

A Report to the
Ocean Township Planning Board

1982 MASTER PLAN
FOR THE
TOWNSHIP OF OCEAN
OCEAN COUNTY, NEW JERSEY

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Consultant

Charles H. Mackie Associates, Inc.
Engineers and Planners
Barnegat, New Jersey
and Norwalk, Connecticut

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III. NATURAL RESOURCE INVENTORY

PURPOSE AND SCOPE

In the Pinelands area, as in other sections of Ocean Township, protection and enhancement of the community's natural and historical resources are important local planning and development objectives. This was recognized with the passage of state enabling legislation a decade ago leading to the establishment of municipal environmental commissions (40:56A-2 Chapter 35, Laws of 1972). Since that time, local commissions have been formed and natural resource inventories (NRIs) prepared in many New Jersey communities to assist in land use planning and development review. Consideration of natural resources is also embodied in the State's Municipal Land Use Law.

Existing Sources and Their Use

Ocean Township does not have an environmental commission but has two existing sources of information on natural and historical resources. These are:

- 1) Detailed soils and vegetation maps prepared by the Pinelands Commission at 1"=2000', conforming to U.S. Geological Survey (USGS) 7.5 minute quadrangle maps. Transparent overlay copies were provided to the Township by the Commission in 1981, along with supplementary information on soil types and characteristics. Information on plants, wildlife, water quality, and other environmental characteristics is also available from the Pinelands Commission.
- 2) An NRI prepared for the Township in 1978 by the Conservation and Environmental Studies Center, Inc. This report presents information on a range of environmental characteristics (including soils and vegetation) and describes the Township's history, culture, facilities, and land use. While some useful information is presented,

the scale of maps in this report is much too small for local planning and evaluation of specific development proposals.

The following comments are made relative to the use and validity of these sources.

- Pinelands maps are the most comprehensive and up-to-date sources for vegetation and soils information. Similarly, water quality and wildlife data available through the Pinelands Commission should supercede other sources, where similar or conflicting information is presented.
- Information contained in the 1978 NRI provides a useful overview of the Township, particularly its history and cultural features. However, maps are too small to permit meaningful analysis, and much of the environmental information has been superceded and refined by the Pinelands Commission.

Scope and Objectives of This Inventory

It is not the intention of this report to provide a composite document drawn from all three existing sources. Instead, this report dwells on those factors with which local officials can most readily deal and which have the most widespread relationship to land use decisions -- namely, soils and vegetation. Therefore, this inventory is intended as an overview of and supplement to Pinelands Commission soil and vegetation maps, and is based on information provided by the Commission. Two basic objectives are intended to be served by this report:

- To enable local officials to quickly identify key environmental characteristics and concerns for a particular site.
- To enable officials to make decisions on a proposed development with respect to building siting, on-site waste disposal feasibility, fire hazard potential, and the like.

Local Planning and Development Review

Pinelands Commission soils and vegetation maps should be regarded as the principal sources of information for use in local land use planning and development review. Maps and explanatory text in this report will aid in the understanding of Pinelands soils and vegetation information.

Soil Maps. In reviewing a development application, local officials can locate the subject parcel on the Pinelands 1"=2000' soils maps and determine the soil symbol (or symbols) associated with the parcel in question (e.g. DpB). Reference can then be made to this report for further identification of soils and their characteristics which affect development.

Vegetation Maps. Similarly, a parcel can be located on the Pinelands 1"=2000' vegetation maps or on the Vegetation Map in this report (see pocket) to determine the general vegetation community involved. This report can then be consulted for information on threatened and endangered plants, wildlife, and water quality, among others. While these are important factors, soils and vegetation data are most easily dealt with by local officials because they are mapped. It is felt that the Pinelands Commission, as an active participant in the development review process, is best equipped to deal with these other environmental factors. Therefore, a review of these other environmental factors is not included in this report. Instead, lists of Pinelands plants and wildlife and their habitat types, furnished by the Commission, are contained in a separate appendix.

Limitations of Data

It should be pointed out that all existing data is generalized. Conditions in the field may vary from those generalized on maps. Site inspections and verifications may be required, where available data is suspect or is too broad for development review and site planning purposes.

SOILS

The characteristics of soils have a great bearing on land use and water quality, particularly in determining the feasibility and impacts of septic tanks, solid waste disposal operations, and agricultural chemicals. Knowledge of these characteristics can help officials minimize in advance problems associated with these and other activities.

Soil Series Found in Ocean Township

Several types of soils are found in undeveloped and undisturbed areas of the Township. These types are grouped below by depth to seasonal high water table.

