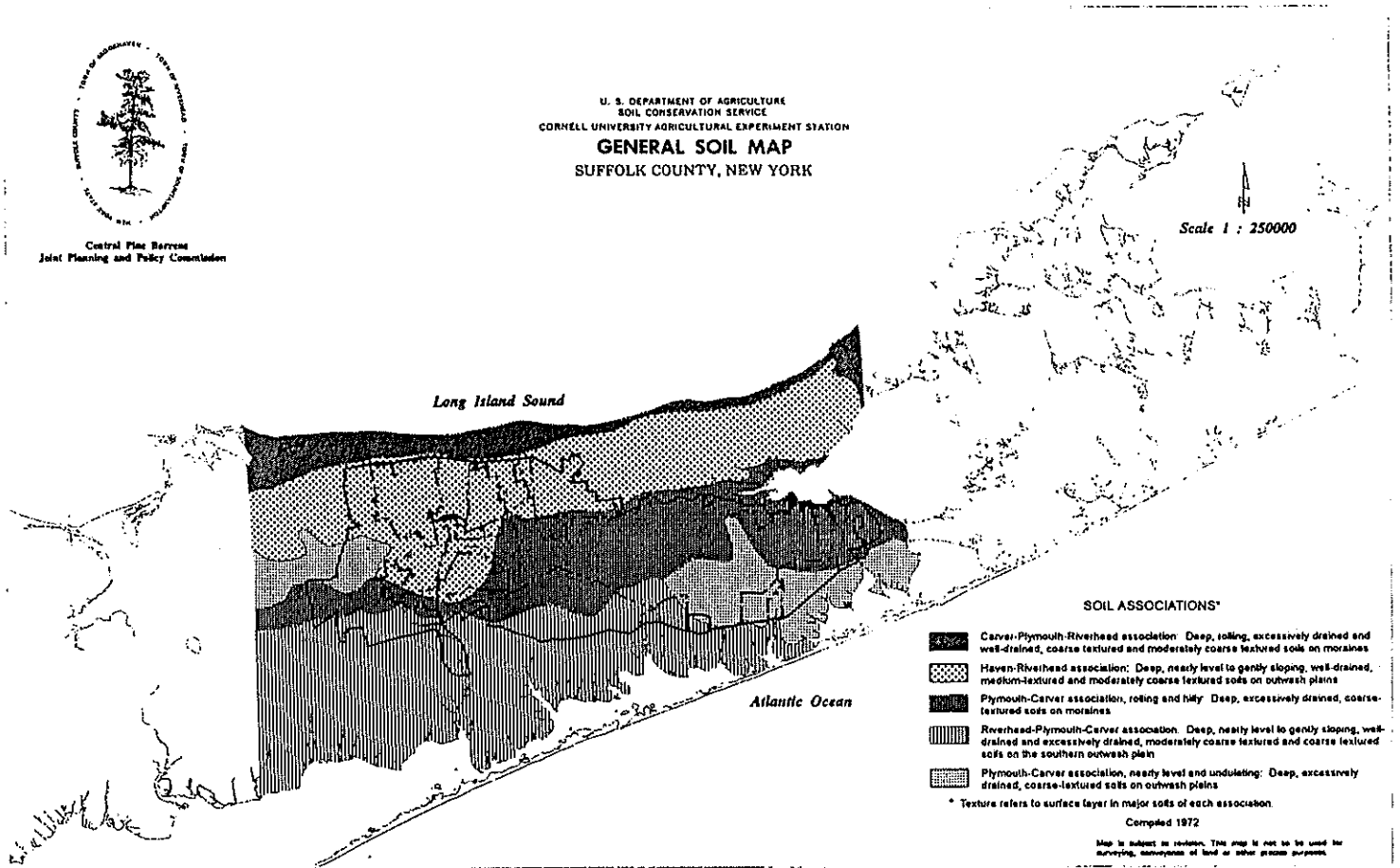
Carver Association, Nearly Level and Undulating.

3.2.1 Haven-Riverhead Association

The Haven-Riverhead Association is located as a band varying in width from 2 to 4 miles wide along the northern portion of the Central Pine Barrens area (see Figure 3-1). According to the Soil Survey, this association consists of deep, nearly level to gently sloping, well-drained, medium-textured and moderately coarse textured soils on outwash plains. Characteristically it is nearly level with short gentle slopes along shallow drainageways with some areas pitted by steep-sided kettle holes. Slopes range from 1 to 12 percent in this association.

The Soil Survey states that this association constitutes 26 percent of the county soils and is comprised of approximately 40 percent Haven soils and approximately 30 percent Riverhead soils, with the remaining 30 percent of this association consisting of minor soils. This association constitutes approximately 25 percent of the Central Pine Barrens area. The Haven and Riverhead soils are found together across most landforms. However, Haven soils are most extensive at slightly higher elevations and at greater distances from drainageways.

Figure 3-1: General Soil Map, Suffolk County, New York



The Soil Survey describes Haven soils as deep, well drained and medium textured soils, whereas Riverhead soils are described as deep, well drained and moderately coarse textured soils. The surface layer of Haven soils is loam and their subsoil is loam or silt loam. The surface layer and subsoil of Riverhead soils is sandy loam. Both Haven and Riverhead soils are present throughout the county with Haven soils mostly found on outwash plains located between the two terminal moraines. Riverhead soils are found on rolling to steep areas on the moraines and in level to gently sloping areas on outwash plains. Slopes for Haven soils can range from 0 to 12 percent, but generally range from 1 to 6 percent. Slopes for Riverhead soils are characterized as nearly level to steep, however they are generally nearly level to gently sloping. The substratum for both Haven and Riverhead soils is sand and gravel. The depth to the substratum for Haven soils ranges from 18 to 36 inches and 22 to 36 inches in Riverhead soils.

Minor soils of this association, as stated in the Soil Survey, include steeper Carver and Plymouth soils that are found on the sides of drainageways and on the steep sides of kettle holes. Soils of the Haven series' thick surface layer are found in the bottom of shallow depressions. Soils within this association that have a high water table include Canadice (Canadice soils are in low-lying wet areas west of the Village of Greenport), Raynham, Scio, and Sudbury soils. Raynham, Scio, and Sudbury soils are found in low-lying areas near ponds or marshes. The largest such area is near Brookhaven Laboratory.

According to the Soil Survey, native vegetation for the Haven-Riverhead association consists of black oak, white oak, red oak, and scrub oak. Native vegetation for the Haven soils is the pitch pine vegetation. The majority of the areas within this association have been cleared. The soils of this association from the Brookhaven-Riverhead town line eastward comprise the largest area of farmland in the county. These lands are used extensively to grow potatoes and other vegetables. These soils are predominantly gently sloping to nearly level and have moderate to high available moisture capacities. Crops within these soils respond well to applications of lime and fertilizer. These factors make this association one of the best farming areas

in the county. Appendix 1-1 presents the limitations of soils within this association for particular uses related to planning. Since these soils have good drainage and can be excavated with ease, the Soil Survey considers this association to have an excellent potential for housing developments and similar uses, except in areas with a higher water table or that are strongly sloping which would place more severe limits on non-farm uses.

3.2.2 Plymouth-Carver Association, Rolling and Hilly

The Plymouth-Carver Association, rolling and hilly is located in a central band varying in width from one to two miles wide from the western boundary of the Central Pine Barrens area and widening to 4-5 miles wide east of Yaphank to Riverhead (see Figure 3-1). This association is described in the Soil Survey as consisting of deep, excessively drained, coarse-textured soils that are located on the Ronkonkoma moraine. The soils within this association are characterized as strongly sloping to steep with slopes ranging from 8 to 35 percent.

The Soil Survey states this association constitutes 19 percent of the county soils. It is comprised of approximately 45 percent Plymouth loamy sand soils and approximately 30 percent Carver and Plymouth sands with the remaining 25 percent comprised of minor soils. This association constitutes 50 percent of the Central Pine Barrens area. Plymouth and Carver soils are deep and excessively drained. Plymouth soils have a surface layer and subsoil of sand or loamy sand. Carver soils have a surface layer and subsoil of sand and are similar to Plymouth soils, except they have a distinctive gray or light-gray subsurface layer that is lacking in Plymouth soils. Both Plymouth and Carver soils have a substratum of sand and gravel. The depth to the substratum in Plymouth soils ranges from 20 to 36 inches and in Carver soils, 16 to 32 inches.

Carver and Plymouth sands are generally found on steeper soils on ridgetops and the lower part of slopes. Gently sloping Plymouth loamy sand soils are mainly on the intervening areas. Areas along the crests of some ridges have a large amount of gravel on the surface that are generally small and

scattered throughout the association.

Minor soils in this association include Haven and Riverhead soils that are nearly level and scattered throughout this association; Atsion and Berryland soils along with the land type identified as Muck have a high water table and are situated adjacent to streams, ponds and marshes. The largest areas of these soils and land type are along the Peconic River and nearby ponds, with these areas extending eastward from the headwaters of the river to its mouth in Riverhead. There is extensive cut and fill land in the western portion of this association.

According to the Soil Survey, the soils of this association have a characteristically poor cover of scrub oak, white oak, black oak and pitch pine. Additionally, only a small portion of this association has ever been farmed. This association provides an important source of gravel in the County. Appendix 1-1 presents the limitations of soils within this association for particular uses. In the western portion of the county, this association is largely in housing developments. It is considered by the Soil Survey to be poorly to fairly suited for crops commonly grown in the county.

Furthermore, steep slopes on much of the area and difficulty in establishing and maintaining lawns and landscape plantings severely limit the use of these soils for housing developments or similar nonfarm uses. Severely limiting the use of some areas for sewage effluent disposal are the areas of soils within this association that have a high water table. There are soils within this association with a rapid permeability that would allow water and wastes to move quickly from cesspools and septic systems and potentially cause contamination of groundwater supplies (*see* Appendix 1-1).

3.2.3 Riverhead-Plymouth-Carver Association

The Riverhead-Plymouth-Carver Association extends in a west to east band ranging from less than .5 miles to 2 miles in width along the southern portion of the Central Pine Barrens area boundary. This association is described in the Soil Survey as deep; nearly level to gently sloping; well-drained and excessively drained; moderately coarse textured and coarse textured soils on the southern outwash plain. Slopes range from 1 to 6 percent with slopes that range from 8 to 35 percent on the sides of

drainage channels. The portion of this association that adjoins the Great South Bay and Moriches Bay along its southern edge is indented by many short tidal creeks.

According to the Soil Survey, this association constitutes 21 percent of the county soils. This association is comprised of approximately 45 percent Riverhead soils, approximately 30 percent Plymouth loamy sand soils and approximately 10 percent Carver and Plymouth sands with the remaining 15 percent of this association comprised of minor soils. This association constitutes approximately 10 percent of the Central Pine Barrens area. Riverhead soils are deep and well drained, whereas Plymouth and Carver soils are deep and excessively drained. Riverhead soils have a surface layer and subsoil of sandy loam with many areas of the lower part of the subsoil being loamy sand. Plymouth soils have a surface layer and subsoil of loamy sand or sand. Carver soils have a surface layer and subsoil of sand. The substratum of all three soil series are sand and gravel. The depth to substratum in Riverhead soils is 22 to 36 inches, in Plymouth soils, 20 to 36 inches and in Carver soils 16 to 36 inches.

The nearly level Riverhead and Plymouth soils are dominant on broad, flat areas between intermittent drainageways with Riverhead soils at slightly higher elevations and greater distances from the drainageways than the Plymouth soils. Carver soils are located on the sides of intermittent drainageways.

Minor soils within this association include Haven soils that are adjacent to Riverhead soils but at slightly higher elevations. Other minor soils within this association include Berryland, Walpole and Wareham soils and the land type Tidal marsh that have a high water table. These later soil types and land type are found along the margins of tidal creeks or at the southern ends of drainageways that have elevations near that of the water table. Large areas of Riverhead and Haven soils have been altered by grading operations in developed areas. There are also large areas of cut and fill in this association where housing tracts have been developed. The Soil Survey indicates the native vegetation within the Riverhead soils areas of this association consists of black oak, white oak, red

oak, and scrub oak. Within the Carver and Plymouth soils it consists of scrub oak, white oak, black oak, and pitch pine.

This association is largely in woods within the inland area of the Central Pine Barrens. According to the Soil Survey, areas that are primarily developed are located along the shore with development gradually encroaching into the inland areas. Appendix 1-1 presents the limitations of soils within this association for particular uses related to planning. Due to the coarse-texture of the Plymouth and Carver soils, the suitability of the soils of this association for farming are limited. However the areas of Riverhead soils are suited for most locally grown crops. This association is well suited to urban and suburban development due to its level topography, ease of excavation and good drainage. Effluent from cesspools and septic systems that are located in soils with high water tables could potentially contribute to groundwater contamination. Wet soils within this association are severely limited for most nonfarm uses.

3.2.4 Plymouth-Carver Association, Nearly Level and Undulating

This association is found only in two areas within Suffolk County which are also located within the Central Pine Barrens area. One is in the vicinity of Coram and the other covers a broad sandy plain that extends eastward from Eastport to Hampton Bays (see Figure 3-1). The only breaks in these flat areas occur from widely spaced drainageways. This association is described in the Soil Survey as deep, excessively drained, coarse-textured soils on outwash plains and is characteristically nearly level. The western part of this association consists of more strongly sloping soils than the eastern part. The eastern area was laid down by glacial outwash and is not pitted. Slopes within this association generally range from 1 to 8 percent with a few areas that are steeper.

The Soil Survey states this association constitutes 5 percent of the County. This association is comprised of approximately 50 percent Plymouth loamy sands and approximately 25 percent Carver and Plymouth sands with the remaining 25 percent comprised of minor soils. This association constitutes approximately 15 percent of the Central

Pine Barrens area. Plymouth and Carver soils are deep and excessively drained. Plymouth soils have a surface layer and subsoil of sand or loamy sand. Carver soils have a surface layer and subsoil of sand and are similar to Plymouth soils, except they have a distinctive gray or light-gray subsurface layer that is lacking in Plymouth soils. Both Plymouth and Carver soils have a substratum of sand and gravel. The depth to the substratum in Plymouth soils ranges from 20 to 36 inches and in Carver soils, 16 to 32 inches.

The Soil Survey identifies Haven, Riverhead, Atsion, Berryland and Wareham soils as minor soils within this association. There is extensive cut and fill land in the western part of this association. Riverhead and Haven soils are well drained while Atsion, Berryland and Wareham soils are more poorly drained. The western part of this association has been used mainly for housing and developments. The eastern part of this association is wooded except for the airfield area at Westhampton Beach.

According to the Soil Survey, native vegetation for this association is characterized by a poor cover of scrub oak, pitch pine, and white oak. It is not well suited for most crops grown in the County due to its coarse texture, droughtiness and low fertility. Notwithstanding their coarse texture, these soils have few limitations for nonfarm uses. (See Appendix 1-1). Due to the droughty nature of soils within this association, it has severe limitations for use in establishing and maintaining lawns and foundation plantings. Cesspools and septic systems located within rapidly permeable soils in this soil association could potentially contribute to the contamination of water supplies beneath them. Minor soils with a high water table have severe limitations for nonfarm use.

3.3 Soil Resources Associated with Environmentally Significant Resources

Soil resources within the Central Pine Barrens area include prime agricultural soils on previously cleared land and soils and land types that have a high water table and are associated with environmentally sensitive wetland and tidal marsh areas.

3.3.1 Prime Agricultural Soils

Soil capability groups, as defined in the Soil Survey, were used to identify prime agricultural soils within the Central Pine Barrens area. Prime agricultural soils within the Central Pine Barrens area are identified on the Prime Agricultural Soils Map included in Appendix 1-2. These soils are within capability classes I and II since they have few or moderate limitations that reduce the choice of plants or require moderate conservation practices. Included in these soil classes are:

Haven loam, 0 to 2 percent slopes, (HaA) - Capability Unit I-1

Haven loam, 2 to 6 percent slopes, (HaB) - Capability Unit IIe-1

Haven loam, thick surface layer - Capability Unit IIw-2

Plymouth loamy sand, silty substratum, 0 to 3 percent slopes, (PsA) - Capability Unit IIs-1

Riverhead sandy loam, 0 to 3 percent slopes (RdA) - Capability Unit IIs-1

Riverhead sandy loam, 3 to 8 percent slopes (RdB) - Capability Unit IIe-2

Scio silt loam, till substratum, 2 to 6 percent slopes (ScB) - Capability Unit IIe-1

Scio silt loam, sandy substratum, 0 to 2 percent slopes (SdA) - Capability Unit IIw-1

Scio silt loam, sandy substratum, 2 to 6 percent slopes (SdB) - Capability Unit IIe-1

Sudbury sandy loam (Su) - Capability Unit IIw-1

3.3.2 Soils Associated with Environmentally Sensitive Areas

Atsion, Berryland, Canadice silt loam, Muck, Raynham, Scio, Sudbury, Walpole, Wareham, and Tidal marsh soils and land types are soil resources associated with environmentally sensitive wetland and tidal marsh areas. These soil and land types have characteristically high water tables that are

indicative of wetland and tidal marsh areas. The discussion of associations that contain these soils can be found at the beginning of this section. These soils are generally found in low lying areas near streams, drainageways, ponds or marshes. Soils such as these with high water tables could potentially contribute to groundwater contamination from effluent from cesspools and septic tanks and have certain severe use limitations as indicated in Appendix 1-1.

4. Hydrology and Water Quality Overview

4.1 Introduction

Environmental Conservation Law Article 57 requires that the Central Pine Barrens (CPB) comprehensive land use plan be designed to preserve the ecology and ensure the high quality of groundwater within the CPB, and that preparation of the plan be based on previously undertaken and current ecological and groundwater studies (Sections 57-0121(1) and (5)). Information on such topics as CPB ground and surface water hydrology, water quality, and water supply pumpage was therefore compiled to meet this requirement. Although Article 57 does not specify that such information be included in the plan (*see* E.C.L. Section 57-0121(6)), a summary is presented here to allow a more complete understanding of plan derivation.

Hydrologic and water quality information is important to the planning process because it allows the development of conceptual, statistical, analytic, and numerical models of the ground and surface water systems, which, in turn, help in understanding how these systems work and provide a means for predicting system responses to future conditions. The following discussions identify the major types and sources of information that are applicable to the CPB planning process, and provide summaries of relevant data and concepts. Referenced sources include U.S. Geological Survey (USGS) studies, Brookhaven National Laboratory (BNL) and Suffolk County Department Health Services (SCDHS) monitoring data, and recent work by State University of New York (SUNY) at Stony Brook and SCDHS on the Peconic River and Estuary system.

4.2 Hydrogeology

Issues concerning surface water ecology and water supply generally involve the two uppermost major geologic units the upper glacial deposits, and the older, deeper deposits of the Magothy formation. However, sophisticated modelling of the hydrologic

system also requires an understanding of the deeper formations; the bedrock, Lloyd Sand, and Raritan clay. (Figure 4-1). This section will focus on the shallowest units. Data and discussions on the deeper units can be found in De Laguna (1963), Jensen and Soren (1974), and Soren and Simmons (1987).

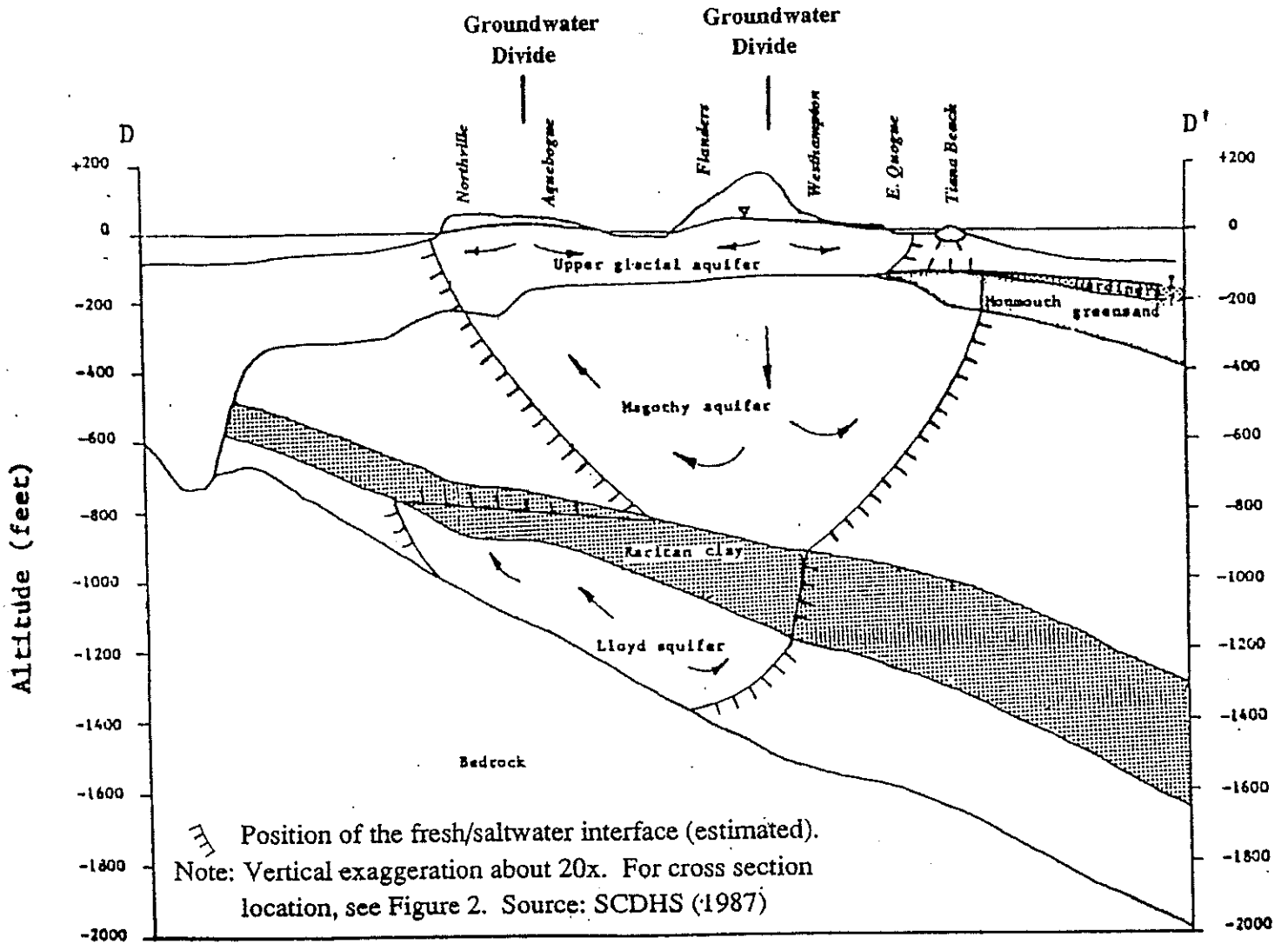
4.2.1 Ronkonkoma Moraine and Outwash Plains

The most prominent topographic feature of the CPB is the Ronkonkoma glacial moraine (Figure 4-2), which traverses the area west-east, bisecting the western portion, dipping south of Brookhaven National Lab, and trending along the northern portion of the South Fork. (Jensen and Soren 1974). The moraine influences surface drainage patterns, but is not a significant factor affecting groundwater flow. To the south of the moraine lies a relatively flat glacial outwash plain composed of sand and gravel that contains very little silt or clay; to the north lie a series of shallow basins (Selden, Manorville, Riverhead) filled with similar outwash deposits from both the Ronkonkoma moraine and the Harbor Hill moraine, which runs along the north shore. (De Laguna 1963). These highly permeable outwash deposits comprise the major portion of the upper glacial aquifer. (*see* Upper Glacial Aquifer, below). For a more detailed history of Long Island glaciation, see Sirkin (1994), and Sanders and Merguerian (1994).

4.2.2 Surficial Silt and Clay Deposits

At the close of the glacial period, mud and silts are believed to have been deposited in swamps and lakes in the low lying area between the moraines. (De Laguna 1963; Warren et al., 1968). This deposition, in combination with the reworking of wind-eroded glacial material (loess), produced shallow silt and clay deposits that now are found locally, particularly in lowlands along the Peconic River and in minor headwater tributaries. These deposits are at most 5 to 10 feet thick, and are generally found less than 30 feet below grade. They retard recharge, forming swampy areas or ponds that persist even when the surrounding water table declines, thus creating perched or semi-perched surface water systems.

Figure 4-1: Hydrogeologic Cross Section D-D'



It is not known whether such deposits underlie all of the freshwater ponds and wetlands in the headwater areas of the Peconic and Carmans Rivers.

4.2.3 Glacial Clay Units

The stratigraphy of the upper glacial deposits is complex, and includes a number of local, and possibly subregional, clay units that affect groundwater movement. Within the sequence of glacially-derived sediments is a thick clay unit that has been identified in the western portion of the CPB area as Smithtown Clay. Beginning at elevations ranging from 10 to 70 feet above sea level, it extends downward in thicknesses of 30 to 100+ feet. (Krulik and Koszalka 1983). This unit is believed to have been deposited in a lake or series of lakes that formed north of the Ronkonkoma moraine, and the sequence "outwash-clay-outwash" is typical of much of the intermorainal area as far east as the North Fork. (Long Island Regional Planning Board (LIRPB) 1992). At Manorville, a clay unit (possibly related to the Smithtown Clay) was found to extend from sea level to a depth of -30 to -60 feet, although it was not identified below BNL. (De Laguna 1963). Where present, these clays can be expected to impede the downward flow of groundwater, resulting in water table "mounding," and may also confine deeper groundwater in areas such as the central and lower Peconic River valley. (*see* Upper Glacial Aquifer Flow and Magothy Aquifer Flow, below).

4.2.4 Upper Glacial Aquifer

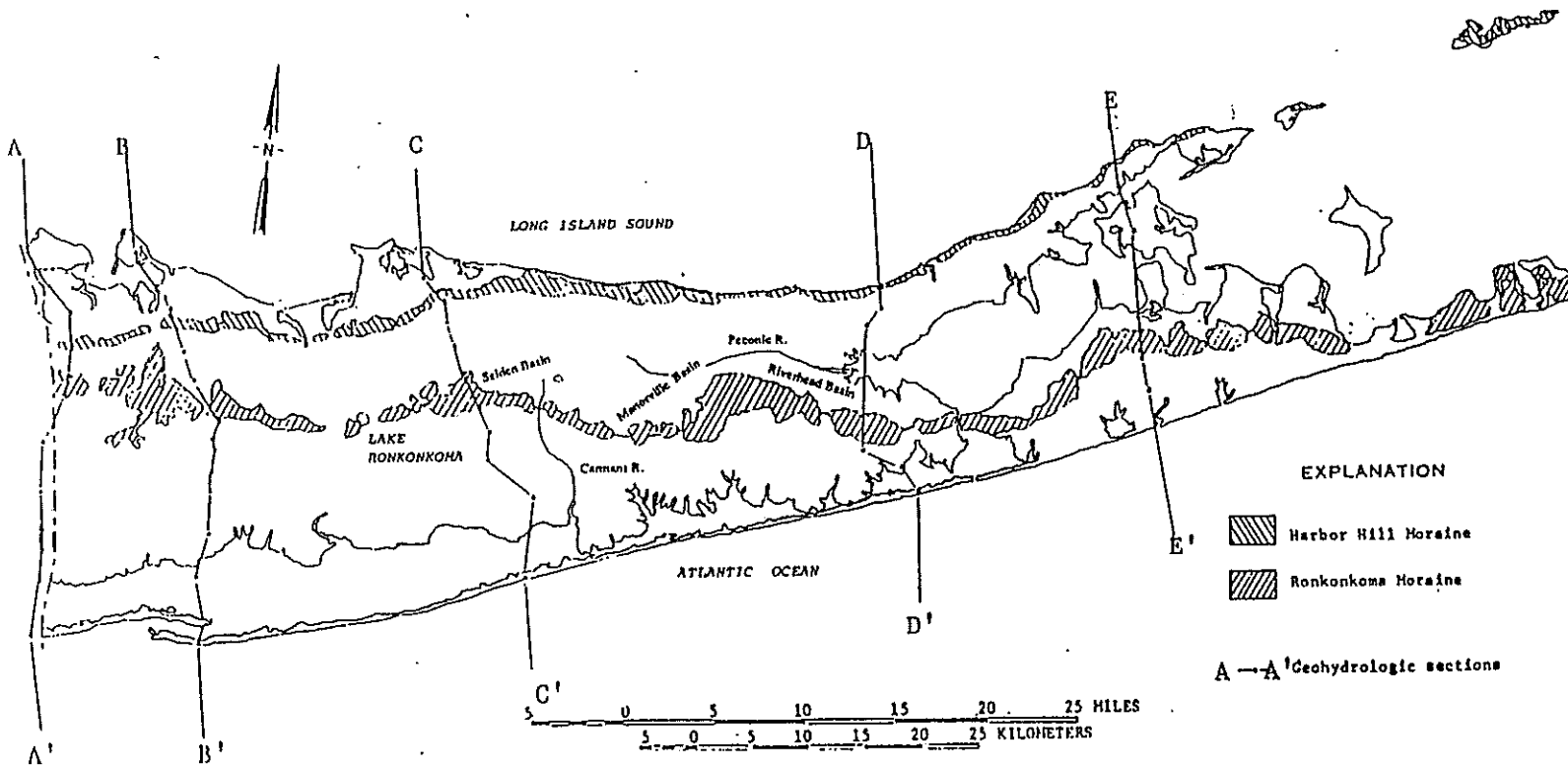
The sequence of glacial deposits within the CPB area is generally on the order of 200 feet thick. Exceptions are found on the Ronkonkoma moraine, and in areas where the Magothy was eroded, including north-central Brookhaven, where 600-700 feet of glacial deposits fill a northeast-southwest trending valley running from Rocky Point to Centereach. (Koszalka 1984; Soren and Simmons 1987). The saturated portion of this sequence, comprising the upper glacial aquifer, is generally on the order of 150 feet thick below the outwash plain south of the Ronkonkoma moraine, but much greater to the north where the Magothy was eroded. (*see* above). The combination of high aquifer

permeability and moderate thickness limits the effects of glacial pumping wells on water table elevations; for example, a typical supply well extracting 1,000 gallons per day (gpm) would produce calculated drawdowns of 2 feet at a distance of about 300 feet, 1 foot at a distance of about 1,000 feet, and one-half foot at a distance of about 2,000 feet. (SCDHS 1987). It should be noted, however, that even such modest reductions in water table elevations, when they occur long-term, may have negative impacts on sensitive wetland ecosystems. (SCDHS 1987).

4.2.5 Gardiners Clay Unit

The Gardiners Clay unit is generally present as a 10-20 foot thick mixture of clay and sand lying about 100 feet below sea level separating glacial and Magothy deposits throughout much of the region south of the Ronkonkoma moraine. (De Laguna 1963). De Laguna also identified a clay unit below BNL as being Gardiners, although this determination was not reflected in later USGS reports. (Jensen and Soren 1974; Soren and Simmons 1987). In any case, these clays are not believed to be a significant hydrologic barrier to the recharge of the Magothy from the upper glacial aquifer within the CPB area. (De Laguna 1963).

Figure 4-2: Glacial Moraines and Basins



Geology adapted from De Laguna (1963), and Jensen and Soren (1974)

GLACIAL MORAINES AND INTER-MORAINAL BASINS

4.2.6 Magothy Aquifer

Below the southern portions of the CPB, the deposits of the Magothy formation are found at 100-150 feet below sea level and range in thickness from 800 to 900 feet. In the northwestern portion of the CPB, where the Magothy surface was eroded, the top surface of the Magothy is found as deep as 500-600 feet below sea level, and may be only 100 feet thick. (Jensen and Soren 1974; Soren and Simmons 1987). Magothy deposits consist primarily of clayey sands or sandy clays, which have lower hydraulic conductivities than the overlying glacial deposits. (De Laguna 1963). The lower 100-200 feet of the Magothy generally consists of coarse sands and gravel beds with higher conductivities. (Jensen and Soren 1974). Localized clay lenses, some as thick as 50 feet, are believed to be present throughout the formation, but are not believed to be a major barrier to groundwater movement. (De Laguna 1963).

4.3 Ground and Surface Water Hydrology

This section describes the various components of the hydrologic cycle: rainfall, recharge, and stream discharge as well as the movement of groundwater through the aquifer system.

4.3.1 Precipitation

All naturally occurring fresh water in the CPB area, as in all of Suffolk County, originates as precipitation. Long-term (40-year) average precipitation rates for Brookhaven National Lab (Upton) have been reported as 46.3 inches per year for 1943-1982 (Krulik 1986) and 48.4 inches per year for 1950-1989. (Naidu 1992). Annual rates generally decrease by a few inches from the center of the island shoreward, and from west to east, possibly due to influences of land topography (e.g., the Ronkonkoma moraine) and the prevailing west to east direction of wind and storm movement. (see Miller and Frederick 1969). Precipitation at BNL reached a high of 68.7 inches in 1989, and a low of 31.8 inches (or 34% below the long-term average) during the drought in 1965. Lows approaching those of 1965 were also experienced in 1980 and 1985. (Naidu 1992). Monthly precipitation rates are fairly consistent throughout

the year, so that no distinct wet or dry seasons are distinguishable. March, August, November, and December are the wettest months at Upton, averaging about 4.5 inches, while June, July, and September are the driest months, averaging between 3 and 3.5 inches. (Krulik 1986).

4.3.2 Recharge

The amount of precipitation recharged to the aquifer system is reduced by the amount lost to evaporation and plant transpiration (cumulatively referred to as evapotranspiration) and by the amount lost through direct runoff to streams or tidal water bodies. Evapotranspiration has been calculated, using the Thornthwaite method for average precipitation conditions, to range from 22.4 inches per year for shallow-rooted vegetation in sandy loam soils in Riverhead, to 23.9 inches per year, for deep-rooted vegetation in silty loam soils in Upton. (Peterson 1987). Direct runoff for the CPB area has been estimated to be only about 0.5 inches per year (Krulik 1986), so that recharge to the aquifer system under average precipitation conditions is calculated to range from 22 to 26 inches per year (or 1.05 to 1.24 million gallons per day (mgd) per square mile), with recharge patterns reflecting precipitation patterns. (Peterson 1987). Total recharge for the 100,000 acre (156 square mile) CPB area, therefore, is on the order of 164-193 mgd.

4.3.3 Hydrogeologic Zones

The CPB area encompass regions of deep aquifer recharge on both sides (north and south) of the groundwater divide, which traverses central Brookhaven and splits into North and South Fork branches, beginning in the area near the northwest corner of Brookhaven National Lab, and extending eastward. (Figure 4-3; see Upper Glacial Aquifer Flow, below). The boundaries of the CPB area approximate those of deep-flow Hydrogeologic Zone III, with the exception of the westernmost portion of the zone, as defined by the 208 Study (LIRPB, 1978) and later delineated by the SCDHS for the Suffolk County Sanitary Code (Figure 4-3). The Peconic River and upper reaches of the Carmans River drain the east-central and south-central portions of Hydrogeologic Zone III, respectively, and represent subsystems with shallow

flow components within the deep recharge area. The CPB also includes areas surrounding the lower freshwater portion of the Carmans River, which extends into shallow-flow Hydrogeologic Zone VI.

4.3.4 Water Table and Depth to Water

The water table within the CPB reaches a maximum elevation of 50-55 feet above mean sea level along the divide in the westernmost portion of the area, and drops off to the north, south, and east, being about 25-35 feet at North Country Road (Route 25A), 40-45 at the LIE in Medford, 35-50 feet at BNL, and generally less than 30 feet on the South Fork. Long-term average annual water table fluctuations due to seasonal variations in precipitation are generally less than a few feet; however, declines as great as 4 feet (10%) from the long-term average were observed at BNL during the 1960s drought. (Krulik 1986). Depths to the water table from land surface range from over 150 feet along the moraine, to about 80 feet north of the main divide, and 40 feet on the southern outwash plain and between the divides, declining to less than 10 feet in areas near the Peconic River and drainage ways at its headwaters. (Wallace et al., 1968). Maps of areas with less than 4 feet from land surface to seasonal high water table elevations were prepared and used in CPB Plan preparation.

4.3.5 Upper Glacial Aquifer Flow

The rate of vertical flow in the upper glacial aquifer is greatest at about 6 feet per year near the divides, and decreases to a negligible amount at the shoreward boundaries of deep-flow Hydrogeologic Zone III. (SCDHS 1987). Horizontal groundwater flow velocities within the upper glacial aquifer are generally on the order of one-half foot per day near the main divide and on the South Fork portion of the CPB, based on water table gradients of about 2-3 feet per mile, and about one foot per day for most other portions, based on a gradient of 5 feet per mile.

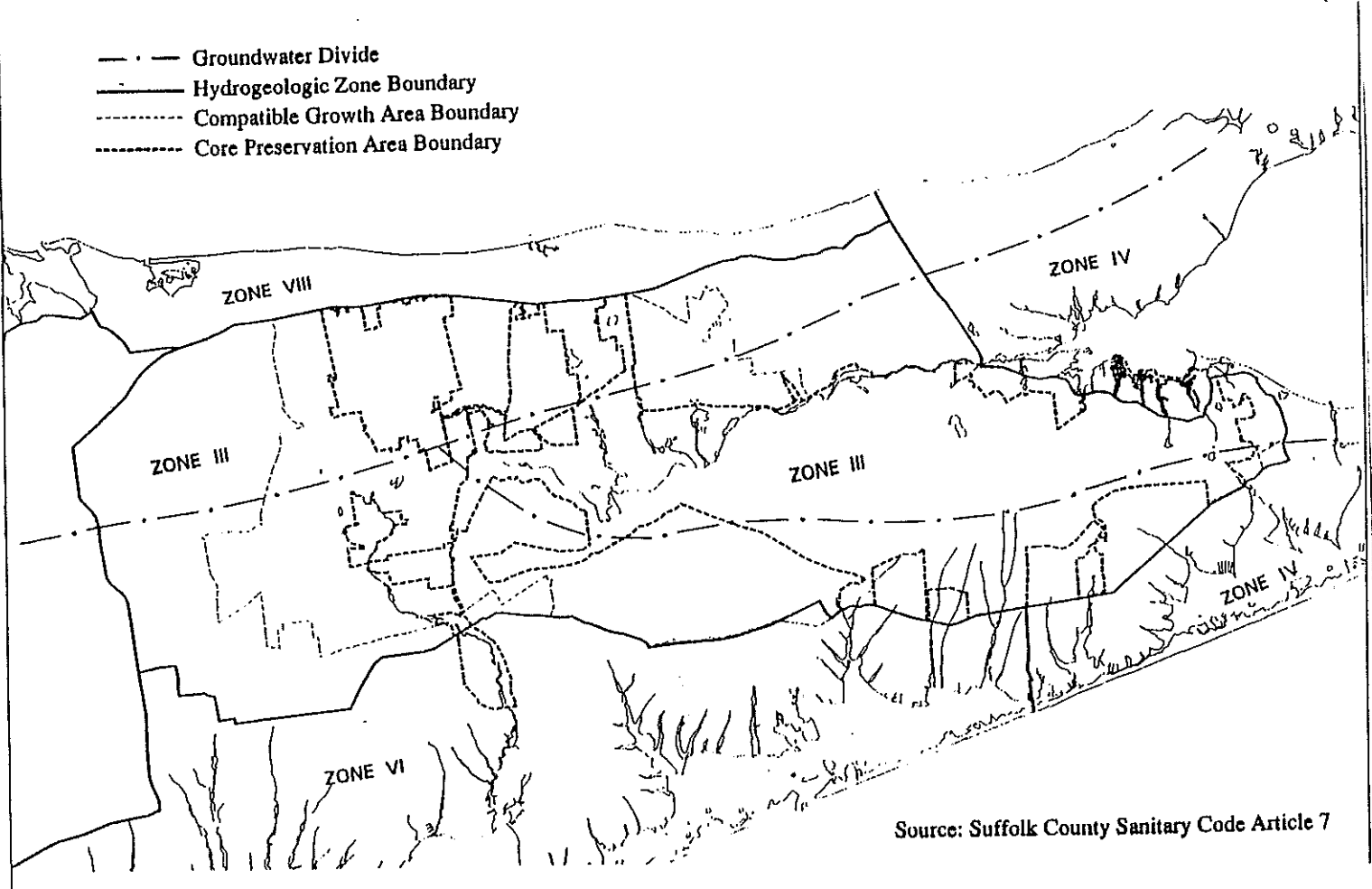
The directions of horizontal flow follow water table gradients, and are primarily north and south on the respective sides of the main groundwater divide, with a small easterly component throughout most of the CPB (except directly to the east of the Carmans River, where flow is south-southwest). The

influence of the Peconic River extends westward just beyond Brookhaven National Lab, where the main groundwater divide splits into a northern branch that approximately bisects the Navy's Calverton facility, and a southern branch that generally follows the topographic high formed by the Ronkonkoma moraine. (Figures 4-2 and 4-3; see Jensen and Soren 1974; LIRPB 1992). Most of the recharge in the region between the divides discharges to the Peconic river via shallow flow. The shallow-flow groundwater contributing area of the Peconic River was delineated by Krulik (1986), and his work was utilized by the SCDHS for the Brown Tide Comprehensive Assessment and Management Program (BTCAMP). (SCDHS 1992).

4.3.6 Magothy Aquifer Flow

Recharge of the Magothy from the upper glacial aquifer is greatest near the main groundwater divide, and gradually decreases seaward, until it is negligible at the deep recharge zone boundaries. Groundwater within the Magothy moves slower than in the upper glacial aquifer. It moves generally 0.1-0.2 feet per day even though head gradients are similar which reflects the lower hydraulic conductivity of the deeper unit. Residence times are thus much greater for the Magothy, taking hundreds of years for water recharged near the divide to be discharged at the shoreline. (Buxton and Modica 1992). The Magothy has an easterly component of flow below the entire CPB area, and Magothy water contributes to the underflow to the Peconic Estuary east of the Peconic River. (SCDHS 1992).

Figure 4-3: Hydrogeologic Zones and Groundwater Divides

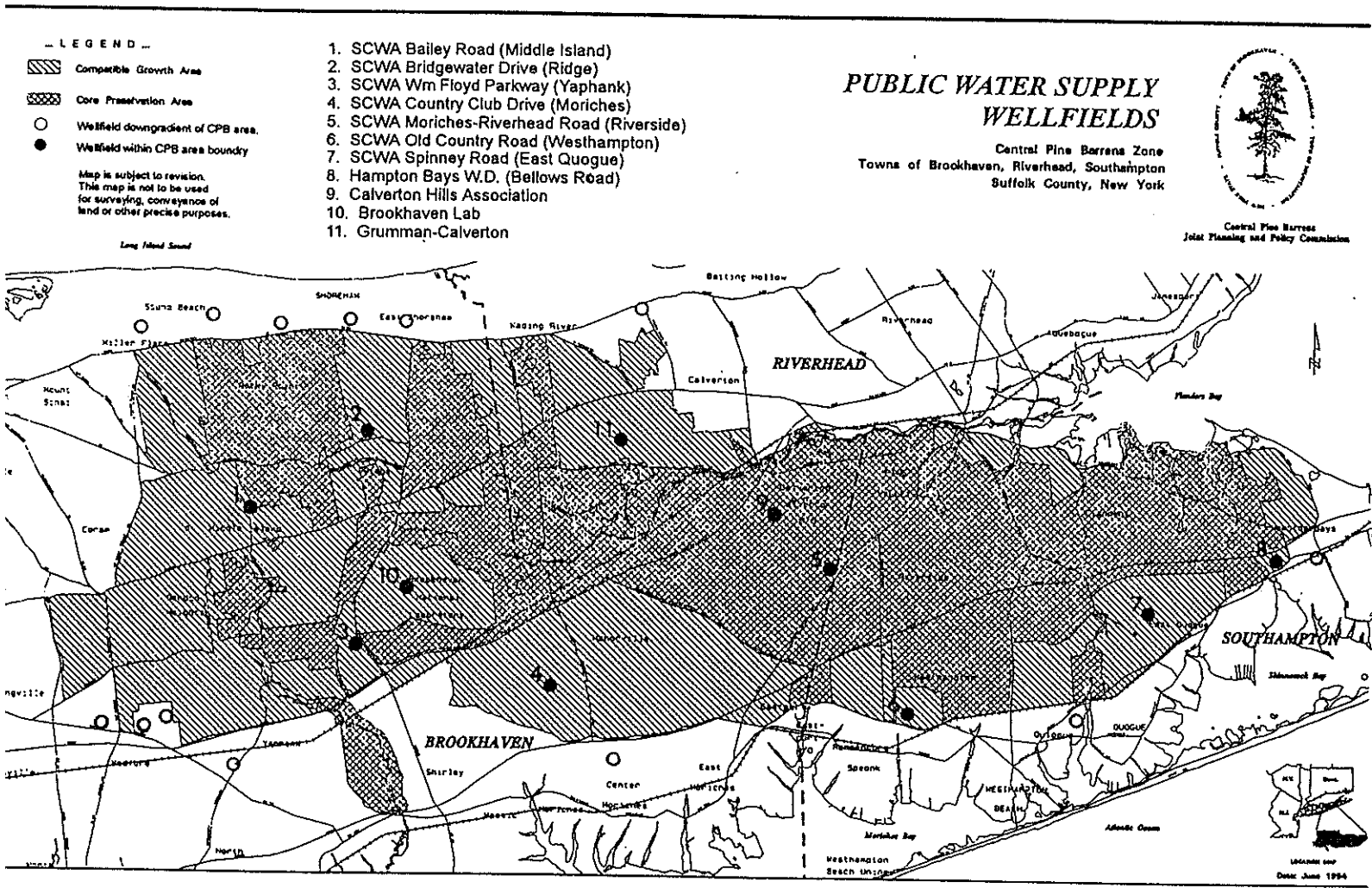


Source: Suffolk County Sanitary Code Article 7

4.3.7 Water Supply Pumpage

Seven Suffolk County Water Authority (SCWA) public water supply wellfields are located within the CPB boundaries (Figure 4-4): Bailey Road (Middle Island), Bridgewater Drive (Ridge), William Floyd Parkway (Yaphank), Country Club Drive (Moriches), Moriches- Riverhead Road (Riverside), Old Country Road (Westhampton), Spinney Road (East Quogue). Pumpage for 1992, which was a year of average precipitation, totalled about 3 mgd, of which 2.6 mgd or 87%, was pumped from the upper glacial aquifer. The largest public pumpage occurred at the William Floyd Parkway wellfield, where two glacial wells produced 0.8 mgd, and one Magothy well produced 0.2 mgd. Other withdrawers within the CPB included Brookhaven National Lab (4.2 mgd), the Hampton Bays Water District (Bellows Road wellfield, 0.46 mgd), Calverton Hills Association (0.05 mgd), and Grumman-Calverton (0.2 mgd, estimated). Another 6.8 mgd was pumped in 1992 by the 13 public supply wellfields located just downgradient of the CPB area, which probably pump water originating within the CPB. (Figure 4-4). Total withdrawals from the CPB area in 1992, therefore, were as much as 14.5 mgd, which is equivalent to about 8% of recharge, but only a small percentage of this pumpage is believed to be used consumptively. Most pumpage is returned to the aquifer system in the general area from which it was pumped, although in some cases this may be outside (south) of the CPB area boundary. The largest consumptive use occurs at BNL, where on the order of 1 mgd of cooling water is lost to the atmosphere. (Naidu, 1993).

Figure 4-4: Public Water Supply Wellfields



4.3.8 Streamflow

A significant portion (on the order of 25%) of the precipitation recharged within the CPB area leaves the groundwater system via streamflow, primarily in the Peconic and Carmans Rivers. The Peconic River system derives flow from areas as far west as BNL, and perched marshlands located just west of William Floyd Parkway, although this flow across the western portion of the lab is intermittent, usually occurring only after heavy rainfalls or during times of high water table elevations. Streamflow at the downstream (eastern) boundary of BNL is often minimal (Naidu 1992), but overall has been estimated to average 0.6 mgd. (Warren et al., 1968). Farther east, at Wading River-Manorville Road, flow averages around 2 mgd, but has been measured to vary from 1 to 28 mgd, reflecting water table fluctuations and the intensity of rainfall events. (Warren et al., 1968). Flow on the lower Peconic River, as measured at the USGS gauging station located 0.4 miles west of Riverhead, has ranged from 10.4 mgd (1966) to 43.9 mgd (1984), with a long-term (1942-92) average of 24.0 mgd (Spinello et al., 1993); an estimated 1.4 mgd, or 6% of the long-term average flow, is runoff. (SCDHS 1987). At the mouth of the river, just east of County Route 105, the average total freshwater flow rate is estimated to be 34 mgd, which includes 14 mgd of groundwater estimated by the USGS to be discharged to the river downstream of the USGS gauging station. (SCDHS 1992).

The Carmans River flows south through a gap in the Ronkonkoma moraine from its headwaters located in the area of Artist Lake in Middle Island. (see Figure 4-2). It reaches the dividing line between Hydrogeologic Zones III and VI at Yaphank, about six miles from its headwaters, with flows measured at the USGS gauging station ranging from 8.3 mgd (1967) to 24.3 mgd (1979), and a long-term (1942-92) average of 15.6 mgd. (Spinello et al., 1993). Farther south, the rate of discharge of groundwater to the river increases as it traverses the outwash plain, and by the time the river reaches the boundary of the CPB at Route 27, some 12 miles south of its starting point, the average flow rate has increased to about 35 mgd. The southernmost 3 miles of the river are tidal, where it gains an estimated additional 11.5 mgd of

groundwater, bringing the total freshwater discharge into Bellport Bay at the mouth of the river to 46.5 mgd. (Warren et al., 1968).

4.4 Pond and Wetland Hydrology

The general status of knowledge concerning wetland hydrology has been characterized as "inadequate" (Kusler 1987), and this characterization holds true for the wetlands of the CPB area, where no systematic investigation of each individual wetland and its relation to groundwater has been made. Five of the six dominant surface hydrologic cover types associated with wetlands in glaciated regions (Hollands 1987) have been identified in the CPB area: open water bodies (ponds), vegetated wetlands other than cranberry bogs, inactive cranberry bogs, perennial streams, and ephemeral streams. Only active cranberry bogs are no longer present. Many of these wetlands have been altered by man through the creation of small channels (such as those interconnecting the Manorville ponds), the erection of small dikes and embankments to create cranberry bogs, and the construction of mill dams on the Peconic and Carmans Rivers to create artificial lakes.

Many of the CPB wetlands are found in kettle holes, which were formed by the melting of detached, buried blocks of glacial ice. These steep-sided depressions generally have no drainage outlet, and the wetlands at their bottoms can be either perched or groundwater fed. The rates of sediment input from runoff and dust, and the creation of organic sediments due to biological activity within CPB wetlands without surface outlets, can be assumed to have been minimal prior to development, or they would have long since filled in. Wetlands without surface outlets may both receive and discharge to groundwater, with a net balance favoring discharge, since rainfall generally exceeds open water evaporation rates for Long Island, estimated to be 34 inches per year. (Pluhowski and Kantrowitz 1964). Where stormwater runoff is directed into such ponds, they may rise above the water table and create small, localized recharge mounds. Perched and semi-perched systems, including ephemeral (post-precipitation) streams, have been identified

around BNL. (Warren et al., 1968). These systems lie above the water table and can drain in any direction, independent of underlying groundwater flow.

4.5 Ground and Surface Water Quality

This section describes the known quality of water throughout the various stages of the hydrologic cycle within the CPB, beginning with input from rainfall, followed by movement through surface wetlands and groundwater, and concluding with output as streamflow and underflow.

4.5.1 Precipitation

Precipitation inputs to the CPB's hydrologic system are related to natural processes and to recent, anthropogenic sources such as fossil fuel combustion emissions and agricultural fertilizers, which can add nutrients and various contaminants to fragile wetland ecosystems and groundwater. Precipitation on Long Island, as elsewhere, is naturally acidic, but has been made more so by air pollution. pH values now generally range from 3.5 to 6 (Spinello et al., 1983), with a long-term (1965-89) average at BNL of 4.3. (Schoonen and Brown 1994). The input of plant nutrients is of greater concern. While concentrations of phosphorus are generally negligible (<0.1 ppm; Spinello et al., 1983), nitrogen, in the form of nitrate and ammonia, was found at BNL during 1969-1973 to range from non-detect to 2.8 ppm, with an average of 0.5 ppm. (Frizzola and Baier 1975). More recent data (1982-89) from BNL also indicate an average total nitrogen concentration of about 0.5 ppm (Schoonen and Brown 1994). Data from the New Jersey Pinelands (Morgan and Good 1988) and recent work by SUNY at Stony Brook with data collected at BNL during 1986-1989 (Proios and Schoonen 1994) demonstrated a distinct difference between storms originating over the ocean which contribute sea salt aerosols containing ions of sodium, chloride, magnesium and storms coming across the continent which also contain nitrate, ammonia, sulfate, potassium, and calcium ions from soil and mineral dust, agricultural activities, and industrial air pollution. These relationships have been used by Stony Brook researchers to estimate atmospheric loadings to the

Peconic River watershed based on the frequency of various storm types. (Proios and Schoonen 1994).

4.5.2 Groundwater Quality

Shallow groundwater within the CPB area has a wide range of quality conditions, reflecting the nature and extent of local development. At one extreme is near "pristine" water found in undeveloped areas; it cannot be called truly pristine due to the low levels of contamination now introduced by rainwater. Such water is naturally acidic, and very low in plant nutrients such as nitrate-nitrogen (0.02-0.3 ppm), ammonia-nitrogen (0.02-0.2), sulfate (5-6 ppm), and total phosphorus (0.01-0.05 ppm), since these are readily taken up by vegetation in the nutrient-poor CPB ecosystem. It is also very low in dissolved minerals such as potassium, calcium, and magnesium. (Soren 1977; SCDHS unpublished data). Iron and manganese, however, are sometimes found at concentrations exceeding drinking water standards, although the low dissolved oxygen conditions associated with high metals concentrations are generally limited to deeper parts of the glacial aquifer and the Magothy aquifer.

At the other quality extreme are areas within or adjacent to major facilities such as BNL, Grumman, and Westhampton Airport, and areas near smaller commercial establishments such as gas stations along Route 25, where significant localized contamination of groundwater with petroleum products and/or organic solvents has occurred. Radiological impacts have been detected southeast of BNL, where a number of private wells have been impacted by tritium discharged by the Lab's sewage treatment plant, although at levels within the drinking water limit. (Naidu 1992).

Groundwater quality below residential areas reflects the impacts of sanitary sewage and lawn chemicals, which on occasion have contaminated shallow private wells beyond drinking water standards in more densely developed areas. Overall, however, residential development has not caused significant degradation of water quality in terms of water supply, and public supply wells have generally continued to produce water of excellent quality (i.e., nitrate-nitrogen less than 1-2 ppm, with no detectable organics). Exceptions have occurred in

agricultural areas, where fertilizers and pesticides have leached to groundwater. (LIRPB 1992). For example, the SCWA's shallow glacial well at Spinney Road (East Quogue), located immediately downgradient of a farming area, has had nitrate-nitrogen over the 10 ppm drinking water standard, and is currently blended with the deeper, less contaminated glacial well water. Both have aldicarb concentrations high enough to prompt the voluntary installation of Granular Activated Carbon (GAC) filters. Nutrients and pesticides related to turf management may also be a problem in some areas. (LIRPB 1992). For example, tetrachloroterephthalic acid (TCPA), a breakdown product of the herbicide Dacthal, has been detected in a glacial well at SCWA Bridgewater Drive (Ridge), and the SCWA's two glacial wells at Country Club Drive (Moriches) have nitrate-nitrogen in the 3-4 ppm range, with elevated sulfates, probably related to current turf management and past farming activities in nearby upgradient areas. (Figure 4-4).

4.5.3 Pond and Wetland Water Quality

Chemical concentrations in the ponds and other wetlands of the CPB area have not been comprehensively documented, but present evidence indicates that these systems are similar to those in the New Jersey Pinelands. Specifically, they are highly acidic and nutrient deficient when in the undisturbed state. In New Jersey, phosphorus appears to be the primary nutrient that limits biological productivity in even marginally disturbed systems, while both phosphorus and nitrogen may limit productivity in undisturbed, pristine systems. (Morgan and Philipp 1986; Schoonen and Brown 1994). The sources, quantities, and significance of human inputs are now being investigated, including atmospheric pollution and stormwater runoff that may contain road salts, fertilizers, and pesticides. Septic system effluents and fertilizers may also be a source of nitrogen to groundwater-fed wetlands, but are probably not a significant source of phosphorus, since phosphate is relatively immobile in groundwater. (De Laguna 1964; NYSDOH 1969). Hydrologic factors are also believed to affect wetland water quality and ecology, including the presence of surface water inlets and outlets, the relationship to the water table, which may control the routes of contaminant input and the response to

rainfall variations, and the water depth and bottom sediment composition, which control plant species, and therefore waterfowl populations and other fauna.

4.5.4 River and Underflow Water Quality

Water quality conditions in the Peconic and Carmans Rivers are monitored by the USGS, SCDHS, and BNL, and have recently been the subject of investigation by SUNY at Stony Brook. (Schoonen and Brown 1994). The average total nitrogen concentration measured by SCDHS at the USGS gauging station on the Peconic River during 1988-1990 was 0.5 ppm, with nitrate and organic matter contributing approximately equal amounts of nitrogen to annual loadings. A distinct seasonal variability in nitrate-nitrogen concentrations was observed, however, reaching as high as 0.6 ppm during the winter months when biological uptake is minimal. (SCDHS 1992). Total phosphorus at the gauging station during the same time period averaged 0.1 ppm. (SCDHS 1992). Traces of freon and 1,1,1-trichloroethane have also been found routinely in the river. (SCDHS unpublished data).

