Conservation Element

(*adopted* August 1, 2013)

INTRODUCTION

The Conservation Element of the Master Plan addresses the issues of the preservation and management of environmentally sensitive lands. In this context, environmentally sensitive lands include stream corridors, open water, freshwater wetlands, floodplains, soils with high water tables, steep slopes, aquifer recharge lands and areas with significant vegetative cover, including the urban forest resources of the Township. The preservation of these natural resources constitutes the main objective of the Township's conservation efforts. Conservation is a term that may also be used in conjunction with preserving the "built environment", that is significant buildings and streetscapes. Policies concerning this latter form of conservation may be found in the Town Center Sub-element, Historic Preservation and Circulation Elements.

The Conservation Element is designed to meet the goals and objectives of the Master Plan with a special emphasis on the goal of Protecting the Land. This element aids in achieving this goal by describing the natural environment, identifying environmentally sensitive lands, and recommending methods of land preservation. Retention of environmentally sensitive lands and mature woodland also assists in meeting the goal of Preserving the Past through the preservation of portions of the rural landscape. The element serves to provide techniques to meet the objectives under the goal of Envisioning the Future. Part of the foundation for the Conservation Element is the Environmental Resource Inventory (ERI) that was most recently updated in June 2013[1] and has been adopted as a technical appendix to the Master Plan.

In the overall structure of the Master Plan, the Conservation Element is closely allied with the Open Space and Recreation Plan Element. The Master Plan has been deliberately structured to begin with the lands that are to be retained for conservation and other open space purposes. Once these are described and mapped, land for development purposes is discussed in subsequent elements.

[1] - Delaware Valley Regional Planning Commission, 2013. None of the maps included in the ERI are intended, and should not be construed as supplanting, any map within any element of the Master Plan, but is intended for illustrative and supplemental purposes, only.

GEOLOGY

Geologic formations provide the parent material for the production of soils. Their characteristics help determine the suitability of land for development. The primary role of geology for land use policy relates to the supply of groundwater and the disposal of effluent. In Moorestown, approximately one-quarter of the land area is outside the sanitary sewer service area, and because of the heavy clay layers that exist in much of the Township, adequate percolation for septic systems is often difficult to obtain. Geology is also important in identifying potential problem areas for existing development that use private well and septic systems. Lastly, geology aids in identifying aquifer recharge areas.

There are two basic types of geologic formations, surficial and bedrock. In Moorestown, only surficial geology creates constraints for development since bedrock is at a significant depth – too deep to play a part in human activities at the surface. Surficial formations in Moorestown consist of unconsolidated sands, gravels, silts and clays that formed as layers under the ocean. The rise and fall of the oceans, corresponding to glacial periods, successively inundated the land. Erosion from streams cutting through previously deposited materials on the land emptied into the ocean, creating distinct layers.

Moorestown is located within the Inner Coastal Plain, one of the five major geologic provinces in the State. A line beginning south of Marlton and drawn in a northeast direction towards Wrightstown roughly describes the boundary between the Inner Coastal and Outer Coastal Plains in Burlington County. The Inner Coastal Plain is west and north of the line and the Outer Coastal Plain is south and east of the line. The difference between the two is related to the time of deposition of the sediment that makes up the surficial geology. The land in the Inner Coastal Plain represents deposits made during the Cretaceous period (63 to 125 million years ago). The Outer Coastal Plain has deposits that are as recent as one million years ago. The boundary between the two geologic provinces is marked by a series of hills called *cuestas* that are partially cemented aggregates. Being partly cemented, *cuestas* have been less eroded than the surrounding land. Mt. Laurel and Mt. Holly are examples of *cuestas*. Both the Inner and Outer Coastal Plains are tilted towards Cape May. The oldest strata are located along the Delaware River and the youngest at the Atlantic coast. Like the edges of a pack of cards, the strata are exposed at the surface. Sedimentary layers become progressively deeper towards the southeast corner of the State.

In the Township five geologic formations have been identified (*see* Geology Map). These include the Magothy and Raritan, and Marshalltown Formations; the Englishtown Sand; and Merchantville and Woodbury Clays.