Depth to Seasonal High Water Table

Soil Series

5.0 feet or more

Aura (AxB)
Downer (DOA, DpA, DpB)
Evesboro (EvB, EvC)
Lakewood (LwB, LwC)
Woodmansie (WOB, WOC)

1.5 to 5.0 feet

Hammonton (HCA)
Lakehurst (LhA)

Less than 1.5 feet

Atsion (At)
Berryland (Be, BF)
Manahawkin Muck (Ma)
Muck (Mu)
Tidal Marsh (SS)

Variable and unknown

Pits and Made Land

Pinelands Commission maps show the location and distribution of these soil series for the entire Township. These series are grouped according to depth to seasonal high water table in the Soils Map (see pocket at rear of report).

East of the Parkway, Manahawkin Muck is the dominant soil series along Oyster and Waretown Creeks. Atsion and Berryland soils are also present in these wet areas. Bay islands and some bayfront lands on the mainland are Tidal Marsh soils. Made Land is dominant, however, along the mainland

bayfront, with Atsion and Lakehurst sands and Manahawkin Muck also found. East of Route 9, between the creeks, Lakehurst sand is most abundant, followed by Manahawkin Muck and Berryland sand. Between the creeks, but west of Route 9, series occur in great variety. Lakehurst and Lakewood sands are most prevalent, but Downer, Evesboro, and Woodmansie soils are also present.

Manahawkin Muck is also the principal soil series in the Oyster Creek system west of the Parkway. Atsion and Berryland sands are also found here and along other creeks, including Long Branch and Cabin Branch in the Forked River system. Lower elevations flanking these creek beds and flood plains are characterized by Lakehurst sand and Hammonton sandy loam, with the Lakehurst series dominant. Major concentrations west of the Parkway are immediately south of Oyster Creek and north of Wells Mill Pond to the Lacey Township line.

Downer sandy loam is dominant in higher elevations south of Oyster Creek and west of the Parkway. Downer loamy sand and Evesboro sand are also abundant. Lakewood and Woodmansie sands are found here in smaller areas. Northwest of Oyster Creek, Woodmansie and Lakewood sands and Downer loamy sand are most prevalent. Downer and Aura sandy loams are also found.

Soils Characteristics and Interpretations

Soil characteristics recorded by the Pinelands Commission for each soil series are:

- Soil drainage class
- Hydrologic soils group
- Permeability
- Depth to seasonal high water table
- Septic tank suitability class
- Agricultural class
- Acidity (pH)

These characteristics are summarized in Table 10 for soils series occurring in the Township.

Soil Drainage Class. Seven (7) natural soil drainage classes are recognized by the USDA Soil Conservation Service.

- ED - excessively drained soils are commonly very porous and rapidly permeable. They have a low available water capacity. Water is removed from these soils very rapidly. This class is represented primarily by the Lakewood sands in Ocean Township.
- SED - somewhat excessively drained soils are also very permeable. Water is removed from these soils rapidly. This class is also represented by Evesboro sands.
- WD - well drained soils are those in which water is removed from the surface readily but not rapidly. Downer and Woodmansie soils are representative of this class in Ocean Township
- MWD - moderately well drained soils are wet for a small but significant part of the time, usually because of a slowly permeable layer, a relatively high or intermittently high water table, surface additions of water by runoff from areas upslope or a combination of these conditions. Lakehurst and Hammonton soils are included in this drainage class.
- SPD - somewhat poorly drained soils are wet for significant periods, but not all the time, because of a slowly permeable layer or a high water table. Hammonton and Lakehurst soils are also represented in this group.

TABLE 10
CHARACTERISTICS OF SOIL SERIES FOUND IN OCEAN TOWNSHIP

Soil Series	Soil Drainage Class	Hydrologic Soils Group	Permeability (in./hr.)	Depth to Seasonal High Water Table (ft.)	Septic Tank Limitation	Agricultural Soils	Acidity (pH)
Atsion (At) - sand	PD-VPD	D	2.0-6.0	0-1.0	2	N	3.6-5.0
Aura (Axß) - sandy loam	MD	B	0.2-2.0	over 6.0	6	P	3.6-5.0
Berryland (Be, BF) - sand	VPO	D	2.0-6.0	0-0.5	2	U	variable
Downier (DoA) - loamy sand	MD	B	0.6-6.0	over 6.0	4	P	3.6-5.0
Downer (DpA, Dpß) - sandy loam	MD	B	0.6-6.0	over 6.0	4	P	3.6-5.0
Evesboro (Evß, Evc) - sand	ED-SED	A	over 2.0	over 6.0	3	N	3.6-5.0
Hammonton (HcA) - sandy loam	MWD-SPD	B	0.6-6.0	1.5-4.0	2	P	3.6-4.4
Lakehurst (LhA) - sand	MWD-SPD	A	2.0-6.0	1.5-3.5	2	N	3.6-5.0
Lakewood (LwB, LwC) - sand	ED	A	0.6-20	over 6.0	3	N	3.6-5.0
Made Land (Mn, PD, PH)	V&U	V&U	V&U	V&U	V&U	V&U	3.6-5.5
Manahawkin (Ma) - muck	VPD	D	0.2-6.0	0-1.0	1	U	-
Muck (Mu)	VPD	D	0.2-6.0	0	1	U	-
Pits (Pn)	V&U	V&U	V&U	V&U	V&U	V&U	6.6-7.3
Tidal Marsh (SS)	V&U	D	over 6.0	0	1	N	3.6-4.4
Woodmansie (WoB, WoC) - sand	MD	B	0.6-6.0	over 6.0	4	N	3.6-4.4