While these concentrations are relatively low, they do not reflect pristine conditions, and it must be emphasized that the river is a major source of nutrients to environmentally-stressed Flanders Bay, even with the relatively low levels of current development within the Peconic River watershed. (SCDHS 1992). The nutrient loadings derived from the estimated 14 mgd of shallow groundwater gained by the Peconic River downstream of the gauge are also significant, given the higher levels of development and agricultural activity in this area. (SCDHS 1992). The underflow that discharges directly to Flanders Bay has also experienced significant degradation due to nitrogen loading from agriculture and development (SCDHS 1992), although the contribution of Magothy water to underflow pollution loadings is probably minimal, given the present high quality of Magothy water emanating from the CPB area.

Evaluations of the significance of pollution sources within the Peconic River watershed are ongoing by the SCDHS, BNL, and SUNY at Stony Brook. Chemical budgets developed by Stony Brook and

water quality data collected at multiple points along the river implicate road salts, fertilizers, and lime used on turf as factors in river quality degradation. (Schoonen and Brown 1994). Other Stony Brook data indicate that inorganic chemical concentrations in the headwaters of the Peconic River can increase after a rainfall, while those near the mouth decrease; the reasons for this response are as yet unknown. (Choynowski and Schoonen 1994). Based on a BTCAMP investigation of the relationship between groundwater and surface water quality in the Peconic River and Flanders Bay areas, the SCDHS has proposed stringent development controls in the Peconic River groundwater-contributing area. This includes limiting new residential development to no less than two acres per dwelling unit, or its equivalent in the remaining, undeveloped portions of the Peconic River groundwater shed, and establishing a policy of no net increases in nitrogen loading from point sources. (SCDHS 1992).

Water quality data collected by the SCDHS at the USGS gauging station on the Carmans River at Yaphank indicate total nitrogen concentrations are in the 1-2 ppm range, which are higher than those observed for the Peconic River. (Spinello et al., 1993). Intermittent traces of 1,1,1-trichloroethane have also been detected. (SCDHS unpublished data). Thus the Carmans River represents a significant source of nutrients, and possibly other contaminants, into poorly-flushed Bellport Bay.

4.6 Bibliography: Hydrology and Water Quality Overview

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5. Ecosystems Overview

5.1 Introduction

A central goal of the Long Island Pine Barrens Protection Act is to "protect, preserve and enhance the functional integrity of the Pine Barrens ecosystem resources, including plant and animal populations and communities thereof." (E.C.L. 57-0121(2)(a)). Hence it is necessary to survey the existing ecosystem so as to tailor the plan to fulfill its legislative charge.

5.2 Description of the Ecosystem

The Long Island Central Pine Barrens region is a complex mosaic of pitch pine woodlands, pine-oak forests, coastal plain ponds, swamps, marshes, bogs and streams. Characteristic of Pine Barrens natural communities is their evolution in the presence of frequent fires. The dominant tree species in the frequently burned areas is the pitch pine, (*Pinus rigida*) which is highly fire adapted and somewhat fire resistant (*see below*). Pitch pine woodlands are characterized by widely spaced pitch pine. This spacing allows abundant sunlight to penetrate the open tree canopy allowing dense growth of the shrubby scrub oak (*Quercus ilicifolia*), and smaller heath species such as black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium pallidum* and *V. angustifolium*), sheep laurel (*Kalmia latifolia*) and wintergreen (*Gaultheria procumbens*). In less frequently burned areas various species of tree oaks codominate, and the tree canopy is more closed. Under these more shaded conditions, scrub oak and heath shrubs decline in importance. (Reiners 1965, 1967). The herbaceous layer tends to be fairly sparse but is more developed in sunlit conditions. Characteristic species of the herbaceous layer include bracken fern (*Pteridium aquilinum*), and Pennsylvania sedge (*Carex pensylvanica*). Located in freshwater wetlands are Red maple (*Acer rubrum*), tupelo (*Nyssa sylvatica*) and Atlantic White Cedar (*Chamaecyparis thyoides*).

Prior to European settlement, pine barrens species

probably existed on at least the coarsest, fire-prone soil types, although the actual geographic extent of the Pine Barrens at that time is unknown. Post-settlement land use practices may have expanded the area occupied by Pine Barrens vegetation. (*see Evolution and History of the Pine Barrens*). As recently as 100-150 years ago the Pine Barrens may have covered as much as 250,000 acres, more than one quarter of the area of Long Island. (Cryan 1980). The largest contiguous, intact Pine Barrens is the majority of the 52,500 acres designated as the core preserve. Much of the remaining Pine Barrens of the Compatible Growth Area, especially in Brookhaven, is fragmented and dissected by residential development, agricultural fields, highways, factories, golf courses, sand and gravel mines and shopping centers.

As noted in the Geological Overview, several soil associations typify the Central Pine Barrens region. Soils of the pine barrens have developed on coarse sandy and gravelly unconsolidated sediments deposited by the last two advances of Pleistocene glacial ice. The advance approximately 60,000 years ago deposited the hilly Ronkonkoma Moraine, which runs from Nassau through the Central Pine Barrens and out to Montauk Point. The final glacial advance 23,000 years ago formed the Harbor Hill moraine along the North Shore and North Fork. (Figure 4-2). During glacial retreat, sand and gravel washed from the morainal deposits formed extensive outwash plains between the two moraines and south of the Ronkonkoma Moraine to the Atlantic Ocean. This glacially deposited material is heterogenous in composition and texture. The Pine Barrens have developed primarily in areas where the deposits are coarse, and have given rise to soils in the Plymouth-Carver association. (Figure 3-1). Plymouth-Carver soils are textured, well-drained to excessively well-drained, acidic, and nutrient poor. Pine Barrens also may be found on medium to moderately coarse-textured Haven and Riverhead soils, associated with Plymouth-Carver soils in the southern and northwestern portions of the Central Pine Barrens.

The combination of droughty, nutrient-poor soils and frequent fire have created a harsh environment to which relatively few species have been able to adapt. Consequently, present plant communities of the dry uplands generally are of low diversity and

low productivity. (Whittaker and Woodwell 1969). Whether the effects of past disturbance on Pine Barrens species richness contributed to present diversity is unknown. Pine Barrens natural communities are characterized by plant and animal species that are uncommon in the moist, deciduous forests that surround the Central Pine Barrens. As a result, the biota of the Central Pine Barrens tends to be unusual, and includes many rare species especially adapted to Pine Barrens conditions.

Pine Barrens freshwater wetlands are characterized by a different kind of environmental rigor. Pristine Pine Barrens water typically is acidic and nutrient-poor; water levels may fluctuate widely both seasonally and from year-to-year, especially in coastal plain ponds. Many of the plants that have adapted to these unusual conditions cannot survive elsewhere, because of their inability to compete with the more cosmopolitan, "weedy" species found in nutrient-rich habitats. In fact, coastal plain ponds (in the Central and South Fork Pine Barrens) harbor one of the highest concentrations of rare plant species in New York.

Like the plant communities, wildlife of the Central Pine Barrens is generally low in diversity. The rigorous conditions preclude use by many species which are found in the richer mesic communities elsewhere on Long Island. On the other hand, there are numerous species which are particularly adapted to this harsh environment. This is especially true of the insects.

Some species of vertebrates are virtually ubiquitous throughout the Central Pine Barrens. Mourning dove (*Zenaida macroura*), American crow (*Corvus brachyrhynchos*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), red fox (*Vulpes fulva*), masked shrew (*Sorex cinerea*), eastern mole (*Scalopus aquaticus*) and Fowler's toads (*Bufo woodhousei*) are both common and widespread. The distribution and abundance of most other species, however, is largely restricted by availability of plant communities. The most typical associates of these communities are discussed below.

The invertebrate fauna of the Central Pine Barrens is not well known. "Except for Lepidoptera [moths and butterflies], however, and a few groups such as

tiger beetles . . . and cerambycids . . . , the insect fauna of most northeastern pine barrens has not been intensively studied . . ." (Wheeler 1991). Numerous insects take advantage of the looser soils in that they frequently deposit their eggs in the ground. In addition, the predominant oaks are heavily exploited by a wide array of insects. The moth and butterfly fauna is especially rich; twelve species of rare Lepidopterans are known from the Central Pine Barrens. (Southampton 1993).

5.3 Ecological Processes

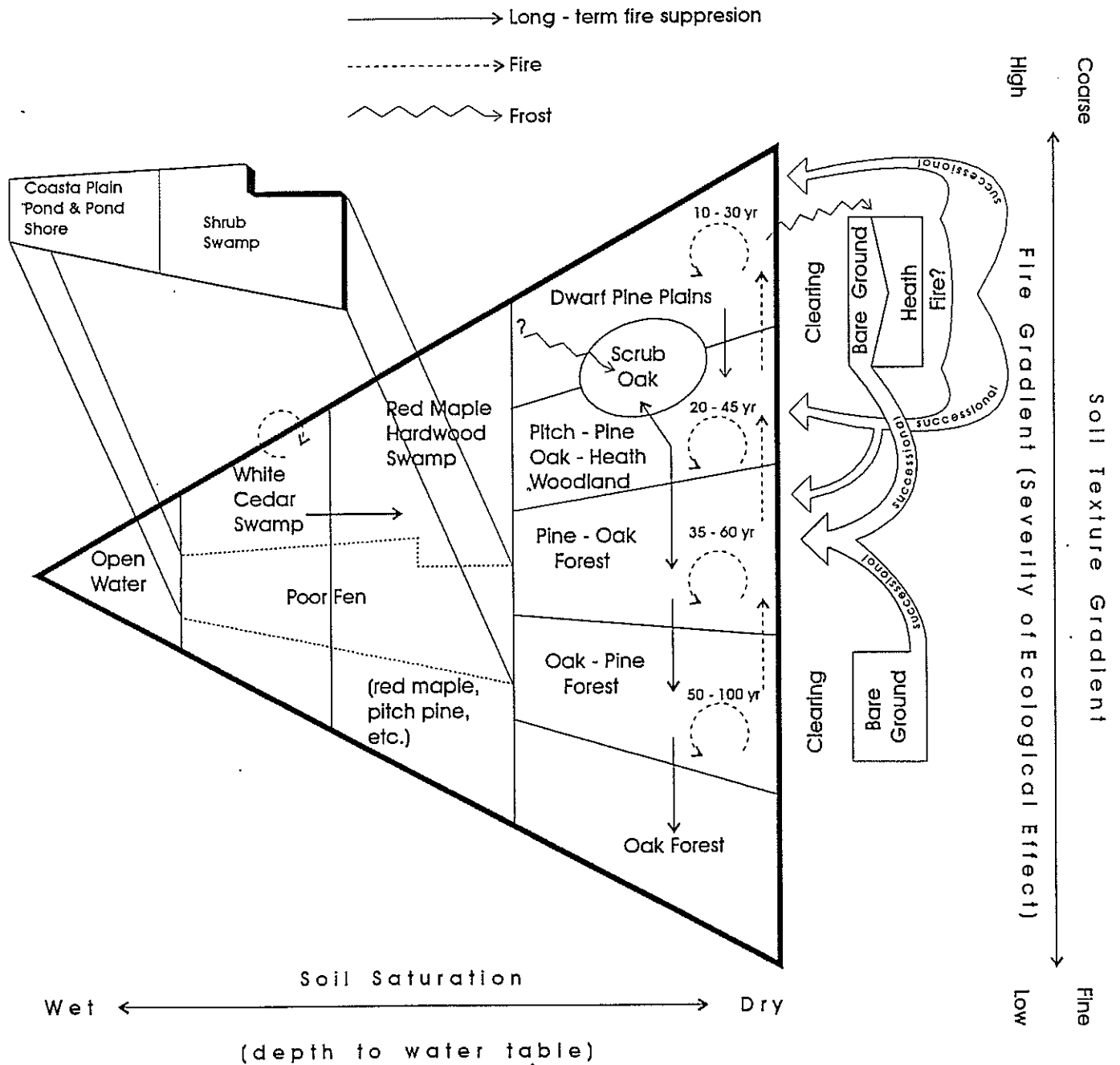
5.3.1 Vegetation

Pine Barrens natural communities are distributed on the landscape in a complex mosaic determined by an interaction of environmental factors and history. The key environmental factors controlling vegetation types are: (1) soil saturation (depth to water table), (2) soil texture and nutrients, (3) fire regime, and (4) human disturbance (clearing, logging). Insect herbivory and frost damage are secondary factors that also may influence vegetation composition.

Natural community types are related to key environmental factors in the conceptual model shown in Figure 5-1, which is a modification of Whittaker's interpretation of the New Jersey Pine Barrens. (Whittaker 1979).

Figure 5-1: Ecological model of the Central Pine Barrens, Long Island, New York

Ecological model of the Central Pine Barrens, Long Island, N.Y. Adapted from R. Whittaker's (1979) depiction of the New Jersey pine barrens. Oak-pine forests are considered to be a variant of pine-oak forests by the New York Heritage program. Scrub oak areas are variants of pitch pine-oak heath woodland. Although not generally thought of as a pine barrens vegetation type, oak forests are present in the Pine Barrens and represent one end of the upland vegetation continuum.



On the chart, the horizontal axis represents depth to the water table, which is critical in separating uplands from wetlands. There may be as little as a half meter difference in elevation between a swamp and a dry pitch pine woodland. (Zampella et al., 1992). The topographic interface between open water and uplands may be occupied by pond shores, shrub swamps, poor fens, cedar swamps and/or red maple swamps, depending upon site topography, hydrology, and history. It is difficult to accurately represent the complexity of interrelationships among wetland types in the conceptual model, partly due to the limitations of this generalized, simplified model, and in part due to the lack of detailed ecological information.

Upland forest vegetation types are arrayed along the vertical axis of the model (Figure 5-1), which represents the combined gradients of soil texture and ecological effects of fire. Fire history terminology can be confusing due to inconsistencies in usage. (Romme 1980). For this discussion, the term "severity of ecological effects" refers to a combination of attributes of individual fires (fire intensity, fire severity), and the overall fire regime of the site (fire frequency and mean fire return interval). Fire intensity has most commonly been used to refer to fire temperature (units of energy released/area). Fire severity refers to ecological effects such as consumption of forest floor organic matter and mortality of overstory trees. (Romme 1980). Fire frequency refers to the number of fires per unit time in a designated area. Mean fire return interval refers to the mean number of years between two successive fires in a designated area of specified size. (Romme 1980).

At the extreme upper end of the fire gradient in the conceptual model (Figure 5-1), the fire return interval is the shortest (i.e., fires are the most frequent), and the fires tend to be the most severe (e.g., stand-replacing crown fires that consume forest floor litter and duff). On the lower end of the gradient, the fire return interval becomes longer and the fires tend to be less severe. Fires tend to be the most frequent and the most severe on the coarsest soils, which tend to be vegetated by drought-tolerant, flammable vegetation. (*see below*).

Natural community types typical of the most drought-prone soils with the severest fire regime are the dwarf pine plains and pitch pine-oak-heath woodlands. These communities grade into the pine-oak forests, which are maintained by a less severe fire regime. (Figure 5-1). Tree oaks become more common, and pitch pine less common, as fire severity and frequency decrease. Pine-oak forests in which oaks predominate are referred to as oak-pine forests in Figure 5-1. Oak-pine forests are included within the pine-oak type classification by the New York Natural Heritage Program, but are separated in this discussion because of their decreased flammability and lower fire frequency. At the end-point of the fire frequency gradient, where fires are the least frequent and least severe, are oak forests. Although not a Pine Barrens vegetation type, oak forests are included in the model because they represent one end of the upland vegetation continuum. Small areas of oak forest with few or no pitch pines do occur within the Central Pine Barrens.

Pine Barrens vegetation types throughout the northeast are located in regions with humid climates and ample rainfall, and are surrounded by mesic hardwood forests. Despite these factors, the unusual Pine Barrens plants and animals manage to persist. How do the Pine Barrens resist invasion by deciduous forest species? It appears that as result of the reinforcing interactions of droughty, nutrient-poor soils with highly flammable, fire-adapted vegetation and frequent wildfire, an environment is created hostile to the mesic hardwood forest while remaining conducive to the Pine Barrens vegetation.

Pine Barrens soils typically are 80-96% sand and drain very rapidly. Only vegetation that can withstand these droughty soils, and the soil's low nutrient levels and acidity, can persist. Many Pine Barrens plants produce waxes, resins, or volatile oils which help leaves retain moisture, (Burg 1983) and which may also reduce insect herbivory. (Patterson, personal communication). The very existence of these waxy compounds which allows the vegetation to exist on the Pine Barrens soil also increases the potential for fire. The compounds are highly flammable. Furthermore they contain volatile oils which vaporize when heated. The vapors ignite at relatively low temperatures and

greatly increase the likelihood that fires will reach the tree crowns. (Patterson, personal communication). The oils and resins also increase the amount of heat emitted during a fire. (Patterson, personal communication). Additional characteristics that favor fire include litter that decomposes slowly and thus tends to accumulate on the soil surface, litter of low water-absorbing capacity, litter of low mineral content, high plant surface-to-volume ratio, high dead-to-live plant tissue ratio, and "ladder fuels" that carry flames upward from the ground. (Rundel 1981, Latham and Johnson 1993).

Mutch hypothesized that "fire-dependent plant communities burn more readily than non-fire-dependent communities because natural selection has favored development of characteristics that make them more flammable." (Mutch 1970). Positive feedback between flammability and fire-dependence would favor the persistence of fire-dependent communities, and inhibit invasion by species of nearby alternative communities. Latham and Johnson have postulated that fire-facilitating species, including those of the Pine Barrens, are also tolerant of nutrient scarcity. (Latham 1993). Fire-facilitators thus may gain a competitive advantage from fire due to long-term decreases in nitrogen availability, as well as to outright elimination of fire-sensitive competitors. Fire-facilitating species produce biomass and litter that are highly flammable, thereby increasing the likelihood and severity of wildfire. Frequent severe fires decrease nutrient levels, further favoring the fire-facilitators. This Pine Barrens-stabilizing feedback loop may be destabilized by suppression of fire, addition of nutrients, or prolonged wet weather. Under these conditions fire frequency decreases, nutrient-demanding, fire-intolerant plant species increase, and Pine Barrens species decline. With prolonged fire suppression, vegetational succession leads to the replacement of Pine Barrens by oak forests. (Figure 5-1).

Many Pine Barrens plant species exhibit adaptations to fire, including pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia*). McCune has classified North American pines into five groups, including a "fire-resistant" group and a "fire-resilient" group. (McCune 1988). Fire-resistant pines are tall, have thick bark, long needles, large seeds and are slow

to initiate seed production. Fire-resilient pines have low-to-moderate fire tolerance as mature trees, but produce cones at a young age, produce abundant small, readily dispersed seeds, and have a high degree of cone serotiny. Serotinous cones are cones that open only after being heated to high temperatures, such as occur during a fire. Reproductive behavior of fire-resilient pines is typical of "r-selected" pioneer species that survive as seeds through infrequent catastrophic fires, and have high potential for explosive reproduction. (McCune 1988). McCune classifies pitch pine in the fire-resilient group, but it also possesses some attributes of the fire-resistant group, namely its relatively long needles and thick bark, which increase its fire-resistance. However, pitch pine also possesses the fire-resilient attributes of precocious cone production and production of abundant small seeds. Pitch pine is usually not serotinous, but in areas with an unusually high fire frequency (short fire return interval) the serotinous trait is favored. (Ledig and Little 1979, Givnish 1981). For example, pitch pine in both the New Jersey and Long Island dwarf pine plains have a high frequency of cone serotiny.

Pitch pine shares with three other species in McCune's fire-resilient group (*P. leiophylla*, *serotina* and *virginiana*) the capacity to resprout vegetatively from dormant epicormic buds, located both beneath the trunk's bark and on the root collar. (Stone and Stone 1954). In the frequently burned dwarf pine plains, vegetative pitch pine sprouts may bear cones as young as 3 years. (Ledig and Little 1979). The ability to resprout ". . . may provide a mechanism for improved survival of fire-susceptible species on sites subject to fire-free intervals shorter than required for plentiful seed reproduction." (McCune 1988). The ability to resprout declines with age in tall pitch pines. (Andresen 1959). However, the effect of age on resprouting of dwarf pines in the Long Island pine plains is not known. Windisch suggests that dwarf pines in New Jersey do lose their ability to resprout with age. (Windisch 1990). Although vegetative reproduction often predominates, production of seedlings is important for replacement of senescent trees. Pitch pine seedlings survive and grow best under the conditions of full sunlight, exposed mineral soil, and reduced competition, conditions that usually follow severe fires.

Scrub oak also is fire adapted, and rapidly recovers from even a hot crown fire. The plants have large root collars, just below the soil surface, which bear numerous dormant buds that resprout readily when above-ground branches are killed. (Unnasch 1990). New shoots grow rapidly, often setting fruit after three years, and reaching maximum size in 7-10 years. (Wolgast and Stout 1977). Acorn production reaches a maximum when the sprouts are 5-7 years of age, and slowly declines thereafter. (Wolgast 1973). Scrub oak seedlings can become established only during the first few years following fire, due to decreased predation by white-footed mice. (Unnasch 1990). In addition to rejuvenating acorn production, fire has been found to stimulate a 4 to 9 fold increase in scrub oak foliage and shoot production during at least the first four years following fire in a scrub oak habitat in Pennsylvania. (Hallisey and Wood 1976). Concentrations in the foliage of crude protein, phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg) also increased following fire. (Hallisey and Wood 1976). Fire-stimulated increases in forage quantity and quality may be important for maintaining populations of lepidopteran species (primarily moths) that feed primarily on scrub oak.

Ericaceous shrubs including blueberries, huckleberry and wintergreen, and herbs such as bracken fern, also quickly resprout and regain former biomass and production levels following fire. (Hallisey and Wood 1976). Additionally, increased protein levels have been measured in post fire resprouts of the blueberry. (Hallisey and Wood 1976). Periodic fire is required to open the canopy and provide the light levels required by herbaceous species typical of grassy openings in the pine barrens.

Development of upland Pine Barrens community types is controlled by an interaction between the fire regime and the soil texture and fertility. Both fire and soil characteristics are used as the vertical axis in the conceptual model (Figure 5-1), based on the assumption that coarse, droughty soils should tend to be more fire-prone. Therefore, natural communities associated with the shortest average fire return interval also would tend to be correlated with the coarsest soils, as was found by Olsvig. (Olsvig 1979). She reported an increase in the

percentage of coarse sand, a decrease in the percentage of silt and clay, and a decrease in nutrients (P, K, Ca, Mg) going from oak-pine forest, to pine-oak forest, to (transitional) pitch pine oak heath woodland, to dwarf pine plains and to successional heath areas. However, similar data gathered for Long Island by Seischab and Bernard in 1993 (unpublished), unlike the Olsvig research, failed to reveal a clear gradient in soil texture across the same range of community types. Thus it appears that although pine barrens vegetation in general occurs on coarse soils, the same soil type may support different pine barrens community types, both on Long Island and in New Jersey.

Although the presence of well-drained, droughty soils are a prerequisite for development of flammable, Pine Barrens community types, (Patterson, personal communication), it appears that differences in fire regime may to at least some extent override soil characteristics in driving genetic selection and shaping plant community types in specific locations. Differences in spatial scale, position on the landscape, and potential for human-set fires may also be involved. For example, vegetation on small patches of droughty soil surrounded by mesic soils and vegetation, small areas isolated by firebreaks (natural or human-created) from their surroundings, and areas distant from human ignition sources would be relatively unlikely to burn. In contrast, fire would be much more likely in large areas uninterrupted by firebreaks, and which therefore could be burned by fires originating in many different locations within the area. This is known as the "fired" concept. (Windisch 1993, unpublished). The presence of humans would increase the likelihood of ignitions, since fires today primarily originate from arson. Pre-settlement fire regimes would have been strongly influenced by locations of Native American populations.

The dwarf pine plains are thought to have historically had the shortest fire return interval, perhaps as frequently as every 10-30 years (Windisch 1992) or even as often as 6 years. (Cryan 1982). Pitch pine-oak-heath woodland communities may have burned an average of every 20-35 years (Windisch unpublished). The most extensive occurrences of this community are as transition zones between the dwarf pine plains and

surrounding pine-oak forests. The mean fire return interval in pine-oak forests may have ranged from 40-60 years in pine-dominated areas to 50-100 years in oak-dominated areas. (Windisch 1992; Cryan 1980). Oak forests dominate natural areas with fire return intervals greater than 100 years. These estimates of fire return intervals are imprecise, and need further verification and correlation with vegetation types (*see* Status of Research in the Central Pine Barrens).

Fire severity may be just as important as the fire return interval in shaping Pine Barrens vegetation. Anecdotal evidence suggests that severe, stand-replacing fires that consume most or all of the soil organic matter may have contributed to the creation of the dwarf pine plains and pitch pine oak heath woodland communities. A model more detailed than that shown in Figure 5-1 should be developed, including all aspects of the fire regime. Such a model cannot be created yet due to insufficient information. Such a model could be prepared after completion of a fire history and historical land use study for the Pine Barrens.

Superimposed on the natural environmental gradients are human-caused disturbances such as land clearing, sand and gravel mining, draining of swamps, and logging. Pitch pine can readily reseed cleared and abandoned areas. Pine Barrens vegetation ultimately reclaims disturbed areas through the process of natural succession. (Figure 5-1). However, succession proceeds very slowly in the dwarf pine plains, where large areas of heath have persisted for many years after sites were cleared. (Olsvig 1979; Windisch 1990). Succession may require 50 or more years to reclaim cleared areas in the pine plains with tall pitch pines invading in some locations. (Windisch 1990). When these areas were cleared much or all of the topsoil probably was removed. Since most soil nutrients are located in the surface organic horizons, vegetation regrowth may be limited by a lack of nutrients. The addition of nutrient-rich organic matter in the form of compost has been effective in restoring disturbed pine plains in New Jersey. (Fimbel and Kuser 1993). A possible explanation for the slow revegetation could be due to a scarcity of pine seed. This scarcity is a result of the fact that many of the surrounding dwarf pines have serotinous cones that would not open

until heated by fire.

Fire also may be a significant environmental factor for Pine Barrens wetlands which are likely to have been burned over during periods of drought in the past. Coastal Plain Atlantic white cedar swamps depend on fire, or other disturbance to create the sunlit conditions necessary for seed germination and seedling survival. (Laderman 1989). Without fire, white cedar may eventually be replaced by shade-tolerant red maple. The role of fire in the ecology of coastal plain ponds is unknown. Occasional fire may be necessary to eliminate shrub and tree species from coastal plain ponds, and to reduce organic matter. (Schneider and Zaremba 1991).

Scrub oak is often damaged by late spring frosts, and may be eliminated in frost-prone, low-lying areas such as the drainage swales in the southern and western portions of the pine plains, which are vegetated primarily with short heath shrubs. Insect herbivory may be important throughout the Pine Barrens. Pitch pines have been killed by periodic outbreaks of the pine looper, which may modify forest structure and composition.

5.3.2 Wildlife

The key environmental factors which control the distribution and abundance of wildlife are:

1. vegetative cover-type,
2. soil moisture and free water;
3. size and shape of habitat patches;
4. juxtaposition of habitat patches to other habitat types;
5. range expansions, introductions and extirpations;
6. levels of human disturbance; and
7. for many migratory organisms, the conditions which exist in other portions of their range.

5.3.2.1 Vegetative Cover Type

Of these factors, the vegetative cover-type, or plant community, is the most important. Differences in plant parameters such as species composition, size, density, age, condition and structural height diversity can determine a community's suitability as habitat for a given species of wildlife. As a general rule, vertebrates tend not to depend upon single plant species while invertebrates are frequently

dependant upon individual species for their survival.

5.3.2.2 Soil Moisture Content

As mentioned above, the level of soil moisture bears an obvious relationship to the plant community: diversity and abundance generally increase as soil moisture increases. Invertebrate fauna shares this relationship with soil moisture as well. Vertebrate wildlife frequently depend upon invertebrates as a food source and, thus, their abundance and diversity tend to be greater in moister soils. When free water is available for an extended period of time, aquatic communities of both invertebrates and vertebrates can exist.

5.3.2.3 Habitat Availability

The size, shape and juxtaposition of habitat patches are key determinants of wildlife distribution. When large blocks of habitat are divided, reduced in size, or separated from other blocks, habitat fragmentation occurs. This phenomenon frequently results from human alteration of the landscape and poses a significant threat to biodiversity, both regionally and globally.

The theory of island biogeography suggests that the size of a patch or "island" of habitat is directly related to the diversity of the wildlife it will support. In essence, bigger patches of habitat support a greater diversity of wildlife than smaller patches.

Size is also important because some species of wildlife will not use a patch of otherwise suitable habitat if it is too small. Such "area sensitive" species require at least a threshold-sized patch for their territories or home ranges. As an example, some species of wildlife are primarily adapted to finding their life needs in an interior niche of a forest. As consequence, they require large blocks of forest habitat in which an acceptable interior niche can be located and in which they can avoid edges.

The shape of habitat patches also affects the wildlife species composition. "Edge" occurs where two different habitat types meet. A given acreage of habitat type has the least edge if it is circular;

linear habitat patches have the greatest amount of edge. This is a purely geometric relationship. Some species of wildlife, the generalists and opportunists, are adapted to edge environments while others, the specialists, suffer from the existence of edge, due to increased competition, predation or parasitism.

The physical relationship of a patch of habitat to other patches is important in determining wildlife distribution. Some species of wildlife require more than a single type of habitat. As an example, an animal may use terrestrial habitats during the non-breeding season but may require a wetland for a breeding site. Thus, the existence of an otherwise suitable habitats cannot support some species if a breeding site is not available nearby.

Biogeographic theory also suggests that the distance between an island and the nearest similar island is important. A patch nearer a patch of the same type will support more wildlife species than a same-sized patch which is further away. In other words, closer islands support a greater diversity of wildlife because opportunities for immigration are greater.

Travel amongst habitat patches is also facilitated by travel corridors. Corridors are simply linear (approximately) patches of habitat which provide adequate cover for travel but do not necessarily provide food or breeding sites. Conversely, barriers to wildlife movements must be considered in determining whether a suitable habitat is created. Natural or artificial barriers may preclude wildlife use of otherwise viable habitats.

An animal's range can shrink or expand due to natural or human causes. In many cases, the causes are only poorly understood, especially when they appear to be naturally induced. Changes in bird distribution are well recorded. Some human activities have a direct and virtually permanent effect on wildlife distribution. As an example, extirpations of nonmigratory species can preclude their use of otherwise suitable habitats. Humans also frequently introduce nonindigenous species of wildlife, domestic animals, disease vectors and plants. The effects of the introduced species can be beneficial to individual species but may, in some cases, be deleterious to indigenous communities. In such situations, the effects can result in increased competition, predation, disease and habitat

degradation. On the other hand, populations can also be restored by humans.

Human disturbance itself can also restrict the use of available habitats. Some species are intolerant of the sounds, sights and even smells which are characteristic of developed landscapes. The species may purposefully abandon or avoid such areas. This phenomenon is generally observed by vertebrates. Invertebrates are especially affected by the use of pesticides and artificial lights.

For migratory species, such as many birds, most bats, and some fishes and insects, conditions in other parts of their ranges may restrict their total population sizes and/or migratory routes, and thus limit their abilities to exploit available habitats.

lines drawn across ecological gradients and represent a simplification of the complex, real landscape.

5.4 Description of Ecological Communities

Ecological communities are classified and defined in this plan according to the 1990 Reschke scale. (N.Y. Natural Heritage Program and N.Y.S. Department of Environmental Conservation). Reschke defines a community as ". . . a variable assemblage of interacting plant and animal populations that share a natural environment." A biological community, or complex of interrelated communities, together with its associated non-living environment constitutes an ecosystem. (Primack 1993).

Significant communities and rare species are referred to as "elements" by the New York Natural Heritage Program. These elements have been assigned ranks reflecting their rarity. The global rank reflects the rarity of the element throughout the world, and the state rank reflects the rarity within New York State. The definitions in Figure 5-2 are from the New York Natural Heritage Program.

Communities are dynamic entities that change with time, intergrade with each other spatially and temporally, to form a complex mosaic in the landscape. Individual community types may include a considerable range of variability. Ecological communities may occur naturally or be human-created. The community boundaries indicated in Figure 5-3 are necessarily artificial

Figure 5-2: Global and State Ranking for Elements of Rare Communities and Species

GLOBAL

RANK	ELEMENT
G1	Critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining acres or miles of stream) or especially vulnerable to extinction because of some factor of its biology.
G2	Imperiled globally because of rarity (6 - 20 occurrences, or few remaining acres or miles of stream) or very vulnerable to extinction throughout its range because of other factors.
G3	Either rare and local throughout its range (21 - 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range (e.g. a physiographic region), or vulnerable to extinction throughout its range because of other factors.
G4	Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5	Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
GH	Historically known, with the expectation that it might be rediscovered.
GX	Species believed to be extinct.
GU	Status unknown.

STATE

RANK	ELEMENT
S1	Typically 5 or fewer occurrences, very few remaining individuals, acres or miles of stream, or some factor of its biology making it especially vulnerable in New York State.
S2	Typically 6 - 20 occurrences, few remaining individuals, acres, or miles of stream, or factors demonstrably making it very vulnerable in New York State.
S3	Typically 21 - 100 occurrences, Limited acreage or miles of stream in New York State.
S4	Apparently secure in New York State.
S5	Demonstrably secure in New York State.
SH	Historically known from New York State, but not seen in the past 15 years.
SX	Apparently extirpated from New York State.
SE	Exotic, not native to New York State.
SR	State report only, no verified specimens from New York State.
SU	Status unknown.

5.5 Natural Pine Barrens communities

Natural communities present within the Central Pine Barrens that are currently recognized by the Natural Heritage Program are listed in Figure 5-4. Salt marsh communities are not Pine Barrens community types, but do occur within the Flanders area of the Central Pine Barrens. In addition to the communities listed in Figure 5-4, two additional communities have been recognized in this document: Pine Barrens vernal pools and wet Pine Barrens. Community definitions that follow are based in large part on those of Reschke. (Reschke 1990).

Figure 5-4: Natural Pine Barrens Communities in Descending Order of State Rarity

Dwarf pine plains	G1G2	S1
Coastal plain Atlantic white cedar swamp	G3G4	S1
Coastal plain stream	G3G4	S1
Coastal plain poor fen	G3?	S1
Coastal plain pond	G3G4	S2
Coastal plain pond shore	G3G4	S2
Pitch pine-oak-heath woodland	G3G4	S2S3
Salt panne	G3G4	S3
Pine barrens shrub swamp	G5	S3
High salt marsh	G4	S3S4
Low salt marsh	G4	S3S4
Chestnut oak forest	G3G4	S4
Pitch pine-oak forest	G4G5	S4
Salt shrub	G5	S4
Red maple-hardwood swamp	G5	S4S5

5.6 Upland Communities

5.6.1 Pitch Pine-oak forest G4G5 S4

The dominant trees are pitch pine mixed with one or more of the following oaks: scarlet oak (*Quercus coccinea*), white oak (*Q. alba*), black oak (*Q. velutina*) or red oak (*Q. rubra*). The relative proportions of pines and oaks are quite variable. The shrub layer consists of scattered clumps of scrub oak (*Q. ilicifolia*) and a nearly continuous cover of low heath shrubs such as huckleberry (*Gaylussacia baccata*) and blueberries (*Vaccinium pallidum*, *V. angustifolium*). Herbs such as: Bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*) and Pennsylvania sedge

(*Carex pensylvanica*) are sparse. Scrub oak coverages tend to be highest in the pine-dominated stands and lowest in oak-dominated stands. (Reiners 1967). Heath shrub abundance decreases with increasing cover by scrub oaks and tree oaks. Forests dominated by oaks have been considered to be a separate forest type (oak-pine forest) by McCormick and Jones (1973), Olsvig et al. (1979), Whittaker (1979), and Windisch (1992). However, the New York Natural Heritage Program does not make this distinction, since there is no evidence that plant species composition differs in pine-dominated versus oak-dominated stands (Reschke, personal communication). Division of this community into pine-oak and oak-pine types makes sense for management purposes, however, since a

high proportion of pitch pine indicates higher flammability and presumably a more recent fire incidence.

The wildlife community can vary dramatically as this dry forest type varies from pine-dominated to oak-dominated. Nevertheless, some animals are found throughout these communities. Common birds are rufous-sided towhee (*Pipilo erythrophthalmus*), bluejay (*Cyanocitta cristata*), red-tailed hawk (*Buteo jamaicensis*) and bobwhite (*Colinus virginianus*). Eastern cottontail rabbit (*Sylvilagus floridanus*) and eastern chipmunk (*Tamias striatus*) are common mammals. Three snakes, the hognose (*Heterodon platyrhinos*), black racer (*Coluber constrictor*) and garter snake (*Thamnophis sirtalis*), are typical reptiles. Except when surface water is available nearby, the Fowlers' toad (*Bufo woodhousei*) is the only common amphibian.

Numerous other birds use Central Pine Barrens uplands during migrations. Dozens of species of flycatchers, warblers, thrushes, vireos and other neotropical insectivores forage in woodlands during their northward and southward travels. The richer woodlands in stream corridors are especially valuable.

When pitch pine is the principal canopy species, pine warblers (*Dendroica pinus*) are found in the taller stands. In the more open stands, the prairie warbler (*Dendroica discolor*), common yellowthroat (*Geothlypis trichas*), field sparrow (*Spizella pusilla*), brown thrasher (*Toxostoma rufum*) and brown-headed cowbird (*Molothrus ater*) are prevalent. Blue-winged warblers (*Vermivora pinus*) and indigo buntings (*Passerina cyanea*) are found at habitat edges.

When oaks dominate the canopy, red-eyed vireos (*Vireo olivaceus*), northern orioles (*Icterus galbula*) and scarlet tanagers (*Piranga olivacea*) are found in the tree-tops during the breeding season. They are joined by raptors, crows (*Corvus* spp.), grey (*Sciurus carolinensis*) and flying squirrels (*Glaucomys volans*) and grey tree frogs (*Hyla versicolor*). The vegetation in the forest forms distinct levels or stories. These create a host of different niches. The middle level hosts the hole-nesting birds and animals such as great crested

flycatcher (*Myiarchus crinitus*) and eastern wood pewee (*Contopus virens*), hairy woodpecker (*Picoides villosus*) and raccoon. The lower shrub story accommodates the grey catbird (*Dumetella carolinensis*), ovenbird (*Seiurus aurocapillus*), wood thrush (*Hylocichla mustellina*) and others which nest on or near the ground. On or just below the ground surface are the ground dwellers: ruffed grouse (*Bonasa umbellus*), rufous-sided towhee, white-footed mouse (*Peromyscus leucopus*), box turtle (*Terrapene caroliniana*) and red-backed salamander (*Plethodon cinereus*). The larger blocks of forest support nesting great horned owls (*Bubo virginianus*) and whip-poor-wills (*Caprimulgus vociferus*). Both of these species forage in more open areas but nest in woods. The owl nests in trees while the goatsucker nests on the ground.

5.6.2 Chestnut oak forest G3G4 S4

The chestnut oak forest community description does not precisely describe the hardwood forests found in the Pine Barrens, but is the best fit among the forested uplands community types recognized by the Heritage Program. Chestnut oak forests are dominated by chestnut oak (*Quercus montana*) and red oak. Common associates are white oak, black oak and red maple. American chestnut (*Castanea dentata*) was common in these forests prior to the chestnut blight. Although chestnut and red oak do occur in the Pine Barrens, they are uncommon. The best description of the hardwood forests in the Pine Barrens is the description of the pitch pine-oak forest but with pitch pines absent, namely a forest dominated by a variable mix of scarlet oak, white oak and black oak. Chestnut may be common in localized areas, such as the steeply sloping morainal areas south of Route 111 in Manorville. Characteristic shrubs are black huckleberry, mountain laurel and blueberry. Common groundlayer plants are Pennsylvania sedge and wintergreen. Wildlife is similar to that found in the oak-dominated pine-oak forests.

5.6.3 Dwarf pine plains G1G2 S1

This low-diversity woodland community is dominated by dwarf individuals of pitch pine, and scrub oak. The canopy is generally from 1 to 3 meters tall, and may form a dense thicket. Black huckleberry and blueberry (*V. pallidum*) form a low

shrub canopy under the pines and scrub oak. The only other common vascular species are hudsonia (*H. ericoides*), bearberry (*Arctostaphylos uva-ursi*) and wintergreen. The groundcover includes an especially diverse flora of foliose and fruticose lichens. Community variants occurring within the dwarf pine plains include areas of heath shrubs and scrub oak thickets in which pitch pine is rare or absent. As previously noted, disturbance, frost or an unusually short fire return interval may be involved in creating these variant communities.

Many hypotheses have been suggested to account for the diminutive stature of pitch pines in the dwarf pine plains, including location relative to prevailing winds and ignition sources, high fire frequency, low nutrient soils, aluminum toxicity, physical response to repeated burning, drought, and genetic selection. Aluminum toxicity has been ruled out by the studies of Andresen. (Andresen 1959). Therefore, the actual "cause" may be an interaction among the remaining factors. It seems reasonable that the primary factors shaping the Long Island pine plains would be similar to those that shaped the New Jersey pine plains; namely, a higher than average fire frequency with resultant genetic selection for rapidly resprouting dwarf trees that bear serotinous cones at a young age. (Givnish 1981). Garden experiments with dwarfed pitch pines in New Jersey have indicated a genetic basis for dwarf stature, shrubby growth form and precocious cone production. (Good and Good 1975; Givnish 1981). High fire frequency appears to be the selective agent favoring serotiny in the New Jersey plains. (Givnish 1981).

Similar garden experiments have not been performed with Long Island's dwarfed pitch pines, but it is likely that genetics are important in the Long Island plains as well. Analysis of the DNA of dwarf and tall pines is now being done, with results anticipated very soon. (Colosi, personal communication). Genetic selection is a process that may take hundreds of years (Colosi, personal communication), especially in the case of dwarf pines which reproduce following fire primarily by vegetative sprouting. (Windisch, personal communication). If indeed the Long Island dwarf pines are a genetic ecotype distinct from the surrounding taller pines, it is likely that the Long Island pine plains evolved in response to elevated

fire frequencies prior to European settlement. The cause of that elevated fire frequency is unclear. The Long Island dwarf pine plains are located on a large, coarse glacial outwash fan that has given rise to some of the most rapidly draining, drought-prone soils in the Pine Barrens. There are relatively few wetlands within the dwarf pine plains area that could serve as natural firebreaks, so the pine plains may represent a large "fireshed" superimposed upon coarse, droughty soils and flammable vegetation. The combination could have given rise to a high incidence of fire both pre- and post-European settlement. Past patterns of Native American habitation also could have played a role in the development of the pine plains.

Fire has been infrequent in the pine plains for the last several decades. The most recent extensive fires were in the 1930's and 1940's, with large areas probably having been unburned in the prior decades. (Windisch 1994). The prolonged absence of fire may be resulting in the death of the oldest dwarf pine sprout clumps, and their gradual replacement by non-dwarf pines, particularly at the perimeter of the pine plains. (Windisch 1990, Cryan 1982). Windisch speculates that a stem-killing fire following a long fire-free period could result in the death of most or all of the senescent dwarf pine sprout clumps. (Windisch 1990). Dwarf pines cored and aged by Seischab and Bernard in 1993 (unpublished) were only 15-20 years old, but many of these trees appear to have been located on sites of former clearings, revegetated in recent decades. At this time we do not have enough information on dwarf pine ages and rates of senescence to assess the effects of fire suppression on the vegetation of the dwarf pine plains.

The wildlife community of the dwarf pine plains is dominated by a few songbirds: prairie warblers, field sparrows, brown thrashers and towhees. The northern harrier (*Circus cyaneus*), which is listed by the NYSDEC as threatened also nests here. Amphibians are virtually absent. An especially diverse assemblage of lepidopterans (moths and butterflies) is found in the dwarf pine plains, including several rare species. The dwarf pine plains support the largest, densest population of the coastal barrens buckmoth (*Hemileuca maia*), which thrives in the dense scrub oaks. These moths

pupate beneath the soil's surface, safe from the typical autumn fires, and emerge in mid-October as adults. They have the capacity to pupate until the following fall if conditions for emergence are unfavorable. Buck moth larvae depend on the abundance of fresh, nutrient-rich young scrub oak sprouts that are produced after a fire.

5.6.4 Pitch pine-oak-heath woodland G3G4 S2S3

"A Pine Barrens community that occurs on well-drained, infertile sandy soils in eastern Long Island . . . The structure of this community is intermediate between a shrub-savanna and a woodland." (Reschke 1990). Widely spaced pitch pine and white oak form an open tree canopy with 30-60% cover. A few black and scarlet oaks also may occur. Typically there is a fairly dense shrub layer dominated by scrub oaks (*Q. ilicifolia* and *Q. prinoides*), with some heath shrubs such as huckleberry and blueberry.

This community resembles the pitch pine-scrub oak barrens ("Oak Bush Plains") vegetation type found in western Suffolk County. However, these community types may be distinguished based on the presence of tree oaks scattered throughout the pitch pine-oak-heath woodland. Tree oaks are rare or absent in the pitch pine-scrub oak barrens. (Reschke, personal communication). Also, openings in the pine and scrub oak canopy in the pitch pine-oak-heath woodland have heath shrubs such as huckleberry, blueberry and bearberry, whereas canopy openings in the pitch pine-scrub oak barrens are predominantly grassy or herbaceous, with high herb diversity. (Reschke personal communication, Reschke 1990). In a few localized areas heath shrubs predominate, scrub oaks are absent and pitch pines are few and scattered. In some locations these "heath variants" of the community type are a successional stage following clearing, or following destruction resulting from bombing practice during the 1940's. In low-lying areas frost damage due to cold air drainage may eliminate scrub oak and pitch pine, and result in a dominance of heath shrubs.

Pitch pine oak heath woodland occurs most abundantly in the transition zone between the dwarf pine plains and the surrounding pitch pine-oak forest, as well as in several other locations in the

pine barrens. (Figure 5-3). The extent of this community was mapped in western Southampton by Eric Lamont, Martin Shea and others, and is referred to as "pitch pine-scrub oak barrens" in the Southampton Town Western GEIS. (Southampton 1993).

The fire regime needed to create and maintain this community is not rigorously documented. Reschke suggests that the historic fire interval probably was more than 15 years. (Reschke 1990). Windisch estimates a fire interval of 10-30 years. (Windisch 1992). In order for tree oaks sprouts to attain sufficient size to set acorns following a crown fire, a minimum fire interval of 15-20 years probably would be necessary. Some pitch pine-oak-heath woodland occurrences in the western Pine Barrens are in areas known to have had severe fires in recent decades. (H. Davis, personal communication).

Fire affects the fauna here in several ways. The prevalent dead, standing trees which result from frequent fires offer an abundance of cavities for hole-nesting birds. Black-capped chickadees (*Parus atricapillus*) and great crested flycatchers will use such trees in the more densely-wooded sections. Eastern bluebirds (*Sialia sialis*) and tree swallows (*Tachycineta bicolor*) will use scattered trees in more open sites. Fires which reduce the shrub layer provide suitable foraging conditions for the bluebird which frequently pursues its insect prey on the ground. Numerous small mammals, snakes, insects and other invertebrates avoid fire in underground burrows.

5.7 Wetland Communities

Over 4,300 acres of NYSDEC regulated freshwater wetlands are found in the Central Pine Barrens. The majority of this acreage occurs within the two principal river systems. The Peconic River encompasses about 2,000 acres and the Carmans River encompasses about 1,000 acres. One-hundred-sixty-two other wetlands comprise the balance of the acreage. There are 7 wetlands between 15 and 100 acres in size. The remainder are smaller than 15 acres each.

There are many different kinds of wetlands within

the Central Pine Barrens. By far, the most common type is a hardwood swamp dominated by red maple (*Acer rubrum*). This type is found throughout the Central Pine Barrens and frequently serves as a border between uplands and other wetland types. It is found where soils are saturated or inundated for brief periods during the growing season. As soils become saturated more frequently or for longer periods, other wetland community types appear. The generally low levels of nutrients and the high acidity result in harsh environments in which only specially-adapted organisms can thrive. Coastal plain ponds and pond shores are found where water levels fluctuate greatly.

Numerous wildlife require the free water provided by the ponds, swamps, bogs, streamcourses and saltmarshes of the Central Pine Barrens. Mallards (*Anas platyrhynchos*), black ducks (*A. rubripes*) and wood ducks (*Aix sponsa*) are the most prevalent waterfowl. They breed and feed in Pine Barrens surface waters. Belted kingfishers (*Ceryle alcyon*), little green-backed (*Butorides striatus*) and great blue herons (*Ardea herodias*), ribbon (*Thamnophis sauritus*) and northern water snakes (*Natrix sipedon*) hunt here, as do snapping turtles (*Chelone serpentina*). Tree and barn swallows (*Hirundo rustica*) "hawk" flying insects on the wing.

The NYSDEC listed endangered tiger salamander (*Ambystoma tigrinum*) frequently breeds in Central Pine Barrens ponds when they are free of predatory fish. They are joined by grey treefrogs and Fowler's toads as well as spring peepers (*Hyla crucifer*) and wood (*Rana palustris*), green (*R. clamitans*) and bull frogs (*R. catesbiana*). In dry years, lesser yellowlegs (*Tringa flavipes*) and other sandpipers such as pectoral (*Calidris melanotos*), solitary (*Tringa solitaria*) and spotted (*Actitis macularia*) feed on exposed mudflats during their migrations. The spotted sandpiper also stays here to breed.

Many of the permanent surface water bodies of the Central Pine Barrens support fish. Fish diversity is generally low, especially in more acidic waters. Ponds support those species which favor warm, shallow weedy areas. Yellow perch (*Perca flavescens*), white perch (*Morone americana*), carp (*Cyprinus carpio*), goldfish (*Carassius auratus*) and sunfishes (*Lepomis* spp.) are common. Largemouth

bass (*Micropterus salmoides*) and rock bass (*Ambloplites rupestris*) prefer the cleaner waters, as do golden shiner (*Notemigonus crysoleucas*) and chain pickerel (*Esox niger*).

As for moths, the Southampton WGEIS noted

. . . bogs and swamps support a number of highly specialized borer moths, including several rare species. These noctuid moths...have evolved strictly to live in conditions of extreme wetness, acidity, and nutrient poor soils. . . . Certain borer moths, while rare regionally, can be extremely abundant seasonally in localized areas of the Central Pine Barrens. . . . (Southampton 1993).

5.7.1 Coastal plain ponds G3G4 S2; Coastal plain pond shores G3G4 S2

Coastal plain ponds on Long Island are located on glacial moraines and outwash plains, with fine to coarse sandy substrates. The ponds are small (most < 2 ha) and shallow with gently sloping pond shores. (Zaremba and Lamont 1993). Coastal plain ponds are identified based primarily upon their plant species composition rather than geologic origin. The elevation of nearly all coastal plain ponds is essentially the same as the elevation of the regional groundwater table, indicating that the ponds are in direct contact with groundwater. Overton Road pond is 50-60 feet higher than the local groundwater table, indicating that it is "perched," presumably on localized layers of relatively impermeable substrate. (Zaremba unpublished). Currans Road South and Randall Road North ponds are about 10 feet higher than groundwater, and thus may be perched. (Zaremba unpublished).

Coastal plain ponds are commonly isolated, with no inlets or outlets, and depend on direct precipitation and groundwater inputs. However, many of the Central Pine Barrens ponds in the Peconic River headwaters are interconnected by surface water flow. Regardless of their water sources, pristine coastal plain ponds are characterized by fluctuating

water levels and acidic, nutrient-poor, high quality water. These ponds harbor one of the largest concentrations of globally and statewide rare species on Long Island, including the tiger salamander, banded sunfish, six species of damselflies and dragonflies, and more than a dozen species of plants.

A distinctive community of plants has adapted to the pond shore conditions of fluctuating water levels, nutrient poor soil and water, and the acidic environment. Periods of both high and low water are essential in maintaining the structure, composition and diversity of the pond shore plant community. Periodic flooding is necessary to kill seedlings of woody shrubs and trees invading from surrounding upland, (Zaremba and Lamont 1993), and may also be important in transporting nutrients and seeds. Periods of low water are required to expose substrate for seed germination and growth. In low water years an enormous diversity of sedge, grass and flowering herb species appear, growing in concentric rings at elevations determined by the species' need for nutrients and tolerance of flooding. Recent studies have revealed that the natural heterogeneity of coastal plain pond shores appears to be a result of long-term fluctuations in water levels, spatial and temporal variability in nutrients, and reproductive strategies. (Schneider 1994). The ability of many seeds to remain dormant in high-water years plays an essential role in the capacity of these species to respond when pond margins are exposed in low-water years.

Five distinct vegetation zones (habitats) have been described for coastal plain pond shores by Zaremba and Lamont. (Zaremba 1993). Different species are characteristic of each of these different zones:

1. Upper wetland shrub thicket. This is often a Pine Barrens shrub swamp community.
2. Upper, low herbaceous fringe. A narrow band of vegetation on a peaty substrate that is only marginally above general high water levels, and may not occur at all ponds.
3. Sandy exposed pond bottom. The outermost pond bottom exposed during droughts is often very sandy and dominated by annual species. Soil moisture is related to groundwater depth.

The highest concentration of rare species occurs in this zone.

4. Organic exposed pond bottom. The organic exposed pond bottom is more frequently flooded than the sandy zone, hence has a greater accumulation of organics. This zone has a low species diversity.
5. Permanently flooded zone with emergent and floating species. Pond bottom substrates are generally covered with loose layers of organic debris. Species diversity and overall cover are generally low.

5.7.2 Pine Barrens shrub swamps G5 S3

Pine Barrens shrub swamps are wetlands that often occur at the margins of coastal plain ponds, as a transition zone between the pond shore and the surrounding pine barrens forest. Shrub swamps also occur in wet depressions with little or no standing water. (Reschke 1990). Characteristic species include leatherleaf (*Chamaedaphne calyculata*), highbush blueberry (*Vaccinium corymbosum*), sweet pepper-bush (*Clethra alnifolia*), male-berry (*Lyonia ligustrina*), fetterbush (*Leucothoe racemosa*), buttonbush (*Cephalanthus occidentalis*) and winterberry (*Ilex glabra*). Sphagnum mosses are common in the groundlayer.

5.7.3 Coastal plain Atlantic white cedar swamp G3G4 S1

Coastal plain Atlantic white cedar swamps occur on "organic soils along streams and in poorly drained depressions . . . Atlantic white cedar (*Chamaecyparis thyoides*) makes up over 50% of the canopy cover." (Reschke 1990). Red maple (*Acer rubrum*) may be a codominant tree. Characteristic shrubs include sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), and swamp azalea (*Rhododendron viscosum*). Several species of sphagnum moss dominate the groundlayer.

Atlantic white cedar regenerates only under conditions of full sunlight and moist, but not flooded, conditions. Mature stands of Atlantic white cedar are dense, with little light penetration of the canopy. Therefore white cedar regeneration occurs only following removal of mature trees by

processes such as logging, fire, high wind, protracted flooding, or occasional salt water flooding resulting from severe storms. (Laderman 1989). Historically, fires or blowdowns were the most common canopy-opening events. The composition of stands following fire depends on the amount of organic soil consumed by the fire, the presence of hardwoods and shrubs in the killed stands, and available seed sources. (Little 1979). Fires during high water periods favor regeneration of white cedars. Intense fire when water levels are low results in peat burning, and a lowering of the forest floor. The resultant flooding prevents white cedar regeneration. A bog, shrub swamp or deciduous hardwood swamp may then form. (Laderman 1989). If substrate conditions are unsuitable, or sources of white cedar seed have been eliminated, white cedar may fail to become established and the area will instead become a red maple-hardwood swamp.

Flooding or draining due to human-caused alterations of the hydrologic regime also could cause the loss of white cedar. Degradation of water quality by direct storm water runoff, or due to groundwater contamination from fertilizers or septic tank leachate, has the potential to adversely affect white cedars and characteristic cedar-associated species. (Ehrenfeld 1983, Schneider and Ehrenfeld 1987).

Ironically, the complete protection of white cedar swamps will ensure their eventual senescence and loss. There are ". . . no simple, definitive guidelines for optimal management practices of cedar wetlands; there are too many biological unknowns for any simple formula." (Laderman 1989). Little proposed an approach to cedar management which involved clearcutting or strip cutting, the removal of slash, the control of competing hardwoods, and the control of deer browse. (Little 1950).

White cedar swamps were formerly extensive on Long Island, but have been reduced to a few scattered remnants by past logging and draining. (Laderman 1987). The largest white cedar swamp remaining on Long Island is in Cranberry Bog County Park in Southampton Town (between the Peconic River and Riverhead-Moriches Road).

The highly acidic waters of white cedar swamps limit use by wildlife. Nevertheless, swamp sparrows (*Melospiza georgiana*) can be found here and four-toed salamanders (*Hemidactylum scutatum*) inhabit the sphagnum zone. Most noteworthy is the rare Hessel's Hairstreak butterfly (*Mitoura hesseli*), which is dependant upon the white cedar as its host plant.