MAGOTHY AND RARITAN FORMATION - The Raritan consists chiefly of light-colored sand and clay, with clay more frequently found in the lower half and sand found in the upper half of the formation. The formation is extremely variable in composition and its thickness is not constant, ranging from 150 to 300 feet at the outcrop and increasing to the southeast to over 500 feet. Near the Delaware River, however, the beds are only 25 to 30 feet thick.

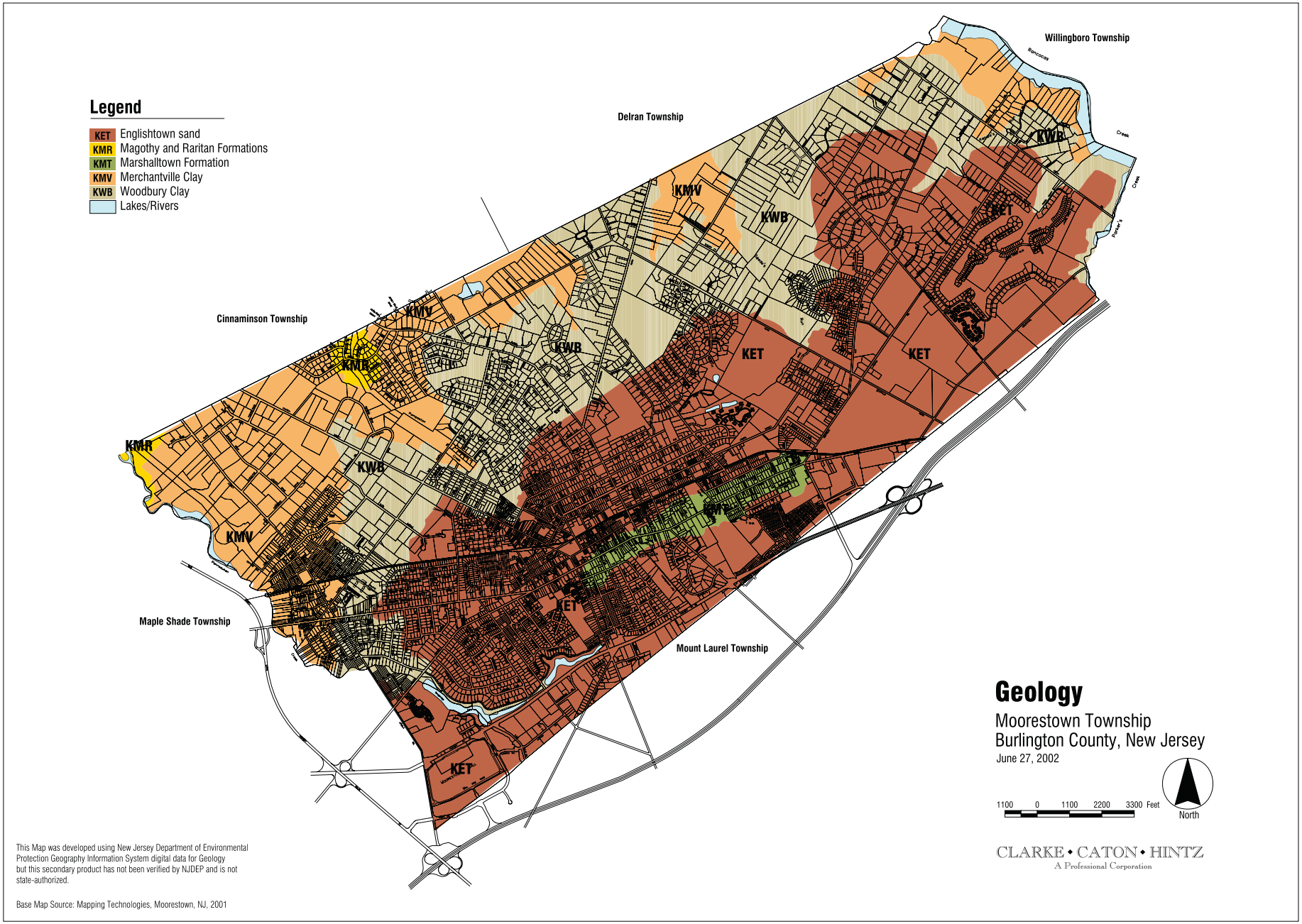
MARSHALLTOWN FORMATION - This formation consists of sandy clays ranging in color from gray to black. The clay contains varying amounts of argillaceous glauconite (marl). Marl, also called greensand, is generally calcareous sands, silts and clays containing phosphoric acid. Marl was used as a fertilizer prior to the advent of mass-produced nitrogen fertilizers and is a component of a number of the geologic formations as well as many soils found in Burlington County. Because of the widespread deposits in the County, it also lent its name to the village of Marlton. The formation ranges from 30 to 40 feet thick.