V&U - variable and undetermined; site investigation necessary

Source: Pinelands Commission

- PD - poorly drained soils are wet for long periods. The water table is seasonally near the surface for prolonged intervals. This class is represented by Atsion sands.
- VPD - Very poorly drained soils are wet nearly all the time. The water table remains at or near the surface a greater part of the time. Berryland soils and Manahawkin Muck are included in this class.

Soils in the PD and VPD classes are defined as wetland soils in the Pinelands Comprehensive Management Plan. Lands with these soils are subject to strict limitations on the types of development permitted by the Commission.

Hydrologic Soil Groups. All soils have been classified into four hydrologic groups (A,B,C and D) according to their infiltration and transmission rates. Representatives of Groups A, B, and D occur Ocean Township

- Group A - Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well to excessively drained sands or gravels. These soils have a high rate of water transmission (water readily passes through them) and low runoff potential. Evesboro, Lakehurst and Lakewood soils are included in this category.
- Group B - Soils having moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately deep to deep, and moderately well to well drained soils. These soils have a moderately coarse texture and moderate rate of water transmission. Downer and Woodmansie soils are included in this group.

- Group C - Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impedes downward movement of water or soils with moderagely fine to fine texture. These soils have a slow rate of water transmission.
- Group D - Soils having very slow infiltration rates when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission and high runoff potential. Atsion and Berryland sands, Manahawkin Muck and Tidal Marsh soils are found in this group.

The volume of stormwater runoff is generally determined by the soil's characteristics, as classified in the hydrologic groups, and by its hydrologic condition. The condition depends on the soil's moisture content at the time of a storm, its humus and organic content, and its temperature.

Permeability. Ocean Township soils range from moderately slow to moderately rapid permeability. Permeability is a measure of the rate at which soil transmits water, and is described in the following manner:

●	Very Slow	Less than 0.06 inches per hour			
●	Slow	0.06 - 0.2	"	"	"
●	Moderately Slow	0.2 - 0.6	"	"	"
●	Moderate	0.6 - 2.0	"	"	"
●	Moderately Rapid	2.0 - 6.0	"	"	"
●	Rapid	6.0 - 20.0	"	"	"
●	Very Rapid	More than 20.0	"	"	"

Depth to Seasonal High Water Table. The depth to seasonal high water table represents the level to which the water table rises during the wet season, which in the Pinelands is the spring. This factor is one of the most restrictive to development in the Pinelands and is the basis for calculations of allowable residential growth in the Regional Growth Area, where subject to requirements of the Pinelands Comprehensive Management Plan (CMP). Three categories are defined:

- Less than 1.5 feet.
- 1.5 - 5.0 feet.
- More than 5 feet.

Development faces physical and administrative restrictions in areas characterized by soils with less than five feet of depth above seasonal high water table.

Septic Tank Limitation. Pinelands soils are chemically inert and unable to assimilate waste placed in or on the land. One major source of waste which has been linked to groundwater problems is septic tank effluent. The soil factors which limit the use of septic tanks and soil absorption systems as a means of on-site wastewater disposal are broken down into six groups, based on water table depth and permeability class. From most restrictive, the groups are:

- Class 1. - Occasional to frequent flooding. Septic tanks do not function well in flooded conditions. These conditions allow for the movement of bacteria and viruses through the soil. (UNACCEPTABLE)
- Class 2. - Seasonal high water table of less than 5 feet. This group includes SPD, PD, and VPD soil drainage classes. Between 4-6 feet of soil are required to prevent the movement of pathogenic organisms from a septic leach field trench bottom to the water table. Current Soil Conservation Service mapping techniques only provide seasonal water table information to a depth of five feet. These data,

therefore, provide a general guide to soil suitability for septic systems, but site-specific investigations are needed. This group also includes soils with permeability less than 0.2 inches per hour. Septic tanks do not function well in these impermeable soils because movement of liquids in the drainage field is too slow to relieve the build-up in the septic tank. (UNACCEPTABLE)