5.7.4 Red maple-hardwood swamps G5 S4S5

Red maple-hardwood swamps occur "in poorly drained depressions, usually on inorganic soils. This is a broadly defined community with many regional and edaphic variants." (Reschke 1990). On Long Island red maple and black gum (*Nyssa sylvatica*) are the dominant trees. The shrub layer may be quite dense. Characteristic shrubs are sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), arrowwood (*Viburnum recognitum*) and swamp azalea (*Rhododendron viscosum*). Herbs include cinnamon fern (*Osmundea cinnamomea*), Royal fern (*O. regalis*), and skunk cabbage (*Symplocarpus foetidus*).

Insectivorous birds use the red maple-dominated swamps at all times of year. A wide variety of migratory insectivorous birds uses the deciduous swamps during their spring and fall movements. The early flowering red maple attracts a rich insect life which is used by vireos, warblers, thrushes and many others, including dozens of species of birds which winter in the tropics.

During the colder months, a guild which includes kinglets (*Sylviidae*), nuthatches (*Sittidae*), woodpeckers (*Picidae*), titmice (*Paridae*) and brown creepers (*Certhia familiaris*) searches for insect larvae in the many dead trees in these swamps.

5.7.5 Coastal plain poor fen G3? S1

Coastal plain poor fens are sphagnum moss-dominated peatlands, with scattered sedges, shrubs, and stunted trees. (Reschke 1990). The largest such fen on Long Island, at Cranberry Bog County Park, is dominated by sphagnum and sedges. (Reschke, personal communication). This relatively rare (G3?S1) community appears to be a successional stage in transition to a shrub or

hardwood swamp.

5.7.6 Coastal plain stream G3G4 S1

Two of the four major rivers of Suffolk County are found in the Pine Barrens: the Peconic River and the Carmans. These slow-moving, often darkly-stained streams may contain abundant submerged vegetation, including pondweeds (*Potamogeton pusillus*, *P. epihydrus*), naiads (*Najas flexilis*, *N. guadalupensis*), waterweeds (*Elodea nuttallii*, *E. canadensis*), stonewort (*Nitella spp.*), bladderwort (*Utricularia vulgaris*), duckweed (*Lemna minor*) and white water-crowfoot (*Ranunculus trichophyllus*).

Cool streams are home to the eastern mudminnow (*Umbra pygmaea*), banded killifish (*Fundulus diaphanus*), and, where stocked, brown trout (*Salmo trutta*). Swamp darter (*Etheostoma fusiforme*), which only exist in this region of the state, may occur where surface waters are unpolluted and free of turbidity and silt, in both coastal streams and swamps. The tessellated darter (*Etheostoma olmstedi*) is attracted to similar habitats, but also occurs in large open bodies of water. American eels (*Anguilla rostrata*) can be found in some streams as well as in the tidal waters. Three species of sticklebacks: the ninespine (*Pungitius pungitius*), the threespine (*Gasterosteus aculeatus*) and fourspine (*Apettes quadracus*) are also common.

5.7.7 Low salt marsh G4 S3S4; High salt marsh G4 S3S4

Salt marsh occurs in the Hubbard Creek Marsh on Peconic Bay, in the Flanders area. Low salt marsh extends from mean high tide down to mean sea level and is regularly flooded by semidiurnal tides. Vegetation is a nearly monospecific stand of cordgrass (*Spartina alterniflora*). High salt marsh occurs from mean high tide up to the limit of spring tides and is periodically flooded by spring tides and flood tides. Vegetation consists of a mosaic of patches dominated by either dwarf cordgrass or salt-meadow grass (*Spartina patens*). Also common are spikegrass (*Distichlis spicata*) and black-grass (*Juncus gerardi*).

The very limited expanse of saltmarsh within the Central Pine Barrens supports the full range of

wildlife typical of saltmarsh elsewhere on Long Island. Many waterbirds rely upon marine organisms for food. The NYSDEC listed endangered piping plover (*Charadrius melodus*) is known to breed here, as is the endangered least tern (*Sterna antillarum*) and the threatened common tern (*Sterna hirundo*). The diamondback terrapin (*Malaclemys terrapin*), our only saltmarsh reptile, lives here year round and nests in nearby uplands.

5.7.8 Salt panne G3G4 S3

A salt panne is a poorly drained, shallow depression in both low and high salt marshes, found in the Hubbard Creek Marsh on Peconic Bay. Soil water salinities fluctuate in response to tidal flooding and rainfall. Pannes in low salt marsh usually lack vegetation. Pannes in high salt marsh are irregularly flooded, and are vegetated by dwarf cordgrass, glassworts (*Salicornia europaea* and *S. virginica*), marsh fleabane (*Pluchea odorata*), salt marsh plaintain (*Plantago maritima ssp. junkets*), arrowgrass (*Triglochin maritimum*) and salt marsh sand spurry (*Spergularia marina*).

Pond holes within the pannes may contain mummichog (*Fundulus heteroclitus*) and sheepshead minnow (*Cyprinodon variegatus*).

5.7.9 Salt shrub G5 S4

Salt shrub occurs in the Hubbard Creek Marsh on Peconic Bay, in the Flanders area. Salt shrub is a shrubland community that forms an ecotone between salt marsh and upland vegetation. Salinity levels are generally lower than in the salt marsh and the elevation is higher. (Reschke 1990). Characteristic shrubs are the groundsel-tree (*Baccharis halimifolia*), saltmarsh elder (*Iva frutescens*). Typical herbs are the salt-meadow grass (*Spartina patens*) and switchgrass (*Panicum virgatum*).

Both pitch pine, red maple and black gum are found in this community, which is transitional between upland Pine Barrens and wetland communities such as red maple swamps and shrub swamps. The shrub and herb flora is very similar to that of red maple swamps.

5.7.10 Pine Barrens vernal pond (G3G4 S2 elsewhere in New York); Vernal pool (G4 S3S4 elsewhere in New York)

Pine Barrens vernal ponds, and vernal pools, are not yet documented by the Heritage Program for the Central Pine Barrens, but wetlands resembling these communities do occur. Alternatively, these wetlands may be considered variants of coastal plain ponds, red maple-hardwood swamps or pine barrens shrub swamps. These wetlands are seasonally fluctuating, groundwater-fed ponds dominated by grasses and herbs. At some sites these are mixed with low shrubs. These wetlands are often small, covered by a closed-over tree canopy, and carpeted with leaf litter. (Zaremba, personal communication). Plant species composition is similar to that of shrub swamps and red maple-hardwood swamps.

5.8 Human-created Communities

In this document a distinction between "natural" and "human-created" communities has been drawn. This dichotomy is artificial, and somewhat arbitrary, but nevertheless useful. The range of communities found within the Central Pine Barrens exists along a continuum where, at one extreme, communities exhibit relatively few effects from human activities. At the other extreme, the communities are the direct result of human manipulation of the environment (e.g., lawns and agricultural lands). Lands which have been previously burned, logged, cleared, farmed, or developed may show the effects of these activities for decades or centuries. Communities are treated as "natural" wherever the overwhelming forces which have shaped their present state have been natural. The strongest such force is succession, but fire and the natural dispersion of organisms also play major roles.

Historically, sun-loving herbaceous plants must have been the most common in grassy patches and open areas created by fire or other disturbance within the Pine Barrens. Widespread development and fire suppression has resulted in a loss of these openings. (Southampton 1993). Some of these herbaceous plants now are rare, and persist primarily in human-created habitats such as

roadsides, successional old fields, and mowed areas.

5.8.1 Successional old field G4 S4; Successional Shrubland G4 S4

Successional old field is a "meadow dominated by forbs and grasses that occurs on sites that have been cleared and plowed (for farming or development), and then abandoned. This is a relatively short-lived community that succeeds to a shrubland, woodland or forest community." (Reschke 1990). Weedy non-native species typically are a major component of the flora. These include bluegrasses (*Poa pratensis*, *P. compress*), timothy (*Phleum pratense*), quackgrass (*Agropyron repens*), sweet vernal grass (*Anthoxanthum odoratum*), orchard grass (*Dactylis glomerata*), chickweed (*Cerastium arvense*), Queen-Anne's lace (*Daucus carota*) and dandelion (*Taraxacum officinale*). Native species include goldenrods (*Solidago rugosa*, *S. juncea*, *S. nemoralis*, *Euthamia graminifolia*), old-field cinquefoil (*Potentilla simplex*), asters, evening primrose (*Oenothera biennis*) and ragweed (*Ambrosia artemisiifolia*).

When woody cover increases to 50% or more, the community becomes a successional shrubland. (Reschke 1990). Characteristic woody species include red cedar (*Juniperus virginiana*), blackberries (*Rubus spp.*), hawthorne (*Crataegus spp.*), choke-cherry (*Prunus virginiana*), serviceberries (*Amelanchier spp.*), sumac (*Rhus glabra*, *R. copallina*), arrowwood (*Viburnum recognitum*) and multiflora rose (*Rosa multiflora*).

The mixed shrublands and hedgerows support a bird community typical of sunny but densely tangled vegetation. Grey catbirds, song sparrows, yellow warblers and bobwhite quail are common. Blue-winged warblers can be found near the taller vegetation. Cottontail rabbits flourish amidst the undergrowth. Woodcocks (*Philohela minor*) perform their courtship flights here in the spring. The numerous shrubs and saplings attract field sparrows and cedar waxwings (*Bombycilla cedrorum*). Fallen fruits feed meadow jumping mice (*Zapus hudsonius*), raccoons, box turtles and others.

Meadow voles (*Microtus pennsylvanicus*), black

racers and garter snakes and kestrels (*Falco sparverius*) are most abundant in the grasslands. Grasshopper sparrows (*Ammodramus savannarum*) use grasslands if the taller herbs or woody plants provide them with suitable singing perches. Meadowlarks (*Sturnella magna*) and bobolinks (*Dolichonyx oryzivorus*) use areas where the grass is shorter, as do upland sandpipers (*Bartramia longicauda*) and rough-legged hawks (*Buteo lagopus*).

5.8.2 Cropland/row crops G5 S5

Areas of active agriculture in the Pine Barrens include sod farms, nurseries, and truck crops (vegetables and fruits).

Canada geese (*Branta canadensis*), white-tailed deer, mourning doves, raccoons, crows, blackbirds (Icteridae), starlings (*Sturnus vulgaris*) and English sparrows (*Passer domesticus*) all forage in cultivated farmlands and may be pests to farmers. Killdeer (*Charadrius vociferus*), horned lark (*Eremophila alpestris*), water pipits (*Anthus spinoletta*) and other birds use the bare earth of fallow fields.

5.8.3 Mowed lawn G5 S5; mowed lawn with trees G5 S5

"Residential, recreational, or commercial land in which the groundcover is dominated by clipped grasses and forbs. . . . Ornamental and/or native shrubs may be present." (Reschke 1990).

5.8.4 Mowed roadside/pathway G5 S5

Included in this category are infrequently mowed areas along roads, pathways mowed through meadows, old fields, woodlands, forests, or utility right-of-way corridors. The vegetation may resemble that of old fields and shrublands; either grasses, sedges and rushes, or forbs, vines and low shrubs may dominate. Mowed areas at the Naval Weapons Industrial Reserve Plant (NWIRP) at Calverton are grasslands dominated by little bluestem (*Schizachyrium scoparium*), spike grass (*Danthonia spicata*), switchgrass (*Panicum virgatum*), asters, goldenrods, false indigo (*Baptisia tinctoria*) and sweet fern (*Comptonia peregrina*). Diversity is lower in frequently mowed areas near

the runway aprons, and higher at less disturbed sites. (NWIRP 1989).

Residential, industrial and institutional land uses generally involve both structures and landscaped areas. These developed areas frequently provide wildlife habitat. Northern orioles, chipping sparrows (*Spizella passerina*) and house finches (*Carpodacus mexicanus*) nest in shade trees. Blackbirds, starlings, robins (*Turdus migratorius*) and northern flickers (*Colaptes auratus*) feed on lawns. Deer and geese will graze on the larger expanses. Norway rats (*Rattus norvegicus*), barn swallows, grey squirrels and raccoons reside within many buildings.

5.9 Occurrences of Rare Pine Barrens Natural Communities and Species

5.9.1 Communities

The Natural Heritage Program records a total of 52 occurrences of state rare natural communities (S1-S3) in the Central Pine Barrens, as shown in Figure 5-5. Of these, almost all are within the Core Preservation Area. Only one occurrence of pitch pine-oak-heath woodland and six occurrences of coastal plain pond shores are in the Compatible Growth Area. It is important to note that there has not been a comprehensive documentation of all occurrences of every community type in the Central Pine Barrens. Therefore, the list in Figure 5-5 may be incomplete.

Figure 5-5: Occurrences of Rare (S1-S3) Natural Communities in the Central Pine Barrens

Natural Community type	Number of documented occurrences
Coastal plain pond shore	38
Coastal plain pond	2
Coastal plain poor fen	2
Coastal plain Atlantic white cedar swamp	2
Pine barrens shrub swamp	1
Dwarf pine plain	1
Pitch pine-oak-heath woodland	5
Salt panne	1
TOTAL OCCURRENCES	52

It is noted that all of the ponds and pondshores in the Core Area are ranked B2 or B3 for overall biodiversity significance by the New York Natural Heritage Program. (Appendix 2-1).

Of the six pondshores in the compatible growth area, two are ranked B2 (Lake Panamoka, North Pond), three are ranked B3 (Artist Lake, Currans Road South, Overton Road Pond), and one is ranked B4 (Coreys Pond). Despite human impacts (physical disturbance of the pondshores, altered water chemistry), four of these six ponds remain of special biological value based upon their biodiversity rank, quality of their pondshores (EO rank, Appendix 2-1), and suite of rare species. (Zaremba, personal communication). These four ponds are Lake Panamoka, North Pond (near Lake Panamoka), Currans Road South Pond, and Overton Road Pond.

5.9.2 Plants

A total of 205 occurrences of 54 rare plant species (S1-S3) have been documented in the Core Preservation Area. In the Compatible Growth Area 35 occurrences of 18 rare plant species have been documented. (Appendix 2-2). Many additional rare species have been known to occur in the Pine Barrens in the past, but have not been documented in recent decades. There has not been a comprehensive documentation of all species of rare plants in the Central Pine Barrens. Further searches could add more species to those listed in Appendix 2-2.

By far, the greatest concentrations of known rare

plant species occur in wetland habitats: coastal plain pondshores (19 species), coastal plain ponds (11), wet pine barrens (10) and red maple-hardwood swamps (5). (Figure 5-5). Mowed areas, roadsides, and other open sites support 8 rare plant species. Six (6) rare species are found in salt marsh communities. (Figure 5-5). Very few rare plant species are found in forest or woodland communities, and those few are associated with open, sandy areas including roadsides (*Cyperus houghtonii*, *Minuartia caroliniana*, *Prunus pumila var depressa*).

5.9.3 Animals

Rare vertebrate species are the banded sunfish, tiger salamander, eastern mud turtle, osprey, piping plover, common tern and least tern. All of the vertebrate species may also be found in habitats and communities outside of the Pine Barrens. Rare invertebrate species include moths, butterflies and damselflies. Most of these rare invertebrate species occur only in Pine Barrens habitats and are absent or uncommon elsewhere on Long Island. There has not been an attempt to comprehensively document all species of vertebrate and invertebrate animals in the Central Pine Barrens. Further searches could add more species (especially moths and butterflies) to those discussed below.

Banded sunfish: *Enneacanthus obesus* (G5 S2) is listed by NYSDEC as a Species of Special Concern. In New York, it is known from 4 sites within the Peconic River drainage. It prefers slow-moving, weedy areas.

Habitat needs: The banded sunfish's aquatic habitat should be protected from loss and degradation. The known sites are all on public land within the Core Preservation Area which effectively precludes direct disturbance and loss.

Tiger salamander: *Ambystoma tigrinum* (G5 S3) is listed by NYSDEC as endangered. This mole salamander is known from 61 sites within the Central Pine Barrens. Tiger salamanders use small ponds for breeding sites. Fish-free waters allow breeding salamander adults, eggs and larvae to avoid a major source of predation. During the non-breeding season, adults and post-larval young dwell in tunnel systems beneath adjacent woodlands. They frequently range as much as 1000 feet from breeding ponds. Little scientific information exists as to the extent of movements by individuals amongst breeding sites. Nevertheless, it is obvious that populations have dispersed over time. Tiger salamanders exist on Long Island from Nassau County eastward onto the South Fork.

Habitat needs: The majority of the tiger salamander's known populations (38 of 61) are within the Core Preservation Area. In the compatible growth area, numerous sites require protective efforts by state and local governments. Although there is no law which specifically protects the habitats of endangered or threatened species, existing laws are currently being used to protect a significant portion of the animal's habitats. The breeding ponds are fully protected by both state and local wetlands laws. Much of the surrounding upland habitat is also protected under the New York State Environmental Quality Review Act (SEQRA). Generally, at least half of the uplands within 1000 feet of each known breeding pond is preserved as large blocks of naturally-vegetated open space.

Protection for corridors which connect known sites should be considered, as without opportunities to travel amongst sites, populations could become genetically isolated and subject to local extinction.

Eastern mud turtle: *Kinosternon subrubrum* (G5S1) is listed by NYSDEC as threatened. It is known from only 4 locations in New York State; 3 of these are at least partially within the Central Pine Barrens. This species uses "shallow, slow- or non-

flowing fresh or brackish water with soft bottom and abundant aquatic vegetation." It nests and hibernates in nearby uplands. On Long Island it is known to use areas as much as 400 feet from ponds.

Habitat needs: The majority (3 of 4) of the mud turtle's known populations extend beyond the Central Pine Barrens. One is on private lands within the Compatible Growth Area. As discussed above, there is no law which specifically protects the habitats of endangered or threatened species but existing laws are currently being used to protect a significant portion of the animal's habitats. The breeding ponds are fully protected by both state and local wetlands laws. The surrounding upland habitat is protected under SEQRA.

The following species are found within the Central Pine Barrens but are far more common in coastal areas elsewhere on Long Island. Each is listed as either threatened or endangered, and is currently protected through regulation and through management. These species will be discussed only briefly.

Osprey: *Pandion haliaetus* (G5 S4) is now known from over 250 nests on Long Island each year. Three (3) of these are found within the Central Pine Barrens.

Piping plover: *Charadrius melodus* (G3 S2) is known from over 70 active nest sites on Long Island each year. One of these is within the Central Pine Barrens.

Common tern: *Sterna hirundo* (G5 S3) is known from over 60 active nest sites on Long Island each year. One of these is within the Central Pine Barrens.

Least tern: *Sterna antillarum* (G4 S3) is known from over 60 active nest sites on Long Island each year. One of these is within the Central Pine Barrens.

Invertebrate Wildlife: The Natural Heritage Program lists 42 recent occurrences of rare invertebrate wildlife in the Central Pine Barrens. Forty-one (41) are within the Core Preservation Area, the other occurrence is within the Compatible

Growth Area.

5.9.4 Upland species

The species below are found within the Central Pine Barrens. Virtually all are restricted to Pine Barrens habitat types and are absent or uncommon elsewhere on Long Island. One species, the White M Hairstreak, is found within the Compatible Growth Area. All others are known from the publicly owned land within the Core Preservation Area. As a result, their habitats are protected.

Coastal barrens buck moth: *Hemileuca maia maia* is found from 10 locations within the Central Pine Barrens; it attains its highest densities, over 1000 adults per acre, in the dwarf pine plains. It requires scrub oak and dwarf chinquapin oak as a host plant.

Habitat needs: Scrub oak-dominated communities need to be maintained.

Frosted elfin: *Incisalia irus* is a butterfly which is known from a single swale. It appears to require wild indigo (*Baptisia tinctoria*) and blue lupine (*Lupinus perennis*) as host plants.

Habitat needs: Weedy areas with wild indigo and blue lupine are required. Although the single known site is within the Core Preservation Area, it is a managed railroad right-of-way. Natural succession could threaten the future of this habitat type. Mowing or prescribed burning may be useful in maintaining such areas.

White M hairstreak: *Parrhasius M-album* is a butterfly which is known from a single old field in the Compatible Growth Area. This species appears to use goldenrods (*Solidago spp.*) and milkweed (*Asclepias spp.*) as host plants.

Habitat needs: Natural succession could threaten the future of this habitat type. Mowing or prescribed burning may be useful in maintaining such areas.

5.9.5 Dwarf Pine Plains Species

A noctuid moth with no common name, *Chaetagnathia cerata* is known from a single occurrence.

A noctuid moth with no common name, *Heterocampa varia* is known from 2 occurrences and is believed to depend upon pitch pine and oaks.

Jair underwing, *Catocala jair ssp. 2*, is a moth which depends upon oak and blueberry leaves.

Herodias underwing, *Catocala herodias gerhardi*, is a moth which depends upon oak (especially scrub oak) and blueberry leaves. It is known from 2 locations.

Dusted skipper, *Atrytonopsis hianna*, is a butterfly known from a single location. It appears to rely upon big and little bluestem grasses as host plant.

Violet dart, *Euxoa violaris*, is a butterfly which is known from a single occurrence.

Zale species #1, *Zale lunifera*, is a moth which is known from a single occurrence.

Pink sallow, *Psectraglaea carnosus*, is known from 2 occurrences.

Habitat needs for dwarf pine plains species: These species all require that the dwarf pine plains' natural community be protected. The location of this area within the Core Preservation Area affords it some protection. It is likely that the dwarf pine plains will need to be actively managed, perhaps through burning, to maintain its existing habitat characteristics.

5.9.6 Wetland species

Hessel's hairstreak, *Mitoura hesseli*, is a butterfly which is known from 4 Atlantic white cedar swamps. It relies upon this cedar (*Chamaecyparis thyoides*) as its host.

Pitcher plant borer, *Papaipema apassionata*, is a moth which is known from a single bog. It relies upon the pitcher plant (*Sarracenia purpurea*) as its host.

Chain fern borer, *Papaipema stenocelis*, is a moth which is known from a single site. It feeds on the rhizomes of Virginia chain fern (*Woodwardia virginiana*).

Lateral bluet, *Enallagma laterale*, is a damselfly which is known from 2 ponds. Eggs are laid in emergent vegetation. Larvae are aquatic, and post larval stages (teneral) inhabit nearby upland vegetation.

Barrens bluet, *Enallagma recurvatum*, is a damselfly which is known from 8 ponds. Eggs are laid in emergent vegetation. Larvae are aquatic, and post larval stages (teneral) inhabit nearby upland vegetation.

Painted bluet, *Enallagma pictum*, is a damselfly which is known from 2 ponds. Eggs are laid in emergent vegetation. Larvae are aquatic, and post larval stages (teneral) inhabit nearby upland vegetation.

Round-necked damselfly, *Nehalennia integricollis*, is known from a single pond.

Habitat needs for wetland species: The above species' aquatic habitats need to be protected from loss and degradation. The known sites are all on public land and within the Core Preservation Area which effectively precludes direct disturbance and loss.

5.10 Ecological Principles of Conservation Reserve Design

In order to preserve natural ecosystems and halt the extinction of species it is necessary to think on a large scale, at the level of ecosystems and landscapes, (Franklin 1993), and to establish large core reserves, or assemblages of linked reserves, surrounded by "semi-natural" buffer zones. (Franklin 1993, Noss 1992, Noss and Cooperrider 1994). Core reserves should be large enough and extensive enough to include the full range of communities, successional stages, physical habitats, environmental gradients, and ecosystem processes in a region. The buffer zone should be managed to minimize the ecological contrast between the buffer and the core. (Franklin 1993). The extensive literature on the optimal design of conservation reserves has been reviewed by Shafer. (Shafer 1990). Only the most important ecological considerations are discussed here. These considerations are general guidelines which were interpreted within the context of the Long Island

Pine Barrens.

Ecological processes. In order to maintain functional, viable ecosystems in perpetuity, it is essential to maintain ecological and evolutionary processes, such as natural disturbance regimes (primarily fire in the pine barrens), hydrological processes (including surface and groundwater flow and fluctuating water levels in coastal plain ponds), nutrient cycles, genetic selection and biotic interactions (including predation). (Noss 1992, Noss and Cooperrider 1994). Large reserves are more likely to allow ecological processes to continue than are small, isolated reserves. In some cases active management may be required to maintain essential ecological processes that are no longer operable due to human alterations of the landscape.

Edge effects. Organisms located at or near the transition zone between a naturally vegetated, original habitat and an adjoining disturbed area (matrix) are subject to "edge effects," including increased sunlight and wind, altered humidity, altered temperatures, exposure to invasive exotic species, increased predation, increased exposure to human disturbance, etc. These edge effects may extend considerable distances into the natural habitat. Edge effects may favor some species while eliminating other species, or greatly modifying their growth, viability and genetic makeup.

The following material concerning wildlife reserves has been excerpted from McDougal's 1994 work.

Size. The general rule for optimizing the effectiveness of a conservation area is "bigger is better." Large reserves offer both more area *per se* and generally can be expected to exhibit a greater degree of habitat heterogeneity than small ones. They are also more likely to allow the continued operation of disturbance regimes at a range of scales. These processes act to maintain spatial and temporal heterogeneity in "whole" ecosystems but generally are not functional in small, isolated

preserves. (Noss and Harris 1986; Pickett and Thompson 1978). Large reserves are more likely to allow for the persistence of viable populations of species with relatively large area requirements, those that depend upon more than one habitat type for their resource needs and ephemeral species which are dependent upon a dynamic mosaic of newly created habitat for continued presence in the region. Large reserves are also more likely to protect metapopulations (complexes of interdependent subpopulations which are affected by recurring extinctions, and linked by recolonization from large reservoir populations) than are small reserves. (Murphy et al., 1990).

Population size. Small populations are particularly subject to fluctuations and random events, and random extinctions due to demographic and environmental [variability] are more important in small populations. (Shaffer 1981). The first species to disappear from small reserves are frequently those at high trophic levels, or larger, more specialized members of feeding guilds. (Wilson and Willis 1975). Species with variable populations that are dependent on patchy or unpredictable resources seem particularly sensitive. (Noss 1983). Since nature reserves are essentially habitat islands (i.e., areas of natural landscape surrounded by a culturally modified matrix), the potential for recolonization of a species that becomes extinct within the reserve is often limited or non-existent. This makes it critical that the area of the reserve is large enough to maintain viable populations of its

component species. When this is not the case, and as the surrounding matrix is further altered extinction may become an important process within the reserve. (Pickett and Thompson 1978). Large populations are more likely to maintain greater levels of genetic variability than small populations, and this can be an important factor in allowing adaptive response to changing environmental conditions.

Shape. Fragmentation of habitat into isolated remnant patches generates a number of problems including 1) reduction in the effective size of the reserve due to physical and biological edge effects, 2) increasing domination by species characteristic of human landscapes and 3) the loss of large, wide-ranging, or ecologically specialized species. (Noss and Harris 1986). Given two habitat patches of equal area but different shapes, these problems are often more pronounced in those with a significantly greater edge: interior ratio. These factors become particularly important in extreme cases where a reserve is so small or narrow that no interior habitat exists within it. In large reserves shape may be less important. In general it has been suggested that a design that maximizes interior habitat and minimizes edge effects is most desirable. When this is not possible a buffer zone adjacent to the core preservation area is important.

Buffer zones. Edge effects can be dramatic, and the higher the contrast between the 'natural' landscape of the reserve and the culturally modified matrix surrounding it the greater these

effects will be. (Franklin 1993). The role of the buffer zone is that of a transition area which filters out the effects of [human] disturbances (Baker 1992), or minimizes their impact when they reach the core area. The buffer zone can be considered an ecological boundary, a zone of interaction and change between the core reserve and the surrounding matrix. (Schoenwald-Cox 1988). In these areas the rates or magnitudes of ecological transfers (e.g., energy flow, nutrients, species) change abruptly in relation to those on either side of the boundary. Boundaries may vary in their permeability or resistance to these transfers as a consequence of the nature of the boundary itself and the responses of different materials, organisms or abiotic factors to the boundary. (Wiens et al., 1985). The effectiveness of the buffer zone as a transition area depends on its size, ecological characteristics and human activities within it.

Connectivity. Many writers on the design of nature reserves advocate the use of corridors which may act as dispersal routes, facilitating recolonization, gene flow and increasing the effective size of small populations. In fact, empirical evidence on the use of corridors is meager. (Simberloff et al., 1992; Shafer 1990). What actually constitutes a corridor or a barrier is mostly based on assumption. (Forman and Godron 1986). Both are scale dependent and will be perceived differently by different species. (Hanson and Angelstam 1991). It is probably reasonable and prudent to assume however, that connectivity at all scales is more desirable than little or no connectivity. This is

particularly true in those cases where a reserve is irregularly shaped and the connection of adjacent parts may add to the areas conservation value.

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6. Status of Ecosystem Research in the Central Pine Barrens

6.1 Completed Research

There are several major studies and descriptions of Long Island pine barrens flora and communities:

1. pine barrens flora (Britton 1880);
2. plant community descriptions (Harper 1908);
3. plant community descriptions (Conard 1935);
4. the inter-relationships of heath, scrub oak and tree strata with light levels (Reiners 1965, 1967);
5. structure, production, diversity and biomass in the Brookhaven Pine Barrens (Whittaker and Woodwell 1968, 1969);
6. incidence of serotiny in pitch pine in pine barrens along the northeastern coastline, including Long Island (Ledig and Fryer, 1972); and
7. vegetational gradients in the dwarf pine plains. (Olsvig, Cryan and Whittaker 1979).

However in recent years only a few additional studies have been completed:

1. New York Natural Heritage Program's descriptions of pine barrens community types (Reschke 1990);
2. a flora and description of Long Island pine barrens coastal plain ponds (Zaremba and Lamont 1993);
3. environmental controls of plant species diversity in coastal plain pondshore communities (Schneider 1994); and
4. The Nature Conservancy's study of the fire history of the Central Pine Barrens, based on aerial photographs going back to 1938. (Windisch 1994).

Research on the Long Island Pine Barrens has been limited compared to the many studies that have been carried out in the New Jersey Pinelands. Hundreds of New Jersey studies are listed in the

compendia of Buchholz and Good (1982) and Matlack, Good and Gibson (1986). These include papers on botany, plant and community ecology, fire ecology, geology and soils, hydrology and water chemistry, meteorology and zoology. Although much of the information on the New Jersey Pinelands can be applied to the Long Island Pine Barrens in at least a general way, more research studies that specifically address ecological and conservation issues in the Long Island Central Pine Barrens would be of value for future management decisions concerning publicly owned land within the Core Preservation Area.

6.2 Ongoing Research

Pine Barrens communities extend from Maine through New England, New York, Pennsylvania and New Jersey, extending as far south as West Virginia. Considerable research is now ongoing in many of these Pine Barrens areas, including Long Island. Regardless of location, much of this research will be directly applicable to the Long Island Pine Barrens.

6.2.1 The Nature Conservancy's NorthEast Pine Barrens Ecosystem Program

The primary purpose of this program, based in the Conservancy's Eastern Regional office in Boston, is to coordinate research efforts and facilitate communication among Pine Barrens researchers throughout the northeast. Researchers in both the Conservancy and academic institutions are participating.

Goals of the program include:

1. Identify, track and map significant pine barrens occurrences throughout the northeast. Included will be the preparation of a geographic information system (GIS) map of all Pine Barrens occurrences.
2. Development (with New York State Heritage Programs) of a regional classification of Pine Barrens communities. Field surveys and documentation of Pine Barrens communities on Long Island have been included in this effort.
3. Identify sites that would most contribute to

the conservation of diversity in the Pine Barrens and develop range wide ecological goals.

4. Plan for and undertake conservation activity and promote and coordinate compatible biological monitoring and mapping techniques.
5. Identify management, monitoring and research needs and carry out targeted research studies (effects of fire and mechanical disturbance, effects of smoke on air quality, ecological modelling).
6. Develop partnerships at local, state, regional and national levels with academic researchers, government agencies, conservation organizations, and others to advance conservation of North East Pine Barrens.
7. Develop resources and support to accomplish these goals.

6.2.2 Fire behavior and fire ecology

A major research effort is being carried out by Dr. William Patterson, University of Massachusetts (Amherst), funded by the Mellon Foundation through The Nature Conservancy's (TNC) Ecosystem Research Program. (Arlington, Virginia). Dr. Patterson has completed preliminary research at the Waterboro Barrens in Maine, in which past vegetation types were mapped and related to fire history and soils. The current research is entitled "Fire behavior, fire ecology and site relations in Northeastern Barrens ecosystems." (Patterson and White 1993). Objectives are to:

1. Identify and characterize factors most responsible for development and organization of individual community types within barrens ecosystems, and test and revise existing ecological models.
2. Test the importance of growing season fires versus dormant season fires.
3. Develop and test a fuel model that will predict fire behavior for a variety of barrens fuel types.

6.2.3 Fire facilitation hypothesis

Dr. R. Latham and Dr. A. Johnson of the University of Pennsylvania, are carrying out

research in the Pocono Serpentine and Till Barrens. They are testing the "alternate steady states," or "fire facilitation" hypothesis, which will be experimentally tested by looking for possible significant nutrient losses following repeated fires.

6.2.4 Historic vegetation reconstruction in the Long Island pine barrens

The Long Island Chapter of TNC has contracted for this study with William Caplinger, a graduate student at the University of California at Davis. Caplinger is attempting to expand upon and refine Turano's 1983 archival study by incorporating additional sources of information. Caplinger hopes to be able to reconstruct Pine Barrens vegetation at four different time horizons, if possible going back to pre-settlement times.

6.2.5 Pitch Pine Community relationships in New York State and Long Island

Dr. Franz Seischab (Rochester Institute of Technology) and Dr. Jack Bernard (Ithaca College) have been studying pitch pine-dominated plant communities throughout New York for the last two years. In the summer of 1993, they sampled the soils and vegetation in several Long Island Pine Barrens sites, and have prepared a manuscript which has been submitted for publication. (Seischab and Bernard, unpublished).

6.2.6 Interactions between climate and radial growth of pitch pine

Annie Hagar, a graduate student at the University of Maine, Orono, is investigating climate-growth relationships throughout the northern range of pitch pine. She sampled several sites on Long Island in the summer of 1993.

6.2.7 Genetics of dwarf pitch pine

Dr. Joe Colosi (Allentown College, Center Valley, Pennsylvania), is comparing the genetic similarity of dwarf and tall pitch pine on Long Island, in the Shawangunks (New York) and in New Jersey using a DNA polymerase technique (RAPDS). Dr. Jessica Guervitch, SUNY at Stony Brook, is beginning a study of the genetics of dwarf pines on Long Island, with an emphasis on evolutionary

processes.

6.2.8 Community dynamics in ridge top pine barrens of the Shawangunk Mountains of New York

Michael Batchner of the Conservancy's Lower Hudson Chapter is currently developing a research program for the ridge top dwarf pitch pine community, and is developing conceptual community models.

6.2.9 Water quality of wetlands in the Long Island Central Pine Barrens

Baseline research on water quality in coastal plain ponds, possibly including relationships between nutrient levels and flora, are being carried out by Dr. Martin Schoonen and Dr. Glenn Richard of SUNY at Stony Brook, with some collaboration from The Nature Conservancy.

6.2.10 Wetland hydrology and ecology

Tim Simmons, with the Massachusetts field office of The Nature Conservancy, is carrying out Environmental Protection Agency (EPA) funded research on the hydrological regime of coastal plain ponds on Cape Cod, coordinated with the EPA, United States Geological Survey (USGS), Massachusetts Department of Environmental Protection (DEP), and other state and local agencies. An expected product of this research is a spatially detailed hydrological model capable of predicting changes in surface water levels in response to groundwater fluctuations. Ecological responses to hydrological fluctuations also will be modelled. These models will be directly applicable to wetlands on publicly owned land within the Core Preservation Area.

6.2.11 Lepidoptera in the Long Island dwarf pine barrens

Dr. Orland Blanchard completed a survey of the lepidopteran fauna of the dwarf pine plains in 1993, under a contract with the New York State Heritage Program. His data is currently being analyzed.

6.2.12 Survey of fens of New York State

The New York Natural Heritage Program sampled fens in New York State in 1989-1990, including the coastal plain poor fen at Cranberry Bog County Park. Data analysis is ongoing. The aim of the project is to evaluate classification of fen communities, and to examine relationships between fen vegetation, water chemistry, and other environmental factors. (Reschke personal communication).

6.3 Future Research Needs

Research in the Central Pine Barrens has been, and is being, carried out independently and with little formalized coordination by a variety of universities, conservation organizations, governmental agencies, private entities, and individuals. Efforts should be made to increase communication and cooperation among these various researchers. There are many universities and colleges, both on and off Long Island, that have the potential to make significant research contributions and to facilitate communication among researchers.

Research, monitoring and inventory in the publicly owned land within the Core Preservation Area could be directed towards the following objectives:

1. Set specific ecological goals for individual sites, and for publicly owned land within the Core Preservation Area as a whole.
2. Better understand the biology of species of concern (rare species, characteristic species, species of local interest).
3. Better understand the environmental factors that create and maintain Pine Barrens natural communities, including fire, cutting and other disturbances.
4. Better understand ecosystem processes and functions.
5. Better understand the past history and evolution of the publicly owned land within the Core Preservation Area.
6. Identify the most serious threats to the survival of species of concern.
7. Identify the most serious threats to the integrity of Pine Barrens natural communities.

8. Identify the most serious threats to the integrity and function of the Pine Barrens ecosystem.
9. Better understand the hydrologic regimes upon which Pine Barrens wetland ecosystems depend.
10. Better understand the effect of different land uses on groundwater quality.
11. Prioritize and guide management actions.
12. Guide and shape public policy and regulations affecting publicly owned land within the Core Preservation Area.

Key areas for future research include: performing baseline species analysis, population and community monitoring; studying the effects of surface and ground water quality and hydrology on wetland species and communities; determining the effects of ecosystem processes and disturbance regimes (e.g., cutting, clearing, and fire) on species and communities; and developing conceptual models of the processes controlling species and communities on the publicly owned land within the Core Preservation Area.

6.3.1 Biological Inventory

Although existing Natural Heritage Program data are good, there is no comprehensive biological inventory of the Long Island Central Pine Barrens. Consequently, additional inventories are needed to update existing Natural Heritage Program data. Inventory needs should be evaluated and prioritized. Specific needs may include:

1. Periodically updating existing Heritage inventories, and evaluating the need for comprehensive surveys for rare species (S1-S3, which includes all federally-listed rare species).
2. Identify suites of Pine Barrens species associated with each natural community type, and select indicator species that could be used to assess natural community condition.
3. Identify species of concern that may not be state rare species, and evaluate the need for an inventory of these species. Such species may include those species that are rare only on publicly owned lands within the Core Preservation Area but not

elsewhere, species that have especially strong interactions with other pine barrens species, species critical to the maintenance of natural community structure and/or function, species of local interest, and species especially threatened by human activities in the Core Preservation Area (such as reptiles and amphibians).

6.3.2 Biological and environmental monitoring

Monitoring also should be an essential component of future research efforts. Baseline data gathering and on-going monitoring are essential if managers are to accurately assess the impacts of human activities, and track the results of management actions. Monitoring can provide a feedback loop of useful information.

1. Fire management effects: develop pre- and post-burn monitoring protocols that are comprehensive, and adaptable to different situations. A good initial approach might be to use New York Natural Heritage Program releve forms, with additional information including numbers of saplings and seedlings of tree species, duff thickness, and fuel loads.
2. Develop monitoring plans for selected rare species (including threatened or endangered species) and indicator species, such as damselflies, lepidoptera, and herbaceous plant species characteristic of grassy openings.
3. Develop (as needed) monitoring plans for species of special concern, regardless of rarity.
4. Evaluate the need for monitoring of selected natural community types (e.g., coastal plain ponds).
5. Develop a monitoring plan to track changes with time in the overall mosaic of natural community types found on publicly owned lands within the Core Preservation Area.
6. Establish permanent plots in a wide variety of Pine Barrens community types to monitor long term changes due to succession in the absence of fire, and to ascertain preburn conditions and monitor post-burn changes. Such plots could

provide information that would be invaluable for refinement of the conceptual model of natural community dynamics. Data on three decades of community change would be obtained by surveying plots at the Brookhaven National Laboratory, and then comparing the results with published data concerning the same sites which is available from the 1960s. (Reiners 1965 and 1967, Whittaker and Woodwell 1968 and 1969).

7. Baseline water quality monitoring in coastal plain ponds.

6.3.3 Land use history and fire history

Understanding the history and evolution of the Long Island Central Pine Barrens will help in understanding the processes and conditions that created the Long Island Central Pine Barrens. This knowledge could influence present-day ecological goals, and would have direct implications for the kinds of appropriate and effective management actions necessary to maintain the publicly owned lands within the Core Preservation Area. Several important areas of studies are discussed below.

1. Historic vegetation reconstruction. As noted, this is currently being performed by W. Caplinger of the University of California at Davis. Information gained from this study would be utilized in conceptual community modelling efforts, and also could influence ecological goals for the publicly owned lands within the Core Preservation Area.
2. In depth fire history of selected areas within the Central Pine Barrens. An overall fire history study of the Pine Barrens, based on analysis of old aerial photographs (1938-present), was completed in October 1994 by A. Windisch, under contract with The Nature Conservancy. Windisch documented over 130 fires in or near the Central Pine Barrens, but could not precisely locate all of them, in part because the time intervals between available United States Department of Agriculture (USDA) aerial photography was as long as 14 years. He believes there may have been as many as 145 fires that

are not yet documented. In order to more completely understand the effects of fire regime on vegetation, the study could be expanded using more closely spaced photography and additional documentation from old newspapers and other historical sources. Detailed information on the past fire history for specific sites will be analyzed along with vegetation reconstruction maps at approximately 10 year intervals for the last 60 years (the limit of aerial photography). This analysis should indicate the effects of different fire regimes in creating and maintaining natural community types, and will be a critical component of conceptual community modelling efforts.

3. Palynological (pollen grain) studies in cores of lake, pond and marsh sediments. Pollen grains and charcoal particles are recovered and identified from dated layers in cores of undisturbed sediments. Such studies could reveal changes in land use, fire frequency and vegetation composition over the last several hundred to several thousand years. To date, the only study that has been done in the Long Island Pine Barrens was Backman's study of a core from Deep Pond. (Patterson and Sassaman 1988). Other palynological studies on Long Island have investigated coastal or marsh environments. (Clark and Patterson 1985, Clark 1986a, Clark 1986b). Palynological studies (including pollen and charcoal) may be the best, or only, way to adequately reconstruct relationships between fire history and Pine Barrens species' abundances both pre- and post-settlement (up until the early 1900's).
4. Phytolith studies. Phytoliths are silica particles that form within plant cells. Phytolith size and shape can be used, under some circumstances, to identify the plants from which they came at least to the family or genus level, and sometimes to the species level. Identifiable phytoliths thousands of years old have been recovered from dry upland soils. If the soil profile can be dated, phytoliths can be used to reveal past land use and vegetation changes in a manner similar to the

palynological studies. However, phytoliths have most successfully been used for grass species. It is not yet known if phytoliths from trees such as pitch pines or oaks can be identified to species, or if they occur in sufficient quantity to be useful. Thus initial research would be quite experimental, until methodological problems are resolved.

6.3.4 Conceptual ecological models of upland natural communities

The term "model" is used here in its broadest sense, namely that of an analogy used to help visualize something that can not be directly observed. Conceptual models, not quantitative mathematical models, are of the greatest interest in analyzing Long Island Central Pine Barrens conditions. Types of conceptual models include narrative, pictures, box and arrow diagrams, black box models, matrix models, computer flow charts, etc. (Jorgensen 1986).

Conceptual ecological models are useful tools that can:

1. be used as an instrument to survey complex systems;
2. be used to reveal system properties;
3. reveal weakness in our knowledge and thereby set research priorities;
4. test scientific hypotheses. (Jorgensen 1986).

The conceptual ecological model shown in Figure 5-1 is a pictorial model that illustrates general community relationships to variables such as soil texture, fire return interval, and elevation. Future research could expand the upland component of this model into a more detailed model (probably a box and arrow diagram type) that would include more detail about the effects of environmental factors in creating and maintaining individual community types within the Pine Barrens ecosystem. Key environmental factors appear to be soil texture, moisture, and nutrients, fire regime, cutting, clearing, frost and herbivory. The model should relate different communities to each other along temporal and environmental gradients and incorporate information about the effects of

different types of fire regimes on community structure and composition.

A more detailed model for publicly owned lands within the Core Preservation Area would be invaluable in setting informed ecological goals, directing future research, guiding the development of an overall fire management plan for the Core Preservation Area and guiding the development of land management and conservation plans for specific sites within the publicly owned land in the Core Preservation Area. Results of initial experimental burns will be used to test and revise the model.

A preliminary version of similar conceptual model was developed for Maine's Waterboro Pine Barrens at a Nature Conservancy workshop in 1991. The model is being refined and tested by ongoing research at Pine Barrens sites in Maine, New York, New Hampshire, and Massachusetts. (Patterson and White 1993, Helmboldt and Batcher 1994). Results of these modelling efforts may serve as a good, but incomplete, basis for a model for the publicly owned land within the Core Preservation Area. The Long Island Central Pine Barrens contains at least one plant community not present at any of the other sites being studied: the dwarf pine plains, a rare community type. In addition, the other sites being studied are fairly small ($\leq 2,000$ acres), so even if their average fire return interval is the same as on Long Island, these small sites will have had many fewer fires than the larger Long Island Central Pine Barrens.

Development of a Long Island-specific model will require information from a variety of sources. A GIS approach is suggested to synthesize the spatial information, similar to the approach being taken by Patterson and White. (Patterson and White 1993). Vegetation-environment relationships may be examined using transition matrices, redundancy analysis and/or canonical correlation analysis, again similar to the approach being taken by Patterson and White. (Patterson and White 1993). A model applicable to the entire Long Island Central Pine Barrens could be based upon in-depth studies of selected areas of publicly owned land within the Core Preservation Area.

Available information for the model:

1. A map of present vegetation types;
2. Conceptual model of the Waterboro Barrens in Maine. (Patterson and White 1993);
3. Windisch's fire history study of the Long Island Central Pine Barrens;
4. United States Department Agriculture-Soil Conservation Survey (USDA-SCS) soils map of Suffolk County;
5. Soil analyses and vegetation data (Seischab and Bernard, unpublished data; NY Natural Heritage Program); and
6. Historic vegetation reconstruction. (Caplinger, ongoing).

Additional studies which would be necessary in order to develop a model:

1. Possible refinement of the map of present Long Island Pine Barrens vegetation types prepared for this plan, by subdividing natural community types into variants such as pine-oak forest, oak-pine forest, etc.
2. Follow-up fire history studies for selected areas, using more closely spaced aerial photography to fill in information missing from Windisch's study.
3. Maps of past land use/vegetation types at 10 to 15 year intervals beginning with 1932 aerial photography (USDA). Required for ground-truthing the maps will be data on vegetation attributes within mapped community types (density, basal area, crown cover and age of overstory species, shrub cover within height classes, and herb cover). Some data are already available (*see* 6.3.3 above).
4. Data on environmental factors (including soil physical and chemical characteristics, soil moisture, microclimate, and topography).
5. Information on herbivory and the impact of pine loopers on pitch pine mortality.
6. Information on successional stages following land clearing in each of the upland vegetation type. This should come from maps of past vegetation types. (*see* 6.3.3 above).

6.3.5 Wetland ecology

1. General conceptual model for coastal plain ponds. A general conceptual model explaining how environmental factors influence plant community composition within Long Island coastal plain pondshores has been prepared by Schneider. (Schneider 1994). Additional work could refine and elaborate upon this model.
2. The sensitivity of aquatic flora and fauna to changes in water quality, nutrient loading, hydrologic or ecological regime could be further refined. Future study could include nutrient inputs in precipitation, groundwater and surface runoff. Information is available from New Jersey wetlands.
3. An experimental management program could be developed for white cedar swamps. Little has proposed an approach to cedar management that involves clearcutting or strip cutting, removal of slash, control of competing hardwoods, and control of deer browse. (Little 1950).

6.3.6 Wetland hydrology

1. Fine-scale wetland hydrologic models may be developed. Such models are an expected product of ongoing research on coastal plain ponds on Cape Cod. This research is being carried out by the Massachusetts Field Office of TNC, and is funded by the U.S. EPA (*see* above).
2. To further refine our understanding of natural water level fluctuations of publicly owned wetlands within the Core Preservation Area, and the relative roles of groundwater and runoff inputs, hydrologic studies that include water quantity and chemical budgets could be conducted at significant wetland systems. Such studies would be most appropriate for coastal plain ponds that have not been appreciably affected by human activities.
3. To further refine the understanding of the fate of chemical pollutants on wetland systems on publicly owned lands within the Core Preservation Area, hydrologic studies that include water quantity and chemical budgets could be conducted at

impacted wetland systems, especially coastal plain ponds. Such wetlands should be those that appear to be receiving increased nutrient loading, but that still support rare natural communities, and rare plant and animal species.

4. To improve management programs for the Carmans and Forge Rivers, detailed delineations of the shallow groundwater contributing areas of these systems could be made.
5. Management strategies to address succession, exotic species and canopy shading within the vicinity of freshwater wetlands could improve current understanding of these systems.

6.3.7 Species ecology

1. Reproductive ages, sprouting ages and senescence of pitch pine and scrub oak. This information may aid in developing a detailed ecological model of the response of Pine Barrens vegetation to disturbance and fire.
2. Genetics of dwarf pitch pine: Is dwarf pitch pine a genetic ecotype? Such information may have implications for reconstruction of past vegetation composition, as well as management implications for the dwarf pine plains. Additional research may be needed to follow up on ongoing studies by Dr. Joseph Colosi (Allentown College, Center Valley, Pennsylvania), and Dr. Jessica Guervitch (SUNY at Stony Brook).
3. Effects of clearings on forest interior birds. There have been numerous studies of the effects on birds of fragmentation of intact forest into isolated "islands," but few, if any, studies of the effect of clearings within otherwise intact, contiguous forests. Such a study would be helpful to evaluate potential negative effects on forest interior birds of clearings used for management of game birds or grassland birds.
4. Insects. Preliminary surveys of pine barrens insects have been carried out (New York Natural Heritage Program), but the data base is still meager. More knowledge about the habitat and environmental

requirements of lepidopterans, dragonflies and damselflies would be helpful in understanding these species. Essentially nothing is known about many other types of insects.

6.3.8 Oldfields/Grasslands

Equal percentages of these communities could be managed by mowing and prescribed burning, then allowing succession to occur. This may then allow conclusions to be drawn regarding the different growth intervals.

6.3.9 Roadsides/Firebreaks

Coordination of roadside mowing is considered a research need. By tracking the mowing intervals, patterns of regrowth may be discernible.

6.3.10 Food Plots

1. The addition or deletion of food plots, and the possibility of placing food plots along firebreaks, comprise a research need. This may permit an analysis of the growth of the food plot plants to be undertaken.
2. The importance of buffer areas between food plots and surface water systems is identified as a potential research need.

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7. Cultural Resources: Historic and Archaeological

7.1 Definitions of Terms

Before one can develop a more complete understanding of cultural resources, it is important to understand the nature of these resources and the terms used in pertinent sections of the Central Pine Barrens Plan. Accordingly, the following terms used in this section are defined as follows:

Aboriginal - Pertaining to native inhabitants (i.e., the original Native American inhabitants of Long Island).

Adaptive Reuse - The retrofitting and preservation, as opposed to destruction, of an historic structure for a new purpose. (e.g., the use of an historic residence or for an office.)

Archaeological Resources - Material remains of past habitations or activities which may be below or above ground.

Cultural resource - As defined by the National Park Service in its "Cultural Resources Management Guidelines," cultural resources are:

Those tangible and intangible aspects of cultural systems, both living and dead, that are valued by or representative of a given culture or that contain information about a culture . . . and [they] include but are not limited to sites, structures, districts, objects and artifacts, and historic documents associated with or representative of peoples, cultures, and human activities and events, either in the present or in the past. Cultural resources also can include the primary written and verbal data for interpreting and understanding those tangible resources.

As commonly defined, these may be archaeological (that is, found beneath the surface) or above-ground resources.

These may include, but are not limited to:

1. Components of structures and features (houses, mills, piers, fortifications, earthworks, ditches and mounds, roads, etc.).
2. Artifacts of human manufacture (lithics, pottery, textiles, glass, etc.).
3. Intact or fragmentary objects and artifacts used by humans (crystals, shells, minerals, etc.).
4. By-products, waste products or debris resulting from the manufacture or use of human-made or natural materials (slag, dumps, shell middens, lithic scatters, etc.).
5. Organic material (vegetable and animal remains, etc.).
6. Human remains.
7. Intact, or components of, petroglyphs, pictographs, intaglios or other works of artistic or symbolic representation.
8. Components of shipwrecks.
9. Environmental and chronometric specimens (pollen, seeds, wood, shell, bone, charcoal, tree core samples, certain soils and sediments, etc.).
10. Paleontological specimens that are found in direct physical relationship with a prehistoric or historic resource.
11. Any locale considered sacred or otherwise of special importance to any particular living group.

Cultural Resource Survey - An analysis of a particular parcel undertaken to determine if cultural resources, either historic, prehistoric or archaeological, are present on or beneath the parcel. The Stage (Phase) I cultural resource survey is designed to determine the presence or absence of cultural resources in a project's potential impact area. To facilitate planning, the Stage I survey is divided into two logically progressive units of study: the Stage IA Literature Search and Sensitivity Study and the Stage IB Field Investigation. Stage (Phase) II investigations are conducted to obtain detailed information on the "integrity, limits, structure, function and cultural/historical context of an archaeological site" to determine if it is eligible for listing on the National Register. (1994 New York Archaeological Council standards (referenced in the

Appendix)). Stage III investigations are more detailed than those conducted for Stage II investigations and are conducted if adverse impacts are anticipated to occur to an archaeological or historic resource either listed on or eligible for State or National Registers.

Disturbance - A cultural resource site is considered "disturbed" only when it can be documented that all potential cultural remains have been destroyed or removed from their original contexts. The presence of plowing or construction activities does not necessarily indicate total disturbance of a cultural resource. An example of disturbance would include a sand mine where surface and subsurface excavation and removal has extended well below the surface.

Historic - Any cultural resource dating from the period between the onset of written records (which on Long Island is typically placed around the time of first European contact in the sixteenth century) and 50 years ago.

Historic District - An area designated legally by a governmental body or agency in which historic resources are located and in which a particular set of regulations or guidelines apply to foster the preservation of the historic resources contained within the district. The designation also applies to an area which is generally recognized for its historic resources and is eligible for designation as an historic district.

Historically Significant - For purposes of this Plan, the criteria used to determine significance are those adopted for the National and State Registers of Historic Places or local municipalities.

Landmark - An historic structure, site, area or other form of cultural resource which has received a designation from a Municipal Cultural Resource Preservation Agency which grants the cultural resource additional protection beyond those afforded to non-landmark cultural resources.

National Register - The National Register of Historic Places. An official listing of historic resources established and maintained by the Federal government to foster the preservation of particular cultural resources.

Native American - Pertaining to the original aboriginal inhabitants of Long Island.

The New York Archaeological Council (NYAC) - A professional, non-profit organization comprised of professional New York State archaeologists whose purpose is to ensure maintenance of the highest standards in archaeological investigations and to foster archaeological resource preservation and education.

Paleontological - Pertaining to fossil evidence and/or remains (e.g., bones, leaves).

Prehistoric - Prior to the time of written documentation. On Long Island, this period dates from roughly 10,000 B.C. to the 16th century.

State Register - The New York State Register of Historic Places. An official listing of historic resources established and maintained by New York State to foster the preservation of particular cultural resources.

7.2 Overview of Cultural Resources in the Central Pine Barrens

When Walt Whitman described the pine barrens in his writings he noted the:

wide central tracts of pine and scrub oak . . . monotonous and sterile. But many a good day or half day I have, wandering through those solitary crossroads inhaling the peculiar and wild aroma.

The Long Island pine barrens protection area contains a wealth of cultural resources. It contains areas with significant historic and/or archaeological resources worthy of preservation. These resources contribute both to the visual enhancement of the landscape and to present knowledge of land use and ecology in the Central Pine Barrens. Data collected from such resource sites can contribute to our knowledge of past climatic and precolonial ecological conditions, thereby assisting in the development of an ecological model of the Central Pine Barrens. In addition, many significant

resources are located together with other sensitive resources such as wetlands. These significant cultural resources also trace, with unusual fidelity, the heritage of this area of Suffolk County.

7.2.1 Prehistoric and Native American Resources

Native Americans, also referred to as American Indians, were the first human inhabitants of the Central Pine Barrens and all of Long Island. Archaeologists believe they arrived in the area around 12,000 years ago; however, most Native Americans feel that their presence has a much greater antiquity. Archaeologists working on Long Island and elsewhere in the northeastern United States usually employ a system of three periods to divide up the span of time between the first settlement of the region by Native Peoples and the arrival of the European explorers and colonists in the sixteenth century. This chronological scheme is shown in the Figure 7-1.

The earliest inhabitants of Long Island are termed Paleo-Indians. Although the date of their initial arrival is not certain, it is fairly clear that they settled in the area not long after the retreat of the glacial ice that covered Long Island during the later stages of the Pleistocene glacial epoch. At that time, Long Island was not an island. Due to the lower level of the sea (atmospheric moisture was frozen as glacial ice), the shoreline of the Atlantic Ocean was hundreds of miles south of its present location. Further, reflecting conditions of a landscape just emerging from the last "ice age," the vegetation was relatively treeless and probably resembled the tundra of modern Alaska and northern Canada. Large mammals (mastodon, mammoth, etc.) roamed the Northeast and were hunted by Paleo-Indians using weapons tipped with a distinctive stone point that was grooved ("fluted") to facilitate its attachment to a spear or dart shaft. Although little is known of Paleo-Indian lifeways, it is assumed (based on comparisons with modern hunting groups and archaeological information from better-known areas of North America) that group sizes were fairly small and that settlements were moved often during the course of a typical year.