ENGLISHTOWN SAND - This formation is a conspicuous bed of white or yellow quartz sand. Locally some beds have been cemented by iron oxide into massive stone. The rusty colored stones uses locally in building construction are examples of this aggregation. In places, the formation also contains thin laminae of fine clay. The formation ranges from 20 to 140 feet in thickness.

MERCHANTVILLE CLAY - This formation is a black, glauconitic, jointed clay about 60 feet thick. It is generally greasy in appearance and massive in structure, and weathers to a brown earth. Both the Merchantville Clay and the following formation, Woodbury Clay, account for the large areas of clayey soils found in the Township that are concentrated in its northwestern half.

WOODBURY CLAY - The Woodbury is a black, jointed clay about 50 feet thick which weathers to a light chocolate color. When dry, it breaks into innumerable blocks, many showing a curved or conchoidal fracture.

Additional information on the geology of Moorestown may be found in the ERI under Physiography and Map 13: Geology. Geology also affects ground water yields as is discussed the section, Groundwater.


Legend
KET Englishtown sand
KMR Magothy and Raritan Formations
KMT Marshalltown Formation
KMV Merchantville Clay
KWB Woodbury Clay
Lakes/Rivers
Willingboro Township
Delran Township
Cinnaminson Township
Maple Shade Township
Mount Laurel Township
KET
KMR
KMT
KMV
KWB
Geology
Moorestown Township
Burlington County, New Jersey
June 27, 2002
1100 0 1100 2200 3300 Feet
North
CLARKE • CATON • HINTZ
A Professional Corporation
This Map was developed using New Jersey Department of Environmental Protection Geography Information System digital data for Geology but this secondary product has not been verified by NJDEP and is not state-authorized.
Base Map Source: Mapping Technologies, Moorestown, NJ, 2001