• Class 3. - Permeability greater than 6 inches per hour. This group includes excessively and somewhat excessively drained soil drainage classes. Soils with permeabilities greater than 6 inches per hour present a special concern because they do not filter effluent effectively. If current design criteria were followed, septic fields in such soils would have very small bottom trench areas. These designs may permit rapid downward movement of water, nitrates, pathogenic bacteria and virus. (MARGINALLY ACCEPTABLE)

• Class 4. - Permeability greater than 2 inches but less than 6 inches per hour. Permeability between 2 and 6 inches per hour would also be expected to allow rather rapid movement of virus and breakthrough of phosphorus. These soils are the well-drained members of hydrologic group B. However, since trenches would be designed with larger bottom areas than in more permeable soils, it would take longer for the phosphorus to break through. Concentrations of both phosphorus and nitrate reaching the groundwater are also more dilute, since they are spread over a larger area. Only soils in this group which have a subsurface with permeability less than 2 inches per hour would minimize virus movement. Woodmansie and Downer soils are included in this category. (ACCEPTABLE)

- Class 5. - Variable and undeterminable, site investigation required. These soils need to be examined on an individual basis because they have been previously disturbed and predictions of their properties cannot be made. (UNCLASSIFIED)
- Class 6. - Permeability greater than 0.2 but less than 2 inches per hour. Soils with permeabilities in this range are the moderately drained members of hydrologic group "B". Water is not expected to move fast enough to flush virus to the groundwater, and the phosphorus absorption capacity should be sufficient to prevent migration to the groundwater for several years. These soils are the least restrictive in the Pinelands for septic leach fields. Aura soils are members of this class.

Agricultural Soils. Soils considered best for agricultural purposes are classified as prime agricultural soils (P), unique soils (U), and soils of statewide importance (S). These classifications are defined by the U.S. Soil Conservation Service.

- Prime soils (P) - those best suited and currently available for producing food, feed, forage, fiber, and oilseed crops. Current land use could be cropland, pastureland, rangeland, forest land, or other undeveloped land, but does not include built-up urban land. Prime farmland soils have the quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed according to modern farming methods. The Aura, Downer and Hammonton soils found in Ocean Township are classified as Prime agricultural soils.

- Unique soils (U) - are those other than prime soils which can support the production of specific high-value food and fiber crops. A special combination of soil quality, location, growing season, and moisture supply is present in these soils to produce sustained high quality and/or high yields of a specific crop when treated and managed according to modern farming methods. Examples of such crops are citrus, olives, cranberries, fruit and vegetables. Berryland soils and Manahawkin Muck are classified as unique soils.
- Soils of statewide importance (S) - these can also support the production of food, feed, fiber, forage, and oilseed crops. Criteria for defining and delineating this land are determined by state authorities. Generally, additional farmlands of statewide importance include those that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce as high a yield as prime farmlands if conditions are favorable. Ocean Township contains no soils of statewide importance.
- Unclassified (N) - These soils are not classified as to agricultural importance. They include Atsion, Evesboro, Lakehurst, Lakewood, Tidal Marsh, and Woodmansie soils in Ocean Township.

Acidity (pH). Typically, surfaces of Pineland soils are extremely acid (pH 3.6-4.0). Subsoil and substratum layers tend to be extremely acid or very strongly acid (pH 4.2-5.0), with an average pH of about 4.6. The relatively low pH values of Pineland soils and their low fertility are both traced to their dominant quartz content. Recommended pH levels for most vegetative and field crops, for example are 6.0-6.5 and 6.3-6.5, respectively. Berry crops, on the other hand, depend on

the high-quality acidic waters (pH 4.0-5.0) abundant in the Pinelands.

Summary of Development Suitability

Most undeveloped areas east of Route 9 and old Main Shore Road are characterized by soil series having a depth to seasonal high water table less than 1.5 feet. Soils in the 1.5-5 foot range are prevalent in lands bordering Route 9 and Old Main Shore Road. Generally, both areas would be considered unacceptable for on-site waste disposal because of high water table conditions. Lands particularly restrictive to non-sewered development are "wetlands" with less than 1.5-foot depth to the seasonal high water table. Transitional lands in the 1.5 to 5-foot range may or may not have limitations. In the past, lands on or near the bayfront have been elevated to permit use of on-site septic systems by dredging and filling to create lagoon developments. More recently, the area is being sewerred to overcome on-site waste disposal problems.

Except for lands along and adjacent to creeks and streams, most areas west of Route 9 are characterized by soils having a depth to seasonal high water table greater than five feet. Such areas are generally not restrictive to development and the use of on-site sewage disposal methods, except as they may otherwise be limited by Pinelands regulations.