The Archaic period was characterized by the gradual development of more-or-less modern environmental conditions. Humans adapted to the

abundant resources provided by the interior woodlands, ponds, rivers, and the coastal estuaries by exploiting a broad range of food (e.g. nuts, large and small game, seed-bearing plants, fish, etc.). By 3,000 B.C., Long Island was heavily populated, with population of the entire island probably numbering in the thousands. Archaeological evidence of this apparent "population explosion" is reflected by the large number of archaeological sites dating to this period and by the size of the individual settlements, many of which exceed ten acres. Late Archaic settlements (long and short term) are found in all types of environmental settings, including those which are now within the Central Pine Barrens of interior Long Island.

The so-called Terminal Archaic (1,000 - 700 B.C.) is widely known as a period marked by the practice of elaborate funerary rituals. On Long Island, large cemetery complexes containing cremated human remains, stone bowls made from imported raw materials from Rhode Island, Connecticut, and/or Pennsylvania, fishtail-shaped projectile points, red ocher, and other symbolically important materials date to this time. During this age, pottery made its first appearance.

Archaeologically, little behavioral change was observable during the Woodland period. Some artifact forms were altered (e.g., projectile point shape) and pottery seemed to become increasingly important over time, but the long-established economic pattern of the exploitation of a broad range of natural resources continued. During the Late Woodland (ca. A.D. 1,000-1,500), agriculture (especially corn and beans imported from the American tropics) became very important in the economies of native groups living along the Hudson River and in what is now upstate New York. The importance of agriculture on Long Island during this time is still not well known, and is a topic much debated by archaeologists. Regardless of the importance of foods like corn, beans, and squash in the diet, it is clear that Native peoples on Long Island continued to hunt, gather, and collect the abundant products of the natural environment. This strategic use of a diverse range of available resources characterizes native economies on Long Island to the present day.

Native cultures were greatly changed with the

European arrival in the fifteenth and sixteenth centuries. Infectious diseases took a heavy toll and Indians were increasingly "marginalized" economically. However, even though native communities were ravaged by diseases and social disruption, they maintained and nourished their traditional ways of life. There was continuity in belief systems and the structure of social relations, despite the horrendous impact of infectious diseases introduced by the Europeans. These traditions continued well after European contact, and native peoples still actively maintain their ancestral communities and cultures. They live today on State-recognized reservations (Shinnecock and Poospatuck) and in enclaves throughout Long Island.

Figure 7-1: Prehistoric Chronology for Long Island

Period Name	Start	End	Characteristics
Late Woodland	1000 A.D.	1500 A.D.	<ul style="list-style-type: none"> • Agriculture begins in Hudson River and/or upstate New York, but status of Long Island agriculture at this time debatable.
Middle Woodland	0 A.D.	1000 A.D.	<ul style="list-style-type: none"> • Little change observable. • Increased use of pottery. • Intensive use of coastal resources.
Early Woodland	700 B.C.	0 A.D.	
Terminal Archaic	1000 B.C.	700 B.C.	<ul style="list-style-type: none"> • Elaborate burial customs and artifacts. • First appearance of pottery. • Stone bowls made from imported materials from elsewhere on East Coast.
Late Archaic	4000 B.C.	1000 B.C.	<ul style="list-style-type: none"> • Increase in number of archaeological sites and size of settlements. • Consumption of shellfish. • Population numbering in thousands by 3000 B.C.
Middle Archaic	6000 B.C.	4000 B.C.	<ul style="list-style-type: none"> • Appearance of modern flora and fauna.
Early Archaic	8000 B.C.	6000 B.C.	<ul style="list-style-type: none"> • Beginning of adaptation to interior.
Paleo-Indian	10,500 B.C.	8000 B.C.	<ul style="list-style-type: none"> • Arrived shortly after retreat of Late Pleistocene ice. • Fluted projectile points on weapons. • Small group sizes. • Frequent movements of settlements during year.

Prehistoric and historic Native American archaeological sites have been found throughout the Central Pine Barrens. These include remote areas without standing water, moraines, areas adjacent to rivers and other surface waters, and coastal areas. A number of sites are known to be present in municipal lands.

7.2.2 Historic and Cultural Resources

In addition to prehistoric resources, many historic resources are found in both the Core Preservation Area and the Compatible Growth Areas. Although somewhat isolated from primary settlements in the

colonial (period from approximately 1640 to 1776) and nineteenth century periods, this region traces an unusual variety of historic and cultural features warranting protection.

Historically, lumbering and woodcutting were among Suffolk County's most prominent industries. Before the Civil War, Suffolk was recognized as the first woodcutting county in New York State. Numerous cutting camps sprang up throughout the area to harvest hardwoods, such as white oak, to satisfy New York City's seemingly insatiable appetite for wood. It was used as a fuel and as a building material. Pine was harvested only after

hardwoods became scarce. The completion of the Long Island Railroad's main line in 1844 provided a condition in which numerous large scale fires, triggered by engine sparks and cinders, routinely ravaged the young trees spared by the woodcutters. This situation, and the continuing annual fires in various parts of the region, may have perpetuated the "barrens" of today.

Many other traditional activities occurred in the Central Pine Barrens. These activities included cranberry and blueberry farming in the vicinity of the Peconic River, brickmaking, the use of water-powered mills for grinding grain and milling lumber, duck farming, crop farming, nursery farming, operation of taverns, inns and general stores, sandmining, tanning, harvesting of wood (such as Atlantic white cedar) for shipbuilding and shingles, operation of forges for manufacturing iron products from bog iron, charcoal-burning for manufacture of charcoal, operation of gun clubs and hunting lodges and creation of pine tree products from sap (including turpentine and pine-tar).

Extensive remnants of Suffolk's historic past, can be found within the pine barrens zone. The region is dotted with the remains of old carriage roads, townscapes and structures which remain in mute testimony as evidence to the former isolated, inland settlements. Although the pine barrens region is often overlooked in serious evaluations of Long Island's architectural and social history, the region contains excellent examples of American architecture reflecting the 18th through the early 20th century schools. The region was involved in various incidents during the Revolutionary War. Numerous landscape features, such as Camp Upton's World War I trenches, also trace Long Island's heritage. Furthermore, the area contains some of Long Island's most famous landmarks, including magnificent Victorian homesteads, elegant hunting lodges, and the structure which spawned an entire American architectural style, the Big Duck.

A map, prepared by the Suffolk County Department of Planning, showing many of the known historic sites of the Central Pine Barrens is referenced in the Appendix. However, it should be noted that this illustrates only some, not all, of the existing historic resources in the Central Pine Barrens and does not show archaeological or Native American

sites.

7.2.3 List of Historic Resources within Brookhaven

The following is a list of historic resources in the Central Pine Barrens portion of the Town of Brookhaven. A more extensive description of these resources is cited in the Appendix. However, this list is by no means all-inclusive of all historic resources in Brookhaven:

Coram Historic District, Coram
Site of Richard W. Smith Tavern and
Town Pump, Coram
Coram Mini-District, Coram
Lester H. Davis House, Coram
Natural Swamp and Clay Area, Coram
St. Francis Church, Coram
Isaac Smith House, Coram
Walter Overton House, Coram
S. B. Swezey House, Coram
Washington Memorial Park, Coram
Site of Phannemiller/Ephelant House,
Coram
Brewster Terry House, Coram
Hammond/Higgins/Manzoni House, Coram
Site of I. Overton House & Cider Mill,
Coram
Gordon Heights District, Gordon Heights
Mary AME Zion Church, Gordon Heights
Mr. Lowry's Casino, Gordon Heights
Gordon House/McNeese Casino, Gordon
Heights
Community Missionary Baptist Church,
Gordon Heights
Mrs. Armstrong's House, Gordon Heights
The Ebenezer Sabbath Day Church,
Gordon Heights
St. Michaels Recreation Center, Gordon
Heights
H. D. Petty House, Middle Island
Site of Brewster House, Middle Island
Bayles House, Middle Island
Milestone, Middle Island
Middle Island Historic District, Middle
Island
Hudson House, Middle Island
Site of Swezey House, Middle Island

Middle Island Presbyterian Church, Middle Island
 Union Cemetery, Middle Island
 Lopped Tree, Middle Island
 Davis House, Middle Island
 Swezey Brick House, Middle Island
 "The Elephant Tree," Middle Island
 George Albing House, Middle Island
 Charles Edwards House, Middle Island
 Edwin Edwards House, Middle Island
 Major Leek House, Middle Island
 Hurtin House Archaeological Site, Middle Island
 Methodist Church, Middle Island
 Dayton House, Middle Island
 School Administration Building, Middle Island
 Davis House, Middle Island
 Cathedral Pines County Historic Trust Area, Middle Island
 Randall Cemetery at The Ridge, Ridge
 Randall House, Ridge
 New York State Fire Tower, Ridge
 Trenches and Bunkers, Town Rifle Range, Ridge
 Robert Randall House, Ridge
 Lustgarten Neon Sign, Ridge
 Cooperative Hunting Area Station, Ridge
 Longwood (Smith) Estate, Ridge (listed on the National Register)
 The Ridge School, Ridge
 Brookhaven National Lab/Camp Upton, Upton
 Trenches at Brookhaven National Laboratory, Upton
 Yaphank Historic District, Yaphank
 James H. Weeks House, Yaphank
 William J. Weeks House Foundation, Yaphank
 Michael Hololob House, Yaphank
 Mary Louise Booth House, Yaphank
 Anthony House, Yaphank
 St. Andrew's Episcopal Church, Yaphank
 Howell-Overhoff House, Yaphank
 Hammond House, Yaphank
 DeLa Marca-Kovarik House, Yaphank
 Homan-Gerard House, Yaphank
 Gerard Mill Site, Yaphank
 Robert H. Hawkins-Jacobsen House/Homestead, Yaphank (listed on National Register)
 Yaphank Community Shop, Yaphank
 Yaphank Garage, Yaphank
 Wittman Rabbitry, Yaphank
 Stroud House, Yaphank
 Lopped Trees, Yaphank
 Luhly House, Yaphank
 Greener House, Yaphank
 Neuss-Williams House, Yaphank
 Sylvester Homan House, Yaphank
 Richard Homan House, Yaphank
 Yaphank Union Cemetery, Yaphank
 Engelbach House, Yaphank
 School, Yaphank
 Overton-Mouzakes House, Yaphank
 Lakeview Building, Yaphank
 Joseph Hololob House, Yaphank
 Agnello House and Barn, Yaphank
 Herbert House and Milestone, Yaphank
 Cook House, Yaphank
 Ripple House, Yaphank
 Yaphank Presbyterian Church, Yaphank
 Presbyterian Parsonage, Yaphank
 Arthur Davis House, Yaphank
 John Ed Davis House, Yaphank
 Homan House, Yaphank
 Saggese House, Yaphank
 Serino B. Overton House, Yaphank
 Overton-Schmidt House, Yaphank
 Stills House and Pantentella House, Yaphank
 S. F. Norton House, Yaphank
 Swezey-Avery House, Main Street
 Hoeffner House, Yaphank
 Isaac Mills/Nathaniel Tuthill House, Yaphank
 D. D. Swezey House, Yaphank
 Hawkins Cemetery, Yaphank
 Robert F. Hawkins/Dooley House, Yaphank
 Mini-replica Octagon Firehouse, Yaphank
 M. Homan House, Yaphank
 Site of Mordecai Homan House, Yaphank
 Philips House, Yaphank
 C. Dayton House, Yaphank
 S.N. Randall House, Yaphank
 Howell House, Yaphank
 Siegfried Park, Yaphank
 Camp Sobaco, Yaphank
 J. P. Mills House, Yaphank
 A. Cook House, Yaphank
 Long Island Railroad Bridge, Carmans

River
 Southaven County Historic District,
 Yaphank
 Yaphank County Historic Trust Area
 (listed on National Register)
 Hudson House, Lake Panamoka
 Trinity Evangelical Lutheran Church,
 Rocky Point
 Robinson Barn, Rocky Point
 RCA Communications Sites (Radio
 Central), Rocky Point
 Howell House, Rocky Point
 Solomon Townsend/Jeremiah Petty Forge,
 Calverton
 Brown's Store, Calverton
 Brown's Bog Earthen Dam/Cranberry Bog,
 Calverton
 Manorville Depot Historic District,
 Manorville
 Sts. Peter and Paul Roman Catholic
 Church, Manorville
 Manorville Bible Protestant Church,
 Manorville
 Raynor House, Manorville
 Yeager House, Manorville
 General Store, Manorville
 The Maples, Manorville
 Morgan House, Manorville
 Lutheran Church (Morgan Property),
 Manorville
 Punk's Hole, Manorville
 Peterson House, Manorville
 Holman House/C. Robinson House,
 Manorville
 Robinson Family Cemetery, Manorville
 H. Husted House, Manorville
 H. Cozin House, Manorville
 Robinson House, Manorville
 Old Long Island Railroad Track/Right-of-
 Way (County Road 91 R.O.W.),
 Manorville
 A. B. Lane House, Manorville
 Manorville School (West Manor School),
 Manorville
 Raynor House, Manorville
 Schoolhouse, Manorville
 Elicha Carter House, Manorville
 E. Ahley/Landrella/Schneitzer House,
 Manorville
 L. Carter Barn, Manorville
 Mrs. R. Briggs House, Manorville

Manorville Cemetery, Manorville
 Cascer Garage, Manorville
 South Manor - Brookfield Historic District,
 Manorville
 Brookfield Presbyterian Church,
 Manorville
 Carter House (North) Site, Manorville
 Carter House (South) Site, Manorville
 Brookfield Cemetery, Manorville
 Wading River Road Cemetery, Manorville
 Wading River Road Lopped Tree,
 Manorville
 Robinson House, Manorville
 S. Davis House, Manorville
 M. Raynor House, Manorville
 Raynor House, Manorville
 South Street Lopped Tree, Manorville
 Davis House, Manorville
 R. Heinrich House/P. Julian House,
 Manorville
 Thomas Clark Memorial, Manorville
 Ruins of Marion DeLavarre Tomb,
 Eastport
 Beebe/Barrett House, Eastport
 Hunters Garden, Manorville
 Rock Hill, Manorville
 Tallmadge Historic Trail, Mount Sinai,
 Middle Island, Coram, Yaphank
 Synagogue Stones, Mount Sinai

7.2.4 List of Historic Resources within Riverhead

Riverhead Town contains numerous historic resources. Many are located along the Peconic River, where a number of mills and forges were found. The following is a list of historic resources in the Central Pine Barrens portion of the Town of Riverhead. A more extensive description of each of these resources is referenced in the Appendix. This list is by no means all-inclusive of historic resources in Riverhead:

Gilbert Raynor House, Manorville
 Davis-Johnson Cranberry Bogs, Manorville
 Lopped Tree, Manorville
 Grumman Airport, Calverton
 Babylon Rod and Gun Club, Manorville
 Mill Site, Manorville
 Rychlinski Blueberry Farm, Manorville
 Calverton Pickle Factory, Calverton
 Central Hotel, Calverton

Calverton Depot, Calverton
Dickinson House, Calverton
Peconic Mills, Calverton
Warner's Duck Farm, Calverton
Old Forge and Swezey Ice House,
Calverton
Camp Wauwepex, Wading River
The Horn Tavern Farm, Wading River
Robert Cushman Murphy County Park -
River Road and Swan
Pond Historic Areas, Manorville

7.2.5 List of Historic Resources within Southampton

Although a number of historic resources are likely to be present in the Central Pine Barrens area of Southampton, no comprehensive inventory was available for inclusion in this section. However, these sites constitute a partial listing:

Black Duck Lodge, Hubbard County Park,
Flanders
Flanders Men's Club, Flanders
The Big Duck, County Site, Flanders
James Benjamin Homestead (Old Benjamin
Homestead), Flanders (listed on National
Register)

7.2.6 Central Pine Barrens Sites Listed on the National Register

There are a number of sites in the Central Pine Barrens which are listed on the National Register of Historic Places. These are as follows:

James Benjamin Homestead (Old Benjamin
Homestead), Flanders
St. Andrew's Episcopal Church, Yaphank
Longwood (Smith) Estate, Ridge
Robert Hawkins Homestead, Yaphank
Homan-Gerard House and Mills, Yaphank

No single, all-inclusive and comprehensive history or inventory of all known cultural resources currently exists for the Central Pine Barrens. There are, however, separate histories on certain topics in many locations. In addition, there are incomplete inventories such as those cited previously.

7.2.7 Existing Public and Private Programs

The following is an overview of existing public and private programs within the Central Pine Barrens for the protection, preservation and restoration of cultural resources and demonstration programs of traditional industries of the Central Pine Barrens.

7.2.7.1 New York State Office of Parks, Recreation and Historic Preservation

The New York State Office of Parks, Recreation and Historic Preservation administers various State laws and regulations concerning cultural resources in the State. These include the New York State Historic Preservation Act of 1980 and Certified Local Government Programs (copies of pertinent laws and regulations are referenced in the Appendix).

The Historic Preservation Act requires that projects sponsored or funded by the State be reviewed for potential impacts to cultural resources; establishes a State Register of Historic Places (similar to the National Register of Historic Places); provides a degree of protection for sites and structures listed on the State Register; and establishes a State Board for Historic Preservation to provide for review of State-sponsored or funded projects which may have impacts on cultural resources.

The Historic Preservation Act was also designed to encourage and assist local governments and private organizations to develop and undertake local preservation programs and activities for the preservation, maintenance and restoration of historical, archaeological and cultural resources. This includes the preparation of "Local Historic Preservation Reports" which cover the current status of local preservation programs; analyzes current preservation problems and proposals for the preservation of cultural resources. In addition, the Historic Preservation Act provides for enactment of local laws and regulations for historic preservation including transfer of development rights, local preservation boards, designations and acquisitions.

The State Office of Parks, Recreation and Historic Preservation also administers the Certified Local Government program. This program is authorized by the amended National Historic Preservation Act

of 1966 and provides for grants-in-aid, via the State Historic Preservation Office, to local governments for historic preservation purposes. Aid is available to those local governments which have enacted a local program for historic preservation which meets certain minimum standards (generally requiring stronger local preservation regulations than most municipalities currently have) set forth by the Federal government and the State. As far as is known, none of the local governments within the Central Pine Barrens have preservation programs which have been certified. There are, however, other local governments on Long Island which have received certification for their preservation programs and which are near the Central Pine Barrens. These are the Villages of Sag Harbor and East Hampton.

The State Office of Parks, Recreation and Historic Preservation also provides review comments to municipalities in regard to potential impacts of development projects on cultural resources. The office informs municipalities of the presence of any known cultural resources in proximity to a site for which information is requested. Part of such information includes New York State Building Inventory Forms known as "Blue Forms," which contain a written and photographic synopsis of cultural resources, primarily historic structures, in the State and which are completed by interested parties. However, some files and information maintained by this agency may not be current. State Parks currently has only one park site in the Central Pine Barrens, Brookhaven State Park located in Ridge and Shoreham, which is undeveloped at present. There are no immediate plans for development of the site as a State Park.

State Parks currently conducts some interpretive demonstration programs at active, developed State Parks located outside of the Central Pine Barrens such as the Caleb Smith State Park in Smithtown. State Parks has no current plan for traditional industries demonstration programs nor programs for restoration of cultural resources in the Central Pine Barrens because these would be provided only for State Parks and the one State Park in the Central Pine Barrens is undeveloped. If Brookhaven State Park were to be developed, or another site were to be acquired by State Parks within the Central Pine Barrens, then the need for such a traditional

industries demonstration program could be evaluated.

7.2.7.2 State Environmental Quality Review Act

The current version of the State Environmental Quality Review Act (SEQRA) requires that impacts to cultural resources be considered when reviewing projects. Part 617, Section 617.11(5) of the SEQRA regulations requires that agencies consider the potential for a project to result in:

the impairment of the character or quality of important historical, archaeological, architectural, or aesthetic resources or of existing community or neighborhood character.

In addition, Part 617, Section 617.12(9) of the SEQRA regulations designates as a Type I action:

any Unlisted action (unless the action is designed for the preservation of the facility or site) occurring wholly or partially within, or substantially contiguous to, any historic building, structure, facility, site or district or prehistoric site that is listed on the National Register of Historic Places, or that has been proposed by the New York State Board on Historic Preservation for a recommendation to the State Historic Preservation Officer for nomination for inclusion in said National Register, or that is listed on the State Register of Historic Places.

7.2.7.3 U.S. Department of the Interior and the Federal Government

The National Historic Preservation Act of 1966 and Executive Order 11593 (issued in 1971) set forth the Federal government's regulatory program for preservation of cultural resources (copies are cited in the Appendix). The Preservation Act authorizes the Department of the Interior to establish and maintain the National Register of Historic Places

(which includes all types of cultural resources), provides for and encourages a national program of cultural resource protection, provides for grants-in-aid to the states and local governments for cultural resource preservation and delegates certain preservation duties and responsibilities to the States. The Executive Order (11593) requires Federal agencies to consider potential impacts of Federally sponsored or funded programs on cultural resources.

On Long Island and in the Central Pine Barrens, the implementation of these Federal regulations is visible in protection of sites via designation to the National Register and National Landmark status, through programs administered by the State as agent for the Federal government and through preservation funds disbursed via the State.

7.2.7.4 The New York State Museum

The State Museum, located in Albany, responds to queries from municipalities regarding potential impacts of development projects on prehistoric and archaeological cultural resources, and the presence of any known cultural resources in proximity to specific sites. As part of this service, the State Museum will also rate a site according to whether or not it contains, or is adjacent to, features which represent a high probability or sensitivity for the presence of such cultural resources. This helps determine the need for a Cultural Resource Survey. Special forms are used for the inquiries and are referenced in the Appendix. The State Museum also maintains a registry of Cultural Resource Surveys.

7.2.7.5 Suffolk County Historic Trust

The definition of "distinctive historical significance" of the Suffolk County Charter is established by:

1. The National Register of Historic Places, National Park Service, United States Department of the Interior, as authorized under the Federal Historic Preservation Act of 1966.
2. The National Trust for Historic Preservation as set forth in *Historic*

Preservation Tomorrow - Revised Principles and Guidelines, National Trust for Historic Preservation and Colonial Williamsburg, 1976.

The Historic Trust concerns itself with all aspects of the preservation of historic buildings, fences, street furniture, trees (including lopped trees), kettleholes, roads, roadsides, boundary ditches, and historic landmarks. These include, but are not limited to: residences and out buildings; commercial and industrial structures and areas; farm buildings; accessory buildings; engineering works (including trestles, bridges, towers, canals, piers, dry docks, wharfs, waterworks, etc.); lighthouses; government buildings; railroad stations and other railroad facilities; educational buildings (including schools and academies); abandoned religious structures; fortifications and ramparts; Indian fields and village sites; cemeteries and village greens; and archaeological sites and their environs.

The Suffolk County Department of Parks, Recreation and Conservation and its Board of Trustees, together with the Director of Historic Services, should, in most instances, be the stewards of properties dedicated to the Historic Trust with custodianship for each property to be decided individually. In most cases, the Department of Parks will also have custodianship, but it is possible that a particular property, or an item, may be entrusted to the custodianship of another, e.g., another County department or even a local historical society or organization. In the case of roads or highways dedicated, the Department of Public Works normally would be the logical steward, except that the Director of Historic Services should be responsible for supervising such a road's historic integrity.

Dedication of County-owned historic properties to the Historic Trust is resolution of both the Suffolk County Legislature and County Executive. The resolution dedicating County-owned property to the County Historic Trust must specify the purpose(s) for which the property may be used.

Unless authorized by charter law approved upon mandatory referendum, property owned by the County and dedicated under this section to the County Historic Trust shall not be taken nor

otherwise disposed of, nor shall it be used for any purpose not specified in the resolution by which the property was dedicated.

Details of Historic Trust dedication and management can be found in the *Suffolk County Historic Trust Manual*, revised edition 1975 (copy of which is cited in the Appendix). Alteration or change of any Historic Trust site owned by the County is considered a Type I action under SEQRA and requires the preparation and submission of a special form and documentation (copy is referenced in the Appendix). Through the County Trust, the Director of Historic Services of the County Parks Department have been involved in the restoration of historic structures in County Parks.

7.2.7.6. Suffolk County Department of Parks and Recreation

The Suffolk County Department of Parks has a number of sites within the Central Pine Barrens. These include Hubbard County Park in Flanders, Cranberry Bog County Nature Preserve in Riverhead, Southaven County Park in Yaphank and Robert Cushman Murphy County Park along the Peconic River, as well as several other undeveloped parklands.

There are currently no demonstration programs of traditional industries within the Central Pine Barrens provided at any of these parks. The traditional activity of hunting does have long-established roots in several of these sites, some of which contain former hunting lodges and gun clubs. Hunting continues in several of these County parks. The Suffolk County Parks Department is currently researching and analyzing the possibility of providing programs within these sites which would replicate traditional industries which formerly occurred in each particular park site.

Traditional industries which occurred within or adjacent to these sites included cranberry farming, milling of lumber and grain, cordwood production and harvesting of Atlantic white cedar for shipbuilding and the manufacture of shingles. An example of a demonstration program might center on Cranberry farming. It formerly occurred at both the Cranberry Bog County Nature Preserve and the Robert Cushman Murphy Park. The county

possesses the tools which were used by the original farmers of the area. They could be used if a demonstration program is initiated. The infrastructure of the bog system could be restored as part of the program. Other potential demonstration programs could revolve around sawmills and grist mills, since such milling operations occurred within or adjacent to several of the above-named parks.

In addition, the possibility of providing an actual structure for holding interpretive programs, including those related to traditional industries demonstrations, could be examined. Several of the County sites contain historic structures, and those of more recent vintage could perhaps be restored for such educational uses. The potential for cooperative efforts in conjunction with other agencies and organizations could also be examined. It should be noted that this agency has prepared an inventory of archaeological and historic resources for many of its properties in the Central Pine Barrens.

7.2.7.7 Town of Southampton

The Town of Southampton does not have a comprehensive listing of known cultural resources within the Central Pine Barrens. However, the Town does have a Town Historian who maintains historical records of the Town and provides guidance and input with regard to historical structures in the Town.

Town Law #40 provides some oversight with regard to historic structures. It also established a Town Landmark committee and procedures for providing protection of sites designated as Town Landmarks. This Committee advises the Town Board on historic sites and structures, and works in conjunction with the Town Planning Board and Town Planning Department in protecting historic sites (more detailed information is referenced in the Appendix). The Town Planning Department utilizes SEQRA, the State Historic Office Archaeological Sensitivity Map, Suffolk County Archaeological Association archaeological sensitivity map and other criteria (including the presence of certain ecological or geological features such as outwash plains north of the Ronkonkoma Moraine, ponds, streams, kettleholes and estuaries)

to determine when a Cultural Resource Survey should be conducted for development sites. The use of certain land use techniques such as clustering has been employed to provide protection for archaeological sites when they are discovered. The Town is restructuring its land use programs and is currently preparing an update of its comprehensive plan which will include an inventory of cultural resources.

7.2.7.8 Town of Riverhead

The Town of Riverhead has an Historic Landmarks Committee and an Architectural Review Board which review some projects on historic sites. A survey of historic sites was conducted by the Society for the Preservation of Long Island Antiquities in 1977 for historic structures in the Town. More recently, an historic structures survey is being conducted for a Business Improvement District in the Town. Additionally, the Town has a Town Historian who provides input regarding historic sites and cultural resources.

7.2.7.9 Town of Brookhaven

In the Town of Brookhaven, Chapter 85, Article XVII of the Town Code establishes an Historic District Advisory Committee, Town Historic Districts, Town Landmarks and procedures for reviewing potential impacts to Historic Districts and Landmarks, such as proposed demolitions (a copy of the pertinent code section is cited in the Appendix).

The Historic District Advisory Committee advises the Town Board and Planning Board with regard to impacts on Town Historic Districts and Town Landmarks. There are currently two Town Historic Districts in Brookhaven in the Central Pine Barrens: the Yaphank Historic District which encompasses Main Street and a portion of Yaphank-Middle Island Road in the center of Yaphank and the Longwood Historic District which encompasses wholly Town-owned land located on the north and south sides of Longwood Road, east of Smith Road and west of William Floyd Parkway in Ridge. The Town Historic District Advisory Committee has also prepared and published a comprehensive handbook to be used in review of projects in historic districts and those involving historic

landmarks and for use in renovation and restoration of structures and sites (a copy is referenced in the Appendix).

The Town Department of Planning, Environment and Development currently reviews projects for potential impacts on cultural resources. The Division of Environmental Protection maintains an inventory of prehistoric, archaeological and historic sites (both in graphic map form and written form) which it utilizes in determining the potential for impacts on such resources by development. During the course of SEQRA reviews, the Division requests the preparation of Cultural Resource Surveys for development projects which may have an adverse impact on cultural resources. This is based on consultation with other agencies including New York State Historic Preservation Office (SHPO), review of the cultural resource maps, site inspections and procedures established by the Division's former part-time Cultural Resource Analyst/Archaeologist.

An informal agreement between the Division of Environmental Protection and the Building Division requires review of all demolition permit applications for potential impacts to cultural resources, prior to issuance of the permit. If significant cultural resources, such as an historic house, are determined to be present, mitigation and alternatives are investigated. These include the preparation of a Cultural Resource Survey or Building Survey and/or the potential for donating the structure to a cultural resource preservation organization.

The Town Historian preserves and maintains Town historical records and provides historical information in response to queries. The Historian is also responsible for the maintenance of Town-owned historic cemeteries. The Town Historian is responsible for overseeing restoration of certain Town-owned historic structures, especially the Smith Estate at Longwood, and for overseeing the Town's annual Longwood Fair held every September at the Smith Estate. The primary theme of this fair is historic. The Town fair includes demonstrations of traditional industries, though not necessarily those directly transferable to the Central Pine Barrens, and provides a forum for various historic preservation organizations.

7.2.7.10 The Society for the Preservation of Long Island Antiquities

The Society for Preservation of Long Island Antiquities (SPLIA) owns, preserves and maintains several historic sites on Long Island. In addition, this organization provides expert input, upon request, to various agencies and organizations in regard to cultural resource preservation. It also maintains an historic research library. This organization has no official role, but was involved in completing the New York State Historic Resources Inventory for Brookhaven Town in the 1970s and early 1980s. It was also involved in the inventories conducted for Riverhead Town. The organization does not maintain any historic structures or sites, or archaeological sites, within the Central Pine Barrens and is not interested at this time in management of cultural resources in the Central Pine Barrens. Additional commentary from this organization is referenced in the survey in the Appendix.

7.2.6.11 The Suffolk County Archaeological Association

The Suffolk County Archaeological Society (SCAA) is concerned with the discovery, preservation and study of archaeological resources in Suffolk County. The Society includes professionally-trained members who provide technical input on archaeological resources, upon request, to both public and private agencies and organizations. In addition, the Society is involved in fostering education about such matters and has published an extensive body of research publications in the field.

The Society also sponsors a series of demonstration programs. These are the Long Island Native Life and Archaeology program at the Hoyt Farm Preserve in Commaek and the Colonial Life and Technology Program (detailed descriptions of these programs are referenced contained in the Appendix), both of which are open to the general public. The SCAA notes that there is a movement towards increasing student awareness and participation in such programs, especially to foster a sense of stewardship.

Consideration could be given to the possibility that

this organization could be involved in programs related to Central Pine Barrens industries, perhaps even occasionally housed in appropriate Central Pine Barrens sites. This organization would be interested in the management of cultural resources in the Central Pine Barrens as it originated the first Cultural Resource Survey of Suffolk County in 1978. The SCAA has attempted to obtain funding to have this inventory updated but has been unable to procure such funds. The SCAA believes that a comprehensive, current inventory of cultural resources in the Central Pine Barrens should be conducted to guide development. It further recommends the hiring of a full or part-time archaeologist or cultural resource analyst to guide Commission decisions and review of matters involving cultural resources and to ensure the quality of Cultural Resource Surveys conducted in the Central Pine Barrens. Additional commentary from this organization is referenced in the survey in the Appendix.

7.2.7.12 Manorville Historical Society

The Manorville Historical Society is a chartered historical society which is concerned with the collection, preservation and dissemination of information regarding the history of Manorville, and with the preservation, repair and restoration of historic sites in Manorville. This organization is also involved in the acquisition and preservation of books, manuscripts, pictures, relics and other articles of historic interest related to Manorville. Additionally, the Manorville Historical Society is involved in the recognition of historic sites and their designation as landmarks.

This organization currently leases the former West Manor Schoolhouse which it is in the process of restoring. It is also currently involved in the protection of area cemeteries thus ensuring that they receive proper care. The Society recommends more care be granted to historic sites, especially cemeteries, and that development review provide for a greater accounting of, and protection for, cultural resources. Additional commentary is provided in the survey referenced in the Appendix.

7.2.7.13 Yaphank Historical Society

The Yaphank Historical Society is a not-for-profit

organization founded in 1974. It is devoted to the promotion and encouragement of historical research. Subject areas of particular interest are: the gathering and dissemination of information concerning the early history of the Yaphank Fire District; the gathering and preserving of books, manuscripts, papers and relics relating to the early history of Yaphank and contiguous areas; marking areas of historic interest with monuments and markers; acquiring or obtaining custody of historic places; acting as the unofficial caretaker of the Town's Yaphank Historic District; promoting the preservation and restoration of all historic structures and sites within the Yaphank Fire District and surrounding areas; and, providing historical research materials for public use and education. It also maintains inventories of historic sites in the area.

It does not regularly review development projects but provides comments to them if the Society determines that the project has the potential to have an adverse impact on cultural resources. The Society is responsible, via a cooperative effort with Suffolk County, for the maintenance and management of the Robert Hewlett Hawkins House (ca. 1850 and listed on the National Register) located on Yaphank Avenue. The Society is also prepared to be involved in the restoration and management of other historic sites in the area within the Central Pine Barrens. Additional commentary from this organization is referenced in the survey in the Appendix.

7.2.7.14 The Nature Conservancy

The Nature Conservancy owns and/or manages a number of holdings in the Central Pine Barrens. At present, there are no identified cultural resources on these sites. The Nature Conservancy has stated that if they did encounter such resources, they would be protected and included in management plans for their sites and would cooperate with other agencies in their protection. However, cultural resources are not contained within the mission of this organization. Additional commentary from this organization is cited in the survey in the Appendix.

7.2.7.15 Suffolk County Historical Society

The Suffolk County Historical Society was founded

in 1886. Its primary purpose is to collect, preserve and interpret the history of Suffolk County, including that of the Central Pine Barrens. The Society has three main areas of operation: a museum open to the public, a research library and archives available for public use and a department of education which is responsible for providing educational programs for schools. The Society holds exhibitions on various historical topics and prepares and conducts interpretive program of traditional industries from Suffolk County's past. This organization could provide interpretive and demonstration programs of traditional industries of the Central Pine Barrens.

7.2.7.16 Other Organizations

The Suffolk County Cooperative Extension operates the Suffolk County Farm which is located in Yaphank just outside, and south of, the Central Pine Barrens boundaries. The farm provides interpretive programs which include demonstrations of farming activities which formerly occurred in the Central Pine Barrens. Consideration could be given to tapping the technical expertise of the farm staff in developing demonstration programs of traditional Pine Barrens industries.

Although not located in the Central Pine Barrens, Old Bethpage Village Restoration in Nassau County, a recreation of an historic village of the mid-19th Century, may be able to provide technical input concerning historical issues. Some of their programs could be emulated in the Central Pine Barrens. Various traditional trades of the mid-1800s are demonstrated at the Restoration including blacksmithing, hat-making, farming and operation of a general store. In addition, the Restoration has extensive technical expertise in restoration of historic sites. The Shinnecock Nation, whose reservation is located in Southampton east of the Central Pine Barrens, annually sponsors a pow wow on Labor Day weekend as part of their continuing program of cultural awareness. In addition, the Shinnecoeks have recently developed a cultural center and museum in Southampton and a program of weekend interpretive and traditional industries camps for non-natives.

8. Scenic Resources

8.1 Environmental Conservation Law Provisions Regarding Scenic Resources

The Long Island Pine Barrens Protection Act (Environmental Conservation Law Article 57) includes scenic resources in the class of resources to be considered during preparation of the Pine Barrens Plan. It also includes unique scenic resources which are of regional or statewide significance as one of the bases of Critical Resource Area definitions. Additionally, in the promulgation of the interim goals and standards for development during the planning period, the Commission included scenic resources as one of the factors to be considered and accounted for in development applications.

Scenic resources had been previously explicitly addressed by the State Legislature. The legislature, in 1972, passed the Wild, Scenic and Recreational Rivers Act (Article 15 of the Environmental Conservation Law). The Rivers Act was intended to protect and preserve, in a free-flowing status, those rivers of the state which possess outstanding natural, scenic, historical, ecological and recreational values important to present and future generations. Rivers meeting the Act's criteria may be designated by the State Legislature for inclusion in the program. They are placed within the wild, scenic or recreational categories based upon current land use patterns.

Currently, four Long Island rivers are within the Act's provisions: the Peconic, Carmans, Connetquot and the Nissequogue. Of these, the Peconic River (in its entirety), and the Carmans River's northern stretch (that portion north of Sunrise Highway) are within the Central Pine Barrens area.

The Rivers Act provides for the setting of boundaries around each river's banks. Development proposals within these boundaries are then reviewed by the New York State Department of Environmental Conservation.

8.2 Definition and Identification of Scenic Resources

The inventory and analysis of scenic resources of the Central Pine Barrens necessarily requires a practical operational definition.

Scenic resources are defined as those landscape patterns and features which are visually or aesthetically pleasing and which therefore contribute affirmatively to the definition of a distinct community or region within the Central Pine Barrens.

Application of this operational definition is guided by the results of studies performed elsewhere, including New Jersey and Cape Cod. The *New Jersey Pinelands Comprehensive Plan* (1981), for example, utilizes the results of a study of visual preferences. Those results identified generic categories of landscapes and views which respondents found appealing. Generally, landscapes with surface water, undisturbed forests and scenes showing small degrees of human impact were found to be preferable over suburban, commercial, excavated or otherwise extensively disturbed landscapes. The study also discriminated among specific categories of preferred water or forest views.

Similarly, Cape Cod's *Regional Policy Plan for Barnstable County* (1991) reported that rural character was important to 74% of the respondents in their choice to live on the Cape, based upon a residents' survey. Consistent with this finding, 60% identified the loss of open space as one of the most serious issues facing the area, and 71% urged protection of scenic landscapes be undertaken.

Consequently, these findings permit us to qualitatively address the value judgement problem posed by the well-worn adage "beauty is in the eye of the beholder." This is accomplished by including in the inventory those scenic resources falling within categories which ranked high on such surveys.

8.3 Functions of Scenic Resources

Scenic areas, open spaces, rural landscapes, vistas, country roads and other factors interact to produce a net effect upon individuals or communities. Some of the commonly listed benefits of this complex of landscapes attributes include:

- **Defining the character of human communities physically located within the area.** This "sense of place" may in turn influence which communities within an area become more desirable locations to live than others.
- **Distinguishing one community from neighboring ones,** by providing physical and perceptual breaks among them. This, in turn helps build a regional identity founded upon a diversity of built and unbuilt areas.
- **Displaying the natural resources of an area, and thereby encouraging tourism and recreational industries with a positive economic benefit.** The *Cape Cod Regional Policy Plan* (1991) estimates that some 48% of that region's economic base is derived from tourism and summer visits, and that activity is linked to rural character and open space resources.

Perhaps the most noteworthy aspect of scenic and aesthetic resources is their *infinite renewability*. Cultural, social and economic activities which are based upon such resources, therefore, can be sustained indefinitely.

8.4 Inventory Methodology

Scenic resources are not definable in isolation from other resource categories. Historic sites and buildings, archaeological sites, community gathering places, surface water bodies, shorelines, rural roads, etc. may be part of, or stand separate from, larger geographic areas identified as scenic. Overlap among resource inventories should therefore be expected. The inventory below notes a number of such overlaps.

Scenic resources are inventoried here within a scale range practical for the study area. Generally, those identified have an areal extent of several acres or larger. Scenic linear features are generally listed only if they are one half to one mile or more in length. This precludes a listing of individual historic buildings, bridges, small creeks, short trail or road segments, etc., despite their possessing "scenic" qualities individually.

At the other end of the spectrum, very large land areas or vague descriptions are also avoided, as they contribute little to eventual analysis or recommendations. Thus, the inventory excludes such entries as "the Core Preservation Area," "all two lane roads within the Core Preservation Area," "all surface waters," etc.

8.5 Scenic Resource Inventory for the Central Pine Barrens

8.5.1 Sunrise Highway (NYS 27) from CR 51 intersection east to NYS 24 intersection
This broad, clear road segment offers northerly views of the Manorville and Riverhead Hills, northerly and southerly views of the dwarf pine plains, Flanders hills, the glacial outwash plain and agricultural lands. Eastbound travelers, under clear conditions, obtain a wide sweep from the north through the east.

8.5.2 RIVERHEAD-MORICHES ROAD (CR 51) AND CENTER DRIVE FROM CR 111 NORTH TO RIVERHEAD COUNTY CENTER.

This roadway provides wide, expansive views of the Manorville and Riverhead Hills, southerly views from the top of moraine and northerly views of Riverhead hamlet and the northerly farmland. This corridor contains one of the few views of the Riverhead region available to motorists or touring cyclists; most such views are available only from interior trails traversing the moraine.

8.5.3 RIVERHEAD-MORICHES ROAD (CR 63) FROM CR 51 NORTH TOWARD RIVERHEAD

This segment provides glimpses of the open water of Wildwood Lake (looking northeasterly through easterly), the NYS Sarnoff Preserve and portions of Cranberry Bog County Nature Preserve.

8.5.4 RIVERHEAD-WESTHAMPTON ROAD (CR 31) AND RIVERHEAD-QUOGUE ROAD (CR 104) FROM SUFFOLK AIRPORT NORTH TO RIVERHEAD

The dwarf pine barrens and the NYS Sarnoff Preserve are visible here. See the separate inventory entries for the Dwarf Pine Barrens and the Riverhead Hills.

8.5.5 FLANDERS ROAD (NYS 24) FROM APPROXIMATELY CROSS RIVER DRIVE (CR 105) EAST TO JACKSON AVE.

Flanders marsh, Birch Creek, Owl Pond and Sears Bellows County Park line this heavily forested corridor. This roadway also passes Birch Creek Road (with its undeveloped Peconic Bay view) and Spinney Road (an interior forest road now split by Sunrise Highway). Architectural history is revealed along stretches of this road to the careful observer. Examples include the 19th century Flanders boarding houses (frequented by vacationing urbanites in the days prior to the paving of Flanders Road), some of the earliest-built private residences in eastern Suffolk (many continuing in private use), several private fishing and hunting club sites (although the actual structures are generally not visible from the main road), and, of course, the much publicized Big Duck.

8.5.6 YAPHANK HAMLET AND YAPHANK-MIDDLE ISLAND ROAD (CR 21) FROM LOWER LAKE NORTH TO CATHEDRAL AND PROSSER PINES

Views available here include the northerly edge of Southaven County Park and the open waters of Lower Lake (Carmans River system), Yaphank hamlet and historic district, Upper Lake (a Brookhaven town park), Warbler Woods and Flower City county preserves, Cathedral Pines County Park and Prosser Pines County Nature Preserve. Considerable historic and cultural resources are present here, and form the basis for part of the scenic nature of the area.

8.5.7 WILLIAM FLOYD PARKWAY FROM NORTHERLY EDGE OF BROOKHAVEN LABORATORY NORTH TO ROUTE 25A

This segment's scenic qualities are derived from an essentially intact buffer of pitch pines and oaks along both sides of the roadway. This continuous green corridor is reinforced by a center median which is heavily wooded north of the Whiskey Road intersection. Few curb cuts or traffic signals disrupt the traveler's impression. Views of the state and town parkland along the eastern side (from

Whiskey Road northbound) comprise the buffer on that side.

8.5.8 ROCKY POINT ROAD (CR 21) FROM APPROXIMATELY WHISKEY ROAD NORTH TO NORTHERN EDGE OF STATE PRESERVE

This corridor is almost entirely forested, with a state-leased farm tract at the intersection with Whiskey Road. A number of natural and historical resources are found off this road corridor (see the separate entry for the NYS Rocky Point lands).

8.5.9 NORTH STREET AND MILL ROAD THROUGH MANORVILLE HAMLET

This area is lightly developed residentially, with a mix of forest, field and agricultural land uses interspersed.

8.5.10 SCHULTZ ROAD AND WADING RIVER-MANORVILLE ROAD

Some light residential development occurs within the large county and federal holdings which dominate the land uses here.

8.5.11 NYS ROCKY POINT NATURAL RESOURCE MANAGEMENT AREA

This 5100+ acre tract includes both marked and unmarked trail systems, with views ranging from north shore forests to pitch pine reclaimed areas and mixed pine-oak woods. Morainal topography occurs in the northern areas, with some open vistas at select points. The northwest quadrant is particularly rolling, with hollows and pocket depressions. Visible to the educated eye, are the scattered artifacts of the former use of the site by the RCA Corporation as a world-wide radio facility. Historical resources are also found in the Sarnoff Preserve (see the Riverhead Hills entry). These historical resources complement the natural resource value of both areas by partly explaining the visually striking patterns of current vegetative cover and trail layouts.

8.5.12 PROSSER PINES COUNTY NATURE PRESERVE

A former white pine plantation, Prosser Pines offers a visually distinct experience through its modest trail circuit which lies under the high, shaded canopy of the white pines. Planted during the 19th century, this area complements the historical resource value of the nearby Yaphank hamlet and road corridor.

8.5.13 SOUTHAVEN COUNTY PARK AND CARMANS RIVER

Scenic views of, and from, the Carmans River abound here. An extensive trail and road system lead from the southerly end, where the river is broad, to the northern end, where the waters of Lower Lake feed into the narrow, fast moving stream of the Carmans River there. Historical and cultural resource values are also abundant, as the site continues to serve its traditional role as a hunting, fishing and canoeing area. Park buildings found here tell the story of the era of the Long Island sportsmen's camps, dating from only one or two generations.

8.5.14 BROOKHAVEN STATE PARK

Marked and unmarked trails traverse the hilly glacial topography in the northerly stretches. Paths often follow contours, emphasizing swales, kettleholes, and ridges. Further south, the trails reveal a mixture of forest types, including a flat, savannah-like area.

8.5.15 PECONIC RIVER AND ASSOCIATED COASTAL PLAIN PONDS FROM MIDDLE COUNTRY ROAD (NYS 24) SOUTH TO SCHULTZ ROAD AND EAST TOWARDS CONNECTICUT AVENUE

A large, somewhat linear, L-shaped corridor, this extensive county holding offers numerous pond shore views from interior trails and roads. Scenic views are provided by such ponds as Woodchoppers, Round, Sandy, Grassy, Duck, Zeeks, Jones and Peasys. Scenic areas are also found in interior trails, especially as they traverse fields or cross vegetation types.

8.5.16 SWAN POND COUNTY PARKLAND

Swan Pond and the former cranberry bogs to its south (into which Swan Pond drains), and the associated uplands offer open water and field views. A boat launch site and an earthen dam provide numerous water views. These are somewhat isolated from the main complex of the Peconic River system noted above, but are distinguished by their views of the former bogs, and the bird life which they now support. Artifacts of former bog activity are present, as they are in Cranberry Bog County Nature Preserve (see separate entry).

8.5.17 MANORVILLE-RIVERHEAD HILLS FROM ROUGHLY THE LONG ISLAND EXPRESSWAY EXTENDING ALONG AN ARC

RUNNING SOUTHEAST AND EAST TO CR 51
A clear day unlocks extensive views from here to the southwest, south and southeast, often reaching to the Atlantic Ocean waters. A number of specific sites are identified on trail maps and guides, and include, for example, Bald Hill and several ridge lines offering views to the north as far as the Long Island Sound bluffs. Trail systems, ridge lines and kettleholes provide other viewpoints. Significant historical sites are also found here, a notable example of which is the traditional semi-annual gathering place known as Hunters Garden.

8.5.18 RIVERHEAD HILLS, AN EXTENSION OF THE ABOVE "ARC", RUNNING FROM CR 51 EAST PAST SUFFOLK COMMUNITY COLLEGE, SPEONK-RIVERHEAD ROAD TO CR 104

This area includes the Hampton Hills county parkland and the NYS David Sarnoff Preserve. Views here include a southerly sweep of the entire dwarf pine barrens area (from the elevations immediately below the radar domes off of CR 51), views of Wildwood Lake, views to the north from the trail system on the southerly portion of the Sarnoff Preserve, and short distance vistas afforded by the rolling nature of the morainal topography.

8.5.19 CRANBERRY BOG COUNTY NATURE PRESERVE LOCATED SOUTH OF RIVERHEAD COUNTY CENTER
Pond shore views, former cranberry bogs, white cedar swamps, upland pitch pine forests are all within short distances in this preserve. With assistance, the visitor can interpret a number of historical artifacts found there to learn about the operation of a typical cranberry bog. This is also evidenced at the Swan Pond site cited elsewhere in this inventory.

8.5.20 SEARS BELLOWS / MAPLE SWAMP / FLANDERS HILLS COUNTY PARKLAND FROM FLANDERS ROAD (NYS 24) SOUTH TO SUNRISE HIGHWAY; FROM PLEASURE DRIVE EAST TO BELLOWS POND ROAD

This complex consists of diverse vegetation, upland forests, high and breezy ridges east of Spinney Road with some short distance views to the east, and wetlands and surface waters associated with Maple Swamp, Birch Creek, Owl Pond, Sears Pond and other local water bodies. Extensive stands of mountain laurel exemplify the diversity of trail views in the midst of the pine-oak woodlands here.

8.5.21 SOUTH FLANDERS AND HENRY'S HOLLOW REGION

Considerable topographic relief (where the moraine falls off abruptly south of Sunrise Highway) offer scenic views here of the knob - and - kettle topography.

8.5.22 DWARF PINE BARRENS

In addition to being the subject of views referenced above, the dwarf pine barrens also offer a less-well publicized view from within. An observer's eye simply rises above the low canopy, revealing an unusual vista.

This area also contains a number of landscape features deriving from military activity at the former Suffolk County Air Force Base (now the County's Gabreski Airport), and the intense subdivision of the area earlier this century. Intriguingly, one such landscape feature is only visible from a viewpoint far to the north along the southerly slopes of the Hampton Hills property. From that vantage point, the peculiar pattern of different stages of growth following selective cutting, fires, etc. is visible on clear days, belied by the rectilinear patterns of various shades of green.

8.5.23 FLANDERS AND HUBBARD COUNTY PARKS, SOUTHAMPTON TOWN RED CREEK PARKLAND

These lands and waters (some are currently restricted) offer rural scenes blending land and water, with elements of former hunting lodges and fields visible. Goose, Birch, Mill and Hubbard Creek provide scenic coastal views from, and of, the waters of Flanders Bay. Penny Pond, Red Creek Pond and (some distance further east) Squires Pond also provide water vistas and scenes frequented by wildlife. Historical resources include the hunting and fishing clubs noted under the Flanders Road corridor entry above.

8.5.24 QUOGUE WILDLIFE REFUGE

Views of Ice Pond, North Pond, and portions of the southerly extent of the dwarf pine barrens are some of the scenic views. Southerly portions of the refuge offer views of Quantuck Creek proper, into which the ponds feed. A careful tour of the site reveals many historical clues to the ice-harvesting practices of years back.

8.5.25 PECONIC RIVER FROM CONNECTICUT AVE EAST TO RIVERHEAD HAMLET AND FLANDERS BAY

Views of, and from, the Peconic River include a

mixture of lightly and partly developed shorelines. The majority of the western portion, from Connecticut Ave to approximately the LILCO gas storage facility on West Main Street in Riverhead, is lightly developed, with long stretches on forested shoreline, even within populated areas. This area includes Peconic Lake, a portion of the Peconic River which widens considerably west of Forge Road. Several fishing access sites also offer scenic glimpses in addition to their basic purpose. Historical and cultural resources are abundant here, both in the structures and land use patterns visible from the river, as well as in the system of dams, embankments and other shoreline alterations introduced over time.

8.5.26 PAUMANOK PATH (PINE BARRENS TRAIL PORTION) FROM ROCKY POINT SOUTH, SOUTHEAST, AND EAST TO SEARS BELLOWS COUNTY PARK, THE RED CREEK REGION, AND OUTSIDE THE CENTRAL PINE BARRENS TOWARDS MONTAUK POINT

The path offers viewpoints for scenes of pitch pine and oak forests, fallow and active agricultural fields, terminal moraines, kettleholes, freshwater lakes and wetlands, ridges, dwarf pine barrens, high points ranging up to 200+ feet, glacial outwash plains, and many of the features listed for other inventory entries.

Many of the preceding inventory entries for parks, preserves and undeveloped areas are threaded together by the Paumanok Path. Connecting trails provide access to the Peconic Bay system, Brookhaven State Park, Westhampton, and other locations. Throughout its extent, the path has been consciously designed to expose the walker to both natural and cultural resources embedded in the landscape.

8.5.27 WILDWOOD LAKE SOUTH OF RIVERHEAD HAMLET

A scenic, broad freshwater lake offering scenic views of, and from, the water. Portions of the lake's shoreline are developed residentially, with the southerly portion partly protected as county parkland and offering wide views from atop a steep shoreline bluff. Wildwood Lake is also visible from the CR 63 scenic road corridor (*see above*).

8.5.28 ARTIST LAKE IMMEDIATELY SOUTH OF MIDDLE COUNTRY ROAD IN MIDDLE ISLAND

Artist Lake has a mostly developed shoreline

(contemporary structures), with residential units on the east and south, and Middle Country road along the northerly side. Some undeveloped property along the west side, and a town-run public access point along the roadway, provide some scenic visual respite from the commercial land use pattern along that portion of Middle Country Road.

8.5.29 LAKE PANAMOKA APPROXIMATELY ONE MILE NORTH OF MIDDLE COUNTRY ROAD, BETWEEN RIDGE AND CALVERTON

Lake Panamoka has a densely developed shoreline (much of the area formerly seasonally-occupied bungalows or cottages) along the west, south and southeast shore, with some town-owned open space along the northeasterly shore. The size and extent of the open water provide a scenic view from those few viewpoints accessible to the public.

8.6 Scenic Resources Issues Analysis

Several observations can be made as a consequence of the scenic resources inventory. They are summarized here in brief in an attempt to infer practical principles for future management efforts.

Scenic road corridors in general are either vistas, providing a panoramic view that may stretch a mile or more, or closer, more visually intimate corridors, which providing a continuous exposure of forest, water views, or rural scenery to the traveler. These two significantly different types of scenic road corridors require very different strategies for their protection.

Additionally, the majority of the scenic road corridors above have several design attributes or incidental characteristics in common. These attributes include limited numbers of intersections, traffic signals, curb cuts, adjacent land uses which are discordant with their surroundings and signs (both public and private). Roadside vegetation (native, street trees, ornamental, etc.) can contribute to, or detract from, scenic qualities as well.

However, generalizations are difficult, and each road corridor must be analyzed individually. Such a difficulty is exemplified by Sunrise Highway. Its scenic qualities derive, in part, from the associated clearing. Yet, clearing to such an extent in current

highway designs is not likely to occur, and therefore does not necessarily provide a lesson to be applied to the other corridors. Conversely, scenic corridors which incorporate close, intimate forested areas may not be easily replicated in other corridors, due to established land use patterns, safety considerations or other factors.

Water views from road corridors listed above vary widely, and are difficult to categorize succinctly. Water views obtained from road corridors are dependent upon maintenance of a visual opening from the roadway, and are sometimes associated with official or unofficial vehicle pull-off spots.

These openings or turn-off parking spots are sometimes associated with actual water access sites for fishing, small boat launching or other activities. Such accesses generally help maintain scenic views. In other situations in the inventory, it appears to be the case that some of the scenic road views are present only because there was roadside clearing for some other purpose (e.g., homes or businesses, highway shoulders, etc.). In still other cases, the view was already present and the concomitant pull-offs, parking areas, and other clearing naturally followed. Cause and effect are not always easily distinguished for scenic road corridors involving water views.

Vista points other than those on road corridors are generally found in interior lands, and only sometimes occur on trail systems. A significant number of views are away from any trails (marked or unmarked).

Interestingly, some of the views available to past Long Island generations are less available to the current generation, as the vegetative cover along a slope immediately below a viewpoint rises or changes species composition, and selective clearing to maintain the views is not practiced. Paradoxically, in other situations, unpredictable (and sometimes unauthorized) clearing due to a variety of causes can actually destroy an interior scenic view, by removing the very elements which constitute the originally scenic qualities. The maintenance of scenic resources is not currently a management focus.

Architecture and site design play a major role in

those scenic views or road corridors where existing land use patterns actually contribute to a scenic resource. Identification of the design factors which cause this is beyond this document's scope, but is an important question for management of such scenic resources.

Roadside management policies may influence scenic qualities through such techniques as use of native plants and trees, mowing or planting strategies, installation or omission of curbs and sidewalks (e.g., "country lane" specifications), types of signs (public and private) permitted, provision of scenic pull-offs which may be combined with fishing, boat access, trailheads, control of roadside litter (a problematic topic at best), consideration of alternatives to pavement, etc.