SOILS

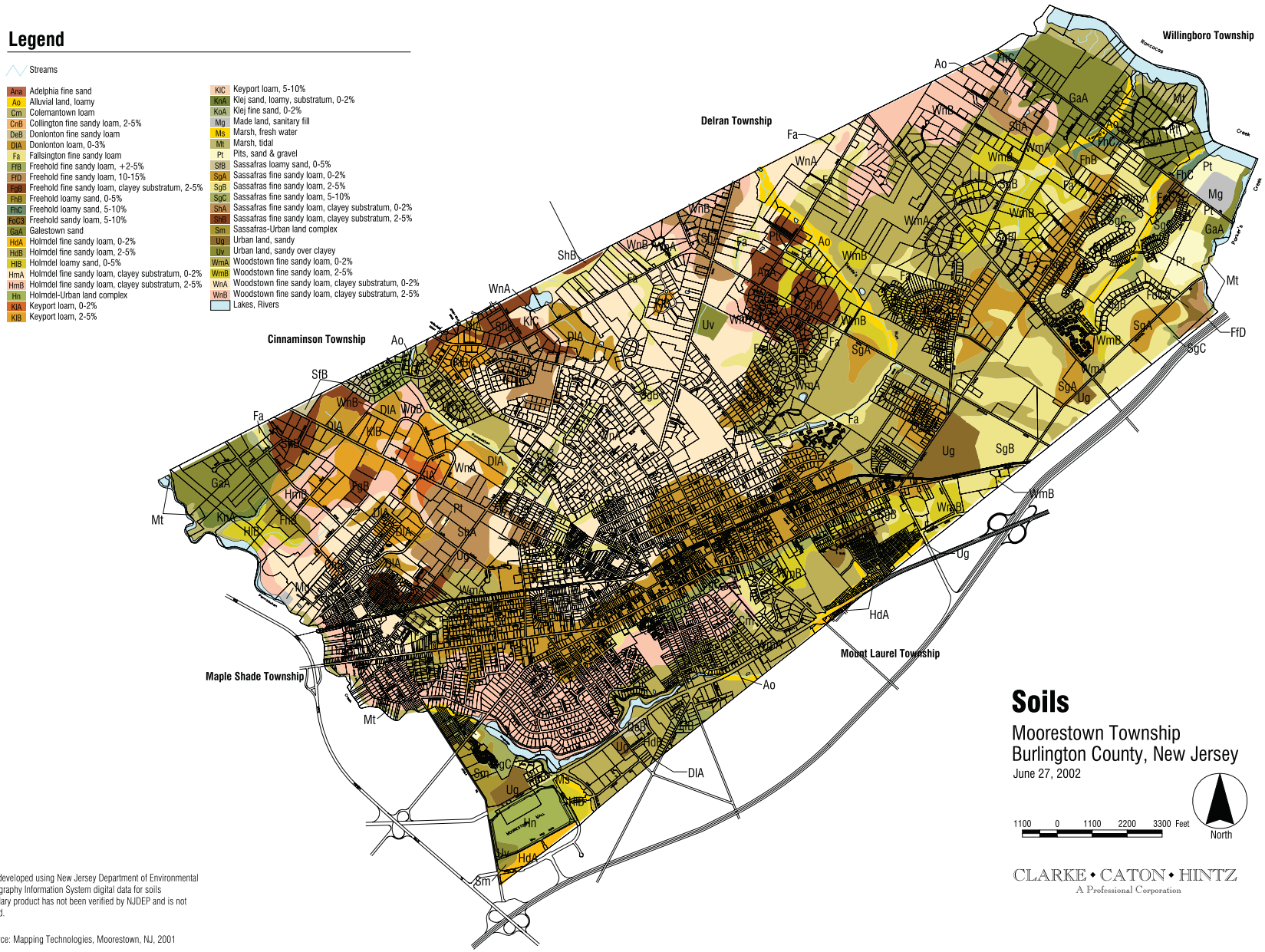
Parent geologic formations play a major role in the formation of different soil types. Soil is formed from the underlying geologic strata, the actions of weathering, organic material, and biological processes to create a material supportive of life on the planet. Soil types have specific characteristics that determine landforms, slopes, drainage, and vegetation that provide the basis for determining suitable land uses for a variety of human activities.

Soils are made up of varying amounts of clay, silt and sand - which are determined by particle size - plus organic matter. Clay particles are the smallest and sand particles the largest in diameter. A number of the soil classifications have similar characteristics and it is usually the lower horizon of the subsoil that provides the distinguishing series. The general soil series are depicted on the Soils map found on the following page and are described generally in this section:

ADELPHIA – This series consists of loamy soils that have a fluctuating water table and are moderately well drained in most places. The glauconitic variant found in the Township is mostly associated with other Adelphia soils and with Collington, Marlton, Kresson, and Shrewsbury soils. The location of this soil type is limited to a small area along the west side of Westfield Road, near the high school.

ALLUVIAL LAND (LOAMY) – Alluvial refers to the deposition process where the surrounding soils have eroded by water action and the sediment is dropped on level areas adjacent to stream banks. As such, the soil is typical of the surrounding land but differs in that no clay layers have had an opportunity to form. Loamy Alluvial soils are a strong indicator of wetlands and are unsuitable for building.

COLEMANTOWN – This soil series is limited to a small area south of the Moorestown Friends School. Colemantown soils are associated mostly with Kresson, Marlton, Adelphia, and Holmdel soils. Colemantown soils occur in lower positions than these associated soils and are more poorly drained. Due to the seasonal high water table and because these soils are subject to ponding and frost action, there are severe limitations for development.