VEGETATION

The vegetation of undeveloped sections of the Pinelands is a major natural resource, providing habitat for wildlife, raw materials for commercial forestry, cover for recreational uses, and opportunities for scenic enjoyment and scientific research. Pinelands vegetation respond dramatically to changes in water table level. Two distinct complexes of vegetation are

found: uplands and lowlands (wetlands). Lowland vegetation occurs where the water table is near or above the surface during some part of the year. Uplands vegetation is found in areas with greater soil depths to the seasonal high water table.

Representative associations in each complex are found in Ocean Township. Major associations are:

- Uplands Complex - Pine-oak forest
 - Oak-pine forest
- Lowlands (Wetlands) Complex - Pitch pine lowland forest
 - Hardwood swamp
 - Cedar swamp
 - Bog
 - Marsh

The type and extent of these vegetative associations are shown in the Vegetation Map (see pocket at rear of report). This map was adapted from Pinelands Commission maps at the same scale (1" = 2000').

Basic Characteristics of Communities found in Ocean Township

Uplands Complex. The uplands of the Pinelands support pine forests. Both are found Ocean Township, but pine-oak is the dominant association west of the Parkway.

Fire plays an important role in determining the composition of these upland forests. Differences in resistance to fire damage, shade tolerance, and reproductive strategies are responsible for the selective action of fire on the different plant species. Following a fire, some oaks and pines have the ability to resprout from dormant buds which lie protected beneath the soil surface and along their trunks. This ability varies among the oaks and pines. Oaks are less resistant to both wounding and killing by fire than pitch or shortleaf pine. The shrub oaks are more fire adapted than the tree oaks, such as white and black oaks. They exhibit a greater capacity to sprout and produce acorns on much younger sprouts following a fire. Pitch pine is more resistant to fire damage and retains

its basal sprouting ability over a longer period of time than shortleaf pine.

Fire also results in the removal of the thick mat of litter covering the forest floor. This provides a more suitable seedbed for pine which, unlike oaks, require mineral soil or a thin layer of litter and minimal shading for the establishment of seedlings. The overall effect of fire favors pine over oak. In the absence of fire or other severe disturbances such as land clearing, pitch pine and shortleaf pine would be replaced by oaks and other hardwoods.

Upland pine-oak forests in the Ocean Township area are dominated by pitch pine, with shortleaf pine also present. Although shrub oaks occur in association with the pine, tree-form oaks are the dominant oaks in the pine-oak forest found in the municipality. These species include black oak, southern red oak, scarlet oak, white oak, and chestnut oak. Common understory shrubs in the pine-oak forest include lowbush blueberry and black huckleberry.

In the oak-pine forest, stems of the tree-form oaks are more numerous than those of the pines. Although pitch pine is usually present in the oak-pine forests, it may often be a minor component of these stands. Black oak is most abundant with white, scarlet, and red oaks and shortleaf pines also occurring. Shrubs present in the oak-pine forest are predominantly lowbush blueberry and black huckleberry. Mountain laurel and other shrub species may also be present.

Lowland (Wetlands) Complex. Major associations occurring in Ocean Township are pitch pine lowlands, hardwood swamps, cedar swamps, bogs, and marshes.

The pitch pine lowland forest is characterized by a dense canopy composed almost entirely of pitch pine. The understory is often dense, supporting maple and blackgum as well as a variety of lowland shrubs, especially sheep laurel. Black

huckleberry, dangleberry, and staggerbush also are common. The shrub layer varies in height, from relatively low shrubs such as sand myrtle and sheep laurel in drier areas, to tall stems of such species as highbush blueberry, pepperbush, and azalea near the swamps. In areas of frequent inundation, leatherleaf may form dense, low thickets. In the drier areas, a well developed herbaceous layer occurs, composed of such species as bracken fern, turkey beard, sedges and grasses, and teaberry.

The pitch pine lowland forest is a transition type. It is found in the gradient between upland forest types and the cedar and hardwood swamps. The boundaries of this lowland forest may be rather abrupt or very gradual, often grading into upland forest and extending onto drier soils. The changes in soil moisture conditions are reflected in changes in species composition. As the soil becomes drier, the relative abundance of wetland species decreased and oaks are observed. The distribution of pitch pine lowland in Ocean Township is typical of its occurrence in other areas of the Pinelands. It occurs in narrow bands along stream courses, in fringes of hardwood swamps, and in other areas of low relief or poor drainage.