Interior views are obviously related to topography and trail layouts. Generally, better views and overall scenic impressions are obtained when trail systems conform to topographic changes in elevation. Appropriate design techniques (switchbacks, etc.) contribute to both erosion control and scenic vista maintenance.

Historical and contemporary scenic vistas may change, or be lost entirely, over time. Restoration and maintenance of historical panoramas, using selective forestry practices, may be required to protect both historical and scenic vistas. previous inventory is not based upon a standardized set of specific criteria for identifying and valuing scenic resources. A set of assessment criteria should be considered for inclusion in the land use plan standards section or future rules and regulations for plan implementation. Suggested standardized criteria based upon established methods for identifying scenic resources are included in Appendix 4-1.

9. Physical Data

Population, Land Use, Public Administrative Boundaries and Infrastructure

This chapter contains population, land use, public administrative boundaries and infrastructure data.

9.1 Introduction

Estimates of population and housing units were based on estimated percentage allocations of population by census tract within the Compatible Growth Area and Core Preservation Areas of the Central Pine Barrens. These allocations are based on numerous sources, including: the most recent Pine Barrens land use map for Brookhaven Town (Suffolk County Water Authority); 1990 Census of Population and Housing data including 1990 census tract and block maps and 1980, 1970, and 1960 census tract maps (US Department of Commerce); maps from *Land Use 1981* (Long Island Regional Planning Board); pine barrens zones lot map (Suffolk County Water Authority); and the multi-unit housing complex inventory maintained by the Suffolk County Planning Department.

9.2 Historic and Current Population

9.2.1 1990 Population Estimates

The 1990 population of the Central Pine Barrens area is estimated to be 57,207. The total population of the Central Pine Barrens comprises 4.3% of Suffolk County's population and occupies 17% of Suffolk's land area.

The number of residents in the Central Pine Barrens has increased dramatically over the past thirty years. The following tables detail that population growth.

Figure 9-1: Central Pine Barrens Population by Town, 1960-1990

	BROOKHAVEN	RIVERHEAD	SOUTHAMPTON	TOTAL
1960	8,466	436	3,623	12,525
1970	18,278	792	4,134	23,204
1980	36,444	1,090	5,471	43,005
1990	49,719	1,303	6,185	57,207

The Brookhaven Town portion of the Pine Barrens Plan area contains the largest portion of the population with 49,719 persons, or 87% of the total Pine Barrens population. The Southampton portion of the Pine Barrens contains 6,185 persons, representing 11% of the population in the Pine Barrens. Riverhead contains 1,303 Pine Barrens residents who account for the remaining 2% of the Pine Barrens population.

The following table shows the percentage increase in population in the Central Pine Barrens, by decade since 1990, for each town.

Figure 9-2: Central Pine Barrens Population by Town, Percent Increase by Decade, 1960-1990

	BROOKHAVEN	RIVERHEAD	SOUTHAMPTON	TOTAL
1960-1970	115.9%	81.7%	14.1%	85.3%
1970-1980	99.4%	37.6%	32.3%	85.3%
1980-1990	36.4%	19.5%	13.1%	33.0%

One of the largest population increases in the Central Pine Barrens occurred between 1970 and 1980, when the area added nearly 20,000 residents, thus increasing the population by 85%. Growth during the 1980's was also strong. The population of the Central Pine Barrens increased by over 14,000 persons, or 33%, from 1980 to 1990. In each of the past three decades, population growth in the Central Pine Barrens has been fastest in the portion in the Town of Brookhaven.

The Central Pine Barrens 1990 population total of 57,207 is comprised of 53,295 (93%) in the Compatible Growth Area, and 3,912 (7%) in the Core Preservation Area. The following table details the population totals by Core Preservation Area and Compatible Growth Area for each town in the Central Pine Barrens.

Figure 9-3: Population in the Core Preservation Area, Compatible Growth Area and the Total Central Pine Barrens by Town, 1990

	BROOKHAVEN	RIVERHEAD	SOUTHAMPTON	TOTAL
Core Preservation Area	2,327	346	1,239	3,912
Compatible Growth Area	47,392	957	4,946	53,295
CENTRAL PINE BARRENS	49,719	1,303	6,185	57,207

The largest population in the Core Preservation Area is found in parts of eastern Manorville, the part of Calverton that is in Brookhaven Town, Ridge, Riverside, Flanders, and Westhampton. The communities with the largest populations in the Compatible Growth Area are Coram, Ridge, Middle Island, and Manorville.

9.2.2 1993 Population Estimates

The Long Island Lighting Company (LILCO) produced population estimates by community as of January 1, 1993. Based on those estimates, 1993 population estimates were generated for the total Central Pine Barrens region. Between 1990 and 1993, the population in the Central Pine Barrens is estimated to have increased by 2,334 to 59,541, for a three year increase of 4.1%.

Since LILCO's population estimates are performed on the community level and not on the smaller census tract level, it is difficult to pinpoint where the population is changing. However, based on available data, it seems that most of the 1990-1993 population increase occurred in Manorville. Less significant growth also occurred in Gordon Heights and in Middle Island.

9.3 Population Density

Brookhaven's population in the Central Pine Barrens represents 87% of the total population in the Central Pine Barrens, yet only 60% of the land area of the Central Pine Barrens lies in Brookhaven. This fact indicates that the population density in the Brookhaven portion of the Pine Barrens is greater than that in the other two Pine

Barrens towns. The following table details the population density for each part of the Central Pine Barrens.

Figure 9-4: Population Density in the Core Preservation Area, the Compatible Growth Area and the Total Central Pine Barrens by Town, 1990 (Persons Per Square Mile)

	BROOKHAVEN	RIVERHEAD	SOUTHAMPTON	TOTAL
Core Preservation Area	57	47	37	48
Compatible Growth Area	886	112	402	717
CENTRAL PINE BARRENS	526	82	135	366

The entire town of Brookhaven has a 1990 population density of 1,573 persons per square mile, while Suffolk County's density is 1,451 persons per square mile. The Brookhaven portion of the Central Pine Barrens contains the highest population density in the Core Preservation Area, Compatible Growth Area and the entire Central Pine Barrens areas. Population densities overall are about 15 times greater in the Compatible Growth Area than in the Core Preservation Area.

9.4 Housing

The total number of housing units in the Central Pine Barrens was estimated to be 23,180 in 1990. This figure represents 4.8% of all housing units in Suffolk County. As the population in the Central Pine Barrens has grown, so too has its number of housing units, as the following table shows.

Figure 9-5: Central Pine Barrens Housing Units by Town, 1960-1990

	BROOKHAVEN	RIVERHEAD	SOUTHAMPTON	TOTAL
1960	4,492	300	1,661	6,453
1970	6,413	411	1,994	8,818
1980	14,131	517	2,507	17,154
1990	19,661	583	2,936	23,180

Brookhaven's 19,661 housing units again account for the largest percentage of housing units in the Central Pine Barrens (85%). Southampton's share of housing units stands at almost 13%, and Riverhead has just under 3% of the Central Pine Barrens' total housing units. The growth in the number of housing units in the Pine Barrens has been the most dramatic in the Town of Brookhaven.

The Central Pine Barrens 1990 housing unit count of 23,180 is comprised of 21,465 (93%) in the Compatible Growth Area, and 1,715 (7%) in the Core Preservation Area. The following table specifies the 1990 housing unit totals by Core Preservation Area and Compatible Growth Area for each town in the Central Pine Barrens.

Figure 9-6: Housing Units in the Core Preservation Area, Compatible Growth Area and the Total Central Pine Barrens by Town, 1990

	BROOKHAVEN	RIVERHEAD	SOUTHAMPTON	TOTAL
Core Preservation Area	902	197	616	1,175
Compatible Growth Area	18,760	386	2,320	21,465
CENTRAL PINE BARRENS	19,661	583	2,936	23,180

As is the case with population, most of the housing units in the Central Pine Barrens are concentrated in the Compatible Growth Area in Brookhaven Town.

9.4.1 Multi-Unit Housing

According to an inventory maintained by the Suffolk County Planning Department, there are 29 multi-unit housing complexes (condominiums, apartment complexes, co-ops) situated in the Central Pine Barrens. All of these complexes are located in the Town of Brookhaven and only one of the complexes, Calverton Hills in Calverton, is located in the Core Preservation Area. Collectively, all of these multi-unit housing complexes contain 11,464 housing units.

A significant portion of the housing in the Brookhaven portion of the Central Pine Barrens is in multi-unit housing complexes. A comparison of those complexes built as of 1990 with the total number of housing units from the 1990 Census shows that 51% of the housing units in the Brookhaven portion of the Central Pine Barrens are in multi-unit complexes (9,951 out of 19,661 housing units). In the entire Central Pine Barrens, 43% of the 23,180 housing units are in multi-unit complexes.

9.4.2 Seasonal Housing

Of the 23,180 housing units in the Central Pine Barrens, an estimated 885 or about 4% are seasonal housing units. Approximately 200 or nearly one quarter of those seasonal homes are estimated to be in the Core Preservation Area.

The presence of seasonal housing adds to the population estimate for the Central Pine Barrens during peak seasonal times (usually the summer season). At an estimated four persons per household in seasonal homes, the population in the Central Pine Barrens can be expected to rise by about 3,500 (about 6%) at peak seasonal times. Guests in year-round housing units, motels, and campsites also add to the seasonal population.

9.4.3 Housing Value

Several crude methods were used to estimate housing values in the Central Pine Barrens. The 1990 Census yielded figures on median housing values of owner-occupied housing units by census tract. A median housing value in the Central Pine Barrens was approximated using those medians. Based on the 1990 census tracts included in the Central Pine Barrens, the median of those median values was approximately \$137,500. When only those census tracts with more than 50% of their population in the Pine Barrens were included, the resulting median value was again about \$137,500.

Another method was used to approximate housing values in the Pine Barrens. A weighted average of housing units and their corresponding median values was calculated, yielding a median value of \$138,228. It is therefore reasonable to say that the median 1990 owner-occupied housing value in the Central Pine Barrens was approximately \$138,000. This figure is almost 17% lower than the Suffolk County median of \$165,900 and 6%

lower than the entire town of Brookhaven's median housing value of \$147,200.

9.5 Income

Per capita income in the Central Pine Barrens is lower than income in Suffolk County as a whole. Based on the 1990 Census data, the overall Central Pine Barrens per capita income is estimated to be \$15,837 in 1989. This figure is 14% lower than the Suffolk County 1989 per capita income of \$18,481 and 4% lower than the Brookhaven Town figure of \$16,441.

9.6 Public Administrative Boundaries - Municipal, School District and other boundaries

Maps containing the following information exist in various public offices:

1. Boundaries of towns, villages, school districts are on the Suffolk County Planning Department geographic information system.
2. The boundaries of all fire districts in the pine barrens have been plotted by hand in red on parcel specific maps (1"=1,000') that had been used for the Special Groundwater Protection Area (SGPA) Study. The source of this information is the most recent Suffolk County tax map books.
3. The water districts appearing on the Suffolk County tax maps have been plotted on the 1"=1,000' maps.
4. A map of Suffolk County sewer districts (SCSD) shows only three districts within the Pine Barrens; SCSD #11 (small parts of which lie on the extreme western part of the Pine Barrens) which has been accounted for on a parcel-by-parcel basis using Tax Map books; and SCSD #23 in Middle Island which does not appear in the tax map books; SCSD #8 for one neighborhood in Ridge which has been noted on a parcel-by-parcel basis.
5. Separate lighting districts do exist within the Town of Southampton. The Town of Southampton Highway Department stated that their department, which covers street lighting, has no maps of these districts. Brookhaven and Riverhead have town-wide lighting districts.
6. Agricultural districts are plotted on the same maps as fire and sewer districts.
7. Ambulance districts exist in Southampton Town and Brookhaven Town.

Southampton and Riverhead Towns have their own police forces, as do the villages of Quogue and Westhampton Beach. Brookhaven Town is part of the Suffolk County Police District.

There are no park districts in the Pine Barrens area

Figure 9-7: Public Administrative Bodies in the Central Pine Barrens

FIRE DISTRICTS					
Brookhaven Town					
Brookhaven	FD3	Yaphank	FL2	Riverhead	FR
Farmingville	FE2	Gordon Heights	FL3	Mastic	FS
Miller Place	FH1	Middle Island	FL4	Center Moriches	FT
Sound Beach	FH2	Ridge	FL5	East Moriches	FU
Rocky Point (without hydrants)	FJ1	Manorville	FM1	Wading River (with hydrants)	FV
Selden (with hydrants)	FK4	Medford (without hydrants)	FP2	Eastport	FW
Coram (without hydrants)	FL1	Medford (with hydrants)	FP3		
Riverhead Town					
Wading River	FD20/ FD301	Manorville	FD23/ FD305	Riverhead	FD44/ FD302
Southampton Town					
Town			VILLAGE		
Eastport	FD30	Flanders	FD41	Quogue	FDY0
Rensselaer	FD31	N/E Southampton Beach Fire Prot.	4D45/ FP45	Westhampton Beach Fire District	FDY8 FDY9
Quogue Fire Protection	FD33/ FP33	N/E Quogue	FD48 FP48		
East Quogue	FD34	Fire District	FP47		
Hampton Bays	FD35	Fire District	FDEE		
Riverhead	FD38	Fire District			
SEWER DISTRICTS					
Strathmore Ridge	8	Selden	11	District #23	23
PARK DISTRICTS - NONE					
LIGHTING DISTRICTS					
BROOKHAVEN		RIVERHEAD		SOUTHAMPTON	
Townwide		Townwide		9 Lighting Districts	
AGRICULTURAL DISTRICTS					
Agricultural District #2			Agricultural District #3		
LAW ENFORCEMENT DISTRICTS					
STATE		COUNTY		TOWN AND VILLAGE	
State Police State Park Police		Suffolk County 5th Precinct Suffolk County 6th Precinct		Riverhead Town Police Southampton Town Police Quogue Police Westhampton Beach Police	
OTHER DISTRICTS					
AMBULANCE		LIBRARY		HYDRANT	

9.7 Land Use within the Central Pine Barrens

One of the first steps in the planning process is the determination of existing conditions, and an inventory and analysis of existing land is a key component of those existing conditions. Information concerning land use provides basic data on land characteristics and the various activities that occupy land in the planning area. Land use analysis helps in examining development patterns and planning for future development and open space preservation.

Each tax map parcel in the Central Pine Barrens had originally been assigned one of dozens of three digit land use codes, based on local assessment information. After a limited number of alterations, each of those land use codes was allocated to one of eleven distinct land use categories. Those categories are agriculture, residential, vacant, commercial, recreation and open space, institutional, industrial, utilities, transportation, waste handling and management and surface waters.

The tax map parcel acreage of the Central Pine Barrens totals 93,470 acres. This figure excludes acreage of road rights of way which are generally not assigned a tax map lot number. Two land use categories account for nearly two thirds of the land in the Central Pine Barrens. These major land uses are vacant land, comprising 35,260 acres (37.7% of the total) and recreation and open space with 25,031 acres or 26.8% of all land in the Central Pine Barrens. Less significant uses include residential (11,599 acres or 12.4%), institutional (10,410 acres or 11.1%) and agricultural uses (4,601 acres, or 4.9%). About half of the acreage in institutional use is contained within the Brookhaven National Laboratory.

Figure 9-8: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in the Central Pine Barrens

CATEGORY	ACREAGE	PERCENT OF TOTAL
Vacant	35,260	37.7%
Recreation and Open Space	25,031	26.8%
Residential	11,599	12.4%
Institutional	10,410	11.1%
Agriculture	4,601	4.9%

The remaining six land use categories are the least significant in terms of acreage. These categories are transportation, commercial, utilities, industrial, surface waters, and waste handling and management. Together, they account for less than 7% of the land use in the Central Pine Barrens.

9.7.1 Core and Compatible Growth Areas

For parcels lying entirely within the Core Preservation Area, the recreation and open space category is the predominant land use category in terms of acreage, totalling 20,574 acres or 47.0% of the Core Preservation Area. Vacant land in the Core totals 15,694 acres or 35.8% of the area. Taken together, recreation and open space and vacant land account for over 80% of the land in the Core Preservation Area. Institutional uses rank a distant third in the Core Preservation Area, accounting for 3,293 acres or 7.5% of the acreage of parcels lying completely in the Core Preservation Area. Residential, utilities, and agricultural uses each account for two to three percent of the land of the parcels that are entirely in the Core.

Figure 9-9: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in the Core Preservation Area

CATEGORY	ACREAGE	PERCENT OF TOTAL
RECREATION AND OPEN SPACE	20,574	47.0%
VACANT	15,694	35.8%
INSTITUTIONAL	3,293	7.5%
RESIDENTIAL	1,419	3.2%
UTILITIES	881	2.0%

The land use pattern in the Compatible Growth Area differs from that in the Core in two major ways. Residential use is a major land use in the Compatible Growth Area but not in the Core. Second, the recreation and open space category is much more dominant in the Core than in the Compatible Growth Area. While vacant land in the Compatible Growth Area is the predominant land use (15,029 acres or 41.5% of the area), residential uses account for 10,067 acres or 27.8% of the total. Agriculture, recreation and open space, each account for nearly 10% of the land in the Compatible Growth Area. Institutional, commercial, and industrial uses each account for two to three percent of the parcels entirely in the Compatible Growth Area.

Figure 9-10: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in the Compatible Growth Area

CATEGORY	ACREAGE	PERCENT OF TOTAL
VACANT	15,029	41.5%
RESIDENTIAL	10,067	27.8%
AGRICULTURE	3,551	9.8%
RECREATION AND OPEN SPACE	3,517	9.7%
INSTITUTIONAL	1,240	3.4%

Many of the parcels in the Central Pine Barrens planning area fall into both the Core and Compatible Growth Areas. Since the land use analysis was performed on the lot level, some difficulties arise when discussing land use in the Core versus the Compatible Growth Areas. In addition to the Core and Compatible Growth Areas, a third category was created for those parcels that fall into both the Core and Compatible Growth Areas.

The parcels falling into both the Core and Compatible Growth Areas total 13,435 acres. A large portion of that land comprises Brookhaven National Laboratory, and the sizeable acreage attributable to institutional use (5,878 acres or 43.8% of the acreage) reflects this fact. In addition, 33.8% of the land lying in parcels in both the Core and Compatible Growth Areas is vacant.

Figure 9-11: Top Five Land Use Categories: Acreage and Percent of Total Land Area for Parcels in Both the Compatible Growth Area and Core Preservation Area

CATEGORY	ACREAGE	PERCENT OF TOTAL
Institutional	5,878	43.8%
Vacant	4,537	33.8%
Transportation	1,302	9.7%
Recreation and Open Space	940	7.0%
Commercial	362	2.7%

The total acreage and percentage breakdown of all land uses by area is shown on the following tables.

Figure 9-12: All Land Use Categories: Acreage and Percent of Total Land Area in the Central Pine Barrens for the Core, Compatible Growth Area and Areas in Both the Core and Compatible Growth Areas

LAND USE CATEGORY	CORE		CGA		CORE & CGA		TOTAL	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
AGRICULTURE	856	2.0%	3,551	9.8%	195	1.4%	4,601	4.9%
RESIDENTIAL	1,419	3.2%	10,067	27.8%	113	0.8%	11,599	12.4%
VACANT	15,694	35.8%	15,029	41.5%	4,537	33.8%	35,260	37.7%
COMMERCIAL	451	1.0%	1,054	2.9%	362	2.7%	1,868	2.0%
RECREATION AND OPEN SPACE	20,574	47.0%	3,517	9.7%	940	7.0%	25,031	26.8%
INSTITUTIONAL	3,293	7.5%	1,240	3.4%	5,878	43.8%	10,410	11.1%
INDUSTRIAL	55	0.1%	727	2.0%	104	0.8%	886	0.9%
UTILITIES	881	2.0%	257	0.7%	0	0.0%	1,138	1.2%
TRANSPORTATION	125	0.3%	552	1.5%	1,302	9.7%	1,979	2.1%
WASTE HANDLING & MANAGEMENT	1	0.0%	103	0.3%	0	0.0%	104	0.1%
SURFACE WATERS	444	1.0%	146	0.4%	3	0.0%	593	0.6%
TOTAL	43793	100%	36243	100%	13435	100%	93470	100%

9.7.2 Vacant Land Analysis

Of the privately owned land in the Central Pine Barrens, 26,892 acres are vacant. This land is contained within 46 different zoning categories among the three Central Pine Barrens towns. Of the privately owned vacant land in the Central Pine Barrens, 77.0% is zoned residential and 18.7% is zoned industrial. The remaining 4.3% is zoned commercial, open space, or had no zoning category in the data base. Most of the industrially zoned vacant land is located in the Town of Riverhead (59%), and is primarily defense/institutional zoning at

Calverton Airport. The following table shows the breakdown of zoning of vacant privately owned land by area.

Figure 9-13: Acreage of Vacant, Privately Owned Land in the Central Pine Barrens by General Zoning Category

	RES.	COMM.	IND.	OPEN SPACE	UNKNOWN	TOTAL
BROOKHAVEN TOWN						
CORE	5,461.03	43.78	0.00	0.00	0.00	5,504.81
CGA	7,790.57	440.58	1,266.60	0.00	595.93	10,093.68
CORE & CGA	333.01	0.43	0.00	0.00	0.00	333.44
TOTAL	13,584.61	484.79	1,266.60	0.00	595.93	15,931.93
RIVERHEAD						
CORE	247.81	0.00	40.74	22.88	0.00	311.43
CGA	123.59	16.72	476.19	0.00	0.00	616.50
CORE & CGA	73.00	2.40	2,451.00	0.00	0.00	2,526.40
TOTAL	444.40	19.12	2,967.93	22.88	0.00	3,454.33
SOUTHAMPTON						
CORE	3,683.53	0.00	749.09	3.88	1.00	4,437.50
CGA	1,728.94	2.99	49.34	0.00	13.10	1,794.37
CORE & CGA	1,271.78	0.00	0.00	0.00	1.60	1,273.38
TOTAL	6,684.25	2.99	798.43	3.88	15.70	7,505.25
CENTRAL PINE BARRENS TOTAL						
CORE	9,392.37	43.78	789.83	26.76	1.00	10,253.74
CGA	9,643.10	460.29	1,792.13	0.00	609.03	12,504.55
CORE & CGA	1,677.79	2.83	2,451.00	0.00	1.60	4,133.22
TOTAL	20,713.26	506.90	5,032.96	26.76	611.63	26,891.51

In the Central Pine Barrens, two thirds of the acreage of privately owned vacant land falls into four residential zones. Those zones are A1 residential (one acre lots), A2 residential (two acre lots), and A5 residential (5 acre lots) in Brookhaven and CR-200 (5 acre residential lots) in Southampton. A full 92% of the 10,254 acres of vacant privately owned parcels entirely within the Core Preservation Area are zoned residential, comprised of 33% zoned A5 residential (5 acre lots) in Brookhaven, 31% zoned CR-200 residential (200,000 square foot lots, about 5 acres) in Southampton and 15% zoned A2 residential (2 acre lots) in Brookhaven.

Based on existing zoning of privately owned land, the potential dwelling unit yield of this vacant land has been calculated. The number of lots per acre for each zoning lot size was obtained from Long Island Comprehensive Waste Treatment Management Plan, Long Island Regional Planning Board, 1978, Table 9-2, page 309. In these yield calculations, only aggregate acreage figures for each zoning category were considered. Specific lots and

subdivisions were not analyzed for potential development or future subdivision. In addition, certain publicly owned parcels might be sold and developed for housing or other uses.

Based on existing zoning of privately owned parcels, a potential for 10,287 additional housing units may be built on what is now privately owned vacant land zoned for residential use. This increase would represent an increase of 44% over the 1990 figure of 23,180. At saturation, therefore, the estimated number of housing units in the Central Pine Barrens is 33,467 units. The following table displays the breakdown of potential additional housing units by area within the Central Pine Barrens.

Figure 9-14: Potential Additional Housing Units Under Existing Residential Zoning of Privately Owned Vacant Land

	BROOKHAVEN	RIVERHEAD	SOUTHAMPTON	PINE BARRENS TOTAL
CORE	2,054	102	800	2,956
CGA	5,191	103	1,022	6,316
CORE AND CGA	123	58	834	1,015
PINE BARRENS TOTAL	7,367	264	2,656	10,287

The largest number of potential additional housing units occurs in the Compatible Growth Area in Brookhaven, followed by the Core Preservation Area in Brookhaven. At an estimated 2.7 persons per household, the additional population is expected to be 27,775, for a total Central Pine Barrens population of 84,982 at saturation.

9.8 Infrastructure

9.8.1 Transportation

The majority of residents in the Pine Barrens and its periphery rely on automobiles for their transportation. The number of employed residents of the total towns of Brookhaven, Riverhead, and Southampton was 226,447 according to the 1990 US Census. None of the 32 largest employment center areas in Nassau and Suffolk Counties lie within the Central Pine Barrens boundaries.

Major employment areas near the Central Pine Barrens are the Patchogue area, the Port Jefferson area, the Ronkonkoma area and the Stony Brook area. Total employment in each of these major employment centers exceeds 10,000, with employment in the Ronkonkoma area exceeding 25,000.

Employed residents of the Central Pine Barrens generally work in nearby major employment centers such as Ronkonkoma, Patchogue, Port Jefferson, Stony Brook, and Riverhead. Significant numbers of workers also travel to the Hauppauge and Brentwood/Central Islip employment centers.

Several noteworthy employment centers do exist within the Central Pine Barrens. The largest employment center in the area is the Brookhaven National Laboratory (BNL). According to the 1990 Census, employment at the BNL site totalled nearly 4,000. Due to the Grumman Calverton Airport, 1990 employment in Calverton was also significant, exceeding 2,000 persons. Other employment concentrations of 1,000 or more workers existed in Rocky Point and Middle Island (primarily retail trade and educational service employment), Riverside, Coram, Medford, and Westhampton.

Of the employed residents of the entire towns of Brookhaven, Riverhead, and Southampton, 47% worked in their township of residence. A full 83% of these working residents were employed in Suffolk County.

Based on the 1990 Census data, it is projected that 80% of employed residents in the towns of Brookhaven, Riverhead, and Southampton drive to work alone. Another 11% carpool to work, 4% use public transit (such a bus or railroad), 2% walk, 2% work at home and the remaining persons use some other means to get to work.

9.8.2 Survey of Existing Thoroughfares

In the Pine Barrens four major thoroughfares provide road access in an east/west direction. They are:

1. *N.Y.S. Route 495, Long Island Expressway (L.I.E).* Volume ranges from 9,900 (1988) at the easterly terminus to 62,400 (1988), 60% of capacity, near the Horseblock Road exit (#65) in Medford. The major collector for the Expressway is William Floyd Parkway (C.R. 46) which contributes 26,800 cars (1992), followed by Port Jefferson-Westhampton Road (C.R. 111) and Patchogue-Yaphank Road (C.R. 101), which contribute 11,100 each (1989 and 1988 respectively).
2. *N.Y.S. Route 27, Sunrise Highway.* Volumes on various sections range from 16,300 (Annual Average Daily Traffic [AADT] 1986) at the easterly end of the pine barrens to 37,100 (AADT 1992) at the intersection of William Floyd Parkway (C.R. 46).
3. *N.Y.S. Route 25A, North Country Road.* Volumes range from 4900 (AADT 1988) at the easterly terminus in Calverton to 34,800 (AADT 1987) for the section between Miller Place-Patchogue Road and C.R. 83.
4. *N.Y.S. Route 25, Middle Country Road (west of L.I.E.), River Road (East of L.I.E).* Volumes range from 6,750 (AADT 1981) at River Road to 31,600 (AADT 1992) between N.Y.S. Rte. 112 and C.R. 83; also includes C.R. 94 and N.Y.S. Rte. 24.

North-south roads that service the Pine Barrens and periphery include:

C.R. 83, Patchogue-Mt. Sinai Road
N.Y.S. Route 112, Port Jefferson-Patchogue Road
C.R. 21, Yaphank-Middle Island Road
C.R. 46, William Floyd Parkway
C.R. 25, Wading River-Manor Road
C.R. 111, Port Jefferson-Westhampton Road
C.R. 55, Eastport Road
C.R. 51, Moriches-Riverhead Road
C.R. 31, Old Riverhead Road
C.R. 104, Quogue-Riverhead Road

9.8.3 Traffic Analysis

A 1990 Traffic Volume to Capacity Report (Hurler 1990) contains the following data on the county roads in the pine barrens vicinity. This report was intended for quick assessments of current average daily traffic volumes for comparison with the theoretical capacities assigned to the County road system. The purpose is to ascertain, at a glance, sections of County road presently at, or exceeding, capacity. It is based on the following theoretical capacity values:

1 lane - 6000 vehicles per day

- 2 lanes - 12000 vehicles per day
- 3 lanes - 18000 vehicles per day
- 4 lanes - 24000 vehicles per day
- 4 lanes (divided) - 35000 vehicles per day
- 5 lanes - 30000 vehicles per day

In instances where a section of County road does not have a consistent number of lanes, the capacity was assessed using the most prevalent demarcation.

None of the frictional factors such as left lane turns, number of curb cuts, adjacent land use, stop signs or traffic signal green times have been factored into this report.

Field data would be necessary to determine actual level of service grades for all of the major roads. Models could then be run to predict degradation in levels of service and determine improvements required to handle future buildout in the Pine Barrens.

Preliminary data shows existing traffic problems located in the following areas:

1. Intersection of NYS Route 25 and NYS Route 112. Although a minor improvement is scheduled for this intersection (a jug handle will be installed at the corner) volume/capacity ratios for the segments of NYS Route 112 south of Route 25 indicate that this intersection is at its capacity. According to an official at N.Y.S. D.O.T. no improvements for the widening of N.Y.S. 112 are scheduled to occur during the next 7 or 8 years.
2. County Road 21 (Yaphank-Middle Island Road) between East Main Street and NYS Route 25. V/C ratios in this vicinity demonstrate this road may be at its handling capacity. Additional information is required from adjacent town roads which act as collectors and arterials. This roads include but not are limited to:
 - a. Mill Road (a.k.a. Coram-Yaphank Road)
 - b. Sills Road
 - c. Long Island Avenue
 - d. Potential Long Island Expressway Service Road & Ramps
 - e. Longwood Road
 - f. Bartlett Road
 - g. Yaphank-Middle Island Road

The 1990 report was meant to be the first step in the analysis of the transportation impacts of the Pine Barrens Protection Plan. Future traffic analyses could include, but not be limited to:

1. Analysis of all major town roads.
2. Potential expansions of L.I.E. service roads and ramps.
3. Various buildout scenarios and buildout timing scenarios.
4. Existing and proposed level of service maps.
5. Frictional effects on road capacity including grade changes, left lane turns, numbers and types of curb cuts, adjacent land uses, traffic control devices, percent of trucks and buses, etc.

9.8.4 Currently Proposed Suffolk County Department of Public Works Road Improvements (SCDPW)

The Department has one project, C.R. 21, Rocky Point - Yaphank Road at Mill Road, within this area. This project is presently in the planning stage. SEQRA review of the project is mandated. It may also be necessary to acquire permits from applicable environmental agencies prior to proceeding with this project.

9.8.5 Potential Areas of Traffic Concern

Given the continuing growth of the South Fork, it may be necessary to increase capacity at the L.I.E./C.R. 111 intersection. Likewise, with increasing delays along C.R. 58, (Old Country Road), North Fork traffic will begin using C.R. 94, Nugent Drive in greater numbers. Consequently, potential problems could arise at the L.I.E./C.R. 94 intersection. County Road 111 is located in the Compatible Growth Area, and C.R. 94 is within the Core Preservation Area.

A northerly segment of C.R. 111, Port Jefferson-Westhampton Road from Miller Place-Yaphank Road to Hollow Road is in the Core Preservation Area. This segment is immediately east of the portion of the C.R. 111 right-of-way (Hollow Road to the L.I.E.) that was dedicated to the County Nature Preserve (Res. 583-88). As a result of this dedication, the original proposed section of C.R. 111 from N.Y.S. Route 25A to the L.I.E. cannot be constructed. However, if future conditions warrant, improvements could be made from N.Y.S. Rte. 25A to C.R. 21, Yaphank-Rocky Point Road.

The volume of traffic along C.R. 21, Rocky Point - Yaphank Road from Mill Road to N.Y.S. Route 25 has increased 40% over the last eight years. Similarly, the segment between N.Y.S. Route 25 and N.Y.S. Route 25A has experienced a 12% increase between 1985 and 1989. If this trend continues, it will be necessary to increase highway capacity along this roadway. C.R. 8, Yaphank By-Pass was originally proposed as an alternate to reconstructing C.R. 21 and was endorsed by the Suffolk County Department of Public Works. However, this project never progressed due to environmental concerns, community opposition and lack of funding. The proposed alignment of C.R. 8 is entirely within the Compatible Growth Area, except for a small segment that passes through the Core Preservation Area near Cathedral Pines County Park.

Appendix 5-1 contains vehicle count ratios and volume growth rates for county roads in the Central Pine Barrens and Appendix 5-2 contains vehicle county at peak hours for state roads within the Central Pine Barrens. This data was supplied by Suffolk County Department of Public Works and N.Y.S. Department of Transportation.

9.8.6 Sewage Treatment Facilities in the Central Pine Barrens

The following comments are offered by the Department of Public Works (Hayduk 1993) concerning the impact of the Pine Barrens legislation on Public Works.

Land use regulations are critical in the design of sewage treatment plants. There is a direct ratio between intensity of land use and volume of effluent. Consequently, any change in land use within a County Sewer District or in treatment standards would have a major impact on the collection and treatment systems of a sewer district.

All of the proposed Sewer District No. 16 (Whispering Pines) falls within the Long Island Central Pine Barrens Area. A significant undeveloped portion of this district lies within the Core Preservation Area. Since the actual formation of the district will not begin until the developer has completed his project(s), only those projects permitted to construct will be incorporated within S.D. No. 16.

Sewer District No. 8 (Strathmore Ridge) and the Dorade Treatment Plant (future S.D. 16 - Whispering Pines Plant) are within the Compatible Growth Area. The proposed alignment of the force main connection from S.D. No. 8 to the Dorade Treatment Plant requires that it pass through the Core Preservation Area.

All of the proposed Sewer Districts No. 17 (Ridgehaven) and No. 20 (Leisure Village) are within the Compatible Growth Area. These are established subdivisions with operating treatment plants that

should not be impacted by this legislation. It is important to note that within Leisure Village there still remains the potential to construct another 267 units.

The Department of Public Works (Wright 1994) has also provided a list of sewage treatment plants within or adjacent to the pine barrens. They have also included excess capacities and a location map. Suffolk County Department of Health Services participated in the collection of this data. This data is included in Appendix 5-3.

9.9 Bibliography: Physical Data

Hayduk, Stephen G., *Impact of the Pine Barrens Legislation on Public Works*. Memorandum to Robert J. Cimino (County Attorney) dated September 1, 1993.

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Suffolk County Water Authority. Land Use in the Pine Barrens. Work map. 1994.

U.S. Department of Commerce, Bureau of the Census. Census block maps, 1990.

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Wright, Ben, *Pine Barrens/Sewage Treatment Facilities*. Memorandum to James Bagg (Council on Environmental Quality) dated July 7, 1994.

10. Land Protection Strategies

10.1 Land Protection Mechanisms

This section describes various techniques by which land protection objectives can be accomplished and illustrates how those techniques have been applied. Also provided are examples of projects in Long Island's Central Pine Barrens or elsewhere on eastern Long Island which illustrate the implementation of these strategies.

It should be noted that the public and private sectors in eastern Long Island have, for many years, been leaders in the land protection and land conservation field and there is a tradition of success and innovation upon which to draw for the Central Pine Barrens protection effort.

Four general land protection actions are listed in the text: voluntary landowner actions; direct acquisition of interests in land; tax incentives for conservation; and land use planning and regulatory techniques. At the end of this section, is a discussion of the major challenge to the implementation of any land protection plan, namely, funding such a plan and discerning potential funding sources. Appendix 6-1 contains a chart summarizing options for conservation and a glossary of terms.

10.2 Land Protection Actions

Land protection actions are summarized in the text that follows. A list of each of these actions with their associated strengths, limitations and requirements for implementation is included in Appendix 6-2.

10.2.1 Voluntary Actions

There are two types of voluntary landowner actions. These actions include (1) landowner contact and education (2) voluntary agreements. Landowner contact and education is relatively straight forward with information provided to landowners. Voluntary agreements include formal agreements

with the landowners.

10.2.2 Direct Acquisition Mechanisms

There are nine mechanisms for direct acquisition of interest in land:

1. The right of first refusal gives a conservation group the right to match bona fide offers from a third party to purchase the land.
2. Leases, licenses and management agreements give the conservation group the right to manage the land.
3. Conservation easement is an agreement by which the landowner conveys a promise to a conservation group to use (or to refrain from using) his/her land in ways which are consistent with conservation objectives.
4. Deed restrictions and reverter clauses subject the property to use restrictions which, if violated, could allow property to revert to another party.
5. Acquisition of undivided interests is a mechanism by which the landowner conveys a percentage interest in the property to a conservation organization.
6. Acquisition of remainder interests subject to restricted life estates is the method by which property is transferred to a conservation group after the donor's lifetime.
7. Acquisition of partial interests such as water, timber, mineral, grazing rights and access rights is an acquisition of specific, limited property rights.
8. Fee acquisition is the straight forward acquisition of all property rights of a specific parcel of land.
9. Dedication of property is when land rights are conveyed legally to an established nature preserve system.

10.2.3 Tax Incentives for Conservation

Tax incentives for conservation are broken into four categories: income tax deductions, estate tax deductions, tax deferral strategies, and real property tax incentives.

Income tax deductions include: gifts or donations of

money or fee title of land (land given to a charitable organizations qualify for charitable contribution tax deduction equal to the property's fair market value); bargain sales whereby land is sold to a charity at below fair market value, with the difference qualifying as a charitable deduction to improve net financial return from the sale; and charitable trusts whereby land is given to a trust which sells the property for conservation and the proceeds are used to provide income to the donor.

A bequest of real or personal property that is given as a gift to a charitable organization results in an estate tax deduction.

Tax deferral strategies include installment sales whereby the sales price is paid by the conservation group over a period of time which allows the seller to defer capital gains taxes until the proceeds are received; like-kind exchanges where the conservation group "trades" property to the seller for land to be acquired which allows the seller to defer taxes until the replacement property is sold; and sale under implied threat of condemnations which is the sale of property to a government agency or conservation group which allows the seller to defer tax until the replacement property is sold.

Real property taxes might be decreased through preferential assessment in return for keeping land open and undeveloped or used for farm or forest purposes.

10.2.4 Land Use and Regulatory Techniques

Land use planning and regulatory techniques are divided into mechanisms that control the location of development, control the provision and timing of infrastructure, control the compatibility of development or a combination of these techniques.

The location and control of development can be implemented by enacting specific zoning requirements and subdivision ordinances which provide for and/or protect large lots, open space, agriculture, flood plains and wetlands. Urban growth boundaries can be implemented which designate areas of intense development integrated with preservation areas. Overlay resource protection districts can be enacted whereby the

underlying zoning remains the same but resources that require special protection such as wetlands, flood plains and critical habitats are identified.

The development of infrastructure can be controlled to allow growth and development to proceed at a planned pace. Infrastructure growth can be controlled with a well planned capital improvements program and/or an adequate public facilities ordinance. Growth management programs provide the timing for municipal planning objectives and development proposals are evaluated against this plan. The compatibility of development can be controlled with performance zoning, cluster zoning and Planned Unit Developments (PUD's). Other land use protection mechanisms combine techniques. These combination mechanisms include transfers of development rights (TDRs) and the assessment of impact and mitigation fees.

10.2.5 Financing Land Acquisition

Especially in eastern Long Island where the cost per acre of land is probably as high as it is anywhere in the continental United States, finding the money for land acquisition is a particular challenge, often involving the need to mix and match various sources of funds. Since traditional land acquisition will continue to be a major focus of the Central Pine Barrens protection effort, it will be a very capital intensive project. Clearly, the magnitude of the land to be acquired and the value of those lands will require continued financial support from all levels of government, since it is only from the public sector that such extensive resources could be provided. Private resources are likely to be used to fund strategic acquisitions and as leverage to secure public funds.

10.3 Land Acquisitions Programs of New York State and Suffolk County

10.3.1 New York State

The 1995 fiscal year budget for New York State includes \$10 million for Core Preservation Area acquisitions. In each of the calendar years 1997 through 1999, an additional 2 million dollars will be available for further acquisitions. This funding

represents the proceeds from a natural resources damages settlement relating to a major oil spill on Long Island, made available from the Natural Resources Damages Account administered by the Commissioner of the New York State Department of Environmental Conservation, as Trustee.

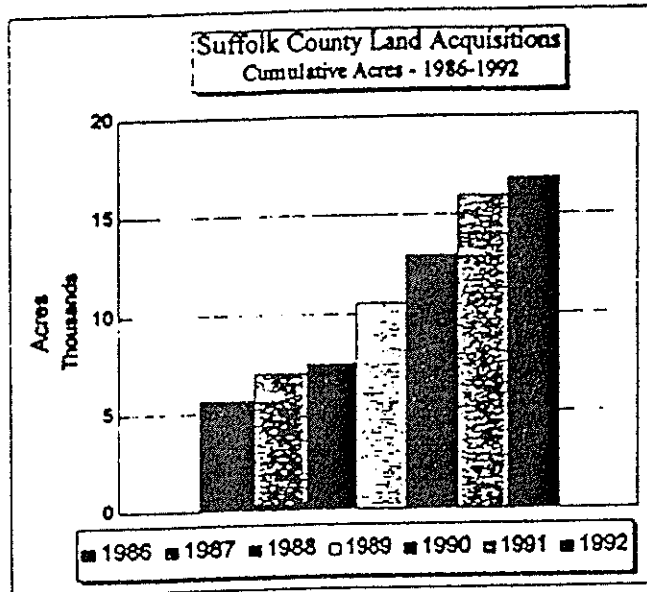
A number of parcels have been identified and targeted for acquisition with this and future state funding. The set of parcels shown here is neither final nor exhaustive. Other parcels might be considered, and parcels shown here may not be purchased. New York State DEC has also obtained \$160,000 from the Intermodal Surface Transportation Enhancement Act (ISTEA) program for acquisitions near Pleasure Drive in the Flanders areas of Southampton.

10.3.2 Suffolk County

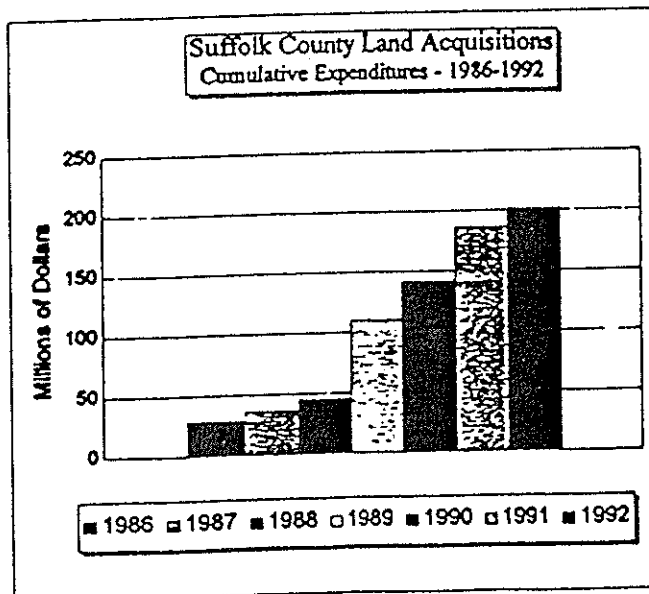
One of the most important sources of land acquisition funds has been Suffolk County. In fact, the County has acquired and preserved more acreage than all other preservation efforts combined. Figure 10-1 shows the results of the County's three land acquisition programs (open space, groundwater protection, and farmland preservation) through 1992. Groundwater protection funds in the amount of \$10 million have been pledged. In addition, annual appropriations for the open space and farmland programs are still occurring, representing approximately \$4 million/year.

Figure 10-1: Land Acquisitions in Suffolk County by Cumulative Acres & Cumulative Expenditures, 1986-1992

Acquisition Year	Cumulative Acres
1986	5,661
1987	7,011
1988	7,435
1989	10,558
1990	12,969
1991	15,972
1992	16,862



Acquisition Year	Cumulative Expenditures (millions \$)
1986	28.7
1987	36.3
1988	45.3
1989	109.9
1990	141.5
1991	186.3
1992	201.3



11. Field Management Status

11.1 Introduction

To gather basic information about the current status of land management activities relating to natural resource management and recreation, a questionnaire was sent to public lands management agencies in January 1994. The questionnaire was divided into three sections:

1. Summary of acres, staffing, budget and other background information.
2. Description of activities on lands managed by each agency.
3. Threats to the land and issues relating to programs

A copy of the survey results is included in Appendix 6-2.

11.2 Town of Brookhaven

Brookhaven owns two nature preserves totalling 175 acres. These are the Panamoka Park Nature Preserve and Twin Ponds Nature Preserve. Both of these are undeveloped and used solely for passive recreation, hiking and educational purposes.

The Town's Division of Environmental Protection is responsible for the oversight of the two preserves. Their primary activity is law enforcement. Natural resource management and site management is minimal, although a *phragmites* control project is underway.

The land management problems of the preserves include erosion and habitat degradation by all terrain vehicles (ATV) use and motorcycles, dumping, vandalism of trails and markers and unauthorized hunting.

11.3 Town of Riverhead

The Town of Riverhead does not own any parks or open space within the Core Preservation Area of

the Pine Barrens.

11.4 Town of Southampton

The Town of Southampton owns 12 sites totalling 602 acres in the Pine Barrens. Three are recreational parks with sports facilities. These are the Red Creek Park (Hampton Bays), the Hampton West Estates Park (Westhampton), and the Ludlam Park (Riverside). The remaining parcels were generally deeded to the Town as open space areas associated with permitted subdivisions. The Town obtained these open space lands for watershed and aquifer protection, buffer land and passive recreation.

Two departments within the Town have management roles within the Pine Barrens. In 1994, the Department of Planning and Natural Resources had four staff people involved in periodic planning and management policy formulation for Town lands within the Pine Barrens. The Department of Parks and Recreation is responsible for management of the Town's three recreational facilities. Five seasonal employees maintain the sports fields and formally landscaped areas in these parks. In one case, the management responsibilities of the 108 acres adjacent to the Quogue Wildlife Refuge have been delegated by the Town to NYSDEC.

Town budget allocations are not specific to the Pine Barrens, or to general resource management. The Environmental Advisory Fund in 1994 totaled approximately \$30,000; these monies are available for town-wide environmental protection and management purposes.

In terms of natural resource management, the Town does not currently engage in biological management for either game or nongame species in the Pine Barrens.

Lack of staff and time for adequate planning are identified as constraints affecting the effectiveness of the Town's Department of Planning and Natural Resources. There are no written management plans for any of the Town's sites. Insufficient funds for land management are also cited as a problem.

The unauthorized uses causing the most serious problems on Town land are overclearing of woodlands for recreational or other purposes, unauthorized off-road vehicle use and dumping.

11.5 Suffolk County

Suffolk County Parks owns 16,302 acres within the pine barrens. Three major parks provide recreational opportunities for an estimated 128,000 County residents. These are Cathedral Pines (in Middle Island), Southaven County Park (in Brookhaven), and Sears Bellows and Hubbard County Parks (located primarily in Southampton Town). The remaining County owned land is undeveloped. Some significant undeveloped properties include Robert Cushman Murphy County Park, Hampton Hills, scattered tracts within the dwarf pine plains, Maple Swamp, and Cranberry Bog/Sweezy Pond.

Activities at Cathedral Pines Park center around group camping and family camping. The County has constructed a new Camping and Environmental Learning Center at this site. Campers can view environmental education films and participate in environmental programs sponsored by the Parks Department.

Southaven is the County's most active recreational facility in the Pine Barrens with recreational activities such as camping, hiking, picnicking, hunting, horseback riding and row boating. Sears Bellows and Hubbard provide similar types of active recreational activities.

The primary activity in natural areas is hiking. However, horseback riding, off road vehicle (ORV) use and mountain biking do occur without the sanction of the Department.

There is a need for interpretative stations within the Pine Barrens especially along the Paumanok Path. Towards this end, the Parks and Planning Departments are developing a parks interpretive plan for some of these areas that suggest capital improvements promoting interpretation of natural resources. Currently, 10% of the total agency operating budget (\$8.3 million in 1994) is spent on Pine Barrens management.

Primary land management activities include law enforcement by park police, management of the recreational facilities (including three campgrounds, picnic areas), swimming and boating areas, building and road maintenance and site management (such as trash pick-up), and some environmental education. By and large, these activities are focused on the developed parklands.

Natural areas of parks and undeveloped properties currently receive little direct attention besides law enforcement. The Parks Department does not currently have any staff positions responsible for natural resource management, although new positions have been requested.

11.5.1 Suffolk County Nature Preserve

The Suffolk County Planning Department has completed an inventory of all County parkland and has identified all land dedicated to the Nature Preserve. In the past it appears that some parcels were inappropriately dedicated to the Nature Preserve in that they do not meet the Preserve criteria, nor were required subsequent management reports prepared. The effect has been a general devaluation of the Nature Preserve designation.

Of the approximately 30,000 acres of parkland, there are approximately 2,500 acres formally dedicated as Nature Preserve. These preserves were established for the following reasons:

1. To preserve endangered, unique, vulnerable or representative biological, ecological, or hydrological resources;
2. To provide a passive recreational setting;
3. To provide outdoor laboratories or learning centers;
4. To safeguard natural features and resources that are vulnerable to human disturbance.

Some of the criteria for choosing Nature Preserve sites are as follows:

1. Serves as a habitat for endangered, threatened or special concern species;
2. Contains a habitat that supports rare plant or animal species;
3. Contains a habitat that serves as a breeding, feeding, or resting sites for

- wildlife;
- 4. Contains geological features vulnerable to human disturbance;
- 5. Is suitable for environmental education;
- 6. Provides a buffer to lands already dedicated to the Nature Preserve;
- 7. Preserves of critical watershed areas.

In an effort to insure that appropriate lands are designated as Nature Preserves, the Planning Department will prepare management reports on a site specific basis that clearly describes the site's unique geological features, endangered species and rare plant habitation as well as the best management practices for stewardship. Those parcels which meet the criteria will be rededicated to the Nature Preserve, those parcels not meeting Nature Preserve criteria will be redesignated for other park uses.

11.5.2 Identified Concerns of the Parks Department

Serious issues facing the Parks Department are compounded by insufficient funds, affecting facility maintenance, natural resource management and law enforcement. As a policy dilemma, the Department is also facing increasing demands by park user groups for specialized recreational uses.

The Department will make every effort to provide increased recreational activities within the County parkland system but only to the extent that it will not compromise the ecological integrity of the parkland.

Illegal use of off-road vehicles (ORV) has been identified as the most serious land management problem on County land, with dumping as a close second. The Department has set a firm policy of banning ORV use in parkland. It has been a difficult ban to enforce. However, some motorized vehicles have been confiscated by park police in an effort to curtail illegal use.

Additionally, all terrain bicycles (ATB) are a cause of concern. Generally, mountain bikers use trails designed for hiking where they cause some erosion but are deemed to pose more of a safety problem. The Department plans to designate parkland for mountain bike use and issue mountain bike permits

along with safety and courtesy instructions.

In terms of land use policies and future park planning, the Parks Department in conjunction with the County Department of Planning will soon issue a park master plan for legislative approval. The plan verifies land use policies already in place and identifies future recreational needs of the County. The Department is also in the process of preparing individual management agreements with private environmental groups and other municipal agencies that are of mutual benefit to the involved agencies.

11.5.3 Cooperative Agreements

The County has cooperative agreements with The Nature Conservancy and the State University of New York at Stony Brook. The Nature Conservancy monitors rare species and natural communities at selected sites. Reports are sent annually to Commissioner of Parks that describe the Conservancy's activities on County lands and recommends for the management actions for ecologically significant areas.

The County has an agreement with the State University of New York at Stony Brook for the use of a County park site as a biological research station. This facility is located at Swan Pond in Robert Cushman Murphy County Park. The University has conducted biological research at this site since October 1988 and subsequently prepared a vegetation map of Robert Cushman Murphy County Park.

The County is also the major landholder of public lands in the Pine Barrens Core Preservation Area. Consequently, based on the aforementioned agreement with State University of New York (SUNY), the County Executive has instructed Parks Commissioner Wankel to develop a proposal to establish a Long Island Pine Barrens Environmental Science Center at Robert Cushman Murphy Park.

11.6 New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP)

NYSOPRHP owns one undeveloped park within the pine barrens. Brookhaven State Park consists of 1500 acres. It is neither staffed nor developed as a

park. Although a park manager from another park is assigned to Brookhaven State Park he does not have an operating budget specifically for this park.

This park is plagued by serious dumping and unauthorized use. Construction and landscaping debris as well as abandoned cars are commonly dumped. Off-road vehicles freely enter the area.

A serious issue facing NYSOPRHP, in general, is insufficient funding for law enforcement, facility and site maintenance, and natural resource management.

11.7 New York State Department of Environmental Conservation (NYSDEC)

NYSDEC owns 7,522 acres within the Pine Barrens. The Rocky Point Natural Resources Management Area (5,154 acres), Sarnoff Preserve (2,183 acres), and the Ridge Environmental Conservation Area (185 acres) are all natural resources management areas which provide a variety of resource-related uses.

Rocky Point and Sarnoff do not have built facilities except for maintenance center areas. The Ridge Environmental Conservation Area is the NYSDEC hunting check station, and also has an interpretive center. All visitors to these sites are required to obtain use permits. Approximately 22,000 visits are made per year.

Primary activities on State Forest land include hunting, fishing, hiking, dog training, nature observation, bicycling and cross-country skiing. At Rocky Point, over 5,000 permits are issued annually for hunting. Over 2,000 permits are issued for hiking and mountain biking on the dedicated trail.

State land is administered by the Office of Natural Resources. Within the office, the Bureau of Forest Management is responsible for the administration and management of the properties, as well as implementation of its Unit Management Plans.

A Unit Management Plan is developed through an integrated team approach, where professionals from all of the regional natural resource units provide

input. The Forest Management Bureau concentrates on silvicultural management and recreational use of the property, including stand prescriptions, prescribed burning programs, evaluation of recreational uses, identification of rare and endangered plant communities, etc. The Forest Rangers address the forest protection function, as they provide on-site stewardship, state land patrol, law enforcement and fire control. The Division of Fish and Wildlife manages hunting, fishing, other wildlife related programs, wildlife population management, restoration, stocking, wildlife habitat enhancement activities and freshwater wetlands protection and management.

Presently the annual staff time dedicated to land management in the Pine Barrens consists of one forester, three forest rangers, one wildlife biologist and two wildlife technicians.

Management goals and objectives are very similar for all properties. It is the policy of the NYSDEC to manage state land for multiple purposes. Natural resource management activities are primarily those related to wildlife management such as annual surveys of deer, quail, breeding birds and tiger salamanders as well administering the hunting program. The wildlife habitat enhancement program includes the maintenance of openings on old antenna fields and firebreaks and the planting of various grasses, annual grains and shrub seedlings for food and cover. Other wildlife management activities include pheasant stocking and the placement of bluebird boxes and other nesting structures.

Written management plans are in draft form for Rocky Point and Ridge. A management plan was written for Sarnoff in 1983, but is recognized as needing revisions.

The unauthorized uses that cause the most serious problems are dumping, illegal access and vandalism. Determining compatible uses is identified as a difficult challenge. Insufficient management funds and the need to resolve conflicting use dilemmas are noted as facility management and administrative issues.

11.8 United States Department of Defense

The Navy owns 3,125 acres associated with the undeveloped portion of the Naval Weapons Industrial Reserve Plant at Calverton (the "Grumman" lands). The Navy has a cooperative agreement with NYSDEC Division of Fish and Wildlife for the management of this land. NYSDEC also manages 901 contiguous acres owned by Suffolk County. Altogether this is referred to as the Navy Cooperative.

Long term wildlife and forest management plans have been written for the area, but both are in need of update. Primary recreational opportunities provided on the areas include hunting, fishing, trapping, canoeing, hiking, nature observation, dog training and field trials. As with the Rocky Point and Sarnoff areas, a permit from NYSDEC is required for access to the area.

Approximately 5,000 permits are issued each year (mostly for hunting), resulting in more than 15,000 visits per year.

NYSDEC management of the property includes the erection of barriers and gates to control ORV access and dumping. Natural resource management of the property includes surveys of deer, quail, breeding birds and tiger salamanders; pheasant stocking, placement of blue bird boxes, wood duck boxes and other nesting structures and habitat management. Wildlife habitat enhancement activities include creating and maintaining openings, planting various grasses, annual grains and tree and shrub seedlings for food and cover.

The unauthorized uses that cause the most serious problems are dumping, illegal access and vandalism.

11.9 United States Department of Energy

The US Department of Energy's Brookhaven National Laboratory (BNL) in Upton comprises approximately 2,500 acres of Pine Barrens. This land is managed by the staff of BNL. This land is not open to the public for safety and confidentiality reasons.

12. Selected Laws Pertinent to the Central Pine Barrens

12.1 Introduction

This section reviews the existing statutory regimes which may be applicable to lands within the Central Pine Barrens in addition to Article 57 of the Environmental Conservation Law. This section is an overview and is not intended to provide a comprehensive analysis of these laws.

12.2 Federal Laws

Existing federal regulations complement and enhance State regulatory programs for the protection and improvement of many natural resources including wetlands, rivers, water quality, floodplains and marine coastlines.