Legend
Streams
Ana Adelphia fine sand
Ao Alluvial land, loamy
Cm Colemantown loam
CnB Collington fine sandy loam, 2-5%
DeB Donlonton fine sandy loam
DlA Donlonton loam, 0-3%
Fa Fallsington fine sandy loam
FfB Freehold fine sandy loam, +2-5%
FfD Freehold fine sandy loam, 10-15%
FgB Freehold fine sandy loam, clayey substratum, 2-5%
FhB Freehold loamy sand, 0-5%
FhC Freehold loamy sand, 5-10%
FoC3 Freehold sandy loam, 5-10%
GaA Galestown sand
HdA Holmdel fine sandy loam, 0-2%
HdB Holmdel fine sandy loam, 2-5%
HlB Holmdel loamy sand, 0-5%
HmA Holmdel fine sandy loam, clayey substratum, 0-2%
HmB Holmdel fine sandy loam, clayey substratum, 2-5%
Hn Holmdel-Urban land complex
KlA Keyport loam, 0-2%
KlB Keyport loam, 2-5%
KlC Keyport loam, 5-10%
KnA Klej sand, loamy, substratum, 0-2%
KoA Klej fine sand, 0-2%
Mg Made land, sanitary fill
Ms Marsh, fresh water
Mt Marsh, tidal
Pt Pits, sand & gravel
SfB Sassafras loamy sand, 0-5%
SgA Sassafras fine sandy loam, 0-2%
SgB Sassafras fine sandy loam, 2-5%
SgC Sassafras fine sandy loam, 5-10%
ShA Sassafras fine sandy loam, clayey substratum, 0-2%
ShB Sassafras fine sandy loam, clayey substratum, 2-5%
Sm Sassafras-Urban land complex
Ug Urban land, sandy
Uv Urban land, sandy over clayey
WmA Woodstown fine sandy loam, 0-2%
WmB Woodstown fine sandy loam, 2-5%
WnA Woodstown fine sandy loam, clayey substratum, 0-2%
WnB Woodstown fine sandy loam, clayey substratum, 2-5%
Lakes, Rivers
Willingboro Township
Delran Township
Cinnaminson Township
Maple Shade Township
Mount Laurel Township
Soils
Moorestown Township
Burlington County, New Jersey
June 27, 2002
1100 0 1100 2200 3300 Feet
North
CLARKE • CATON • HINTZ
A Professional Corporation
This Map was developed using New Jersey Department of Environmental Protection Geography Information System digital data for soils but this secondary product has not been verified by NJDEP and is not state-authorized.
Base Map Source: Mapping Technologies, Moorestown, NJ, 2001

COLLINGTON – The Collington series consists of well-drained loamy soils that contain moderate amounts of glauconite. These soils are associated mostly with Adelphia, Freehold and Marlton soils. However, they lack the mottling that commonly occurs in Adelphia soils and the dark olive sandy clay subsoil that commonly occurs in Marlton soils. They have a higher glauconite content than Freehold soils but lower than Marlton. Native vegetation is a hardwood forest that consists of red oak, yellow poplar, hickory, ash and beech and an understory of viburnum. Collington soil is limited to a small area along Lenola Road.

DONLONTON – This series consists of somewhat poorly drained, nearly level, soils that contain small amounts of glauconite. Donlonton soils are normally found below Keyport soils and above the Colemantown and Shrewsbury soils. Donlonton soils are slowly permeable and have a high available water capacity with a lot of shrink/swell potential and frost heaving. As such, these soils present severe constraints on development. Within Moorestown, Donlonton soils are found in the northwest portion of the Township.

FALLSINGTON – This series consists of nearly level fine sandy loams that are grayish-colored and distinctly mottled. Fallsington soils form in water deposited sediments in low positions, where they receive considerable runoff from higher slopes. Generally, these soils are saturated 6 to 8 months of the year and the water table drops below 3 feet in the summer, though it may be higher when rains are heavy. Because of the high water table, constraints on development are severe. These are usually considered an indicator of freshwater wetlands.

FRESHWATER MARSH – Freshwater Marsh soils are located along Strawbridge Lake, in the southern corner of the Township. As freshwater wetlands, these soils are unsuitable for development.

FREEHOLD - Freehold soils are typically dark grayish-brown, well-drained and sandy. In contrast to other soil types, the soil is low in glauconite. Freehold is distinguished by inclusions of iron among the finer particles that gives it a reddish cast in the lower horizons. Freehold soils occupy higher elevations and are extremely acid. The natural vegetation, typically on slopes, consists of red oak, beech, and yellow poplar. Freehold soils generally present few constraints for development.

GALESTOWN – The series consists of excessively drained nearly level or gently sloping sandy soils that have a little more clay in the substratum than in the surface layer. Galestown soils occur along the Delaware River on a terrace that ranges from 10 to 50 feet in elevation. In Moorestown, these soils are found along the Rancocas and Pennsauken Creeks. Galestown soils are low

in organic matter and hence fertility. They are very strongly acid. The native vegetation is woodland consisting mostly of mixed oaks, hickory and scattered Virginia pines.