The hardwood swamp association occurs along stream courses and poorly drained areas. The canopy of hardwood swamp forests is predominantly trident red maple, commonly associated with blackgum, sweetgum and sweetbay. Sassafras and gray birch also occur frequently. Although nearly pure stands of broadleaved hardwoods are common, in some areas pitch pine and white cedar occur in the canopy. They are often as abundant as the maple, blackgum, sweetgum and sweetbay. The number of woody-plant species and stand composition variability is greatest in the hardwood swamps. The shrubs which occur in the hardwood swamps include highbush blueberry, swamp azalea, fetterbush, sweet pepperbush, and bayberry.

Cedar swamps are found in narrow bands running along many of the smaller stream courses and in larger configurations in the broader valleys. These swamps are characterized by dense, even-aged stands of narrow-crowned Atlantic white cedar. Cedar predominates in the canopy but pitch pine is often present. Trident red maple, blackgum, and sweetbay are also common in the understory. Dangleberry, high-bush blueberry, swamp azalea, fetterbush, sweet pepperbush, and bayberry are likely to occur in the shrub layer. Hardwoods and shrubs are far more numerous and can form a dense layer at the edges of the stands or under stands that have been partially cut or are declining. While herbaceous growth is rarely very dense, there is a wide variety of species present in areas where there are canopy openings. These commonly include pitcher plant, sundew, and chain fern. A rich carpet of mosses covers the ground.

Fires rarely begin or spread in the wet and poorly drained cedar swamps. Unless a fire is driven by a strong wind or drought conditions exist, these lowlands usually act as fire breaks. Atlantic white cedars are extremely susceptible to fire injury because of their thin bark and flammable foliage, and they do not sprout after stems are killed by fire. Subsequent reproduction depends on the depth to which the organic soil has been burned, the nature of the previous stand, and the extent of browsing by deer.

Bogs are also found along stream channels, and shrubs are the dominant vegetation. These include cranberry, leatherleaf, sheep laurel, highbush blueberry, swamp azalea, sweet pepperbush, and staggerbush. The bog designation includes active cranberry bogs, open bogs, and shrub thickets. Shrub thickets, known as sponges, are dominated by leatherleaf and may include highbush blueberry.

Marshes occur in two types: coastal and inland. Marsh areas commonly occurring in Ocean Township are coastal marshes which are often adjacent to bands of hardwood swamp. Vegetation in these marshes is dominated by salt marsh cordgrass and salt hay.

Rush, spike grass, and glassworts are often associated with the dominant spartinas. Species composition in tidal areas changes as salinity decreases. Upper regions of the tidal influence contain cattails, wild rice, and three-square bulrushes.

Distribution of Vegetation in Ocean Township

Easternmost sections of the Township are characterized by lower elevations and wetlands vegetation. Marsh vegetation occurs on the bay islands and in undeveloped sections of the mainland bayfront. Largest areas of marsh vegetation on the mainland occur near Sands Point and between Barnegat Beach and Pebble Beach. Hardwood swamp vegetation, however, occupies the majority of open and undeveloped land east of Route 9. Largest areas are found between Bay Haven and Barnegat Beach, Barnegat Beach and Pebble Beach, Sands Point and Holiday Beach, and Holiday Beach and Skipper's Cove. Small areas of cedar swamp are found between Barnegat Beach and Pebble Beach and adjacent to Oyster Creek near Route 9.

Wetlands vegetation continues west of Route 9 along and adjacent to Oyster and Waretown Creeks. Lowland pitch-pine forest is the prevalent wetlands type between Route 9 and the Parkway. Several small areas of cedar swamp and hardwood swamp are also found. Small patches of bog vegetation also occur in a few locations. The majority of vegetation between Route 9 and the Parkway, however is classified as upland. The pine-oak association is most prevalent near Route 9, while oak-pine forest is the dominant type near the Parkway.

A similar pattern of uplands vegetation occurs west of the Parkway, with oak-pine forest being the dominant type near the Parkway. Higher elevations west of the Parkway, but generally east of Wells Mill Pond are almost entirely occupied by the oak-pine association. In the larger remaining part of the western sector of the Township, however, the pine-oak association takes over as the dominant uplands forest type.

Wetlands vegetation west of the Parkway occurs in great complexity in lower elevations, largely along the Oyster Creek system and tributaries of the Forked River system. Hardwood swamps are dominant along streams and in the wettest areas. Areas of lowland pitch-pine forest are also abundant, particularly in transitional areas adjacent to streams. Relatively large areas of cedar swamp are found both upstream and downstream of Wells Mill Pond. Small bogs occur in the vicinity of the pond, but their largest concentration is in the upper reaches of the Oyster Creek at Brookville.

Nearly 80 percent of the undeveloped land in the Township west of the Parkway is covered by uplands vegetation, generally corresponding to areas where the depth to seasonal high water table is 5 feet or greater. Similarly, a correlation is found between wetlands vegetation types and depths to seasonal high water table less than 5 feet. This correlation is illustrated by data presented in Table 11, which relates soil series found in the Township to most common types of trees occurring within each series.