Federal legislation directs the U.S. Environmental Protection Agency (USEPA) to prepare and administer regulations and programs related to groundwater protection. These include: the Water Pollution Control Act (WPCA), and the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TOSCA), the Comprehensive Environmental Response, Compensation and Liability Act ((CERCLA), also known as "Superfund"), the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and the National Environmental Policy Act (NEPA).

12.2.1 Water Pollution Control Act of 1972

At the time of its enactment in 1972, the WPCA (PL 92-500) represented a major change in federal water pollution control law. It set a national goal of eliminating pollutant discharges by 1985. Although groundwater pollution was not given major emphasis, several Suffolk County programs that receive federal funding under this and subsequent laws stress groundwater resource protection. The 1972 WPCA included the following provisions:

- Provided funding for area wide wastewater

treatment management planning (Section 208).

- Provided funding for wastewater treatment facilities (Section 201) in three phases: Step 1 - Planning; Step 2 - Design; and, Step 3 - Construction;
- Established a federal permit system (NPDES) and effluent discharge limitations for all point sources;
- Placed effluent limitations on three categories of discharges: municipal, industrial, and toxic;
- Created a formal rule making process under which the USEPA identifies toxic pollutants and issues effluent standards;
- Declared a national policy of seeking to prevent discharge of oil or hazardous substances into U.S. waters (Section 311); and
- Directed the USEPA to create national industrial pretreatment standards for discharges to municipal sewage systems.

12.2.2 Clean Water Act of 1977

The 1977 Clean Water Act (PL 95-217) amended the 1972 WPCA and included the following provisions:

- Created a three category classification system for industrial pollution; conventional, toxic, and non-conventional;
- Revised the toxic pollutant portion of the WPCA to empower the USEPA to add or subtract from a previous court imposed list of 65 chemicals. (This led to the initial list of 129 priority pollutants.);
- Strengthened Section 311 by increasing liability limits and gave the USEPA power to establish a special fund for emergency assistance in cases of contaminant discharges;
- Set a major policy of promoting innovative and alternative (I/A) waste management techniques. Sewer construction was specifically excluded from I/A financial incentives;
- Extended the planning period for initial "200 Plans" and directed that plans identify open space opportunities that would result in improved water quality;
- Increased funding to encourage the

- beneficial use of sludge; and
- Made it policy for the states to manage the construction grants program and NPDES, and supported the states by allocating funding for administration.

12.2.3 Peconic Estuary Program

The National Estuary Program (NEP) was established by the federal Water Quality Act of 1987 to protect and preserve nationally significant estuaries which are threatened by pollution, development, or overuse. The United States Environmental Protection Agency administers NEP.

An NEP Management Conference is convened for the following purposes:

- Assessing trends in water quality, natural resources, and estuarine uses;
- Identifying causes of pollution;
- Evaluating relationships between pollutant loads and environmental effects;
- Developing a Comprehensive Conservation and Management Plan (CCMP);
- Planning coordination of CCMP implementation;
- Monitoring effectiveness of actions; and
- Reviewing federal financial assistance programs and development projects for CCMP consistency.

Ultimately, a CCMP must address three management areas:

- Water and sediment quality, dealing with pollution abatement and control;
- Living resources, focusing on protection and restoration; and
- Land use and water resources, including consideration of conservation areas and special protective legislation and initiatives.

Congress added the Peconic Estuary system to the NEP priority list in October 1988. Acceptance of the Peconic Estuary Program (PEP) into the NEP was announced on September 9, 1992, making the Peconic Estuary one of only 21 areas in the NEP. The nomination document sets forth a Management Conference structure in accordance with USEPA guidance, with a Policy Committee, Management Committee, Technical Advisory Committee (TAC),

Citizens Advisory Committee (CAC), and Local Government Committee (LGC). The Policy Committee, which oversees the program, is comprised of high-level policy makers from USEPA, NYSDEC, Suffolk County, and the Local Government Committee. The SCDHS Office of Ecology has been established as a central program office to conduct program management on behalf of the Management Committee, provide technical and administrative support to the PEP, and serve as a continuing resource to Peconic Estuary management.

12.2.4 Brown Tide Comprehensive Assessment and Management Program (BTCAMP)

BTCAMP is significant, as it founded the basis for the Peconic Estuary Program (PEP) Nomination Document as well as the PEP Action Plan. The Peconic Estuary Program has adopted the BTCAMP study area boundary, which comprises the groundwater-contributing area to the Peconic River (i.e., the shallow flow stream subsystem) as well as the groundwater-contributing area to the Flanders-Peconic Bays system. The groundwater-contributing area boundary to the Peconic River is of particular environmental sensitivity.

12.2.5 Municipal Wastewater Treatment Construction Grant Amendments of 1981

The 1981 act (PL 97-117) further amended the 1972 WPCA to include the following provisions:

- Eliminated construction grants funding for Steps 1 and 2. (These could possibly later qualify for reimbursement as part of a Step 3 grant.);
- Directed the states to incorporate the concept of "priority water quality areas" in preparing priority projects lists;
- Replaced 208 Area wide Planning with Section 205 Water Quality Management Planning. Emphasis was placed on identifying non-point measures to meet and maintain quality standards; and
- Expanded and added funding to the I/A program.

12.2.6 Safe Drinking Water Act of 1974, and 1986 Amendments

The SDWA (PL 93-523) was considered the first major federal legislative attempt to assure that the public is provided with an adequate quantity of safe drinking water. It replaced Title XIV of the Public Health Service Act, and included the following provisions:

- Required the USEPA to set Maximum Contaminant Levels (MCLs), monitoring frequencies, and record keeping requirements for "public water systems," which include community and non-community supplies in municipal and private ownership;
- Allowed the USEPA to grant "primacy" to states with regulations at least as stringent as those established by the USEPA under the act and laboratory facilities meeting USEPA criteria;
- Required water suppliers to make public notifications if their systems are in violation of any SDWA requirement (particularly an MCL), and to outline precautionary measures;
- Authorized the National Academy of Sciences to review data and recommend standards for drinking water contaminants;
- Created two procedures, variances and exemptions, that can be used to allow a water supplier to operate while in violation of an MCL (or a minimum treatment requirement, if ever established), but only if it is documented by the supplier that such actions would not result in an unreasonable risk to public health;
- Authorized the USEPA to designate areas that have an aquifer that is the sole or principal drinking water source, and to require review of federal projects so that no federal funds are expended on actions that may contaminate that aquifer; and
- Allowed the USEPA to allocate funds for research and demonstration grants related to water supply.

The SDWA Amendments of 1986 (PL 99-339) strengthened the original act in a number of ways that will require expanded state and local monitoring and administrative programs:

- Requires the USEPA to set additional drinking water standards for organic and inorganic chemicals and microbiological parameters. A time table is established for setting MCLs and MCLGs (Maximum Contaminant Level Goals, previously called Recommended Maximum Contaminant Levels, RMCLs);
- Directs the USEPA to promulgate regulations (within three years) that will require disinfection for all public water systems, and that will identify criteria for granting variances;
- Strengthens USEPA's role in enforcement actions against water supplies that do not conform to regulations;
- Establishes the use of granular activated carbon (GAC) as the baseline for treatment of synthetic organic chemicals; all "best available" technology must be as effective as GAC;
- Prohibits (with minor exceptions) the use of lead solder, flux, and pipe in public water systems, or any residential or non-residential facility connected to a public water system;
- Requires states to submit programs (within three years) that will protect groundwater sources by determining wellhead protection areas, identifying sources of contamination within these areas, specifying contingency plans, and identifying the duties of state agencies, local government, and public water systems; and
- Requires additional monitoring for a list of unregulated contaminants (those with no MCL or MCLG).

12.2.7 Resources Conservation and Recovery Act of 1976

RCRA (PL 94-580) was the first comprehensive federal regulation of solid wastes. It amended the Solid Waste Disposal Act of 1965, which was essentially limited to research and development programs for waste disposal and resource recovery. The 1976 act included the following provisions:

- Provided for three major programs to attain the goals of protecting public health and conserving national resources: a hazardous wastes control program; a land disposal

- regulatory program in each state; and, initiation and support of state and local resource conservation programs;
- Subtitle C provided for an identification and listing of hazardous wastes; standards for storage, treatment, or disposal of hazardous wastes; permits for storage, treatment, and disposal facilities; and, a manifest system to ensure that hazardous wastes are transported from the waste generator to only a "permitted" disposal facility;
- Subtitle D for non-hazardous wastes imposed federal constraints on upgrading or phasing out open dumps; and
- Mandated establishment of criteria for sanitary landfills.

12.2.8 Toxic Substances Control Act of 1976

TSCA (PL 94-469) was intended to fill the gaps in other legislation concerning toxic substances control. It provided for broad regulatory powers regarding toxic chemical manufacturing, use, storage, labeling, and disposal.

12.2.9 Comprehensive Environmental Response, Compensation and Liability Act of 1980

CERCLA or "Superfund" (PL 96-510) was enacted to provide the USEPA with the financial resources needed for emergency response capabilities for spills and environmental accidents. The Act included the following provisions:

- Created a trust fund of up to \$1.6 billion during a five-year period starting in 1981 to provide emergency cleanup of hazardous materials spills and in-place hazardous wastes dumps that threaten the environment (where no responsible party can be identified). The fund is derived primarily from taxes on oil and on 42 specific chemicals; an additional 12.5% of the fund comes from general tax revenues; and
- Directed the USEPA to establish a national priority list of hazardous waste sites; and
- Specified that state authorities must be consulted before the Federal Government cleans up a site.
- The act was reauthorized and amended in

1986 (SARA) with similar provisions.

12.2.10 Federal Insecticide, Fungicide, and Rodenticide Act of 1975

FIFRA (PL 94-140) provides the USEPA with broad premarket clearance powers over all pesticides used in the U.S. to ensure that they do not pose "unreasonable risks" to human health and the environment. The USEPA is directed to consider "unreasonable adverse effects on the environment" in its registration evaluation, and registrants are required to submit information on a continuing basis regarding adverse effects. The act requires establishments that produce pesticides to register with the USEPA, and directs the USEPA to classify each registered pesticide for general or restricted use.

12.2.11 National Environmental Policy Act of 1969

NEPA (PL 91-190) was the first major law to require the preparation of an environmental impact statement (EIS). The act included the following provisions:

- Established a national policy for the environment;
- Created the Council on Environmental Quality (CEQ); and
- Established a requirement for federal agencies to determine if their proposed actions will have a significant impact on the environment. If significant impact is likely, NEPA directed that an EIS be written.

12.2.12 Hazardous Materials Transportation Act of 1974

HMTA (PL 93-633) authorized the U.S. Department of Transportation (USDOT) to regulate interstate commerce of hazardous materials. The Act was primarily intended to control immediate transportation hazards such as radioactive, disease causing, corrosive, explosive, flammable, or toxic materials and compressed gases, but pollution control was specified as a factor to be considered in the development of regulations. The Act directs the USDOT to prepare regulations for manufacturers of hazardous materials requiring transport;

manufacturers of hazardous materials containers; and, transporters of such materials in commerce.

12.3 New York State Laws

State administered environmental and land use controls including the regulations of the Adirondack Park Agency, the Freshwater and Tidal Wetlands Acts, Coastal Erosion Hazard, Wild, Scenic and Recreational Rivers and Mined Land Reclamation programs require protection of and setback of development from important environmental resources, thus protecting open space. Water quality regulations, including septic system and water quality laws, can impact the type and distribution of development.

New York State has a substantial amount of environmental legislation pertaining to groundwater resource management, source controls, water supply and environmental review. The New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) are the two primary state agencies responsible for administering the regulations and programs under state law. Following are brief summaries of selected groundwater legislation, including highlighted portions of the State Environmental Conservation Law (ECL) and Public Health Law (PHL).

12.3.1 ECL Article 8, "State Environmental Quality Review Act"

The intent of the 1975 SEQRA legislation is to ensure that protection and enhancement of the environment is given appropriate weight with social and economic considerations in public policy decisions. Article 8 includes the following provisions:

- Mandates that an environmental impact statement (EIS) be prepared for any action that may have a significant effect on the environment before an agency approves that action;
- Provides a brief summary of what information should be included in an environmental impact statement;
- Stipulates that a draft EIS be prepared as early as possible in the formulation of a

- proposed action;
- Defines "lead agency" and calls for coordination of review among agencies; and
- Directs the NYSDEC to develop rules and regulations for carrying out SEQRA provisions, including criteria for determining whether or not a proposed action may have a significant effect on the environment.

Critical Environmental Areas

The New York State Environmental Quality Review Act (Article 8, N.Y.S. Environmental Conservation Law) rules and regulations (NYCRR Part 617) permit local agencies to designate a specific geographic area within its boundaries as a Critical Environmental Area (CEA). To be designated as a CEA, an area must have an exceptional or unique character covering one or more of the following:

1. a benefit or threat to human health;
2. a natural setting (e.g., fish and wildlife habitat, forest and vegetation, open space and areas of important aesthetic or scenic quality);
3. social, cultural, historic, archaeological, recreational, or educational values; or
4. an inherent ecological, geological or hydrological sensitivity to change which may be adversely affected by any change. Any unlisted action in a CEA must be treated as a Type I action requiring the completion of a long environmental assessment form and a coordinated review process.

Coastal Area Boundary

Another regulatory boundary that traverses the Central Pine Barrens is the New York State Coastal Area Boundary which is administered by the New York State Department of State (NYSDOS). For proposed state permits, funding, and direct actions, each state agency reviews its own actions, usually through the State Environmental Quality Review Act, to ensure consistency with the Coastal Area Boundary.

Significant Coastal Fish and Wildlife Habitats

The NYSDOS has identified Significant Coastal Fish and Wildlife Habitats.

12.3.2 ECL Article 15, Title 27, Wild, Scenic and Recreational Rivers

The Wild, Scenic and Recreational Rivers program regulates land uses within corridors along both the Carman's and Peconic Rivers. Corridors are up to one-half mile in width.

12.3.3 ECL Article 15 "Water Resources"

- Decrees that the power to regulate the water resources of the state is vested with New York State;
- Directs that reasonable standards of purity and quality be maintained;
- Includes provisions for preserving wild, scenic, and recreational river systems;
- Calls for the preparation of comprehensive public water supply studies;
- Title 15 "Water Supply" directs that the NYSDEC approve all applications for water supply development and extensions; that Long Island well drillers be certified by the NYSDEC; and, that all wells on Long Island with capacities greater than 45 gallons per minute (gpm) be approved by the NYSDEC; and
- A 1983 amendment to Article 15 (S.347C/A.416C) added a new subsection covering the prohibition of certain incompatible uses (i.e., uses involving any hazardous waste) over federally designated sole source aquifers; and directs the NYSDEC to promulgate rules and regulations concerning protection of these resources.

Amendments to Title 15 passed in 1986 (S.6156C/A.416C) added or modified the following requirements:

- Placed a moratorium on withdrawals from the Lloyd aquifer (except in certain coastal areas);
- Limited new and renewal permits to a term of 10 years;
- Required public water supplies to submit watershed rules and regulations for new wells pursuant to PHL 1100;
- Required permit reviews to consider aquifer stress, consumptive use, water conservation, leak detection, and consistency with regional plans; and

- Removed the permit exemption for new agricultural wells.

12.3.4 ECL Article 17, "Water Pollution Control"

This article replaces PHL Article 12, and contains the following titles:

- Title 3, "Jurisdiction of the Department" directs the NYSDEC to develop a classification system for state waters in accordance with considerations for best usage, and requires the preparation of standards of quality and purity for each classification. It also gives the NYSDEC administrative jurisdiction to abate and prevent water pollution, and the authority to issue and revoke permits. The NYSDEC is directed to conduct comprehensive studies of water pollution control, and is given authority to issue standards for testing wastes discharges, and to enforce regulations;
- Title 5, "Prohibitions" provides a general prohibition against water pollution in contravention of standards adopted by the NYSDEC as authorized by Article 17. It includes restrictions on the discharge of sewage, industrial wastes, and other wastes;
- Title 7, "Permits" empowers the NYSDEC to issue permits for new discharges of wastes;
- Title 8, "State Pollutant Discharge Elimination System" institutes a permit system (SPDES), which is designed to cover all liquid discharges greater than 1,000 gallons per day (gpd);
- Title 15, "Realty Subdivisions: Sewage Service" defines subdivisions as a division of a tract of land into five or more parcels. It empowers any city or county health department to adopt regulations for the control of sewage facilities, and requires plans to be submitted indicating methods for providing adequate sewage facilities. It also calls for coordination between the NYSDEC and NYSDOH (Public Health Law Article 11, Title II) for realty subdivisions;
- Title 17, "Discharge of Sewage into Waters" details NYSDEC powers to

prohibit or order discontinuance of discharges. It also provides some details on permit requirements, and empowers local health departments to make inspections; and

- Title 19, "State Aid: Collection, Treatment and Disposal of Sewage" details provisions on how municipalities may obtain state financial aid for comprehensive studies and for the construction of sewage facilities.

12.3.5 ECL Article 24, "The Freshwater Wetlands Act."

This article requires the mapping of wetlands and regulates most land uses within 100 feet of the wetland boundary.

12.3.6 ECL Article 27, "Collection, Treatment and Disposal of Refuse and Other Solid Waste"

This article replaces PHL Article 13, Title X, and contains the following titles:

- Title 1, "State Aid" describes how state financial aid shall be provided to municipalities to conduct comprehensive plans for the collection, treatment, and disposal of refuse;
- Title 3, "Private Waste Disposal" calls for all those engaged in cleaning septic tanks (cesspools), scavenging, or disposing of industrial wastes to be registered with the NYSDEC. Registrants are required to make an annual report indicating the number and type of installations cleaned, volume and types of wastes removed, place and manner of disposal; and
- Contains provisions of the State Industrial Hazardous Wastes Management Act of 1979, which directs the Environmental Facilities Corporation (EFC) to construct, operate and finance hazardous wastes management facilities, and to study hazardous wastes technology. The act also mandates the EFC to develop a program for the alternate disposal of hazardous wastes, including siting, marketing and financing.

A recent amendment to Article 27 added subsection

27-0704 which bans new landfills or expansions of existing landfills in deep recharge areas (but includes a provision for allowing limited expansion for solid wastes prior to implementation of a resource recovery system). It also delineates specific provisions for new landfill construction or expansion outside of deep recharge areas. Such provisions include liners, financial surety and prohibition against disposal of industrial wastes (unless approved by the NYSDEC).

12.3.7 ECL Article 33, "Pesticides"

- Title 3, "General Provisions" gives the NYSDEC jurisdiction over the distribution, sale, use, and transport of pesticides. The NYSDEC is empowered to declare what constitutes a pest; determine whether pesticides are toxic to humans and prepare a list of those pesticides; prepare a list of restricted use pesticides and the permitted usage and conditions; and, promulgate rules and regulations;
- Title 5, "Testing" directs the NYSDEC to sample pesticides and describes how sampling is to be carried out;
- Title 7, "Registration" calls for the registration of every pesticide distributed, sold or transported in the state; and
- Title 15, "Seizure" gives the NYSDEC authority to seize and confiscate pesticides under certain specified conditions.

12.3.8 PHL Article II "Public Water Supplies; Sewerage and Sewage Control"

- Title I, "Potable Waters" gives the NYSDOH power to make rules and regulations for protecting public water supplies from contamination. It empowers local health agencies to inspect public water supply facilities, and gives the NYSDOH authority to enforce regulations and fine violators. Under this title, local health agencies can require sewage treatment if deemed necessary to protect public water supplies; and
- Title II, "Realty Subdivisions: Water and Sewerage Service" defines a subdivision as the division of any tract of land into five or more parcels. It requires maps or plans to be filed with appropriate local agencies

indicating the methods to be employed for obtaining an adequate and satisfactory water supply for subdivisions; communal, rather than individual, water systems can be required.

12.3.9 Transportation Law

- Article 2, Section 14f, authorizes the NYSDOT to promote safety in the transport of hazardous materials by all modes; and
- Article 7, Section 161, provides additional authority for the NYSDOT to control carriers transporting hazardous materials.

12.3.10 Navigation Law

- Article 12, Section 191 "Oil Spill Prevention and Control" authorizes the NYSDOT to control the transfer and storage of petroleum; provides liability for damage sustained within the state as a result of the discharge of petroleum by requiring prompt clean up; and, provides a fund for swift and adequate compensation.

12.3.11 General Municipal Law

- Article 5-C, "Water Supply" Section 118 empowers counties, towns, and villages to provide for the development of a supply of water in excess of its own needs, for the purpose of sale to a public corporation or improvement district.

12.3.12 County Law

- Article 5-A, "County Water, Sewers, Drainage and Water Treatment and Refuse Districts" Section 250 *et seq.* empowers each county to establish or extend county water, sewer, drainage, water treatment, or refuse districts. It details procedures for establishing a district, applying to the State Comptroller, and setting up a rate schedule. Authority to create county Water Quality Treatment Districts was added in 1984 (L.1984, c.622). Sewer district formation in Suffolk County is

specifically described (Section 279-a).

12.3.13 Town Law

- Article 12, "District and Special Improvements" Section 190 *et seq.* empowers town boards to establish or extend water storage and distribution districts to acquire or develop supplies of water for sale to water and water supply districts. Authority to create town Water Quality Treatment Districts was added in 1984 (L. 1984, c. 622).
- Article 16, "Zoning and Planning" Section 261 *et seq.* includes under zoning authority a town board's power to regulate the density of population and the location and use of buildings, structures, and land for trade, industry, residence, or other purpose for any areas outside the limits of an incorporated village or city. Section 269 describes conflicts with other laws; it states that if zoning ordinances are more stringent than other statutes, zoning shall govern. If, however, zoning ordinances are less stringent than other regulations, then those other regulations shall govern. The article also describes procedures for amending zoning ordinances, and authorizes a town planning board to prepare and change a comprehensive master plan for the development of an entire area of the town.

12.3.14 Village Law

- Article 7, "Building Zones" and 11 "Water" provide villages similar authority to that provided to towns by Town Law.

12.4 Land Use Regulations: Local Land Use Controls

Local land use controls, including zoning, subdivision regulations and historic district laws can directly and indirectly protect open space and historic structures. "Clustering" and incentive zoning provide protection to sensitive open space areas while concentrating building on other parts of

a site. Transfer of development rights (TDRs) is a related technique which allows for transferring density among sites. Subdivision regulations allow the dedication of land for open space purposes.

12.4.1 History of the Suffolk County Pine Barrens Review Commission

As early as 1978, the NYSDEC sponsored a Task Force Meeting on the Pine Barrens to advocate preservation of its remaining 100,000 acres. The Pine Barrens Planning Council, an advisory body of the Long Island Regional Planning Board, continued this effort, actively studying the feasibility of a Pine Barrens Commission throughout the early 1980's. In April 1984 the Suffolk County Legislature established a Pine Barrens Review Commission of nine members (Local Law No. 7 1984). Approximately fifteen months later, this body reviewed its first application with the County Planning Department providing staff support. Since that first application, approximately 1000 applications have been reviewed by the Commission, referred by the towns of Brookhaven, East Hampton, Riverhead and Southampton. The following table summarizes the Commission efforts.

Figure 12-1: Summary of Applications Received by the Suffolk County Pine Barrens Review Commission through 1992

Year	Applications	Acres	Potential Units	Ares/D.U.
1985	71	3,332	34,370	.97
1986	159	5,128	44,631	1.15
1987	224	4,061	39,891	1.02
1988	218	5,328	22,132	2.41
1989	95	1,691	13,881	1.22
1990	64	1,917	19,990	.96
1991	62	733	7,650	.96
1992	39	325	4,790	.67
Total	932	22,515	18,7331	1.17

Commission procedure is to render an advisory opinion on applications for subdivisions, zone changes, special permits, variances, etc. After an advisory report is issued, the application is reviewed by the Suffolk County Planning Commission. Both reports are returned to the town which, after considering the reports, makes a final determination on the application.

The original 1984 legislation named only nine representatives (including only one from the South Fork of Long Island). In 1986 the Town of East Hampton petitioned the Suffolk County Legislature for representation. Accordingly, the legislature named two new positions and adjusted the terms of office. In addition, the requirements for an override of Pine Barrens Review Commission actions by the Suffolk County Planning Commission were modified as was the requirement for a report to the Suffolk County Planning Commission on each action by the Pine Barrens Review Commission.

Other modifications to the legislation occurred in 1987, when the size of South Setauket Woods Zone was expanded and all Pine Barrens Zones were designated as Critical Environmental Areas under the State Environmental Quality Review Act. Again in 1988, modifications were requested by the villages of Quogue and Westhampton Beach, in

light of the fact that only small areas within the Villages, north of the Long Island Railroad are in the Pine Barrens Zone. Accordingly the requirements for submissions from the two villages were relaxed.

In addition to each town code and the county-chartered commissions, other regulations influencing land development in the Central Pine Barrens are the requirements of the Suffolk County Department of Health Services (amended 1987), the New York State Wild, Scenic and Recreational Rivers Act (1988), and the state certified Special Groundwater Protection Area Plan (1992).

Development continued in the Pine Barrens albeit subject to review powers of the Pine Barrens Review Commission. As early as 1986, a bill amending the Environmental Conservation Law by adding Article 55 was considered in the New York State Assembly to create a New York State Pine Barrens Commission. The bill provided for a comprehensive Pine Barrens management plan, proposed a moratorium on alteration of threatened Pine Barrens areas and proposed an appropriation. (No. A. 6407-A). The effort to establish a state commission continued almost annually until it culminated in bills No. A. 8496-A and S. 5896-A, amending the Environmental Conservation Law by

adding Article 57 which was signed into law on June 14, 1993. For a more detailed discussion concerning the history of the Central Pine Barrens Joint Planning and Policy Commission see the Plan.

12.4.2 Suffolk County Laws

Although most of the county originated authority for groundwater resource management and enforcement is derived from the Suffolk Sanitary Code (*see* Section 12.4.2.7), the following are examples of other relevant county legislation.

12.4.2.1 Local Law 23-1977, "Local Law Implementing the State Environmental Quality Review Act"

The law, as amended by LL 28-1977 and LL 29-1980, formally adopts SEQRA in accordance with Article 8 of the ECL. It prescribes rules, regulations, and procedures for county agencies to comply with SEQRA, and includes lists identifying Type I and Type II actions.

12.4.2.2 Local Law 12-1980, "Local Law Prohibiting the Sale of Certain Cesspool Additive Products in the County of Suffolk"

The law prohibits the sale of any organic chemical(s) or compound(s) for the purpose of cleaning or unclogging sewer lines and/or individual sewage disposal systems unless approved by the SCDHS. It also directs that in order to obtain approval, scientific data, satisfactory to the SCDHS, must be submitted demonstrating that the organic chemical will not adversely affect the groundwater.

12.4.2.3 Local Law 8-1983, "Local Law Providing for Seizure and Forfeiture of Vehicles, Vessels and Other Conveyances Used to Illegally Transport or Dispose of Hazardous Wastes"

The Suffolk County District Attorney is empowered to seize vehicles, vessels, and other conveyances used to illegally transport or dispose of hazardous waste. After a hearing before a civil judge, seized vehicles may be forfeited and sold at auction.

12.4.2.4 Local Law 1-1984, "Local Law Regulating the Use of Public Water Fire Hydrants

for Pest Control and Other Commercial Purposes"

The law requires fire hydrant users, such as tree sprayers and plumbers, to register with the local water purveyor, display user identification emblems and have adequate cross connection (back flow) control devices installed on their trucks. The purpose of the law is to prevent pesticides and other materials from being accidentally introduced into water supplies.

12.4.2.5 Local Law Number 7 1984

Purposes

To ensure the effective management of the land known as the Suffolk County Pine Barrens Zone by protecting sensitive areas, including the underground aquifer, through the creation of a Suffolk County Pine Barrens Review Commission.

General Provisions

- Establishes the Suffolk County Pine Barrens Review Commission and gives it the authority to encourage the preparation of, to review and to evaluate any comprehensive plan which may be adopted for the maintenance and management of the Suffolk County Pine Barrens Zone, including plans which provide for increased specificity in protecting significant resources within the Pine Barren Zone, and promote reasonable economic growth within said zone and which create predictability in governmental decision-making;
- Prior to referring certain municipal zoning actions to the Suffolk County Planning Commission, each town and/or village in Suffolk County having jurisdiction to adopt or amend zoning regulations shall, before taking final action, refer to the Suffolk County Pine Barrens Review Commission any zoning regulation or amendment therefore (herein referred to as "municipal zoning action") which would change the district classification of, or the regulations applying to, real property lying within the Suffolk County Pine Barrens Zone.
- Prior to referring any application for a

special permit to the Suffolk County Planning Commission, each town and/or village in Suffolk County having jurisdiction to issue special permits pursuant to zoning regulations shall, before taking final action, refer to the Suffolk County Pine Barrens Review Commission any application for a special permit which would affect any real property lying within the Suffolk County Pine Barrens Zone.

- Prior to referring any application for a variance to the Suffolk County Planning Commission, each town and/or village in Suffolk County having jurisdiction to issue variances shall, before taking final action, refer to the Suffolk County Pine Barrens Review Commission any application for a variance which would affect any real property lying within the Suffolk County Pine Barrens Zone.
- Prior to referring any proposal for the approval of a plat, to the Suffolk County Planning Commission, each municipal agency authorized by a municipal legislative body to approve plats showing lots, blocks or sites, with or without streets or highways, or the development of plats entirely or partly undeveloped and which have been filed in the office of the Clerk of the County in which such plat is located prior to appointment of such Planning Board and the grant to such board of the power to approve plats, shall refer to the Suffolk County Pine Barrens Review Commission any plat of real property lying within the Suffolk County Pine Barrens Zone.

12.4.2.6 Article 4, Suffolk County Sanitary Code, Water Supply

Purpose

402. To control drinking water supplies and to insure that Suffolk County residents have a healthful and plentiful supply of water.

General Provisions

405. All drinking water made available for human consumption must meet the prevailing standards of the New York State

Sanitary code and any standards promulgated by the Board of Health.

407. A plan for water supply facilities approved by the Suffolk County Department of Health Services and filed by the Office of the Clerk of the County of Suffolk is required for all realty subdivisions, transactions or building construction.

12.4.2.7 Article 6, Suffolk County Sanitary Code

Article 6 of the Suffolk County Sanitary Code regulates the density and sewage facility requirements of residential and non-residential realty subdivisions and developments in Hydrogeologic Zones III, V and VI.

Article 6 requires limiting new development to a density of no greater than 1 dwelling unit per 40,000 square feet, or its equivalent, in unsewered areas in Hydrogeologic Zone III, V, and VI. This density limit is designed to maintain an average of 4 ppm total nitrogen in groundwater, which means that almost no samples will violate the 10 ppm nitrogen standard for any given sample.

In all other hydrogeologic zones in Suffolk County, Article 6 requires limiting new development to a density of no greater than 1 dwelling unit per 20,000 square feet, or its equivalent, in unsewered areas. This density limit is designed to maintain an average of 6 ppm total nitrogen in groundwater, affording 90% confidence level for attaining the 10 ppm nitrogen standard for any given sample.

General Provisions (Summary)

602-A No developer shall after the effective date of this article:

1. engage in the creation of a realty subdivision, or sell, rent, offer for sale or lease any parcel in a realty subdivision unless Department approval has been obtained of the existing or proposed water supply and sewage disposal facilities in the subdivision;
2. engage in the creation of a development, or lease, rent, give devise, or otherwise dispose of any parcel in a development or erect or cause to be erected any

permanent building on any parcel in the development unless Department approval has been obtained for the existing or proposed water supply and sewage disposal facilities in the development.

- 603-D Identifies requirements to obtain and furnish water supply and/or sewerage facilities for a realty subdivision or development by connection to an existing community water and/or sewerage system.
- 605-A Identifies conditions where a community sewerage system method of sewage disposal is required for a realty subdivision or development.
- 605-B Identifies conditions where individual sewage systems may be approved as the method of sewage disposal for all parcels within a realty subdivision or development.
- 606-A Identifies conditions where a community water system method of water supply is required.
- 606-B Establishes minimum requirements for community water systems.
- 606-C Identifies conditions where individual water supply systems may be approved.
- 608-A Identifies conditions where a community sewerage system for sewage disposal is required for the purposes of cluster housing, two-family residences, multi-family housing or commercial or industrial centers.

12.4.2.8 Article 7, Suffolk County Sanitary Code, Water Pollution Control

- Primarily intended to provide additional protection to deep recharge areas and water supply sensitive areas from possible spills and discharges of certain toxic and hazardous materials;
- Restricts storage and discharge of toxic and hazardous materials in deep recharge areas and water supply sensitive areas;
- Exempts facilities and activities such as retail stores, agriculture, and highway construction and repair;
- Specifies possible variances for gasoline service stations and industrial

establishments served by sewage collection and treatment, with effluent disposal outside of deep recharge areas;

- Includes requirements for permits to construct sanitary facilities and to discharge wastes, and to control the commingling of wastes and stormwater discharges; and
- Stipulates requirements for monitoring and reporting; connection to public sewer systems; and, abandonment of sanitary disposal systems.

12.4.2.9 Article 12, Suffolk County Sanitary Code, Toxic and Hazardous Materials Storage and Handling Controls

Purpose

1202 It is the intent and purpose of this article to safeguard the water resources of the County of Suffolk from toxic or hazardous materials pollution by controlling or abating pollution from such sources in existence when this article is enacted and also by preventing further pollution from new sources under a program which is consistent with the Declaration of Policy.

General Provisions (Summary)

- 1205 Declares that it shall be unlawful for any person to discharge toxic or hazardous materials in Suffolk County, unless such discharge is specifically in accordance with a State Pollutant Discharge Elimination System (SPDES) Permit or other permit issued by or acceptable to the Commissioner for that purpose.
- 1210-1216 Regulates the underground, outdoor above ground and indoor storage of toxic and hazardous materials. Controls the utilization of portable containers and tanks. The transfer of toxic and hazardous materials including associated facilities and operations are also governed by this ordinance.

12.5 Town Laws Summarized

12.5.1 Brookhaven Town

Cluster Ordinance, Development Pursuant to 281 of Town Law

Purpose

85-447 To allow the owner or developer of real property to develop it under Town Law 281.

General Provisions

85-447-A The total acreage owned by the applicant or to be included in the proposed development need not be in contiguous parcels or be otherwise contiguous.

85-447-A The owner must specify the number of acres to be dedicated to the town or other municipal agency or to be set aside as open space. The applicant shall state fully the purpose or purposes for which said dedication is to be made or the intended uses, if any, of the open space to be dedicated.

85-308 Permitted Uses, Property Located in Hydrogeologic Sensitive Zones, Industrial Zoning

General Provisions

85-308 B(7) All proposed actions and changes in tenants or occupants or new tenancies or occupancies, shall require notification and coordinated review pursuant to the State Environmental Quality Review Act.

85-308 B(10) All industries, owners, tenants or occupants, whose activity conducted on site involves storage and handling of toxic or hazardous materials and/or industrial discharges, shall be required to submit adequate financial assurances guaranteeing the immediate clean-up of spills or illegal discharges.

85-308 B(11) No industrial discharge shall be permitted unless in conformance with a treatment and disposal

system approved by Suffolk County Health Department and the Town of Brookhaven Department of Planning, Environment and Development.

Change of Ownership or Tenancy for Industrial or Commercial Buildings

Purpose

To control the siting of commercial and industrial uses within the Town.

General Provisions

- Whenever a building, structure or use or alteration thereof is proposed in this district, except for one family dwelling places, permitted agricultural uses and customary uses related thereto, the Building Inspector shall refer the site plan of the proposal to the Brookhaven Town Planning Board for review.
- When a structure or use is changed, sold or leased, the new owner or tenant shall cause notice to be given to the Department of Planning, Environment and Development within thirty (30) days of such sale or lease.

Sand and Gravel Pits, Excavation and Removal of Topsoil

Intent.

Whereas, the Town Board of the Town of Brookhaven recognizes that sand and gravel are valuable natural resources of property owners within certain areas of the town and that in past years the excavation of sand and gravel has proceeded in an unsatisfactory manner resulting in the elimination of ground cover, natural vegetation and the degradation of slopes, radical changes in stormwater runoff and other problems which, in all likelihood, will lead to the permanent sterilization of property within the town; therefore, the purpose and intent of this chapter is to restrict the removal of sand and gravel to those instances where it is absolutely essential to remove said raw materials from a site in connection with the residential, commercial or industrial development of the premises, and further that the purpose and intent of this chapter is to encourage development which utilizes existing slope contours wherever possible

so that drainage patterns and existing vegetation will be subjected to the least disturbance as is practicable.

Wetlands

81-1 Legislative intent. [Amended 2-1-77 by Local Law No. 1, 1977, effective 2-22-77]
It is hereby declared to be the intent of the Town of Brookhaven to protect and enhance the many valuable resources which both tidal and freshwater wetlands possess, to prevent the despoliation and destruction of wetlands by regulating the use and development of such wetlands and to secure the natural benefits of wetlands for the existing and future residents of the Town of Brookhaven. Such wetland resources include flood and storm control, recreational facilities, pollution treatment, wildlife protection, open space and aesthetic appreciation, erosion control, sources of nutrients for marine and freshwater life, means for scientific and educational research, as well as means to protect subsurface water resources. Such resources shall be protected by the Town of Brookhaven pursuant to the authority conferred upon the town by Article 24 of the Environmental Conservation Law, as such Article may from time to time be amended.

Site Grading and Erosion Control Ordinance

Purpose

35-1 To regulate the regrading of land to prevent serious and irreparable damage to natural resources, depreciation of property values, and to protect persons and property from the hazards of periodic flooding.

Minimum Standards

35-3 Whenever a site plan review and approval is required, the site plan shall indicate compliance with the standards provided in this ordinance.

Tree Preservation

Purpose

70-1 To regulate the destruction and removal of trees and to secure protection of trees in order to protect wildlife habitats, ecosystems and aesthetic quality.

General Provisions

70-3, 70-6. Submission of a plan and procurement of a permit is required prior to the destruction or

removal of any tree growing upon a parcel of real property which is in excess of two acres.

HF Horse Farm-Residence District

Purpose

To establish requirements and standards for the permitted uses within an HF-Horse Farm-Residence District.

General Provisions

85-184 Identifies temporary uses requiring Planning Board 85-185 approval such as horse shows. Sets standards for minimum lot size and the number of horses permitted per acre.

A Soil and Water Conservation Plan is required in order to obtain a permit.

12.5.2 Riverhead

Transfer of Development Rights Program

Purpose

95A-2

This chapter is hereby enacted to achieve the goals of preserving and protecting the natural, scenic or agricultural qualities of open lands, to enhance sites and areas of special character or special historical, cultural, aesthetic or economic interest or value and to enable and encourage flexibility of design and careful management of land in recognition of land as a basic and valuable natural resource.

95A-7. Preservation of agricultural land

Consistent with the purposes of this chapter, preservation of agricultural land is of utmost concern. The preservation of agricultural land will achieve the goals of preserving the character of Riverhead and support an economically viable farm industry.

Wetlands, Flood plains and Drainage

107-1 Legislative Intent

The Town Board of Riverhead finds that rapid growth, the spread of development and increasing demands upon natural resources are encroaching upon, despoiling, polluting or eliminating many of its watercourses, coastal wetlands, tidal marshes, floodplain lands, freshwater wetlands, watersheds, water recharge areas and other natural resources

and processes associated therewith which, if preserved and maintained in an undisturbed and natural condition, constitute important physical, social, aesthetic, recreation and economic assets to existing and future residents of the town.

107-4 and 107-5

Regulates by permit the deposit of debris, fill, materials; digging, dredging in water courses, floodplain lands, freshwater wetlands, watersheds, water recharge areas or natural drainage systems.

12.5.3 Southampton Town

330-63 et. seq. Aquifer Protection Overlay District

Purpose

To promote water recharge and prevent the degradation of the sole source aquifer through the regulation of land use in water catchment regions.

General Provisions

330-68 Fertilized vegetation should not exceed fifteen percent (15%) or twenty thousand (20,000) square feet for any tract or lot within the district.

69.1 Prohibits the location of new public or private disposal systems used for, but not limited to, the disposal of septic or waste materials.

Preservation of Open Space, Planned Residential Development

Purpose

52-1A To encourage the flexibility of design and development of land to promote the most appropriate use of land, and to preserve the natural and scenic quality of open lands in order to provide larger areas of open space both for recreational and conservation purposes.

General Provisions

52-4A The number of dwelling units in no case shall exceed the number which could be permitted if the land were subdivided without the benefit of the local law.

52-7A The application of the procedure shall result in the preservation of at least twenty-five percent (25%) of the land in its natural state.

52-8A The use of this procedure shall also result

in the preservation of Class I or II prime agricultural soils, located in the Agricultural Overlay Districts or a water recharge area.

330-7 Transfer of Development Rights

Purpose

330-7A To achieve community planning objectives with reference to natural resources, population, utilities, and housing while maintaining the established overall ratio between population capacity at ultimate community development and the safe yield of the fresh groundwater reservoir within the Town's territorial limits.

General Provisions

330-7 et. seq. Land from which the development rights are to be transferred must have characteristics such that their permanent preservation as open space will result in the preservation of one or more of the following: porous morainal soils; soils found in the Agricultural Overlay Districts, tidal wetlands or lands included within the greenbelt park system or an individual park, beach or public recreation area.

330-57 et. seq. Special Old Filed Map Overlay District

General Provisions

330-57E Authorizes the establishment of an Old Filed Map Overlay District.

58B No building permit shall be issued for the erection of a one family dwelling on a lot containing less than ten thousand (10,000) square feet in the Special Old Filed Map Overlay District.

58C Each and every lot in the Special Old Filed Map District having a lot area of less than ten thousand (10,000) square feet, lawfully existing in a single and separate ownership and having no dwelling unit thereon is hereby granted a fractional development right.

59B Upon accumulating sufficient partial residential development rights as to amount to one (1) or more full residential development rights, such partial rights may

be transferred to any lot in the Special Old Filed Map Overlay District having a lot area of not less than twenty thousand (20,000) square feet.

Vegetation Protection

Purpose

62-2 To regulate the destruction or removal of vegetation to protect the town's fresh water supply, natural noise barriers, wildlife habitats and aesthetic character.

General Provisions

62-4. Damage, destruction, or removal of vegetation on private property without the consent of the property owner or on public grounds without the consent of the Town Board or agent is prohibited.

Wetlands

Purpose

175-1 The Town Board of the Town of Southampton finds and declares it to be the public policy of the town to preserve, protect and conserve its wetlands and the benefits derived therefrom, to prevent their despoliation and destruction, to regulate the use and development thereof and to secure the natural benefits of wetlands consistent with the general welfare and beneficial economic and social development of the town.

Trails Policy

Purpose

295-1 The Master Plan envisions a recreational system which would incorporate the essential natural and scenic resources that have attracted people to the community over the years into a system of largely interconnected parks and open spaces. These resources, such as our morainal and pine barren woodlands, farmlands, ponds, bays and ocean and points of interest, as well as our scenic hamlets, would provide the setting or backdrop for specific recreational facilities and historic sites, or focal points, within the overall system. These focal points would be the active, high-traffic, recreation areas and would be lineally connected to the less active, natural, environmental parks by way of

greenbelt corridors and trails.

12.6 Bibliography: Selected Laws Pertinent to the Central Pine Barrens

Long Island Regional Planning Board. *Airport Joint Use Feasibility Study 1993*. Calverton Airport.

Long Island Regional Planning Board. *Nonpoint Source Management Handbook*. 1984.

Office of Parks, Recreation and Historic Preservation. *Conserving Open Space in New York State . . . The Plan* (Second Printing). 1993.

Suffolk County Comprehensive Water Resources Management Plan Volume 1. Dvirka and Bartilucci, Consulting Engineers, and Malcolm Pirnie Inc., 1987.

13. Public Participation and Community Outreach

13.1 Overview

The community outreach component of the Central Pine Barrens Comprehensive Land Use Plan originates in Environmental Conservation Law Section 57-0121(11) which states that the Commission shall "consult with interested professional, scientific and citizens' organizations and committees" during the development of the land use plan.

In order to meet this mandate, the Central Pine Barrens Commission sponsored public meetings throughout Brookhaven, Riverhead and Southampton in the past twelve months. Over 1500 people have heard directly about the legislation and the process of preparing the draft plan, and have expressed their thoughts about the planning process. Others have personally written or called the Commission with their concerns and questions. Additional people have heard about the planning process through press coverage.

Following the adoption of a final land use plan, continued efforts will be made to make the final plan known to all interested persons. A public hearing will be held on the proposed final plan and individual towns may choose to hold separate public hearings on issues that relate specifically to their locale. Finally, no program would be successful without the input of the very interested individuals who took the time to become involved. To those who did attend a meeting or otherwise participate, thank you.

13.2 Introduction

The goal of the community outreach program is to provide a variety of forums whereby the public can comment and participate in the planning process resulting in a land use plan that reflects the concerns of all interested individuals. To accomplish this task, several levels of public interaction have been necessary and will continue

following the release of the final plan. Of special concern are private landowners within the Core Preservation Area and civic and community groups in the adjacent Compatible Growth and surrounding areas.

Landowners are understandably concerned about land protection mechanisms, compensation techniques and desire general information about the planning process. The first major outreach effort, designed for the private landowners in the Core Preservation Area, was a public meeting held on March 16, 1994. An overview of the Pine Barrens Protection Act was presented and a panel of Pine Barrens representatives were available for questions and answers. In addition, private landowners within the Core Preservation Area have written and called the Commission office and are and continue to be assisted by the Commission staff on an individual basis. An additional briefing session for private landowners was held on August 27, 1994 at Brookhaven National Laboratory.

The purpose of the smaller, community informational meetings was to reach as many stakeholder groups as possible in and around the Central Pine Barrens zone, give general information about the work of the Commission, answer questions and receive comments. Over 1500 people attended the 31 meetings held to date. In addition to the smaller community meetings, three larger, public briefing sessions were held, one in each town. Following these, a public hearing for the plan and the draft environmental impact statement was held on September 28, 1994.

To specifically deal with members of the communities that will be affected by the Pine Barrens Credit program, a community design workshop was held in each town. The purpose of the workshops was to have communities determine what elements of the built environment they appreciate and value and how they would like to see their community develop in the future. By involving the public in the planning and design process, concerns about negative impacts of development can be mitigated before development proposals are prepared and submitted.

13.3 Review of Meetings

13.3.1 Core Preservation Area Landowners

On March 16, 1994, in response to a mailing by the Commission to all property owners within the Core Preservation Area, over 350 persons attended a meeting to hear an overview of the planing process and to ask questions regarding a variety of issues. The meeting was arranged by representatives from the Advisory Committee, the Commission and the Suffolk County Planning Department. More than 20 people spoke on a variety of issues.

On August 27, 1994, at Brookhaven National Laboratory a briefing session specifically for Core Preservation Area landowners was held. The format for this session consisted of various stations set up with the following topics and agencies represented to answer individual questions:

General Information/Survey Collection

Suffolk County Water Authority

List of Core Owners/Plan Info/Comments

Suffolk County Water Authority
Suffolk County Planning Department

Pine Barrens Credit Program

Suffolk County Water Authority
Regional Plan Association
The New Jersey Pinelands Commission

Acquisition Programs/Conservation Easements

Suffolk County Division of Real Estate
Suffolk County Planning Department
New York State Department of
Environmental Conservation
The Nature Conservancy
Peconic Land Trust

Hardship Exemption/Existing Uses/Compatible Growth Area

Suffolk County Water Authority
Long Island Greenbelt Trail Conference

All Core Preservation Area landowners were sent a letter inviting them to the August 27, 1994 session and a landowner survey which they had the option to complete and return. The main purpose of the survey was to give landowners the opportunity to receive more information if they were not able to attend the meeting and also for Commission staff to further ascertain a profile of this group. A total of 3500 surveys were sent and 362 were returned.

The following breakdown shows the locations where these landowners reside as well as the size of the parcels that they own:

Figure 13-1: Landowner Survey Summary: Breakdown By Location of Owner

Locations		
Town of Brookhaven	51	14%
Town of Riverhead	14	4%
Town of Southampton	13	3.5%
Suffolk County (remaining)	47	13%
Nassau County	64	17.5%
New York City (5 boroughs)	53	14.5%
New York State	20	5.5%
Florida	19	5%
New Jersey	12	3%
California	10	3%
Pennsylvania	9	2.4%
Ohio	5	1.3%
Virginia	5	
Louisiana	5	
Connecticut	4	1.1%
North Carolina	4	
Massachusetts	4	
Maryland	3	<1%
Tennessee	2	<1%
New Mexico	2	
Georgia	2	
Rhode Island	2	
Illinois	2	
Mississippi	1	<1%
Missouri	1	
Kansas	1	
Vermont	1	
Texas	1	
South Carolina	1	
Colorado	1	
Alabama	1	
Arizona	1	
Israel	1	

Breakdown by Acreage

Of the 362 landowners that responded a total of 466 parcels were listed as some owners hold more than one parcel. The following overview gives a breakdown of the size of these parcels in acres:

< .25	180	38%
.25-.5	69	15%
.5-1.0	60	13%
1.0-5.0	105	22.5%

5.0-10.0	19	4%
10-50	22	5%
50-100	10	2%
>100	1	<1%

13.3.2 Community Meetings

A list of community organizations including civic organizations, local and regional environmental and business groups and other stakeholders was compiled by Commission staff. Initially, groups were contacted individually to inform them of the Commission's outreach program. Following the adoption of the draft plan, a mailing to all groups was made informing them of the availability of the draft plan and the availability of staff to speak to the group if desired. The meetings took place throughout the Central Pine Barrens zone. The smaller size of the community meetings allowed the time to focus in on one group's needs and concerns.

The formats for the meetings consisted of an overview of the Central Pine Barrens legislation and its requirements, the people responsible for fulfilling them, and most importantly, how this information would affect the particular group.

General information such as fact sheets and meeting schedules were handed out and maps were presented that showed how the boundaries of the Core Preservation Area and Compatible Growth Area related to the area the group was representing. In some cases, slides showing development options for compact growth patterns were presented. In all cases, the opportunity for interactive question and answer sessions was provided.

13.3.3 Public Briefing Sessions

The public briefing sessions took place after the adoption of the draft plan on three consecutive Wednesday nights in September 1994. The main purpose of these meetings was to inform people of the contents of the draft plan and answer their pertinent questions and concerns. Again a station method was utilized. The following topics and agencies were present:

General Information

Suffolk County Water Authority

Pine Barrens Credit Program

Town of Brookhaven
Suffolk County Water Authority
Regional Plan Association

Land Management

Open Space Council
Long Island Greenbelt Trail Conference

Ecology

NYS Department of Environmental
Conservation
The Nature Conservancy
Long Island Builders Institute

Land Protection

The Nature Conservancy

Generic Environmental Impact Statement

Suffolk County Water Authority

Compatible Growth Area/Hardship Exemption

Suffolk County Water Authority
Long Island Greenbelt Trail Conference

13.3.4 Community Design Workshops

1. Purpose

The purpose of the workshops was to engage the public in an active, hands-on, participatory process of analysis and design for future development within their community. A concentrated focus on the existing built environment, coupled with a vision for possible future alternatives, provided the members of the community with the opportunity to help shape the physical form and character of their physical surroundings.

2. Preparation

a. Determination of Study Areas

In Brookhaven, with the approval of the Planning Commissioner for the Town of Brookhaven and the Central Pine Barrens transfer of development rights working committee, the Moriches Bay area planned development districts were selected for further analysis and community outreach efforts by Regional Plan Association. (The draft plan (July 14, 1994) receiving area map outlined three PDD's for this area known as part of A, B & C) Analysis of the Moriches Bay area indicated that while there are three separate and distinct communities; Moriches, Center Moriches and East Moriches, any plan for the future development should look at these areas as a whole and respect the natural boundaries that form the overall "sub-region." For the purposes of this study, the natural boundaries that create the Moriches Bay area were determined to be the Forge River on the west, Sunrise Highway on the north, Little Seatuck Creek on the east, and the Moriches Bay along the south.

In Southampton, the Speonk-Remsenburg school district contains a considerable portion of land within the Core Preservation Area and thus had several areas designated in the draft plan for the use of Pine Barrens Credits. Again, a comprehensive approach was taken and the study area was made of all the land south of Sunrise Highway to Moriches Bay. The eastern boundary was generally the school district boundary, but also followed the Speonk River and its associated watershed. To the west, the study area extended beyond the Speonk-Remsenburg district into the Eastport district. This was due to the fact that the East River and accompanying watershed form the natural boundary of the Speonk-Remsenburg community on the west.

In Riverhead, the delineation for receiving areas was limited in the draft plan to the Calverton area at the junction of the Long Island Expressway exits 72 and 73 and south of Route 25 and Route 58. To the west, the boundary is delineated by the Grumman property and to the east is defined approximately by Kroemer Avenue. This entire receiving areas were chosen for further analysis and community outreach by Regional Plan Association.

b. Study Area Mapping

A base map of tax lots was generated through the

Suffolk County Water Authority geographic information system at a scale of 1 inch representing 400 feet. Topographic information was obtained from the Suffolk County Department of Public Works. This information was overlaid and drawn on the tax lot base map. Current aerial photography was overlaid and used to draw in existing buildings and other site information. School district boundaries and road names was also added. Maps were prepared for each study area and used during the workshops to go through the mapping exercises outlined below. These maps will also be used in further analysis to determine what is feasible for future development. These maps are not included here, but are available for review at the Commission office.

The following outline formed the basis for the agenda of the community design workshops:

3. Workshop Program

a. Introduction (30 min - full group)

An overview of the intent of the workshop, the format and agenda was presented. Smaller break-out groups consisting of 5-10 people will be formed. Other display material including zoning and land use maps, photographs and other relevant information will be presented and made available during the workshop.

b. Participant Orientation (15 min - break-out groups)

The first exercise was to ask participants to mark on the map where they live or work, or are otherwise associated with the study area. This aided in orienting people to the map and the area it encompassed.

c. Assets and Liabilities (20 min - break-out groups)

Participants were asked to mark areas on the map which are the most important assets to the community including favorite places, special buildings or landscapes, or other elements which are essential to the quality of life in their community. In contrast, they also marked on the map any structures, land uses or other factors that threaten the quality of life in the community.

d. Future Growth (20 min - break-out groups)

In this exercise participants were asked to choose where they see future growth within their community and what types of activities this includes, (i.e., recreational, more housing, industrial, etc.), what land uses are needed for what purpose and where should they be located. How does existing zoning allow or hinder desirable future growth patterns?

e. Group Presentation (60 min - full groups)
 Groups representatives were asked to present their findings to all members of the community. This information was helpful in summarizing the similarities and differences that each group observed. As a group, participants were asked to consider real world constraints and prioritize proposed actions.

4. Workshop Results

The results of the workshops contain an account of what the people said during each program element.

Brookhaven (Moriches Bay Area)

The Moriches Bay area community design workshop was co-sponsored by the Moriches Bay Civic Association, the Moriches Bay Chamber of Commerce and the East Moriches Property Owners Association. Mailings were done by each group to their memberships and a press release was also prepared and published for the event.

Assets

- Rural Area
- Marine Resources
- High Property Values
- Active Agriculture
- Downtown

Liabilities

- Composting Facility
- Strip Malls

- Quiet area but close to activity
- Havens Estate Nature Preserve (woods & beach)
- Recreational opportunities
- Employment Opportunities

- Property Taxes
- Low Tax Base
- Gas Leak

Recommendations for Future Growth

- Maintain rural character
- Allow clean industry such as medical arts facilities on the Moriches By-Pass
- Provide affordable housing
- Leave Havens Estate as nature preserve
- Bay Avenue site should have lower density housing
- Seek community development funds for downtown East Moriches improvements
- Require architectural reviews for main streets
- Improve parking behind existing stores
- Utilize parking at Center Moriches firehouse
- Improve intersection at Montauk Highway and Frowein Boulevard.
- Provide day care centers
- Keep active agricultural uses and provide for agri-business and farm markets
- Keep Main Street as a focus of retail activity
- Provide recreational facility near high school including tennis, swimming, horse stables, skating, basketball, etc.
- Allow bed and breakfast facilities, particularly at places like the Marcos Estate.
- Provide a golf course possibly, as a reclamation of a disturbed area
- Explore possible tourist uses
- Improve marina facilities including a ferry to ocean beaches
- Provide cultural facilities possibly along Terrells River corridor, utilizing existing historic building (e.g., the Ketcham Inn)

Southampton (Speonk-Remsenburg)

The Speonk-Remsenburg community design workshop was co-sponsored by the Remsenburg Association, the Speonk-Remsenburg Civic Association and the Citizens Advisory Committee. Individual mailings were made by these groups and a press release was prepared and published.

Assets

- Main Street character
- Open field at west end of hamlet

- Recreational opportunities
- Mill building
- Yacht squadron
- East Pond
- Historic marker on Clay Pit Road
- Active farmland on Old Country
- Hamlet center
- Railroad Station architecture

Liabilities

- Candy's Magic Pub
- Drag strip (noise)
- Houses built on marsh
- Abandoned warehouse on North Phillips
- Industrial uses along Speonk-Riverhead Road
- Law office at east hamlet entry

Recommendations for Future Growth

- Provide senior citizen housing where Candy's Magic Pub is located. Preserve old post office located at the rear of the building.
- Provide interconnected trail system to link coastal areas, school, hamlet center and Pine Barrens.
- Provide public access points to bay.
- Provide a public park at the site of the old quarry pond.
- Provide affordable housing.
- Reclaim abandoned sand mines
- Explore business zoning designation for west side of North Phillips Avenue so that old buildings could be re-used. Alternative business zoning.
- Preserve farmland and explore possibility for a community farm.
- Town should police any illegal activity on Speonk-Riverhead Road.
- Keep future retail uses south of Long Island Railroad
- Provide sidewalks to hamlet center.
- Redesign and coordinate hamlet center parking.