Fire Hazard Classification

The Pinelands contain some of the most hazardous vegetative fuel types in the nation. According to the National Fire Danger Rating System of the U.S. Department of Agriculture, much of the region's vegetative fuel is in the same high hazard category as California chaparral. The New Jersey Bureau of Forest Fire Management has developed a Fire Hazard Classification system to rate an area's potential wildlife hazard severity. The primary factor considered by the system is vegetation (fuels). The ratings are based on the rates of fire spread of the native vegetation and their resistance to fire suppression activities.

TABLE 11

CORRELATION OF SOIL SERIES AND VEGETATION

<u>Soil Series</u>	<u>Most Common Trees (1)</u>
Atsion	Pitch pine; red maple; and black-gum
Aura	Black, white, red, and scarlet oaks; hickories; and few pitch and shortleaf pines
Berryland	Pitch pine; red maple; black-gum; and few Atlantic white cedars.
Downer	Black, white, scarlet, red and chesnut oaks; hickories; and few pitch and shortleaf pines
Evesboro	Pitch and shortleaf pines and few chestnut oaks
Hammonton	Black, white, red, southern red and scarlet oaks; and few pitch and shortleaf pines
Lakehurst	Pitch pine; and few black, white, and chestnut oaks
Lakewood	Pitch shortleaf pines and few chestnut oaks; dwarf form where fires have been severe
Woodmansie	Dwarf pitch pine

(1) in order of abundance

Source: Pinelands Comprehensive Management Plan.

There are five classes of ratings corresponding to five levels of wildlife hazard severity: low, moderate, high, extreme, and variable. Table 12 lists the fire hazard ratings of Pinelands vegetation types.

Pinelands vegetation maps provide a general indication of fire hazard in the municipality. Although pine-oak forest, both are placed in the moderate-to-extreme hazard range. This is because classification depends on height, spacing, maturity, and presence of shrub oaks and other ground fuels, factors which are not currently mapped. Because of the variation among stands, determination of the fire hazard of a specific area requires on site inspection.

Wetlands

The Pinelands Commission is committed to the protection of wetlands in the Pinelands area. Wetlands include areas with very poorly drained (VPD) and poorly drained (PD) soils, as designated by the USDA Soil Conservation Service. Vegetation associations characteristic of wetlands in the Pinelands area include Atlantic white cedar swamps, hardwood swamps, pitch pine lowlands, bogs, and marshes. Other features included in the Commission's comprehensive definition of wetlands are coastal marshes, lakes, ponds, rivers, and streams. Table 13 itemizes principal types of vegetation characteristic of the major wetlands associations found in Ocean Township. These wetlands associations also provide habitat for a number of threatened and endangered plants and animals, further information about which is available from the Pinelands Commission and itemized in a separate appendix to this report.

TABLE 12

PINELANDS FIRE HAZARD CLASSIFICATIONS

<u>Hazard</u>	<u>Vegetation Type</u>
Low	Atlantic white cedar swamps; Hardwood swamps
Moderate	Pine-oak or oak-pine greater than 20 ft. tall and less than 20 ft. spacing; Non- Pine Barrens fores; Pre- scribed burned areas
High	Pine-oak or oak-pine than 20 ft. tal and greater than 20 ft. spacing
Extreme	Immature pine-oak or oak- pine forests; Pitch pine lowlands (all size classes); Plains-type vegetation; Old field grasses
Variable	Inland marshes; Coastal marshes; Cranberry bogs

Source: Pinelands Commission

WETLANDS ASSOCIATIONS AND MAJOR PLANT SPECIES

Coastal Wetlands

Coastal wetlands are banks, low-lying marshes, swamps, meadows, flats, and other lowlands subject to tidal inundation which support or are capable of supporting one or more of the following plants:

salt meadow-grass (*Spartina patens*),
 spike grass (*Distichlis spicata*),
 black grass (*Juncus gerardi*),
 saltmarsh grass (*Spartina alterniflora*),
 saltwort (*Salicornia europaea* and *Salicornia bigelovii*),
 sea lavender (*Limonium carolinianum*),
 saltmarsh bulrush (*Scirpus robustus* and *Scirpus paludosus* var. *atlanticus*),
 sand spurrey (*Spargularia marina*),
 switch grass (*Panicum virgatum*),
 tall cordgrass (*Spartina pectinata*),
 highland bush (*Iva frutescens* var. *araris*),
 cattails (*Typha angustifolia* and *Typha latifolia*),
 spike rush (*Eleocharis rostrata*),
 chairmaker's rush (*Scirpus americanus*),
 bent grass (*Argemone palustris*),
 sweet grass (*Hierochloa odorata*),
 wild rice (*Zizania aquatica*),
 Olney's three-square (*Scirpus olneyi*),
 marsh mallow (*Hibiscus palustris*),
 salt marsh grass (*Spartina cynosuroides*),
 common reed grass (*Phragmites communis*),
 pickerel grass (*Pontederia cordata*),
 arrowheads (*Sagittaria* spp.),
 spatterdock (*Nepher variegatum*),
 red maple (*Acer rubrum*), and
 Atlantic white cedar (*Chamaecyparis thyoides*).

Coastal wetlands include those lands which are delineated by the New Jersey Department of Environmental Protection on official maps at a scale of 1:2,400 listed in N.J.A.C. 7:7A-1.13.

Source: Pinelands Comprehensive Management Plan

Inland Wetlands

Inland wetlands include, but are not limited to:

A. Atlantic White Cedar Swamps.
 Atlantic white cedar swamps are areas dominated by Atlantic white cedars (*Chamaecyparis thyoides*) and supporting one or more of the following hydrophytic plants:
 red maple (*Acer rubrum*),
 sweetbay (*Magnolia virginiana*),
 blackgum (*Nyssa sylvatica*),
 dangleberry (*Caylussacia frondosa*),
 highbush blueberry (*Vaccinium corymbosum*),
 swamp azalea (*Rhododendron viscosum*),
 fetterbush (*Leucothoe racemosa*),
 sweet pepperbush (*Clethra alnifolia*),
 inkberry (*Ilex glabra*),
 pitcher plant (*Sarracenia purpurea*),
 sundew (*Drosera* spp.),
 cinnamon fern (*Osmunda cinnamomea*),
 royal fern (*Osmunda regalis*),
 and sphagnum moss (*Sphagnum* spp.).

B. Hardwood Swamps.

Hardwood swamps are areas dominated by red maple (*Acer rubrum*), blackgum (*Nyssa sylvatica*) and/or sweetbay (*Magnolia virginiana*) and supporting one or more of the following hydrophytic plants:
 gray birch (*Betula populifolia*),
 Atlantic white cedar (*Chamaecyparis thyoides*),
 sweet gum (*Liquidambar styraciflua*),
 sweet pepperbush (*Clethra alnifolia*),
 highbush blueberry (*Vaccinium corymbosum*),
 swamp azalea (*Rhododendron viscosum*),
 fetterbush (*Leucothoe racemosa*),
 leatherleaf (*Chamaedaphne calyculata*),
 dangleberry (*Caylussacia frondosa*),
 cinnamon fern (*Osmunda cinnamomea*),
 chain fern (*Woodwardia* spp.)
 and rushes (*Juncus* spp.)
 or other lowland forests dominated by one or more of the following plants:
 sweet gum (*Liquidambar styraciflua*),
 pin oak (*Quercus palustris*),
 and willow oak (*Quercus phellos*).

C. Pitch Pine Lowlands.

Pitch pine lowlands are areas dominated by pitch pine (*Pinus rigida*) and supporting one or more of the following hydrophytic plants:

red maple (*Acer rubrum*),
 blackgum (*Nyssa sylvatica*),
 gray birch (*Betula populifolia*),
 leatherleaf (*Chamaedaphne calyculata*),
 dangleberry (*Caylussacia frondosa*),
 sheep laurel (*Kalmia angustifolia*),
 highbush blueberry (*Vaccinium corymbosum*),
 sweet pepperbush (*Clethra alnifolia*), and
 wintergreen (*Gaultheria procumbens*).

D. Bogs.

Bogs are areas dominated by hydrophytic, shrubby vegetation including:
 cranberry (*Vaccinium macrocarpon*),
 leatherleaf (*Chamaedaphne calyculata*),
 sheep laurel (*Kalmia angustifolia*),
 highbush blueberry (*Vaccinium corymbosum*),
 swamp azalea (*Rhododendron viscosum*),
 sweet pepperbush (*Clethra alnifolia*),
 dangleberry (*Caylussacia frondosa*), or
 staggerbush (*Lycium mariano*).
 Sphagnum moss (*Sphagnum* spp.), pitcher plant (*Sarracenia purpurea*), sundew (*Drosera* spp.), and sedges (*Carex* spp.) are among the herbaceous plants which are found in bogs. Active cranberry bogs and shrub thickets dominated by leatherleaf (*Chamaedaphne calyculata*) are included in this category.

E. Inland Marshes.

Inland marshes are areas which are dominated by hydrophytic grasses (*Cromineae*) and sedges (*Carex* spp.) and which include one or more of the following plants: pickerelweed (*Pontederia cordata*), arrow arum (*Peltandra virginica*), cattail (*Typha* spp.), and rushes (*Juncus* spp.).