Riverhead (Calverton)

The Calverton community design workshop was co-sponsored by the Calverton Civic Association and Long Island Farm Bureau. Individual mailings

were made by these groups and a press release was prepared and published.

Assets

- Open agricultural lands
- Splish-Splash
- Calverton Links
- Farmstands
- Horse farm

Liabilities

- Omni solid waste facility

Recommendations for Future Growth

- Coordinate Pine Barrens Transfer of Development Rights (TDR) with agricultural TDRs
- Buffer new development with vegetation
- Allow recreational uses as per the hamlet study
- Preserve agricultural uses
- Prevent excessive curb cuts along Route 25

13.3.5 Expert Panel Meetings

On three occasions after the adoption of the draft plan, outside experts covering three topical areas of the plan were brought in for roundtable discussions with various groups involved in the planning process. These were as follows:

October 3, 1994 - Mr. Paul Millmore, Conservation & Management Specialist, East Sussex, England. A lecture and slide presentation was given and the following groups were invited: Land Management Committee, Ecology Committee, Protected Lands Council, SC Parks and Trails Working Group.

October 17, 1994 - Dr. James Nicholas, TDR Consultant, University of Florida. Dr. Nicholas had done some analysis of land values in the Central Pine Barrens to assess the viability of a TDR program in this region. Two sessions were held, one for Town officials and one for the TDR Committee.

October 25, 1994 - Armando Carbonell, Executive Director of the Cape Cod Commission and Andy Young, Former

Selectman, Town of Chatham, Massachusetts. The Cape Cod Commission is very similar to the Central Pine Barrens Commission as it is a regional entity controlled by town governments. Two sessions were held, one for Town officials and one for civic groups.

13.3.6 Meeting Summary

The following list summarizes all public meetings held to date with the number of attendees as shown on the sign-in sheets:

DATE / GROUP (NUMBER OF ATTENDEES)

March 16	Core Preservation Area Landowner Meeting (350)	September 12	Information Meeting (25) League of Women Voters of the Hamptons (12)
April 18	Affiliated Brookhaven Civic Organization (15)	September 14	Town of Brookhaven Public Information Meeting (50)
May 12	East Quogue Citizens Advisory Committee (7)	September 21	Town of Southampton Public Information Meeting (45)
May 12	Peconic Estuary Program Citizens Advisory Committee (18)	September 19	Remsenburg Association (10)
May 19	North Fork Environmental Council (14)	September 22	Moriches Bay Civic Association (35)
May 23	Town of Riverhead Economic Development Task Force (8)	September 28	Draft Land Use Plan and GEIS Public Hearing (225)
June 2	Manorville Taxpayers Association (64)	October 5	Design Professional's Coalition (75)
June 8	Quogue/Westhampton/Speonk/Remsenburg Citizens Advisory Committee (10)	October 11	Moriches Bay Chamber of Commerce (15)
June 14	Citizens Campaign for the Environment (30)	October 20	Speonk-Remsenburg Community Design Workshop (12)
June 16	Long Island Association, Energy & Environment Committee (30)	October 28	Moriches Bay Community Design Workshop (35)
June 22	Wading River Civic Association (19)	November 3	East Yaphank Civic Association (6)
July 14	Speonk-Remsenburg Civic Association (15)	November 7	Medford Taxpayers and Civic Association (30)
July 15	Lake Panamoka Civic Association (50)	November 9	Calverton Community Design Workshop (15)
August 17	Ridge Civic Association (25)	November 14	Mastic/Shirley Chamber of Commerce (40)
August 18	Village of Quogue Trustees/Compatible Growth Area Landowners(20)		
August 28	Core Preservation Area Landowners Workshop (225)		
September 7	Town of Riverhead Public		

14. Suggested Design Guidelines for Pine Barrens Credit Use Areas

14.1 Introduction

The use or redemption of Pine Barrens Credits may occur generally in three ways: designated receiving districts, residential overlay districts (ROD) and planned development districts (PDD). In order to ensure that the use of Pine Barrens Credits is done in a manner that protects and improves the character of existing communities in the compatible growth area and outside the Central Pine Barrens, towns should consider the creation of design guidelines. Towards this end, a discussion of the differences between the types of possible receiving districts is presented, followed by a sampling of guidelines.

14.2 Residential Overlay Districts/Designated Receiving Districts

The purpose of designating residential overlay districts is to utilize existing zoning and land use patterns to achieve a marginal increase in density over a broad area. Residential overlay districts will primarily occur in existing single family zoning districts, hence design guidelines for these districts would be limited to single family residential development. The use of designated receiving districts could also be for the purposes of residential development. However, these areas may also include lands zoned for commercial, industrial or other uses. Hence, as these are not determined at this time, design guidelines could correspond to those specific uses, as designated.

The following factors influence the physical layout of single family residential development and associated infrastructure. Hence, these guidelines will help applied, accomplish the marginal increases in density without undesirable changes in neighborhood character.

14.2.1 Roads

Subdivision roads should be designed to foster

community interaction, protect natural vegetation and allow the opportunity for natural drainage:

- The right-of-way (ROW) width of subdivision roads should be 50 feet and could include a pavement width no greater than 24 feet. The remaining ROW area should provide ample and safe pedestrian and bicycle circulation with connections to the surrounding community.
- Road ROW should be selectively cleared only as necessary to provide pedestrian paths and in so doing, could be designed to preserve trees larger than 12 inches in caliper.
- Roadway centerlines should follow area highpoints or natural topography to foster natural drainage and reduce cutting and filling to minimize clearing of road edges.
- Provide curbing only where natural drainage is impractical and have flexible top coat standards to allow for alternative (porous) materials where appropriate.
- Bury utilities underground if possible.

14.2.2 Open Space

Open space within a subdivision should aim to protect the natural resources of a site and maintain them in large, unfragmented tracts. Furthermore, on individual lots, portions should be maintained in their natural state and should connect with larger, common open space areas of the site and provide open space connections to surrounding areas. Open space should also provide a variety of recreational opportunities depending on ecological sensitivity.

- All open space within a subdivision should be physically connected with the amount of open space to be determined by the quality and quantity of ecological sensitivity of a given site.
- Clearing on individual lots should be limited to those areas that are necessary for development and in so doing should be designed to protect all trees greater than 24 inches in caliper and protect slopes greater than 10%. Where this is not possible, clearing limits should be imposed with the amount to be determined based on ecological sensitivity of a given site.

14.2.3 Common Drives/Utility Corridors

To reduce land area dedicated to paved vehicular use and costs associated with this, coordinate residential driveways for general access off the collector roads. This reduces curb cuts and the suburbanization of roadways. Also, these common rights-of-way could be used to coordinate utility access to a given lot. Random and varied utility access results in excessive site clearing and less efficient use of valuable land area.

All lots should have access from a common drive with a minimum of two lots per drive and should not exceed 12 feet in width. A cleared area, possibly 2-3 feet on each side should be provided for all utility lines. It should be designed to protect individual trees greater than 12 inches in caliper. Required paving materials should be based on site conditions, however porous materials and a design that allows for natural drainage are encouraged.

14.2.4 Drainage/Recharge Areas

Presently in subdivision codes, recharge areas encompass large land areas based on the drainage design criteria and layout specifications. These should be reviewed to correspond more closely with the actual site specific conditions. It is possible to redesign such areas to allow more natural drainage patterns, minimize clearing in and around retention and storage areas, reduce size requirements based on soil conditions and generally use less space while comprising an aesthetic open space element.

Drainage design should correspond to a given site's soil and topographic conditions and should be designed to minimize clearing of native vegetation and excessive site grading. Natural drainage utilizing area lowpoints, swales and similar features are encouraged.

14.2.5 Siting of Buildings/Setbacks

Presently, setback requirements and minimum lot widths play a major role in the actual location of buildings and other site elements, leaving an amount of "leftover" or under utilized land. Setbacks should be designed to foster community interaction and provide more efficient use of

individual lots.

Subdivision layout should be based on traditional Long Island settlement patterns, therefore the maximum front yard setbacks should be 30 feet. An ideal village street corridor, measured between opposing house facades, is a width that does not exceed three times the height of the structures. With 50 foot road ROW, 30 foot setbacks are optimum for fostering social interaction and sense of community. If desired, the same setbacks as the underlying zoning could also be used.

- Setback requirements should be set according to the particular site conditions and incorporate elements of ecological sensitivity if necessary. By adjusting setback requirements to reflect the current conditions of the lot ecologically sensitive features, such as a mature stand of trees, can be preserved.

14.3 Planned Development Districts

The purpose of designating an area as a planned development district (PDD) for the use of Pine Barrens Credits is to utilize an alternative zoning and land use pattern which achieves an overall, coordinated design, resulting in a more comprehensive plan for a given area. Planned development districts can successfully mix land uses, creating or enhancing a "village" type setting with a distinct center, or utilize an existing hamlet center where people can live, work, play, shop and worship. The benefits of such a district include reduced infrastructure costs, reduced automobile trips and a stronger sense of community.

14.3.1 Land Use/Permitted Uses

Standards for land use could be segmented according to activities, i.e., civic uses, residential, retail, etc., each with their own "intent." The types of land uses permitted within a given planned development district will vary in every case based on the location of the proposal within the town, the surrounding land uses, the environmental suitability, marketing analysis and community participation.

Permitted land uses within a given PDD should respond to these factors and also serve to meet the

overall goals of the town's comprehensive plan. The following is a sample of guidelines for one type of permitted use only. All potential uses should have use specific guidelines, however these will vary.

Civic Uses. Foster and encourage uses that improve the sense of community, service localized needs and reinforce the center.

- Civic land uses should comprise 20% of the land area within a given PDD, located within or adjacent to a public square or on a lot terminating a street vista, so as to have direct access from all use areas. These uses include: meeting halls, post offices, day care facilities, schools, clubhouses, religious buildings, recreational facilities, museums, cultural societies, visual and performing arts buildings, municipal buildings and others by special exception.

14.3.2 Community Participation

An important component of the planning process for a planned development district is the involvement of local citizens. This is essential to ensure the plan meets the needs of the community and therefore is accepted, thus creating a successful plan.

- Members of the community should be informed of the planning process for a planned development district prior to the preparation of final plans and shall have the opportunity to participate in the planning.

14.3.3 Fiscal Impacts

A planned development district should not have a negative impact on special districts within the community and should not cause undue or unreasonable growth in any given area.

- All development within the PDD should be balanced so that uses that provide tax rateables will be in proportion to units that generate school age children. The developer should be responsible for

formulating and demonstrating a plan for balancing tax revenue with expenditures.

- Construction of PDD's should be phased in such a manner so as to prevent accelerated growth or negative fiscal impacts in the short term (1-5 years) and to promote balanced growth and positive fiscal impacts during construction and for the life of the project.

14.3.4 Streets

Streets should be designed as part of the public space and should accommodate the pedestrian equitably with the automobile. Street widths will vary depending on the use within the PDD. The following is a sample of a street containing retail uses.

- Streets bordered by lots containing retail uses should have a maximum ROW of 64 feet consisting of two 12 foot travel lanes, 8 foot parallel parking on both sides and sidewalks 12 feet wide.

14.3.5 Parking

Vehicular use areas should be aesthetic components of the PDD and provide coordinated access between use areas as well as provide ample pedestrian circulation.

- Parking requirements may be reduced if it is shown to be unnecessary based on peak usage.
- At least 75% of the off-street parking spaces should be to the rear of the building. However, primary access should be from the front.
- Parking should be designed and located to facilitate "shared parking" in which spaces accommodate peak usage at different timing of day.

14.3.6 Open space

Open space could be designed to protect natural resources and provide for active and passive recreation areas. This would allow for the incorporation of public squares and plazas to

enhance the civic realm and provide greater security.

- All ecologically sensitive areas should be preserved and buffered as necessary. In addition, a minimum of 30% of the site should be for active, strategically located public spaces.
- Ecologically sensitive areas could be incorporated into a contiguous greenspace in and around the development with pedestrian connections where applicable.

14.3.7 Buildings/Setbacks

These may need to be segmented according to uses. The following is for retail uses only.

Allow buildings to create and define the street ROW, thereby lending character to the public realm.

- Retail use buildings should have their facade built directly along the frontage line for at least 60% of the block length.
- Retail use buildings should have no setback on one side lot line.

14.3.8 General Factors

The following factors should be considered as general criteria for evaluating all development:

14.3.8.1 Architecture

The design for a planned development district or new development in a designated residential overlay district should take the opportunity to create a unified architectural character without becoming too repetitive. Recognition of a certain style that has been established and accepted within any given area will aid in blending new development with existing. Building heights, materials and rooflines are components that determine the quality of the built form and should have specific guidelines. The following factors are also relative when considering architecture:

- Scale and Proportion is the size of one architectural element relative to another or to its surroundings. Older, historical

buildings on Long Island appear smaller because they were built to human scale and were expanded incrementally. Additionally, large structures were buffered by mature trees or were nestled into the landscape making them appear smaller. Nearby structures were built in proportion to one another.

- Massing is a building's height, bulk, shape and roof angle. Traditional Long Island structures were composed of a primary mass, expanded by later addition of various smaller masses. The mass of a given structure can be treated in many different ways so that even though two buildings may have the same square footage, one may actually "appear" smaller based on the layout of the footprint. Hence the layout of a building footprint plays a major role in how "massive" a building appears. Traditional rooflines were primarily gable and shed. New buildings should reflect the local architectural character.

- Fenestration is the amount, pattern, size and placement of windows, doors or other openings on the building facade. These play an important role in unifying new structures with existing buildings.

- Siting is the orientation and placement of buildings, as well as other site features, and should respect the natural landscape. The siting of a building should respect the horizon line. Buildings sited at the tops of localized highpoints dominate the landscape, interrupting an otherwise open, natural vista. Sites containing highpoints should be developed near the middle or bottom of slopes utilizing natural vegetation as a buffer. Furthermore, the natural topography should be further respected and used to nestle buildings into the landscape. Reducing cut and fill will minimize clearing and prevent erosion and sedimentation.

14.3.8.2 Signage

Signage is a significant design element, affecting the visual quality and therefore the viability of commercial activity, as well as the directional needs of cars and people. Signs can either add or detract from the community image. Signs not only enhance or define the architecture, but support the intended function of the business being advertised. The quality of signage, material, color, size, and placement are the owner's personal signature. To promote positive visual qualities in new development districts, sign laws should consider the following:

- Using the smallest and least number of signs, since a small, simple, well-located sign is likely to be more effective than an improperly located large sign with excessive information.
- Building signs should complement the scale and style of architecture through accentuated placement either flush with the building (above first floor windows or on existing lintel above door) or projected perpendicular to the building wall in the appropriate location.
- Coordinate signs for a given area to reduce the overall mix of sizes, colors, and styles.
- Reduce the height of free-standing signs and place at eye level with a surrounding vegetative "anchor;" and
- Incorporate materials, colors and textures that are compatible with building materials and are aesthetically accepted.

14.3.8.3 Lighting

Outdoor lighting has a significant impact on the safety, security and visual quality of a development and the community. During the day, lighting fixtures are part of the visual character of the site design. At night, if not carefully designed, outdoor lighting can be a major intrusion upon adjacent properties and regional vistas. Lighting should accomplish the function of providing public safety, security and energy conservation while utilizing fixtures that complement the character of the area.

Designed properly, lighting should:

- Not illuminate areas off-site or beyond the limit of safety.
- Utilize posts and fixtures that are in scale and proportion to the area being illuminated.
- Be of an attractive, indigenous style that blends with architecture and other site features; and
- Be used to accent or highlight special elements of the site or building.

14.3.8.4 Landscape

Vegetation plays an important role in the sense of place of a given area. Negative public to new development is often a response to either hard edges and inadequate landscaping or excessive clearing of site vegetation. Mature, native landscapes are irreplaceable and therefore, proper landscape planning should begin by minimizing clearing and disturbance of existing vegetation. If possible developers should transplant or reuse as much onsite vegetation as possible. Native species require less maintenance, water and fertilizer, and provide an appropriate habitat for local wildlife. Where non-native plantings may be necessary, select species that visually blend with existing vegetation. Maintaining existing vegetation reduces clearing and restoration costs and helps to integrate new development more successfully into the landscape.

Appendix 1. Soils Overview

Appendix 1-1: Limitations for Soil

SOIL	SEWAGE DISPOSAL FIELDS	HOMESITES ¹	STREET AND PARKING LOTS	LAWNS, LANDSCAPING, AND GOLF FAIRWAYS	PIPELINE LOCATIONS ²	SANITARY LANDFILL	CAMP AREAS	PATHS AND TRAILS	PICNIC GROUNDS AND EXTENSIVE PLAY AREAS	ATHLETIC FIELDS AND INTENSIVE PLAY AREAS
ATSIOM SAND	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: sandy surface layer; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: hazard of water pollution; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.
BERRYLAND MUCKY SAND	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: sandy surface layer; high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.
CANADICE SILT LOAM	Severe: slow permeability; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet; hazard of water pollution; texture.	Severe: slow permeability; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.
CARVER AND PLYMOUTH SANDS, 0 TO 3 PERCENT SLOPES.	Slight ⁷	Slight	Slight	Severe: sandy surface layer.	Severe: stability	Severe: rapid permeability; hazard of water pollution.	Severe: sandy surface layer.	Severe: sandy surface layer.	Severe: sandy surface layer.	Severe: sandy surface layer.
CARVER AND PLYMOUTH SANDS, 3 TO 15 PERCENT SLOPES.	Slight to moderate ⁷ slopes in places.	Slight to moderate ⁷ slopes in places.	Moderate to severe slopes.	Severe: sandy surface layer.	Severe: stability	Severe: rapid permeability; hazard of water pollution.	Severe: sandy surface layer; slopes.	Severe: sandy surface layer.	Severe: sandy surface layer.	Severe: sandy surface layer.
CARVER AND PLYMOUTH SANDS, 15 TO 35 PERCENT SLOPES.	Severe slopes ⁷	Severe slopes	Severe slopes	Severe slopes; sandy surface layer.	Severe: stability	Severe: rapid permeability; hazard of water pollution.	Severe: sandy surface layer; slopes.	Severe: sandy surface layer; slopes.	Severe: sandy surface layer; slopes.	Severe: sandy surface layer; slopes.
CUT AND FILL LAND, GENTLY SLOPING ⁸	Slight	Slight	Moderate slopes ⁸	Severe: sandy surface layer.	Severe: stability	Severe: rapid permeability; hazard of water pollution.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.
CUT AND FILL LAND, SLOPING ⁸	Moderate slopes	Moderate slopes	Severe slopes ⁸	Severe: sandy surface layer.	Severe: stability	Severe: rapid permeability; hazard of water pollution.	Severe for trailers; slopes. Moderate for tanks; slopes; sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Severe slopes

Appendix 1-1: Limitations for Soil

SOIL	SEWAGE DISPOSAL FIELDS	HOMESITES ¹	STREET AND PARKING LOTS	LAWNS, LANDSCAPING, AND GOLF FAIRWAYS	PIPELINE LOCATIONS ²	SANITARY LANDFILL	CAMP AREAS	PATHS AND TRAILS	PICNIC GROUNDS AND EXTENSIVE PLAY AREAS	ATHLETIC FIELDS AND INTENSIVE PLAY AREAS
CUT AND FILL LAND, STEEP ⁴	Severe: slopes	Severe: slopes	Severe: slopes	Severe: slopes; sandy surface layer.	Severe: stability	Severe: rapid permeability; hazard of water pollution.	Severe: slopes	Moderate to severe: slopes.	Severe: slopes	Severe: slopes
HAVEN LOAM, 0 TO 2 PERCENT SLOPES	Slight ⁷	Slight	Slight	Slight	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Slight	Slight	Slight	Slight
HAVEN LOAM, 2 TO 6 PERCENT SLOPES	Slight ⁷	Slight	Moderate ³ : slopes	Slight	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Moderate for trailers; slopes. Slight for tents.	Slight	Slight	Moderate: slopes
HAVEN LOAM, 6 TO 12 PERCENT SLOPES	Moderate: slopes ⁷	Moderate: slopes	Severe: slopes ³	Moderate: slopes	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Severe for trailers; slopes. Moderate for tents; slopes.	Slight	Moderate: slopes	Severe: slopes
HAVEN LOAM, THICK SURFACE LAYER	Severe: flooded during prolonged wet periods in places.	Severe: flooded during prolonged wet periods in places.	Severe: flooded during prolonged wet periods in places.	Slight	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Severe: flooded during prolonged wet periods in places.	Slight	Moderate: flooding in places during season of use.	Moderate: flooding in places during season of use.
MUCK	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot; poor stability	Severe: prolonged high water table above a depth of 1/2 foot with some ponding.	Severe: prolonged high water table above a depth of 1/2 foot with some ponding	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot; hazard of water pollution.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.	Severe: prolonged high water table above a depth of 1/2 foot.
PLYMOUTH LOAMY SAND, 0 TO 3 PERCENT SLOPES	Slight ⁷	Slight	Slight	Severe: sandy surface layer.	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.
PLYMOUTH LOAMY SAND, 3 TO 8 PERCENT SLOPES	Slight ⁷	Slight	Moderate: slopes ⁴	Severe: sandy surface layer.	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer; slopes
PLYMOUTH LOAMY SAND, 8 TO 15 PERCENT SLOPES	Moderate: slopes ⁷	Moderate: slopes	Severe: slopes ⁴	Severe: sandy surface layer.	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Severe for trailers; slopes. Moderate for tents; slopes; sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Severe: slopes

Appendix 1-1: Limitations for Soil

SOIL	SEWAGE DISPOSAL FIELDS	HOMESITES ¹	STREET AND PARKING LOTS	LAWNS, LANDSCAPING, AND GOLF FAIRWAYS	PIPELINE LOCATIONS ²	SANITARY LANDFILL	CAMP AREAS	PATHS AND TRAILS	PICNIC GROUNDS AND EXTENSIVE PLAY AREAS	ATHLETIC FIELDS AND INTENSIVE PLAY AREAS
PLYMOUTH GRAVELLY LOAMY SAND, 3 TO 8 PERCENT SLOPES, ERODED	Slight ²	Slight	Moderate slopes ⁴	Severe: sandy surface layer; gravel erosion.	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: slopes; sandy surface layer.
PLYMOUTH GRAVELLY LOAMY SAND, 8 TO 15 PERCENT SLOPES, ERODED	Moderate: slopes ²	Moderate: slopes	Severe: slopes ⁴	Severe: sandy surface layer; gravel erosion.	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Severe for trailers; slopes. Moderate for tests; slopes; sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Severe: slopes
PLYMOUTH LOAMY SAND, SILTY SUBSTRATUM, 0 TO 3 PERCENT SLOPES	Slight ²	Slight	Slight	Severe: sandy surface layer.	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.
PLYMOUTH LOAMY SAND, SILTY SUBSTRATUM, 3 TO 8 PERCENT SLOPES	Slight ²	Slight	Moderate: slopes	Severe: sandy surface layer.	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer.	Moderate: sandy surface layer; slopes
RAYNHAM LOAM	Severe: moderately slow permeability; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: hazard of water pollution; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.
RIVERHEAD SANDY LOAM, 0 TO 3 PERCENT SLOPES	Slight ²	Slight	Slight	Slight	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Slight	Slight	Slight	Slight
RIVERHEAD SANDY LOAM, 3 TO 8 PERCENT SLOPES	Slight ²	Slight	Moderate: slopes ⁴	Slight	Moderate: stability	Severe: rapid permeability; hazard of water pollution.	Moderate for trailers; slopes. Slight for tests.	Slight	Slight	Moderate: slopes

Appendix 1-1: Limitations for Soil

SOIL	SEWAGE DISPOSAL FIELDS	HOMESITES ¹	STREET AND PARKING LOTS	LAWNS, LANDSCAPING, AND GOLF FAIRWAYS	PIPELINE LOCATIONS ²	SANITARY LANDFILL	CAMP AREAS	PATHS AND TRAILS	PICNIC GROUNDS AND EXTENSIVE PLAY AREAS	ATHLETIC FIELDS AND INTENSIVE PLAY AREAS
RIVERHEAD SANDY LOAM, 8 TO 15 PERCENT SLOPES	Moderate slopes ²	Moderate slopes	Severe slopes ³	Moderate slopes	Moderate stability	Severe; rapid permeability; hazard of water pollution.	Severe for trailers; slopes. Moderate for tents; slopes.	Slight	Moderate slopes	Severe slopes
RIVERHEAD VERY STONY SANDY LOAM, 3 TO 8 PERCENT SLOPES	Slight ²	Slight	Moderate slopes ⁴	Severe; very stony.	Moderate; stoniness; stability.	Severe; rapid permeability; hazard of water pollution.	Moderate; stoniness.	Moderate; stoniness.	Slight	Moderate; stoniness; slopes.
RIVERHEAD VERY STONY SANDY LOAM, 8 TO 15 PERCENT SLOPES.	Moderate slopes ²	Moderate slopes	Severe slopes ³	Severe; very stony.	Moderate; stoniness; stability.	Severe; rapid permeability; hazard of water pollution.	Severe for trailers; slopes. Moderate for tents; slopes; stoniness.	Moderate; stoniness.	Moderate slopes	Severe slopes
RIVERHEAD AND HAVEN SOILS, GRADED, 0 TO 8 PERCENT SLOPES. ⁶	Slight ²	Slight	Moderate ⁴ slopes	Slight	Moderate stability	Severe; rapid permeability; hazard of water pollution.	Slight	Slight	Slight	Slight
RIVERHEAD AND HAVEN SOILS, GRADED, 8 TO 15 PERCENT SLOPES. ⁶	Moderate slopes	Moderate slopes	Severe slopes ³	Moderate slopes	Moderate stability	Severe; rapid permeability; hazard of water pollution.	Severe for trailers; slopes. Moderate for tents; slopes.	Slight	Moderate slopes	Severe slopes
RIVERHEAD AND PLYMOUTH VERY BOULDERY SOILS, 15 TO 35 PERCENT SLOPES.	Severe slopes	Severe slopes	Severe slopes	Severe slopes; stoniness	Severe slopes	Severe slopes	Severe slopes	Moderate to severe slopes.	Severe slopes	Severe slopes
SCIO SILT LOAM, TILL SUBSTRATUM, 2 TO 6 PERCENT SLOPES.	Severe; moderately slow permeability in substratum.	Moderate; seasonal high water table at depth of 1 1/2 to 2 feet.	Moderate; seasonal high water table at depth of 1 1/2 to 2 feet.	Slight	Moderate; seasonal high water table at depth of 1 1/2 to 2 feet.	Moderate; ⁸ seasonal high water table at depth of 1 1/2 to 2 feet.	Moderate; seasonal high water table at depth of 1 1/2 to 2 feet.	Slight	Slight	Moderate slopes; moderately slow permeability in substratum.

Appendix 1-1: Limitations for Soil

SOIL	SEWAGE DISPOSAL FIELDS	HOMESITES ¹	STREET AND PARKING LOTS	LAWNS, LANDSCAPING, AND GOLF FAIRWAYS	PIPELINE LOCATIONS ²	SANITARY LANDFILL	CAMP AREAS	PATHS AND TRAILS	PICNIC GROUNDS AND EXTENSIVE PLAY AREAS	ATHLETIC FIELDS AND INTENSIVE PLAY AREAS
SCIO SILT LOAM, SANDY SUBSTRATUM 0 TO 2 PERCENT SLOPES.	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Slight	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Severe: rapid permeability.	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Slight	Slight	Slight
SCIO SILT LOAM, SANDY SUBSTRATUM 2 TO 6 PERCENT SLOPES.	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Moderate: slopes; seasonal high water table at depth of 1 1/2 to 2 feet.	Slight	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Severe: rapid permeability	Moderate: seasonal high water table at depth of 1 1/2 to 2 feet.	Slight	Slight	Moderate: slopes
WALPOLE SANDY LOAM	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: rapid permeability; hazard of water pollution; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.
WAREHAM LOAMY SAND	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: sandy surface layer.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: rapid permeability; seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Moderate: seasonal high water table at depth of 1/2 to 1 1/2 feet.	Severe: seasonal high water table at depth of 1/2 to 1 1/2 feet.

- 1 High water table is less restrictive for houses without basements.
- 2 Stability, as used here, refers to the tendency of the soils to slough on a ditch 6 feet deep; limitations are less restrictive for shallower ditches.
- 3 In some area, the water table is 1 1/2 to 4 feet below the surface of these parts. Downward movement of water is impeded by silt and sand.
- 4 Slight for town or county roads.
- 5 Moderate for town or county roads.
- 6 These units are mainly in built-up areas, and they are not well suited to uses other than present use. Interpretations in the table apply to small ungraded areas.
- 7 Possible pollution hazard to lakes, springs, or shallow wells in these rapidly permeable soils.
- 8 If the till layer is less than 3 feet thick in these soils, the limitation is severe.
- 9 The till substratum of these soils is more difficult to excavate than the substratum of other soils in the county; however, the till does not appreciably reduce workability.
- 10 Water infiltration rates are slightly impeded by silty subsoil in places.

Appendix 2. Ecosystems Overview

Appendix 2-1: Wetlands in the Central Pine Barrens: New York Natural Heritage Program Rankings

NAME	QUADRANT	LOCATION	COMMUNITY TYPE	EO RANK	SITE RANK
Kara Pond	Wading River	CORE	CPPS	C	B2
Pond #2	Wading River	CORE	CPPS	BC	B2
Dead Car	Wading River	CORE	CPPS	B	B2
Passy's	Wading River	CORE	CPPS	A	B2
Duck	Wading River	CORE	CPPS	AB	B2
Sandy	Wading River	CORE	CPPS	AB	B2
Round	Wading River	CORE	CPPS	B	B2
Grassy	Wading River	CORE	CPPS	B	B2
Woodchoppers	Wading River	CORE	CPPS	AB	B2
Zeebs	Wading River	CORE	CPPS	C	B2
Kents Pond	Wading River	CORE	CPP	AB	B2
Jones	Wading River	CORE	CPPS	C	B2
Twin-west	Wading River	CORE	CPPS	B	B2
Twin-east	Wading River	CORE	CPPS	B	B2
Linns Pond	Wading River	CORE	CPPS	B	B2
Third Pond	Wading River	CORE	CPPS	B	B2
Sandy-east	Wading River	CORE	CPPS	B	B2
Block Pond	Wading River	CORE	CPPS	B	B2
Fox Pond	Wading River	CORE	CPPS	A	B2
Off Fox Pond	Wading River	CORE	CPPS	BC	B2
Sandpit Ponds	Wading River	CORE	CPPS	C	
North - Panamk	Wading River	CSA	CPPS	B	B2
Tarbill Pond	Wading River	CORE	CPPS	C	B2
Tarbill-west	Wading River	CORE	CPPS	C	B2
Lake Panamoka	Wading River	CSA	CPPS	BC	B2
Round - Tarbill	Wading River	CORE	CPPS	BC	B2
Coreys Pond	Wading River	CSA	CPPS		B4
Deep Pond	Wading River	CORE	CPPS	C	B3
Beyond House	Mattituck	CORE	CPPS	AB	B2
Grass Pond north	Mattituck	CORE	CPPS	AB	B2
House Pond	Mattituck	CORE	CPPS	A	B2
Grass Pond	Mattituck	CORE	CPPS	AB	B2
Division Pond	Mattituck	CORE	CPPS	A	B2
Randall Rd North	Middle Island	CORE	CPPS		
Randall Rd South	Middle Island	CORE	CPPS	C	B3
Artist Lake	Middle Island	CSA	CPPS	C	B3
Carrans Rd South	Middle Island	CSA	CPPS	BC	B3
Pine Lake	Middle Island	CSA			B3
Weeks	Bellport	CORE	CPP	B	B3
Cranberry Bog	Riverhead	CORE	CPPS/cedar	B	B2
Sweazys Pond	Riverhead	CORE	poor fen	AB	B2
Overton Rd Pond	Bellport	CSA	CPPS	BC	B3
Owl Pond	Mattituck	CORE	cedar swamp	C	B2
Fid/Hubbard Crk	Mattituck	CORE	salt pannes	AB	B2
Maple Swamp	Mattituck	CORE			
Prestons Pond	Wading River	CORE	not documented by NYHP		
Forest Pond	Wading River	CORE	"		
Bellows Pond	Mattituck	CORE	"		
Sears Pond	Mattituck	CORE	"		
Wildwood Lake	Riverhead	CORE	"		

CORE - Core Preserve
 CPP - Coastal Plain Pond

CSA - Compatible Growth Area
 EO - Element Occurrence rank (for CPPS)

CPPS - Coastal Plain Pond Shore

B1 - Outstanding significance.

B2 - Very high significance

B3 - High significance

B4 - Moderate significance.

Appendix 2-2: Recent Occurrences of Natural Heritage Program Plants in the Central Pine Barrens

Latin name	Common name	Natural Heritage Program Rank	CORE	CGA	PpohW	Dpp	CpP	CpPS	SS	WcS	RmhS	WpB	VP	CpPF	Str	SaltM	SoF	Mow	BeDu
<i>Agalinis virgata</i>	Pine-Barren	S2	6	3			X											X	
<i>Aletris farinosa</i>	Stargrass	S2S3	2	0								X						X	
<i>Asclepias purpurascens</i>	Purple milkweed	S1	1	0								X							
<i>Aster nemoralis</i>	Bog aster	S2	2	0			X												
<i>Carex bullata</i>	Button sedge	S1	1	0								X							
<i>Carex buxbaumii</i>	Brown bog sedge	S2	1	0									X						
<i>Carex collinsii</i>	Collins sedge	S1S2	2	1						X									
<i>Carex cumulata</i>	Clustered sedge	S1S2	1	0														X	
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	S3	8	1		X		X	X	X									
<i>Coreopsis rosea</i>	Rose coreopsis	S3	13	7			X												
<i>Cuscuta campestris</i>	Field-dodder	S1	1	0			X												
<i>Cyperus houghtonii</i>	Houghton umbrella sedge	S2	3	0	X														
<i>Cyperus polystachyos var texensis</i>	Cyperus	S2	1	0											X				
<i>Desmodium ciliare</i>	Tick-trefoil	S2S3	2	0														X	
<i>Digitaria filiformis</i>	Slender crabgrass	S1S2	2	0														X	
<i>Eleocharis equisetoides</i>	Knotted spikerush	S2	5	1		X													
<i>Eleocharis tricostata</i>	Three-ribbed spikerush	S1	4	3			X												
<i>Eleocharis tuberculosa</i>	Long-tubercled spikerush	S2	1	0			X												
<i>Fimbristylis castanea</i>	Marsh fimbry	S2	1	0											X				
<i>Gnaphalium purpureum</i>	Purple everlasting	S1	1	0								X							

PpohW = Pitch pine oak heath woodland
 SS = Shrub swamp
 VP = Vernal Ponds
 SoF = Successional old field

Dpp = Dwarf pine plains
 WcS = White cedar swamp
 CppF = Coastal plain poor fen
 Mow = Mowed areas

CpP = Coastal plain pond
 RmhW = Red maple hardwood swamp
 Str = Coastal plain stream
 BeDu = Beach or dunes

CpPS = Coastal plain pond shore
 WpB = Wet pine barrens
 SaltM = Saltmarsh

Appendix 2-2: Recent Occurrences of Natural Heritage Program Plants in the Central Pine Barrens

Latin name	Common name	Natural Heritage Program Rank	CORE	CGA	PpohW	Dpp	CpP	CpPS	SS	WcS	RmhS	WpB	VP	Str	SaltM	SoF	Mow	BeDu
<i>Hedyotis uniflora</i>	Clustered bluets	S1	2	1			X											
<i>Helianthus angustifolius</i>	Swamp sunflower	S2	1	0											X			
<i>Hottonia inflata</i>	Featherfoil	S2	1	0								X						
<i>Hydrocotyle verticillata</i>	Water pennywort	S1	1	0		X												
<i>Hypericum denticulatum</i>	Coppery St. Johnswort	S1	1	0			X											
<i>Hypericum dissimulatum</i>	St. Johnswort	S2S3	2	0			X				X							
<i>Iris prismatica</i>	Slender blueflag	S2	1	0			X								X			
<i>Lechea tenuifolia</i>	Slender pinweed	S2	2	2												X	X	
<i>Lipocarpha micrantha</i>	Dwarf bulrush	S1	1	2			X											
<i>Listera australis</i>	Southern twayblade	S1S2	1	0						X								
<i>Ludwigia sphaerocarpa</i>	Ludwigia	S2	11	0		X												
<i>Lythrum lineare</i>	Saltmarsh loosestrife	S1	1	0											X			
<i>Malaxis bayardii</i>	Bayard malaxis	S1	1	0							X							
<i>Minuartia caroliniana</i>	Pine-barren sandwort	S3	1	1	X												X	
<i>Panicum acuminatum var wrightianum</i>	Panic grass	S1	1	0			X											
<i>Polygonum glaucum</i>	Seabeach knotweed	S3	2	0														X
<i>Polygonum setaceum var interjectum</i>	Swamp smartweed	S1S2	1	0		X												
<i>Proserpinaca pectinata</i>	Comb-leaved mermaidweed	S2	12	0		X	X											
<i>Prunus pumila var depressa</i>	Sand cherry	S2	1	0	X													

PpohW = Pitch pine oak heath woodland Dpp = Dwarf pine plains Cpp = Coastal plain pond CppS = Coastal plain pond shore
 SS = Shrub swamp WcS = White cedar swamp RmhW = Red maple hardwood swamp WpB = Wet pine barrens
 VP = Vernal Ponds CpP = Coastal plain poor fen Str = Coastal plain stream SaltM = Saltmarsh
 SoF = Successional old field Mow = Mowed areas BeDu = Beach or dunes

Appendix 2-2: Recent Occurrences of Natural Heritage Program Plants in the Central Pine Barrens

Latin name	Common name	Natural Heritage Program Rank	CORE	CGA	PpohW	Dpp	CpP	CpPS	SS	WcS	RmhS	WpB	VP	CpPF	Str	SaltM	SoF	Mow	BeDu
<i>Psilocarya nitens</i>	Short-beaked baldrush	S2	11	0				X											
<i>Psilocarya scirpoides</i>	Long-beaked baldrush	S3	20	1				X											
<i>Rhynchospora inundata</i>	Drowned hornrush	S1	7	2		X													
<i>Rotala ramosior</i>	Tooth-cup	S2	3	2				X											
<i>Rumex maritimus var fueginus</i>	Golden dock	S1	1	0												X			
<i>Sagittaria teres</i>	Quill-leaf arrowhead	S1	8	2		X													
<i>Scleria pauciflora var caroliniana</i>	Fewflower nutrush	S1	1	0								X						X	
<i>Scleria reticularis var reticularis</i>	Reticulated nutrush	S3	18	1				X				X							
<i>Scleria triglomerata</i>	Whip nutrush	S2	1	0								X							
<i>Utricularia biflora</i>	Two-flowered bladderwort	S1	2	1		X													
<i>Utricularia fibrosa</i>	Fibrous bladderwort	S2	7	0		X							X						
<i>Utricularia juncea</i>	Rush bladderwort	S2	13	1				X											
<i>Utricularia radiata</i>	Small floating bladderwort	S2	6	3		X													
<i>Uvularia puberula</i>	Mountain bellwort	S1	3	0						X	X								
<i>Viburnum nudum</i>	Possum-haw	S1	2	0						X				X					

PpohW = Pitch pine oak heath woodland
 SS = Shrub swamp
 VP = Vernal Ponds
 SoF = Successional old field

Dpp = Dwarf pine plains
 WcS = White cedar swamp
 CpPF = Coastal plain poor fen
 Mow = Mowed areas

CpP = Coastal plain pond
 RmhW = Red maple hardwood swamp
 Str = Coastal plain stream
 BeDu = Beach or dunes

CpPS = Coastal plain pond shore
 WpB = Wet pine barrens
 SaltM = Saltmarsh

Appendix 3. Cultural Resources: Historic and Archaeological

The following documents are available for public review at the Central Pine Barrens Commission Office:

1. *New York State Archaeological Council Standards*
2. *A Map of Some Historic Sites in the Central Pine Barrens*
3. *A Descriptions of Historic Sites in the Town of Brookhaven*
4. *A Description of Historic Sites in the Town of Riverhead*
5. *A Compilation of New York State Historic Preservation Laws*
6. *A Compilation of Federal Preservation Laws*
7. *New York State Museum Archaeological Site Query Form*
8. *Suffolk County Historic Trust Manual*
9. *Suffolk County Historic Trust Application*
10. *Town of Southampton Historic Preservation Regulations*
11. *Town of Brookhaven Historic Preservation Regulations*
12. *Town of Brookhaven Historic District Advisory Committee Handbook*
13. *Survey Forms form Pertinent Agencies and Organizations*
14. *"New Law Requires Return of Indian Remains," from SCIENCE, November 9, 1990*
15. *"Stewardship and Archaeological Ethics," from ARCHAEOLOGY AND PUBLIC EDUCATION, undated*
16. *"Protecting the Nation's Archeological Heritage," from FEDERAL ARCHEOLOGY, Summer 1994*
17. *New York Archaeological Council Resolution on State Circles and Squares Map*
18. *State Historic Preservation Office Building Structure Inventory Form*

Appendix 4. Scenic Resources

Appendix 4-1: Standardized Set of Criteria for Identifying and Valuing Scenic Resources

TASK: Develop a standardized set of criteria for identifying and valuing scenic resources

A. Basic Assumptions (National Park Service 1975):

1. In general rural or unaltered natural areas have greater natural scenic potential than urban-modified areas.
2. The man-made landscape has scenic value as well, but it is based on different criteria. Townscapes and groups of structures that meet these criteria could be identified as part of the scenic resource base.
3. The limit of visual significance for scenic resources generally lies along the horizon line. This horizon line, or regional viewshed¹, may lie at a considerable distance. It may encompass towns, villages, interstate highways, feeder roads and other points which house or serve people. The question of scenic resource management can play an important environmental, social and economic role. Riverine and estuarine systems, extend a regional viewshed along their corridors. On the whole a regional viewshed follows topographic and access, rather than drainage, patterns. Delineation of a regional viewshed permits an identification of scenic resources within it.
4. Delineation of local viewsheds can be used by planners in consideration of any project for the purpose of identifying locally important scenic factors and for determinations of probable compatibilities or the lack thereof. A local viewshed can be defined as the area bounded by those topographical limits most commonly considered horizons, as in a viewing basin.

The importance of a regional viewshed should relate to area-wide land use, transportation, scenic area acquisition, and major development site selection and planning questions. The importance of a local viewshed relates to the same considerations, e.g., in site planning, acquisition or construction projects, and in project review.

5. Aesthetic value can be ascribed to the buffering of scenic areas from intensive development, large-scale facilities, eyesores or other unattractive environments. Similar value can be ascribed to areas where land-use intensities diminish from hamlet centers to unmodified natural or rural scenic resources.
6. Ordinary natural landscapes have scenic value. This value is increasing with time and the gradual loss of natural, accessible and pleasing natural areas. The enhancement, rehabilitation and protection of such areas would add to the over-all scenic value of the region.
7. Ordinary townscapes, other than actual landmarks or historic districts, contain many elements that are scenically valuable in an architectural, cultural or general environmental sense. Their enhancement, rehabilitation and protection would add to the overall scenic value of the region.
8. The aesthetics of land resources include intangible as well as tangible elements, and non-visual sensory (e.g., smell of the pines) as well as visual qualities. Intangible and non-visual sensory qualities can be weighted in visual resource decisions.

¹"Viewshed is a map that delineates the area from which an observer can see a given object. The boundaries of a 'viewshed' are revealed through a series of line-of-site profiles." (NYSDEC 1983)

Appendix 4-1: Standardized Set of Criteria for Identifying and Valuing Scenic Resources

9. Landscape design questions are heavily interrelated with the public interest and with public opinion. An effective appearance planning process: 1) will need to be easily understood by the public, and 2) will provide for constructive input by communities and individuals prior to critical decision points.

10. More extensive programs – in the forms of acquisition, regulations and inducement – will be needed in order to maximize scenic resource protection.

B. Aesthetic Resource Identification and Assessment Criteria

In any landscape, aesthetic resources may be classified according to the magnitude of their scenic qualities and of their geographic coverage.

Basic Definitions

Aesthetic resources may be divided into two classes: tangible and intangible.

1. Tangible qualities are those which can be touched (as the texture of leaves), seen (as all scenic resources), felt (as the wind or breeze), heard (as the song of birds), or smelled (as the fragrance of roses). Tangible deficits are generally visual eyesores or intrusions (as a debris-cluttered forest glade or a view of blighted structures on the roadside).

2. Intangible qualities are those which cannot be actually seen but which nevertheless play a role in an individual's formation of attitudes towards the landscape. A representative sample of such resources would include:

- urban-to-wild gradient - where natural areas are buffered from developed zones by intervening areas of rural settlement
- diversity - where a mix of landscape characteristics assures the maintenance of public and individual interest
- freedom from intrusion by non-conforming development
- endangerment - where knowledge of imminent or possible loss of the resource (such as with many marshes) lends greater attractiveness to it.

Tangible aesthetic qualities also include non-scenic assets. Historic buildings and sites are examples of the non-scenic category, unless also explicitly attractive.

Distinctions may further be made between natural scenic and man-made scenic resources. Man-made scenic resources are areas outside of hamlet centers that are near scenic natural resources: areas which possess historic, architectural, or regional-cultural quality, or which possess importance as a townscape.

C. Assessment Criteria: Determining Scenic Value

Identifying areas as scenic is not difficult. Much of this is a matter of personal judgment. The judgment may have convincing logic. However, if the identification is to earn acknowledgement as an objective evaluation among public decision makers, particularly in the face of conflicting claims and competing land use interests, it will have its best chances if it can be recognized as a product of a systematic assessment method, in which established criteria for scenic value are employed and personal bias is reduced to a minimum.

Appendix 4-1: Standardized Set of Criteria for Identifying and Valuing Scenic Resources

It is important that the method be systematized, and this can be achieved even if the method is a qualitative one. An expert landscape photographer or landscape architect could be relied on, for example, for systematic field evaluations of a landscape without having to resort to anything more than a notepad and pencil, because of the expert's trained analytical eye and memory-stored knowledge of scenic criteria.

The Central Pine Barrens region is large; a scenic resource assessment system must be capable of use throughout its component areas. A system should be both easily used and understood by non-professionals, as well as professionals, particularly if it is to be applied at the scale of the local setting.

Any system adopted should meet basic requirements of system, simplicity, and usefulness at the local setting scale. Criteria employed should be based in part on assumptions outlined in the preceding text, in part on field observations made during the study reconnaissance, and in part on general knowledge of landscape assessment methods current today.

The following suggested criteria are not rigid and fixed. Other valid criteria may be added, combined, or substituted.

The criteria below are for assessment of positive aesthetic characteristics of the natural landscape. Other modified criteria must be employed for the man-made landscape, for negative features (eyesores, deficits and intrusions), significant viewing points, and areas of special scenic concern.

**SCENIC VALUE ASSESSMENT CRITERIA FOR THE LANDSCAPES OF THE
CENTRAL PINE BARRENS**

Topographic Complexity an index of the diversity as well as the relative relief of an area's landforms (vertical qualities)

Horizon Complexity an index of the irregularity of the interface between land and sky (horizontal qualities)

Vegetative Integrity unity of vegetative species or common forms within a single viewshed

Vegetative Diversity diversity of vegetative species or forms within a single viewshed

Color (Hue) Ingredients color of natural elements (earth, vegetation, water, sky); a criterion that varies with seasons and weather

Pictorial Composition canvas qualities; varies with viewing orientation and is a determinant of **b e s t** viewpoints for given vistas

Vividness a summary quality which expresses the uniqueness and impressiveness of one or more of an area's other qualities

Landscape Dynamics the visual impressions of sun, clouds and weather

Ecosystem Continuity the visible manifestations of ecology, such as marshes, streams, fields and forests seen within a single landscape viewshed.

Appendix 4-1: Standardized Set of Criteria for Identifying and Valuing Scenic Resources

Near/Far Contrast the juxtaposition between foreground or middleground and horizon forms; greatest when the nearer forms are distinct and the horizon forms are blued by haze and appear two-dimensional

Uniqueness (Scarcity) an index of value based on rarity; a quality subject to broad interpretation dependent on the experience and expectations of the individual viewer

Endangerment (Issue-Real) an index of concern for the aesthetic quality of resources facing real or imagined destruction

True-to-Form Rurality a landscape containing forms and materials, both natural and man-made, typical of classic, natural, semi-natural or agricultural areas

True-to-Form Townscapes a townscape containing forms and materials, both man-made and naturalized, typical of architectural styles characteristic of the region's historicity

Human Dynamics visible manifestations of human activity associated with agriculture (e.g., mowing, plowing, irrigation, harvesting.) which are of human scale and interest

Absence of Detractions freedom from disharmonies introduced by natural forces (e.g., storm-eroded slopes) or by man (the latter by far the more important factor) e.g., dumping.

Instructive Qualities characteristics of geological, botanical, or other scientific interest, or which shed light on other qualities of the Central Pine Barrens

Sensitivity to Change a judgemental indicator of the extent to which a landscape unit possesses components which would be blocked, overshadowed, replaced, or otherwise damaged by the intrusion of objects or functions of moderate or average magnitude.

SCENIC CRITERIA BIBLIOGRAPHY

People and the Sound, National Park Service, New England River Basins Commission, Roy Mann Assoc., Inc., 1975.

Aesthetics Handbook, NYSDEC, 1983., p. 17

Appendix 5. Physical Data

Appendix 5-1: V/C Ratios and Volume Growth Rates For County Roads in the Central Pine Barrens (Annual Average Daily Traffic)

Sect. #	Road Name or Section Description	Mileage	Most Recent Count	Year	Raw Capacity Daily 2 Way	V/C Ratio	AT08 Exceeds Cap. ?	Pro- vided Count	Year Taken	Growth Rate (%/yr)
CR 83 No. Ocean Ave./Patchogue Mt. Sinai Rd.			11.55							
1	Howard Ave. to Rte. 27	0.08	1200	92	1200	1.00	Yes	13400	1988	-2.6
2	Rte. 27 to CR 99	1.01	21700	92	35000	0.62		18600	1988	4.2
3	CR 99 to Peconic Ave.	1.45	24400	92	35000	0.70		21400	1988	3.5
4	Peconic Ave. to LIE So. Service Road	0.55	26000	92	35000	0.74		26800	1989	-1.0
5	LIE So. Service Rd. to LIE No. Service Rd.	0.13	34300	92	35000	0.98		35200	1988	-0.6
6	LIE No. Service Rd. to CR 16	0.41	41200	88	35000	1.18	Yes	36800	1985	4.0
7	CR 16 to Rte. 25 (vic. CR 16)	2.09	35100	92	35000	1.00	Yes	39300	1988	-2.7
8	Rte. 25 to Rte. 112	1.39	31600	92	35000	0.90		23300	1987	7.1
9	Rte. 112 to Canal Rd.	2.17	16700	92	35000	0.47		21500	1988	-5.6
10	Canal Rd. to Rte. 25A	1.67	12400	92	35000	0.35		12900	1988	-1.0
CR 21 Yaphank Ave./Main St./Rocky Pt. Rd.			11.75							
1	CR 80 to Rte. 27 So. Service Rd.	0.34	1800	92	12000	0.15		1500	1988	5.0
2	Rte. 27 No. Service Rd. to CR 16	0.19	1100	90	12000	0.09		1000	1987	3.3
3	CR 16 to LIE So. Service Rd.	2.26	4000	89	35000	0.11		3400	1987	8.8
4	LIE So. Service Rd. to LIE No. Service Rd.	0.11	7300	89	35000	0.21		5600	1987	15.2
5	LIE No. Service Rd. to Main St.	0.26	3900	89	12000	0.33		3900	1987	0.0
6	Main St. to East Bartlett Rd.	2.57	13100	89	12000	1.09	Yes	11300	1987	8.0
7	E. Bartlett Rd. to Longwood Rd.	0.18	12600	89	12000	1.05	Yes	11300	1987	5.8
8	Longwood Rd. to Rte. 25	1.39	12200	89	12000	1.02	Yes	14100	1987	-6.7
9	Rte. 25 to Whiskey Rd.	1.83	6700	89	12000	0.56		6400	1987	2.3
10	Whiskey Rd. to Rte. 25A	2.62	11700	90	12000	0.98				
CR 46 William Floyd Parkway			17.34							
1	CR 75 to CR 80	4.84	30200	92	35000	0.86		16600	1988	20.5
2	CR 80 to Victory Ave.	0.38	37100	92	35000	1.06	Yes	34400	1988	2.0
3	Victory Ave. to LIE So. Service Rd.	2.61	24700	88	35000	0.71		20600	1986	10.0
4	LIE So. Service Rd. to LIE No. Service Rd.	0.37	26800	92	35000	0.76		25900	1988	0.9
5	LIE No. Service Rd. to Longwood Rd.	1.43	20700	88	35000	0.59		14600	1985	13.9
6	Longwood Rd. to Rte. 25 So. Access Rd.	2.26	15400	92	35000	0.44		14600	1988	1.4
7	Rte. 25 So. Access Rd. to Rte. 25 No. Access Rd.	0.28	14000	92	35000	0.40		13100	1988	1.7
8	Rte. 25 North Access Rd. to Rte. 25A Ramps & Loops @ Rte. 25 and Rte. 25A	3.31 1.85	9600	92	35000	0.27		10400	1988	-1.9
CR 111 Port Jefferson Westhampton Rd.			4.77							
1	Rte. 27 So. Service Rd. to Rte. 27 No. Service Rd.	0.27	7600	89	35000	0.22		6700	1987	6.7
2	Rte. 27 No. Service Rd. to CR 51	0.47	14700	89	35000	0.42		13700	1987	3.6
3	CR 51 to Eastport Manorville Rd.	1.01	13300	89	35000	0.38		16000	1987	-8.4
4	Eastport Manorville Rd. to LIE So. Service Rd.	2.81	15900	89	35000	0.45				
5	LIE So. Service Rd. to LIE No. Service Rd.	0.21	11100	89	35000	0.32		8600	1987	14.5
CR 55 Eastport Manorville Rd.			0.96							
1	CR 80 to CR 71	0.27	5700	89	12000	0.48		4900	1987	8.2
2	CR 71 to Rte. 27 So. Service Rd.	0.46	6900	89	12000	0.58		6300	1987	4.8
3	Rte. 27 So. Service Rd. to Rte. 27 No. Service Rd.	0.15	5900	89	35000	0.17		4000	1987	23.8
4	Rte. 27 No. Service Rd. to CR 51	0.08	4100	89	35000	0.12		3000	1987	18.3

Appendix 5-1: V/C Ratios and Volume Growth Rates For County Roads in the Central Pine Barrens (Annual Average Daily Traffic)

Sect. #	Road Name or Section Description	Mileage	Most Recent Count	Year	Raw Capacity Daily 2 Way	V/C Ratio	ATDR Exceeds Cap. ?	Provision Count	Year Taken	Growth Rate (%/yr)
CR 51	East Moriches Riverhead Rd.	8.68								
1	CR 80 to Rte. 27 So. Service Rd.	1.18	4300	92	35000	0.12		3700	1988	4.1
2	Rte. 27 So. Service Rd. to CR 55	0.39	6500	89	35000	0.19		5700	1987	7.0
3	CR 55 to CR 111	0.75	6900	89	35000	0.20		5700	1987	10.5
4	CR 111 to Riverhead Speonk Rd.	3.31	6500	89	35000	0.19		5500	1987	8.1
5	Riverhead Speonk Rd. to CR 63	1.39	7800	89	35000	0.22		6600	1987	8.1
6	CR 63 to CR 94	1.66	3200	89	35000	0.09		3100	1987	1.6
CR 31	Old Riverhead Rd.	4.01								
1	CR 80 to Rte. 27	3.21	12600	90	12000	1.05	Yes	9900	1988	13.6
2	Rte. 27 to CR 104	0.80	5500	90	12000	0.46		4900	1988	6.1
CR 104	Quogue Riverhead Rd.	7.45								
1	CR 80 to Old Country Rd.	1.03	1600	90	12000	0.13		1600	1988	0.0
2	Old Country Rd. to Rte. 27	2.19	6100	90	12000	0.51		6100	1988	0.0
3	Rte. 27 to CR 31	1.30	3200	90	12000	0.27		4100	1988	-11.0
4	CR 31 to CR 105	1.57	6900	90	12000	0.58		7800	1988	-5.8
5	CR 105 to Riverhead Traffic Circle	1.36	4600	90	12000	0.38		5400	1988	-7.4
CR 105	Cross River Drive	5.30								
1	CR 104 to Rte. 24	0.94	3000	90	24000	0.13		3100	1988	-1.6
2	Rte. 24 to Rte. 25	2.04	13500	90	24000	0.56		14600	1988	-3.8
3	Rte. 25 to CR 43	1.24	2100	90	24000	0.09		2000	1988	2.5
4	CR 43 to Sound Ave.	1.08	1200	90	24000	0.05		1300	1988	-3.8

Appendix 5-2: V/C at Peak Hours for State Roads (Hourly One Way Peak Counts)

State	Section Number	Peak One Way Hourly	Monthly/ Year	Raw Capacity Hourly One Way	V/C Ratio
25A	North Country Road				
	1. CR 83 to Echo Ave.	1786	6/93	2400	.74
	2. Echo Ave. to Rocky Point Rd.	874	11/93	1200	.73
	3. Rocky Point Rd. to Woodville Rd.	1165	11/93	1200	.97
	4. Woodville Rd. to CR 46 Wm. Floyd Pkwy.	971	6/91	1200	.81
	5. Wm. Floyd Pkwy. to Wading River Rd.	862	7/92	1200	.72
	6. Wading River Rd. to North Road	541	6/93	1200	.45
7. North Rd. to Rte. 25	327	6/91	1200	.27	
25	Middle Country Road				
	1. N. Ocean Ave. to Rte. 112	737	9/93	1200	.61
	2. Rte. 112 to Coram-Mt. Sinai	1326	4/94	1200	1.11
	3. Coram-Mt. Sinai to CR 21	968	11/93	1200	0.81
	4. CR 21 to Rocky Point Rd.	803	9/92	1200	0.67
	5. Wm. Floyd to Wading River Rd.	510	7/92	1200	0.43
	6. Wading River Rd. to 25A	375	7/92	1200	0.31
	7. Rte. 25A to Edwards Ave.	663	6/93	1200	0.55
	8. Edwards Ave. to CR 58	558	6/93	1200	0.47
	9. CR to to 495	190	9/91	2400	0.08
	10. 495 to Mill Rd.	338	9/91	1200	0.28
11. Mill Rd. to CR 94A	418	7/91	1200	0.39	
495	Long Island Expressway				
	1. Rte. 112 to Horseblock	2908	6/91	5700	0.51
	2. Horseblock to Patchogue Yaphank	2836	9/90	5700	0.50
	3. Patchogue-Yaphank Rd. to Yaphank Ave.	2358	9/90	5700	0.41
	4. Yaphank Ave. to Wm. Floyd Pkwy.	2785	6/91	5700	0.49
	5. Wm. Floyd Pkwy. to Wading River Rd.	1093	5/89	5700	0.19
	6. Wading River Rd. to CR 111	1134	5/89	5700	0.20
	7. CR 111 to Rte. 24	851	9/90	5700	0.15
	8. Rte. 24 to NYS Rte. 25	500	9/90	5700	0.09
9. NYS 25 to CR 58	452	9/91	5700	0.08	
27	Sunrise Hwy.				
	1. CR 16 to CR 46	2409	9/93	3700	0.65
	2. CR 46 to Wading River Rd.	902	3/92	3700	0.24
	3. Wading River Rd. to Railroad Ave.	849	3/92	3700	0.23
	4. Railroad Ave. to CR 51	1277	7/93	3700	0.35
	5. CR 51 to CR 111	668	9/91	3700	0.18
	6. CR 111 to CR 31	980	3/92	3700	0.26
	7. CR 31 to CR 104	843	3/92	3700	0.23
	8. CR 104 to Rte. 24	1425	7/93	3700	0.39
9. Rte. 24 to Shinnecock Canal	1526	7/93	3700	0.41	
112	Port Jefferson-Patchogue Rd.				
	1. Peconic Ave. to Rte. 495	1041	4/94	900	1.16
	2. 495 to Horseblock	1267	11/93	900	1.41
	3. Horseblock to Granny	955	10/93	900	1.06
	4. Granny Rd. to Rte. 25	886	4/94	900	0.98
	5. Rte. 25 to CR 83	523	11/93	900	0.58
6. CR 83 to NYS 347	778	6/93	900	0.86	

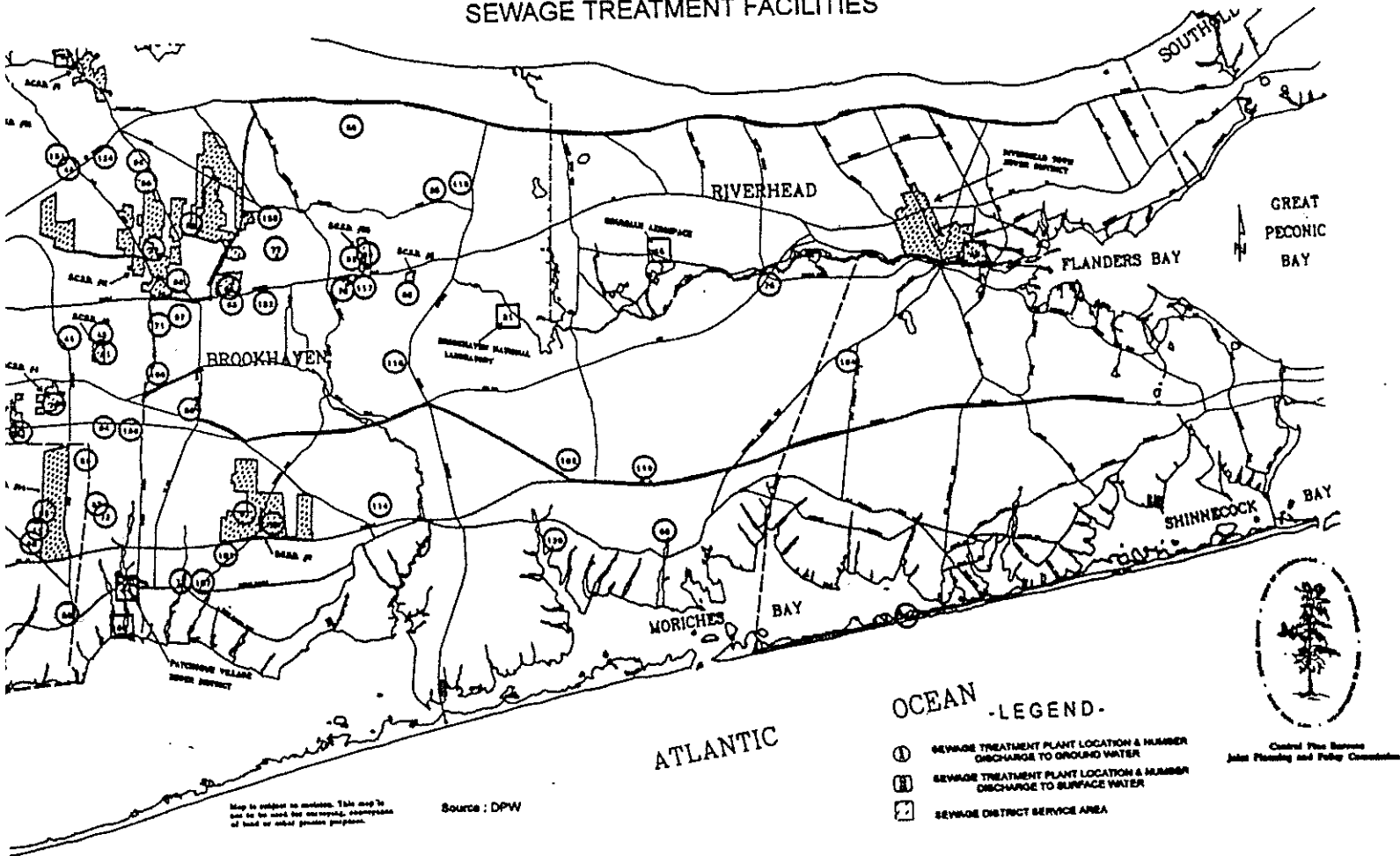
Appendix 5-3: Sewage Treatment Plants Adjacent or Within the Central Pine Barrens

Suffolk County Department of Health Services Number *	Sewer District Name	Excess Capacity** (Gallons Per Day)	Remarks
31	Brookhaven National Laboratory	1,000,000	
35	Leisure Village	0	
45	Grumman Aerospace	85,800	facility closed
48	Greenport Village	< 200,000	unbuilt apartments
55	Rocky Point Apartments	15,000	
63	Homestead Village	50,000	
68	SCSD #8 - Ridge	0	
70	Artist Lake Condominiums	20,000	
71	Village in the Woods	35,000	
76	Heatherwood at Calverton	0	
77	Oak Hollow Nursing Center	20,000	
85	La Bonne Vie	0	
88	Blue Ridge Condominiums	80,000	upgrading underway
92	Englishtown Garden Apartments	0	
97	Bretton Wood Condominiums	0	
98	SCSD #23 - Coventry Manor Townhouses	0	
102	Pine Hill Apartments	0	
104	SCCC - Riverhead	15,000	
106	Allstate Regional Headquarters	0	
110	Colonial Woods (Whispering Pines)	< 350,000	subject to NYSDEC conditions
114	Yaphank County Center	expandable	
115	Ridgehaven Estates	0	
117	Lake Point (Village at Artist Lake)	10,000	
119	Greenwood Village	< 40,000	unbuilt apartments
132	Bal Moral Townhouses at Middle Island	< 30,000	unbuilt apartments
138	Birchwood at Spring Lake	< 200,000	unbuilt apartments

* See map for location
** Theoretical; must be verified, all numbers are approximate.

Appendix 5-3: Sewage Treatment Plants Adjacent or Within the Central Pine Barrens

SEWAGE TREATMENT FACILITIES



Appendix 6. Land Protection Strategies

Appendix 6-1: Land Protection Techniques: Summary of Strengths, Limitations, Requirements and Examples

CHART E. VOLUNTARY LANDOWNER ACTIONS				
Protection Tool	Strengths	Limitations	Requirements	Example
Landowner Contact and Education (information provided to landowner about the importance of his property and ways to use it compatibly with conservation objectives)	<ul style="list-style-type: none"> • Low cost • Covers large area quickly • Prevents destruction through inadvertence • Builds relationship to negotiate stronger levels of protection in the future • Opportunity to gain information about site and owner • Encourages informed management 	<ul style="list-style-type: none"> • Very low level of protection, if any • Interim protection only, if any 	<ul style="list-style-type: none"> • Identification of strategic sites • Trained fieldworkers with expertise in habitat and recreation and excellent people skills • Stylish brochures, attractive information package • Newsletters • File or database system for reporting information from contacts 	The Nature Conservancy
Voluntary Agreements: Registration and Cooperative Management Agreements (formal agreement with landowner indicating importance of property)	<ul style="list-style-type: none"> • All advantages of landowner contact and education, above • Flexible • Higher level of protection than landowner contact alone • Can function as holding action while funds for stronger protection level obtained 	<ul style="list-style-type: none"> • Low level of protection, depends entirely on voluntary commitment • Interim protection only • Not suited for core areas 	<ul style="list-style-type: none"> • Same as above, plus: • Plaque, certificate, or other memorial • Well-drafted sets of voluntary landowner agreement forms • Word processing equipment • Trained negotiators with skills needed to customize forms and create specialized agreements 	The Nature Conservancy

Appendix 6-1: Land Protection Techniques: Summary of Strengths, Limitations, Requirements and Examples

CHART 1: DIRECT ACQUISITION OF INTERESTS IN LAND				
Protection Tool	Strengths	Limitations	Requirements	Example
Rights of First Refusal (gives conservation group right to match bona fide offer from third party to purchase land)	<ul style="list-style-type: none"> Protects against changes in use if current owner decides to sell Can buy time 	<ul style="list-style-type: none"> Little warning or time to arrange financing for purchase price Contingent entirely on owner deciding to sell and terms of actual offer 	<ul style="list-style-type: none"> Same as fee acquisitions, below 	
Leases, Licenses, and Management Agreements (gives conservation group right to manage land)	<ul style="list-style-type: none"> Flexible Allows for active management or restoration short of paying full purchase price Does not require acquisition Works well in buffer areas or in areas not requiring active management 	<ul style="list-style-type: none"> Interim protection only May be ill suited for core areas or highly sensitive areas 	<ul style="list-style-type: none"> Experienced negotiators with knowledge and skills in finance, land use, real estate, and law Experienced land managers with expertise in habitat and recreation Detailed management plan developed by experts Experienced attorneys with expertise in real estate law, tax law, estate and family planning law, and environmental/natural resources law Well-drafted sets of form legal documents Word processing equipment and other administrative capabilities (teletyping, photocopying, etc.) Skilled administrative staff Reliable information about market rents and fees May need hazardous materials evaluation Clear policies and procedures for decision making and management 	The Nature Conservancy has management agreements to protect rare features on Suffolk County Parkland and NY OPRHP Preservation lands.
Conservation Easements (landowner conveys a promise to a conservation group to use (or to refrain from using) his land in ways which are consistent with conservation objectives)	<ul style="list-style-type: none"> Flexible Usually restricts land use permanently Keeps property in private hands and on the tax rolls Can be low cost because of tax incentives to donate Works well in buffer areas, especially if historic uses are compatible 	<ul style="list-style-type: none"> May be ill suited for active management or restoration of core areas, unless restrictions on landowner's use are very tight, and rights granted very broad Possible management difficulties when there is a change in ownership Requires high level of monitoring 	<ul style="list-style-type: none"> Experienced negotiators with knowledge and skills in finance, land use, real estate, and law Experienced land stewards with expertise in habitat and recreation Experienced attorneys with expertise in real estate law, tax law, estate and family planning law, and environmental and natural resources law Well-drafted sets of form legal documents Word processing equipment and other administrative capabilities (teletyping, photocopying, etc.) Skilled administrative staff Appraisal Title report and underlying documents Survey, where need Thorough hazardous materials evaluation Easement documentation report prepared by experts Clear policies and procedures for decision making and management 	Hampton Hills golf course, conservation easement owned by Suffolk County The Peconic Land Trust The Nature Conservancy
Deed Restrictions and Reverters (property is subject to use restrictions which, if violated, could allow property to revert to another party)	<ul style="list-style-type: none"> Permanent restrictions Keeps property in private hands and on the tax rolls May be able to recover costs on resale 	<ul style="list-style-type: none"> May be difficult to resell to a buyer willing to take subject to the restrictions May be difficult to enforce 	<ul style="list-style-type: none"> Same as above 	

Appendix 6-1: Land Protection Techniques: Summary of Strengths, Limitations, Requirements and Examples

CHART II: DIRECT ACQUISITION OF INTERESTS IN LAND				
Protection Tool	Strengths	Limitations	Requirements	Example
Acquisition of Undivided Interests (landowner conveys a percentage interest in the property to a conservation organization)	<ul style="list-style-type: none"> Boys "sue at the table" in management decisions Potential step to full fee ownership Way to divide ownership among conservation partners making contributions of different value toward purchase 	<ul style="list-style-type: none"> Can present serious management problems, especially in the absence of a well drafted co-tenancy agreement Undesirable legal remedies in the event of deadlock 	<ul style="list-style-type: none"> Same as fee acquisitions, below 	
Acquisition of Remainder Interests Subject to Restricted Life Estates (property transfer to conservation group after donor's lifetime)	<ul style="list-style-type: none"> Low cost way to gain possession and control in the future 	<ul style="list-style-type: none"> Uncertain date of transfer of possession (depends on death of land tenant) Management problems during occupancy of life tenant 	<ul style="list-style-type: none"> Same as fee acquisitions, below 	Flanders Gun Club retained life estate to club with Suffolk County
Acquisitions of Partial Interests: Water, Timber, Mineral, Grazing Rights and Access Rights (acquisition of specific, limited property rights)	<ul style="list-style-type: none"> Lower cost way to control resource than full fee acquisition Keeps title to land in private hands and on the tax rolls 	<ul style="list-style-type: none"> May not be permanent (e.g., other owners may be able to reapply for rights or rights acquired may be term rights only) May not completely control use of the resource Difficult to establish good title in seller 	<ul style="list-style-type: none"> Same as fee acquisition, below, plus: Technical experts, (such as hydrologists and water rights attorneys in the case of water rights acquisitions) 	
Fee Acquisitions (acquisition of all property rights in specific parcel of land)	<ul style="list-style-type: none"> High level of protection, gives full ownership and control 	<ul style="list-style-type: none"> Can be expensive if property is not donated If government owned, public may perceive that property is withdrawn from the private domain and may reduce local tax revenues 	<ul style="list-style-type: none"> Experienced negotiators with knowledge and skills in finance, land use, real estate and law Experienced land stewards with expertise in habitat and recreation Experienced attorneys with expertise in real estate law, tax law, estate and family planning law, and environmental and natural resources law Well-drafted sets of farm legal agreements Word processing equipment and other administrative capabilities (fotocopying, photocopying, etc.) Skilled administrative staff Professional specialists (land surveyors, geologists, water quality engineers, appraisers, hazardous waste inspectors, structural engineers, etc.) Appraisal Title report and underlying documents Survey, where needed Thorough hazardous materials evaluation Clear policies and procedures for decision making and management 	NY State DEC NY State OPRSP Suffolk County Sandhampton Town Brookhaven Town Riverhead Town The Nature Conservancy The Peconic Land Trust
Dedications (rights in land conveyed to a legally established nature preserve system)	<ul style="list-style-type: none"> High level of protection, privately owned land, especially if title will be retained by a private conservation organization (protects against condemnation or conversion) Can be flexible by allowing only specific interests to be dedicated 	<ul style="list-style-type: none"> Uncertain incentives for private owners 	<ul style="list-style-type: none"> Same as fee acquisitions, above. 	Suffolk County Nature Preserve, Bird Sanctuary program

Appendix 6-1: Land Protection Techniques: Summary of Strengths, Limitations, Requirements and Examples

CHART III: TAX INCENTIVES FOR CONSERVATION				
	Strengths	Limitations	Applicable Protection Tools	Example
Income Tax Deductions				
Gifts (including fee title and "qualified conservation contributions") (land given to charitable organization qualifies for charitable contribution tax deduction equal to property's fair market value)	<ul style="list-style-type: none"> Reduce cost to conservation entity Potential income tax and estate tax benefits to donor (depending on particular facts and circumstances and subject to donor's compliance with applicable tax laws and regulations) Donor must obtain a qualified appraisal 	<ul style="list-style-type: none"> Partial interest rule (must give entire interest in property except for conservation easements) Taxpayer must satisfy requirements of tax law and regulations 	<ul style="list-style-type: none"> Fee Acquisitions Conservation Easements, Remainder Interests, and Undivided Interests 	
Bargain Sales (land sold to charity at below fair market value, with difference qualifying as a charitable deduction to improve net financial return from the sale)	<ul style="list-style-type: none"> Reduce cost to conservation entity Potential capital gains tax and estate tax benefits to donor (depending on particular facts and circumstances and subject to donor's compliance with applicable tax laws and regulations) Donor must obtain a qualified appraisal 	<ul style="list-style-type: none"> Must establish donative intent taxpayer must satisfy requirements of tax law and regulations 	<ul style="list-style-type: none"> Fee Acquisitions Conservation Easements, Remainder Interests, and Undivided Interests 	
Charitable Trusts (land given to trust which sells property for conservation and proceeds used to provide income to donor)	<ul style="list-style-type: none"> Donor gets income tax deduction for value of remainder interest to go to charity Donor gets income No capital gains tax when property sold by trust 	<ul style="list-style-type: none"> Remainder interest in principal proceeds must go to charity Can't have donation to trust and resale to charity pre-arranged May be complicated and expensive to set up 	<ul style="list-style-type: none"> Fee Acquisitions Conservation Easement 	
Bequests/Devises (a gift of real or personal property under the terms of a will)	<ul style="list-style-type: none"> Potential estate tax benefits to donor (depending on particular facts and circumstances and subject to donor's estate's compliance with applicable tax laws and regulations) Provisions in will relating to bequest should be checked by recipient conservation entity before donor's death 	<ul style="list-style-type: none"> Voluntary agreement (donor can revoke any time before death) Taxpayer must satisfy requirements of tax law and regulations 	<ul style="list-style-type: none"> Fee Acquisitions Conservation Easements, Remainder Interests, and Undivided Interests, subject to partial interest rule 	
Tax Deferral Strategies				
Installment Sales (Sales price to be paid by conservation group to Seller is spread over at least two tax years; allows seller to defer tax until proceeds received)	<ul style="list-style-type: none"> Possible way for conservation entity to finance purchase Potential tax deferral for seller (depending on particular facts and circumstances and subject to donor's compliance with applicable tax laws and regulations) 	<ul style="list-style-type: none"> Taxpayer must satisfy requirements of tax law and regulations 	<ul style="list-style-type: none"> Fee Acquisitions 	
Like-kind Exchanges (conservation group "trades" property to seller for land to be acquired; allows seller to defer tax until replacement property sold)	<ul style="list-style-type: none"> Can serve as alternative to cash payment for conservation entity Potential tax deferral benefit for seller (subject to seller's compliance with tax laws and regulations) 	<ul style="list-style-type: none"> Taxpayer must satisfy requirements of tax law and regulations 	<ul style="list-style-type: none"> Fee Acquisitions Conservation Easements 	
Sale under Implied Threat of Condemnation (sale to government agency or conservation group allows seller to defer tax until replacement property sold)	<ul style="list-style-type: none"> Can reduce cost to conservation entity through tax benefits to seller. Must be threat of imminence of condemnation by a public entity Potential tax deferral benefit to seller (subject to seller's compliance with tax laws and regulations) 	<ul style="list-style-type: none"> Taxpayer must satisfy requirements of tax law and regulations 	<ul style="list-style-type: none"> Fee Acquisitions 	Hither Woods, Montauk to Suffolk County
Real Property Tax Incentives				
Preferential Assessment (landowner gets reduced property tax assessment for keeping land open and undeveloped or used for farm or forest purposes)	<ul style="list-style-type: none"> Low cost, temporary protection Financially attractive to landowner 	<ul style="list-style-type: none"> Reduces revenue to town/county Depends on landowner intentions for continued compliance Administratively complex State constitutional requirements for uniform transaction 	<ul style="list-style-type: none"> Fee title Land subject to conservation easement 	

Appendix 6-1: Land Protection Techniques: Summary of Strengths, Limitations, Requirements and Examples

CHART IV: LAND USE PLANNING AND REGULATORY TECHNIQUES				
Protected Tool	Strengths	Limitations	Requirements	Example
Control Location of Development				
Zoning large lot/open space/agricultural/food plains/wetlands)	<ul style="list-style-type: none"> Identifies sensitive areas for protection Permits potential appropriate uses Regulates density of use 	<ul style="list-style-type: none"> Assumes a certain amount of economic use to allow regulation to withstand judicial scrutiny Depends on landowner to initiate use Could promote wasteful land use patterns 	<ul style="list-style-type: none"> Based on comprehensive plan Local ordinances 	
Subdivision Ordinances	<ul style="list-style-type: none"> Controls provision of infrastructure and the division of property 	<ul style="list-style-type: none"> Same as above 	<ul style="list-style-type: none"> Based on comprehensive plan Need to conform to engineering requirements Local ordinances 	
Urban Growth Boundaries	<ul style="list-style-type: none"> Identifies boundaries of areas which are to be developed intensively and areas which are to be preserved Must be used in conjunction with other public tools such as the provision of infrastructure 	<ul style="list-style-type: none"> Difficult to get agreement among municipalities in a region Lines may need to be adjusted more frequently than planned due to market changes 	<ul style="list-style-type: none"> Needs state enabling law Local ordinance May require cooperation among jurisdictions 	
Overlay Resource Protection Districts	<ul style="list-style-type: none"> Underlying zoning stays the same but resources identified (wetlands, flood plains, critical habitat) require special protection Flexible methods of protection 	<ul style="list-style-type: none"> May get so specialized as to dilute effectiveness of zoning Need to identify potentially compatible uses 	<ul style="list-style-type: none"> Sophisticated environmental information and maps Local ordinance 	
Control Infrastructure (Provision and Timing)				
Capital Improvements Program for Adequate Public Facilities Ordinances)	<ul style="list-style-type: none"> Allows growth and development to proceed as provisions are made to provide adequate public facilities Requires developers to pay for such improvements if area is not served by facilities 	<ul style="list-style-type: none"> Planning time horizon may not be realistic Subject to challenge by developers 	<ul style="list-style-type: none"> Local ordinance needs to be consistent with state enabling authority 	
Growth Management Programs	<ul style="list-style-type: none"> Development proposals evaluated against municipal planning objectives for timing of growth, infrastructure and protection of natural resources Encourages flexibility in quality and rate of growth 	<ul style="list-style-type: none"> Requires special review (and staff expertise) beyond normal review process May need to apportion development permits to control growth rate 	<ul style="list-style-type: none"> State enabling law Local ordinance 	
Control Compatibility of Development				
Performance Zoning	<ul style="list-style-type: none"> Allows flexible site design as long as development plan meets standards Protects natural resources 	<ul style="list-style-type: none"> Development not prohibited, but impacts mitigated Depends on election by landowner 	<ul style="list-style-type: none"> Local ordinance 	
Cluster Zoning/POD's	<ul style="list-style-type: none"> Provides flexible site design Allows critical areas to be set aside Reduces development costs 	<ul style="list-style-type: none"> Open space areas may not be available for public use/management Site design may be inconsistent with adjacent tract development/use 	<ul style="list-style-type: none"> State enabling law Local ordinance 	
Erosion and Sedimentation Controls	<ul style="list-style-type: none"> Development permitted provided surface disturbance minimized and natural resources protected Compatible activities exempted 	<ul style="list-style-type: none"> Affects construction practices, not permanent land protection 	<ul style="list-style-type: none"> Development/construction impact mitigation plan Local ordinance 	
Combination				
Transfer of Development Rights (TDRs)	<ul style="list-style-type: none"> Enables resource protection and development to be concentrated Allows development rights to be separated from land ownership May mitigate impact of land use restrictions by avoiding a "wipe-out" of reasonable financial expectation by landowner 	<ul style="list-style-type: none"> Requires some method to protect land from which rights are taken May not gain public management/use of land from which rights are severed Complicated to administer and to set values for rights 	<ul style="list-style-type: none"> State enabling legislation Local ordinances, plan Allocation of an amount of transferable development rights to designated "sending" areas Designation of "receiving" sites and determination of amount and type of additional development Method of transferring rights for one parcel to another 	3 towns in cooperative with commission working out program. Most tested in Sorokampton
Impact/Mitigation Fees	<ul style="list-style-type: none"> Fees generated from development used to pay for off-site capital facilities, such as open space lands Payment made for mitigation of development used to acquire resource lands 	<ul style="list-style-type: none"> May be subject to legal challenge as a tax, unless there is a rational connection between development and need for facilities, or impact of development, or if consistent with plan 	<ul style="list-style-type: none"> State enabling legislation Local ordinance 	

Appendix 6-2: Results of Public Agency Management Survey

NEW YORK STATE PARKS RECREATION AND HISTORIC PRESERVATION

Preparer: Edward R. Matthews, General Park Manager L.I. Region

Date: May 12, 1994

1. Total number of acres currently managed by your agency on Long Island - 33,270 acres
2. Number of acres managed by your agency in the Central Pine Barrens - 2,137 acres
4. Size of total staff in agency on Long Island: Permanent - 455, Seasonal - 464
5. % of staff with responsibilities in Central Pine Barrens (or number of staff) 2 People (1 Park Manager from Willdwood; 1 staff)
6. Percentage of staff time devoted to the following categories:

		Total on L.I.:	CPB:
law enforcement:	Park Police		
	Permanent -	61	> 1%
	Seasonal -	64	
natural resource management		0	0
(species management, species inventory, monitoring, applied research, fire management)			
site management			> 1%
(trash pick-up, trail maintenance, boundary posting)			
facility management			> 1%
(building and road maintenance)			
recreation		12	0
(camping, boating, hunting golfing, horse riding, etc.)			
environmental education	Permanent	6	
	Seasonal	6	0
(nature center, public and school programs)			

7. Total annual budget of agency: 23 million for L.I. Region
8. % of budget devoted to Central Pine Barrens lands > 1%
9. Sources of funds: State Budget Allocation
10. Percentage of budget spent on the following categories:

	Total on L.I.:	CPB:
law enforcement		> 1%
natural resource management		0
site management		> 1%
facility management		> 1%
recreation		0
environmental education		0

11. What are the major policies that guide your land management programs? Master Plan, Mission Statement for NYSPR-HP
12. Are there policies within your agency that may be counterproductive to the goals of pine barrens legislation? If so, what are they? No
13. Are there barriers to changing policies? If so, what are they? No
14. What other governmental agencies assist or cooperate with your agency? NYS DEC, USF-WIS
15. What non-governmental organizations assist your agency? TNC, Greenbelt
16. What biological management do you conduct for natural communities? Prescribed burn in pond was proposed.
17. What biological management do you conduct for game species? Fence repairs at perimeter to keep deer out of roads.
18. What biological management do you conduct for non-game species? None.
19. Do you have a staff position or department that is responsible for natural resource management? One Regional Conservation Educator and (6) interpretive staff for entire region.

Appendix 6-2: Results of Public Agency Management Survey

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Preparer: David M. Sinclair

Date: January 26, 1994

1. Total number of acres currently managed by the DEC on Long Island: 11,204
2. Number of acres managed by the DEC in the Central Pine Barrens: 7,522
4. Size of total staff in agency on Long Island: 225 (all) Natural Resources: 40
5. % of staff with responsibilities in Central Pine Barrens (or number of staff): 50%
6. Percentage of staff time devoted to the following categories:

	Total LI:	CPB:	Nat. Res. CPB (man yrs):
law enforcement	15%	3%	3
natural resource management (species management, species inventory, monitoring, applied research, fire management)	18%	5%	6
site management (trash pick-up, trail maintenance, boundary posting)	5%	2%	1.5
facility management (building and road maintenance)	5%	0.5%	0.5
recreation (camping, boating, hunting golfing, horse riding, etc.)	6%	4%	4
environmental education (nature center, public and school programs)	4%	0.5%	<u>.5</u> 17 man yrs

7. Total annual budget of agency: ????
8. % of budget devoted to Central Pine Barrens lands: \$600,000? (salaries & operations, -- \$150,000; R&I, \$20,000; and capital)
9. Sources of funds: General Revenue; Conservation Fund (fishing & hunting licenses)
10. Percentage of budget spent on the following categories: Percentages would be based on staffing (see above)

	Total on L.I.:	CPB:
law enforcement		
natural resource management		
site management		
facility management		
recreation		
environmental education		

11. What are the major policies that guide your land management programs? Environmental Conservation Laws; Division of Lands and Forests policies on land management and public recreation (statewide.)
12. Are there policies within your agency that may be counterproductive to the goals of pine barrens legislation? If so, what are they? No
13. Are there barriers to changing policies? If so, what are they? There are no barriers as long as the "policy changes" were consistent with the mission of the agency.
14. What other governmental agencies assist or cooperate with your agency? All
15. What non-governmental organizations assist your agency? All
16. What biological management do you conduct for natural communities? Identification, monitoring, and preservation.
17. What biological management do you conduct for game species? Small and large game - Monitor populations (bird counts, deer, quail, squirrels) and make adjustments in hunting program, if necessary. Pheasant program - Maintain openings at Rocky Pt. tower sites and if necessary plant for food and cover i.e., sorghum, switchgrass, etc.
18. What biological management do you conduct for non-game species? Identification, protection, and biological data collection; Use and access restrictions to preserve populations (tiger salamander, wood ducks, bluebirds) and critical habitat.
19. Do you have a staff position or department that is responsible for natural resource management? Office of Natural Resources; which includes the Division of Lands and Forests (forest rangers, real property, forest management), Fish and Wildlife Division (freshwater fisheries, wildlife, environmental protection), and Marine Resources Division.

Appendix 6-2: Results of Public Agency Management Survey

US DEPARTMENT OF DEFENSE: NAVY

Agency: Navy Cooperative: Managed by the New York State Department of Environmental Conservation, through a Fish and Wildlife Management Agreement.

Preparer: David M. Sinclair (DEC)

Date: January 26, 1994

1. Total number of acres owned by the Navy on Long Island: 15,230 (need to confirm acres)
2. Number of acres managed by the DEC for the Navy: 11,548 (need to confirm acres)
4. Size of total staff in agency on Long Island: 225?
5. % of staff with responsibilities in Central Pine Barrens (or number of staff): 50%
6. Percentage of staff time devoted to the following categories:

	Total on L.I.:	CPB:
law enforcement	15%	3%
natural resource management (species management, species inventory, monitoring, applied research, fire management)	18%	5%
site management (trash pick-up, trail maintenance, boundary posting)	5%	2%
facility management (building and road maintenance)	5%	0.5%
recreation (camping, boating, hunting golfing, horse riding, etc.)	6%	4%
environmental education (nature center, public and school programs)	4%	0.5%

7. Total annual budget of agency: ????
8. % of budget devoted to Central Pine Barrens lands: unknown
9. Sources of funds: General Revenue; Conservation Fund
10. Percentage of budget spent on the following categories: Percentages would be based on staffing (see above)

	Total on L.I.:	CPB:
law enforcement		
natural resource management		
site management		
facility management		
recreation		
environmental education		

11. What are the major policies that guide your land management programs? **Environmental Conservation Laws; Division of Lands and Forests policies on land management and public recreation (statewide.) Fish and Wildlife Management Agreement**

12. Are there policies within your agency that may be counterproductive to the goals of pine barrens legislation? If so, what are they? **No**

13. Are there barriers to changing policies? If so, what are they? **There are no barriers as long as the "policy changes" were consistent with the mission of the agency.**

14. What other governmental agencies assist or cooperate with your agency? **All**

15. What non-governmental organizations assist your agency? **All**

16. What biological management do you conduct for natural communities? **Identification, monitoring and preservation.**

17. What biological management do you conduct for game species? **Small and large game - Monitor populations and make adjustments in hunting program, if necessary. Pheasant program - Maintain openings and, if necessary, plant for food and cover ie- sorghum, switchgrass, etc.**

18. What biological management do you conduct for non-game species? **Identification, protection, and biological data collection; Use and access restrictions to preserve populations and critical habitat. (Tiger salamander)**

19. Do you have a staff position or department that is responsible for natural resource management? **Office of Natural Resources; which includes the Division of Lands and Forests, Fish and Wildlife Division, and Marine Resources Division.**

Appendix 6-2: Results of Public Agency Management Survey

SUFFOLK COUNTY PARKS

Prepared by: **Helen Parker, Assistant Director of Parks**

Date: **February 2, 1994**

1. Total number of acres currently managed Suffolk County Parks on Long Island: **30,000 ± acres**
2. Number of acres managed by your agency in the Central Pine Barrens: **16,302.4 acres**
4. Size of total staff on Long Island -- **150**
5. % of staff with responsibilities in Central Pine Barrens (or number of staff) **10% - 15%**
6. Percentage of staff time devoted to the following categories:

	Total on L.I.: (Unable to separate out CPB)	CPB:
law enforcement	20%	
natural resource management	Incorporated into general management - at this time no specific staff	
(species management, species inventory, monitoring, applied research, fire management)		
site management	20% of time for specific park.	
(trash pick-up, trail maintenance, boundary posting)		
facility management	15%	
(building and road maintenance)		
recreation	40%	
(camping, boating, hunting golfing, horse riding, etc.)		
environmental education	5%	
(nature center, public and school programs)		

7. Total annual budget of agency **\$8.3 million 1994 operating budget.**
8. % of budget devoted to Central Pine Barrens lands **10%**
9. Sources of funds **General Operating Fund.**
10. Percentage of budget spent on the following categories:

	Total on L.I.: (Unable to separate out CPB)	CPB:
law enforcement	\$1.5 million = 18%	
natural resource management	2%	
site management	10%	
facility management	60%	
recreation	100% of the Capital Budget	
environmental education	10%	

11. What are the major policies that guide your land management programs? **Suffolk County Charter -- Park Trustees, Executive and Legislature are policy-making agencies.**
12. Are there policies within your agency that may be counterproductive to the goals of pine barrens legislation? **No**
If so, what are they?
13. Are there barriers to changing policies? If so, what are they? **Recreational uses may be changed only by permission of state and local legislatures and by referendum.**
14. What other governmental agencies assist or cooperate with your agency? **DEC and various townships.**
15. What non-governmental organizations assist your agency? **The Nature Conservancy and other various environmental groups, civic associations, and sporting groups.**
16. What biological management do you conduct for natural communities? **Management agreements with Stony Brook University and The Nature Conservancy.**
17. What biological management do you conduct for game species? **Federal and state laws that regulate hunting.**
18. What biological management do you conduct for non-game species? **Cooperative management agreements with The Nature Conservancy.**
19. Do you have a staff position or department that is responsible for natural resource management? **Three (3) staff positions are in the 1994 Operating Budget.**

Appendix 6-2: Results of Public Agency Management Survey

TOWN OF SOUTHAMPTON

Preparer: Martin Shea, Town Planning and Natural Resources Dept.

Date: March 10, 1994

1. Total number of acres currently managed by your agency on Long Island. Public land inventory has only been partially completed for township. No total acreage figures currently available.
2. Number of acres managed by your agency in the Central Pine Barrens: 602.3 acres currently in town ownership.
4. Size of total staff in agency on Long Island: Total town planning and natural resource staff includes one director, three planners, two environmentalists.
5. % of staff with responsibilities in Central Pine Barrens (or number of staff): Currently, four planning and natural resources staff are only periodically involved in planning and management policy formulation.
6. Percentage of staff time devoted to the following categories: Town Natural Resources Dept. currently consists of two full-time environmentalists, whose partial duties include natural resource management. Town Conservation Board has one full-time environmentalist assigned to wetland protection throughout town. Five bay constables currently assigned to beach and waterways enforcement.
7. Total annual budget of agency:
8. % of budget devoted to Central Pine Barrens lands: Budget allocations are not specific to Central Pine Barrens.
9. Sources of funds: Environmental Advisory Fund, Town budget.
10. Percentage of budget spent on the following categories: Current town budget allocations are not specific to central pine barrens protection needs or even general natural resource management. Environmental Advisory Fund currently totals approximately \$30,000; these monies are available for town-wide environmental protection and management purposes.
11. What are the major policies that guide your land management programs? Western GEIS Comprehensive Plan. Initiative for Groundwater and Pine Barrens Protection, Town Master Plan.
12. Are there policies within your agency that may be counterproductive to the goals of pine barrens legislation? If so, what are they? Current planning and zoning regulations in conflict with contiguous forest protection.
13. Are there barriers to changing policies? If so, what are they? Political, private, and public acceptance of, and readiness for necessary land-use policy changes.
14. What other governmental agencies assist or cooperate with your agency? County planning department, pine barrens review commission.
15. What non-governmental organizations assist your agency? The Nature Conservancy, Group for the South Fork, South Fork Natural History Society, Audubon Society.
16. What biological management do you conduct for natural communities? Ecological community and rare species inventory and mapping, general planning for ecosystem protection and management.
17. What biological management do you conduct for game species? Resource protection and management planning at ecosystem level.
18. What biological management do you conduct for non-game species? Protection and management planning at ecosystem level.
19. Do you have a staff position or department that is responsible for natural resource management? Two full-time environmentalists assigned to resource management in addition to general environmental planning.

Appendix 6-2: Results of Public Agency Management Survey

TOWN OF BROOKHAVEN

Preparer: Diane M. Mazarakis

Date: February 16, 1994

1. Total number of acres currently managed by your agency on Long Island: 235
2. Number of acres managed by your agency in the Central Pine Barrens: 175
4. Size of total staff in agency on Long Island: 9 staff review analysts, 2 secretaries, 1 environmental educator (p/t), 1 laborer.
5. % of staff with responsibilities in Central Pine Barrens (or number of staff) All staff analysts.
6. Percentage of staff time devoted to the following categories:

	Total on L.I.:	CPB:
law enforcement	30%	16%
natural resource management (species management, species inventory, monitoring, applied research, fire management)	10%	5%
site management (trash pick-up, trail maintenance, boundary posting)	5%	5%
facility management (building and road maintenance)	98% (f/t laborer)	2%
recreation (camping, boating, hunting golfing, horse riding, etc.)	0	0
environmental education (nature center, public and school programs)	50%	0

7. Total annual budget of agency
8. % of budget devoted to Central Pine Barrens lands
9. Sources of funds: Municipal
10. Percentage of budget spent on the following categories:

	Total on L.I.:	CPB:
law enforcement	30%	10%
natural resource management	30%	15%
site management	20%	10%
facility management	20%	0
recreation	0	0
environmental education		

11. What are the major policies that guide your land management programs? Preserve the properties as natural, near natural, or restored to natural state.
12. Are there policies within your agency that may be counterproductive to the goals of pine barrens legislation? If so, what are they? No.
13. Are there barriers to changing policies? If so, what are they?
14. What other governmental agencies assist or cooperate with your agency?
15. What non-governmental organizations assist your agency?
16. What biological management do you conduct for natural communities? Phragmites removal.
17. What biological management do you conduct for game species? None.
18. What biological management do you conduct for non-game species? Improve storm drainage into wetlands.
19. Do you have a staff position or department that is responsible for natural resource management? In a regulatory capacity--Division of Environmental Protection.

Appendix 6-2: Results of Public Agency Management Survey

NEW YORK STATE PARKS RECREATION AND HISTORIC PRESERVATION

site: Brookhaven State Park

number of acres: 1,637 acres
person responsible: Bob Nellen - Park Mgr. at Wildwood State Park
size of staff: 2 (off-site)
purpose: aquifer protection, parkland, limited permitted activities
major activities: hiking (Greenbelt Group), Dog Sled Training, Military Vehicles use in conjunction with fire break maintenance, X-Country Skiing.
primary users: Public user groups or individuals by permit only.
developed facility: 15 acres Developed
1,622 acres Undeveloped
estimated number of visitors to these lands/facilities:
Winter - 3,000
Summer - 2,000
written management plans: Yes, attached. Developed Plan in 1977 but not implemented.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

site: Rocky Point Natural Resources Management Area

number of acres: 5154 acres
person responsible: Supervisor; David Sinclair, Supervising Forester Charles Hamilton, Natural Resources
size of staff: 40 (Office of Natural Resources); includes specialists in forestry, wildlife, fisheries, environmental protection, real property, law enforcement and marine resources.
purpose (nature preserve, aquifer protection, parkland, etc.): Multiple - use State Forest
major activities: passive recreation including hunting, hiking, nature observation, bicycling, cross-country skiing, etc.
primary users: recreational users (need permit; see attached).
developed facility: yes or no: No except for parking facilities.
estimated number of visitors to these lands/facilities: approx. 15,000 visits; approx. 4000 access permits are issued annually. (50% hunting and numerous mountain bikes on special trail.)
written management plans: yes or no. No; draft stage.

site: Sarnoff Preserve, Riverhead

number of acres: 2183 acres
person responsible: same
size of staff: same
purpose (nature preserve, aquifer protection, parkland, etc.): same
major activities: same
primary users: same
developed facility: yes or no: No, except for parking.
estimated number of visitors to these lands/facilities: approx. 2000 visits.
written management plans: yes or no. (If yes, please provide.) Yes, compiled 1983. Does need revisions.

Appendix 6-2: Results of Public Agency Management Survey

site: Ridge Environmental Conservation Area

number of acres: 185 acres

person responsible: same

size of staff: same

purpose (nature preserve, aquifer protection, parkland, etc.):

DEC Game Farm, Check Station, and Operations Center; Interpretive Area

major activities: Wildlife Check Station and Holding Area; Facilities maintenance and operations center; Nature Study; Fishing.

primary users: DEC Staff and general public.

developed facility: yes, approx. 30 acres

estimated number of visitors to these lands/facilities: approx. 5000 visits.

written management plans: yes or no. Yes, Draft Unit Management Plan completed Fall 1993.

US DEPARTMENT OF DEFENSE: NAVY

site: Navy Cooperative

number of acres: 4026 acres: 3125 acres - Federal; 901 acres - County

person responsible: Harry Knoch, Regional Wildlife Supervisor

size of staff: 5 (most time Navy and Rocky Pt.) = 3 managers for Navy.

purpose (nature preserve, aquifer protection, parkland, etc.): outdoor recreation area

major activities: passive recreation including hunting, hiking, nature observation, dog training and field trials, etc.

primary users: recreational users.

developed facility: yes or no: No

estimated number of visitors to these lands/facilities: approx. 8,000 visits annually.

written management plans: yes or no. Yes, 1985 (focused on marketability of timber). Due for revisions in 1995.

SUFFOLK COUNTY PARKS

site: Cathedral Pines

number of acres: 265

person responsible: Art Comstock, Park Supervisor.

size of staff: (1) one Park Labor Crew Leader

purpose (nature preserve, aquifer protection, parkland, etc.): parkland

major activities: group camping, hiking.

primary users: organized youth groups, camping clubs

developed facility: yes or no Yes. Environmental learning/group camping center, also parks maintenance building.

estimated number of visitors to these lands/facilities: 6,000 to 8,000 per year.

written management plans: yes or no. No.

site: Southaven County Park

number of acres: 1,340

person responsible: Thomas Downs, Park Supervisor

size of staff: (4) four full time; (20) twenty seasonal

purpose (nature preserve, aquifer protection, parkland, etc.): parkland

major activities: picnicking, camping, boating, fishing, hunting, nature hiking, horseback riding, trap & skeet.

primary users: families

developed facility: yes or no Yes. Picnic grounds, campgrounds, trap & skeets, and various historic buildings.

estimated number of visitors to these lands/facilities: 100,000 per year.

Appendix 6-2: Results of Public Agency Management Survey

written management plans: yes or no. **Yes**

site: **Sears Bellows/Hubbard**

number of acres: **2,300**

person responsible: **Dave Salvador, Park Supervisor**

size of staff: **(3) three Automotive Equipment Operators (AEO)**

purpose (nature preserve, aquifer protection, parkland, etc.): **parkland**

major activities: **swimming, nature hiking, horseback riding, camping**

primary users: **families**

developed facility: yes or no **Yes. Sanitary facilities, stable, Black Duck Historic site.**

estimated number of visitors to these lands/facilities: **20,000**

written management plans: yes or no. **No**

site: **Robert Cushman Murphy County Park/Peconic River Headwaters**

number of acres:

person responsible:

size of staff:

purpose (nature preserve, aquifer protection, parkland, etc.):

major activities:

primary users:

developed facility: yes or no

estimated number of visitors to these lands/facilities:

written management plans: yes or no.

site: **Dwarf Pine Barrens (not established park)**

number of acres:

person responsible:

size of staff:

purpose (nature preserve, aquifer protection, parkland, etc.):

major activities:

primary users:

developed facility: yes or no

estimated number of visitors to these lands/facilities:

written management plans: yes or no.

TOWN OF SOUTHAMPTON

site: **Red Creek Park, Hampton Bays**

number of acres: **40.8 acres**

person responsible: **Allyn Jackson, Superintendent, Town Parks and Recreation Dept.**

size of staff: **Four seasonal employees currently assigned strictly to Red Creek Park. Maintenance Crew of 20 responsible for managing all town parks.**

purpose (nature preserve, aquifer protection, parkland, etc.): **park and recreation area**

major activities: **softball, playground use, picnicking, hiking**

primary users: **softball leagues, families, senior citizens**

developed facility: yes or no **Yes. Park includes softball fields, parking, rest rooms, maintenance facilities, picnic grounds, nature trail**

estimated number of visitors to these lands/facilities: **Approximately 30,500**

written management plans: yes or no. **No**

Appendix 6-2: Results of Public Agency Management Survey

site: Silverbrook Pond, Flanders-Riverhead Rd., Flanders

number of acres: 2.8

person responsible: Management responsibilities have not been officially assigned.

size of staff: Currently none.

purpose (nature preserve, aquifer protection, parkland, etc.): impounded pond/stream acquired for pond and watershed protection purposes

major activities: No established recreational or other human uses--park in mostly natural state.

primary users: Primary park value is aesthetic.

developed facility: yes or no No

estimated number of visitors to these lands/facilities: Less than 500 per year.

written management plans: yes or no. No

site: "Sunrise Estates" properties (E/O Pleasure Dr., W/O Spinny Rd., N/O Sunrise Hwy., Flanders) SCTM No. 0900-202, 02-35, 79.6; 0900-219-01-25

number of acres: 39.1

person responsible: Management responsibilities have not been officially assigned.

size of staff: None

purpose (nature preserve, aquifer protection, parkland, etc.): general open space purposes, aquifer protection

major activities: Very limited trail use.

primary users: No established recreational or other human uses.

developed facility: yes or no No

estimated number of visitors to these lands/facilities: No estimate available.

written management plans: yes or no. No

site: "Sunrise Estates" open space area (E/O Pleasure Dr., W/O Spinny Rd., N/O Sunrise Hwy., Flanders) SCTM No. 0900-202-02-79.5;

number of acres: 2.0

person responsible: Management responsibilities have not been officially assigned.

size of staff: None

purpose (nature preserve, aquifer protection, parkland, etc.): Park and recreation.

major activities: No significant human activity or use on-site.

primary users: No established recreational or other human uses.

developed facility: yes or no No

estimated number of visitors to these lands/facilities: No estimate available.

written management plans: yes or no. No

site: Quogue Refuge eastern bufferland SCTM No. 0900-313-01-42.1; 0900-287-01-1.55

number of acres: 108.7

person responsible: Management responsibility has been delegated by Town to NYSDEC

size of staff: one full-time refuge manager

purpose (nature preserve, aquifer protection, parkland, etc.): buffer to Quogue Refuge

major activities: Area currently restricted. No significant human activities.

primary users: No established recreational or other human uses.

developed facility: yes or no Yes--on bordering contiguous Refuge.

estimated number of visitors to these lands/facilities: Less than 500 on Town-owned buffer lands.

written management plans: yes or no. No

Appendix 6-2: Results of Public Agency Management Survey

Appendix 6-2: Results of Public Agency Management Survey

site: Red Creek Park Open Space Lands

number of acres: 284.2
person responsible: Management responsibilities have not been officially assigned.
size of staff: No full-time staff currently assigned to this land.
purpose (nature preserve, aquifer protection, parkland, etc.): passive recreation; aquifer protection
major activities: hiking, some cross-country skiing
primary users: hikers
developed facility: yes or no No
estimated number of visitors to these lands/facilities: Approximately 500-1,000 per year
written management plans: yes or no. No

site: Ludlam Park, Ludlam Ave., Riverside (0900-140-02-56)

number of acres: 4.0
person responsible: Allyn Jackson, Superintendent, Town Parks & Recreation
size of staff: No full-time staff assigned strictly to park, except for one seasonal attendant.
Maintenance details and led by town-wide crew of 20.
purpose (nature preserve, aquifer protection, parkland, etc.): park and recreation area
major activities: softball, basketball, tennis, playground use
primary users: little league teams
developed facility: yes or no Yes
estimated number of visitors to these lands/facilities: No estimate currently available.
written management plans: yes or no. No

site: The Registry subdivision open space area E/o Cr 104 Quogue-Riverhead Rd., Westhampton 0900-218-01-77.17

number of acres: 20.5
person responsible: Management responsibilities have not been officially assigned.
size of staff: none
purpose (nature preserve, aquifer protection, parkland, etc.): general open space purposes
major activities: Property in natural state.
primary users: No established recreational or other human uses.
developed facility: yes or no No
estimated number of visitors to these lands/facilities: No estimate available; very limited use.
written management plans: yes or no. No

site: Seasons Development Corporation Subdivision Open Space Area 0900-249-01-9.15

number of acres: 17.3
person responsible: Management responsibilities have not been officially assigned.
size of staff: none
purpose (nature preserve, aquifer protection, parkland, etc.): general open space purposes
major activities: Property remains in undeveloped state.
primary users: No established recreational or other human uses on site; visual amenity to bordering residential subdivision.
developed facility: yes or no No
estimated number of visitors to these lands/facilities: No estimate available.
written management plans: yes or no. No

Appendix 6-2: Results of Public Agency Management Survey

site: **Property E/O Riverhead-Quogue Rd., East Quogue SCTM No. 0900-250-04-01**
number of acres: 37.4
person responsible: **Management responsibilities have not been officially assigned.**
size of staff: **None**
purpose (nature preserve, aquifer protection, parkland, etc.): **general open space purposes**
major activities: **Property is in an undeveloped state.**
primary users: **No established recreational or other human uses on site.**
developed facility: **yes or no No**
estimated number of visitors to these lands/facilities: **No estimate available.**
written management plans: **yes or no. No**

site: **Hampton West Estates Park, Stewart Ave., Westhampton**
number of acres: 17.7
person responsible: **Allyn Jackson, Superintendent of Parks & Recreation**
size of staff: **summer park attendant, maintenance details handled by town-wide staff of 20**
purpose (nature preserve, aquifer protection, parkland, etc.): **active recreation**
major activities: **tennis courts, ballfields, playground use**
primary users: **Hampton West Estates residents**
developed facility: **yes or no Yes**
estimated number of visitors to these lands/facilities: **No estimate currently available.**
written management plans: **yes or no. No**

site: **Dwarf Pine Barrens property (SCTM 0900-281-02-46.1)**
number of acres: 5.0
person responsible: **Management responsibilities have not been assigned.**
size of staff: **No staff assigned to site.**
purpose (nature preserve, aquifer protection, parkland, etc.): **aquifer protection**
major activities: **No significant human activities on site.**
primary users: **No established recreational or other human uses.**
developed facility: **yes or no No**
estimated number of visitors to these lands/facilities: **No estimate available.**
written management plans: **yes or no. No**

TOWN OF BROOKHAVEN

site: **Panamoka Park Nature Preserve**
number of acres: 19.9
person responsible: **Diane Mazarakis, Division of Environmental Protection**
size of staff: **attending preserve = 3**
purpose (nature preserve, aquifer protection, parkland, etc.): **nature preserve**
major activities: **passive use, educational, hiking**
primary users: **Town residents**
developed facility: **yes or no No**
estimated number of visitors to these lands/facilities: **200 per year (max.)**
written management plans: **yes or no. Management plan is being prepared.**

Appendix 6-2: Results of Public Agency Management Survey

Appendix 6-2: Results of Public Agency Management Survey

site: **Twin Ponds Nature Preserve**
number of acres: **155**
person responsible: **John Pavacic, Division of Environmental Protection**
size of staff: **3**
purpose (nature preserve, aquifer protection, parkland, etc.): **nature preserve**
major activities: **passive use, hiking**
primary users: **Town residents**
developed facility: **yes or no No**
estimated number of visitors to these lands/facilities: **300 per year (max.)**
written management plans: **yes or no. Management plan in progress.**

Appendix 6-2: Results of Public Agency Management Survey

SUMMARY TABLE

Ranks: 1-extreme, 2-major, 3-moderate, 4-minor

Ranking of Human Impacts on Resources									
	BNL	DEC	DEC/NVY	OPR	SCP	SH	BHVN	RVHD	TNC
overcrowding		4	4	4	4	1	0		
vandalism		3	3	1	3	4	3		
overuse		4	4	4	3	2	0		
unsafe conditions		3	3	1	3	4	0		
dumping		3	3	1	1	2	3		
unauthorized access		3	3	1	1	2	2		
use conflicts nat vs. rec		4	4	1	2	1	0		
human-caused erosion		4	4	1	2	3	0		
env sensitive area development		0	0	4	0	3	0		
plant collection/removal		4	4	4	4	4	0		
excess hunt/fish		0	0	1	4	2	3		
wetland draining/filling		0	0	4	0	3	0		
chemical pollution		0	0	1	0	3	0		
human disturbance to wildlife		4	4	2	4	3	0		
problems from adjacent land use		4	4	2	4	2	0		
noise in park		0	0	4	4	3	0		
noise outside park		4	4	3	4	3	0		
damage to views		0	0	4	4	2	0		
Ranking of Natural Impacts on Resources									
	BNL	DEC	DEC/NVY	OPR	SCP	SH	BKHVM	RVHD	TNC
wildfires		4	4	2	4	?	0		
natural fire exclusion		0	0	1	4	1	0		
flooding		0	0	4	4	0	0		
groundwater drawdown		0	0	2	4	4	2		
eutrophication		4	4	1	4	3	2		
erosion		4	4	1	3	2	0		
fragmentation		4	4	4	3	1	2		
soil compaction		0	0	4	4	4	0		
habitat damage by animal overpop		0	0	3	4	4	0		
invasive non-native plant encroachment		4	4	3	4	1	0		
invasive non-native animal encroachment		4	4	4	4	2	0		
plant disease		4	4	4	3	4	0		
insect infestation		3	3	4	3	4	0		

Appendix 6-2: Results of Public Agency Management Survey

Facility Management & Administration										
	BNL	DEC	DEC/NVY	OPR	SCP	SH	BKHVN	RVHD	TNC	
insufficient mgt funds		2	3	1	1	1	0			
lack of surveyed boundaries		3	3	4	2	4	0			
ownership by other resource rights		0	0	1	0	2	0			
illegal encroachment		3	3	3	4	3	0			
in-holdings		0	0	4	4	3	0			
inadequate rules/regs		4	4	4	3	2	0			
conflicting use reqs by non-agency entities		2	2	1	4	4	0			

Facility Management & Administration (continued)		
	What unauthorized uses cause the most serious problems?	What other constraints or problems do you encounter in the management of your agency's land?
BNL	No response yet.	No response yet.
DEC	dumping; illegal access and subsequent activity; vandalism.	Staffing; funding; determining compatible use
DEC/NVY	dumping; illegal access and subsequent activity; vandalism.	Staffing; funding; determining compatible use
OPR	dumping; illegal access and subsequent activity; erosion and vegetative damage caused by dirt bikes and ORV; arson; vandalism.	The lack of a budget, dedicated staff and enforcement personnel have made it unfeasible to proceed with the Master Plan.
SCP	ORVs	setting policy for various recreational uses
SH	overclearing; unauthorized ORV use; illegal dumping	Lack of staff and time constraints limit the Town's ability to develop a comprehensive resource management plan.
BKHVN	ATV and motor cross	1) erosion and habitat degradation due to ATV use and dirt bikes; 2) dumping; 3) vandalism of trails and markers; 4) unauthorized hunting.
RVHD	No response yet.	No response yet.
TNC		