HOLMDEL - Holmdel soils are similar to Freehold soils and are often found in association with them. Holmdel soil, however, is less well drained than Freehold and often has a high late winter water table. Consequently, mottling is common in the lower subsoil. Holmdel usually are more steeply sloped than Freehold soil. Higher elevations of Holmdel soil contain red, scarlet, and white oaks, yellow poplar, beech and hickory in their natural state. Less well drained areas are dominated by pin oak, willow oak, and sweetgum.

KEYPORT - This series is found in a few areas in the northwest portion of the Township. Keyport soils have a high available water capacity and are slowly permeable. Where slopes exceed 2%, runoff is moderate to rapid and erosion is a hazard. These soils are moderate in organic matter and in fertility, and are very strongly acid. Natural vegetation is a hardwood forest consisting of yellow poplar, red oak, white oak, ash, beech and hickory.

KLEJ - This series is found on river terraces (along a small portion of the Pennsauken Creek in Moorestown) and consists of deep, nearly level and gently sloping sandy soils. Klej soils are rapid or moderately rapid in permeability and have a low available water capacity. Fertility is low. The natural vegetation is a hardwood forest that consists mainly of black ash, white oak and hickory.

SAND AND GRAVEL PITS- Sand and Gravel is a descriptive term rather than a soil series. As the name suggests, this type indicates the creation of borrow pits where the topsoil has been removed, exposing the underlying geologic layers which have been excavated for construction purposes. About half of the Laurel Creek Golf Course and the now-closed Township landfill on Creek Road are located on a former sand and gravel pit. Additionally, there are several smaller areas in the Township that are mapped as sand and gravel pits, although there are no longer any active sand and gravel operations in Moorestown.

SANDY URBAN LAND - This land type consists of cut-and-fill areas, most which have been developed. Where the original soil was removed and substratum exposed the material remaining is rapidly permeable and extremely low in organic material and fertility. The Kmart shopping plaza and Lockheed Martin complex exhibit these characteristics.

SANITARY FILL MADE LAND - This classification refers to soils that have been intermixed to such an extent by human activities that it is no longer possible to determine the original soil type. A portion of the former sanitary landfill at the northeast corner of the Township near Creek Road is the only location of this soil classification.

SASSAFRAS – Sassafras soils are associated with Woodstown, Freehold, Holmdel and Downer soils. Near the Delaware River, Sassafras soils are normally occupying a higher position above Woodstown and Holmdel soils. Sassafras and Woodstown soils developed in material deposited by glacial water on the glauconitic marine deposits in which Freehold and Holmdel formed. The native vegetation is a hardwood forest consisting mostly of red oak, white oak, black oak, scarlet oak, hickory, beech, yellow poplar and scattered Virginia pine.

TIDAL MARSH - In Moorestown, Tidal Marsh soils are low lying lands inundated by tides. Tidal Marsh land is in the stream corridors of the Rancocas Creek, Parkers Creek and Pennsauken Creek. Tidal Marsh is by definition freshwater wetlands and is unsuitable for development. The soil contains substantial proportions of organic material combined with silt. Vegetation is almost entirely grasses.

WOODSTOWN - These soils consist of moderately well drained, sandy and loamy soils that are nearly level or gently sloping. Woodstown soils generally are associated with Sassafras and Fallsington soils. The Woodstown series formed in water-laid material and usually occurs below Sassafras and above Fallsington soils. Woodstown soils have a fluctuating water table that rises to a depth within two feet of the surface in winter. However, this soil is not usually considered a wetlands indicator and with proper techniques may be developed.

Additional information on soil characteristics may be obtained from the ERI under the Soils, Steep Slopes, Topography and Surface Landscapes sections and their associated maps.

PERMEABILITY AND AQUIFER RECHARGE

Permeability is the ability of surface water to move through the soil to reach underlying soil and geologic strata, which varies with the quality of soil horizons or layers. In Moorestown, virtually all of the soil types exhibit slow permeability. The few areas of moderate and rapid permeability are located in the northeast portion of the Township along the Rancocas Creek and Parkers Creek, and in the western corner of the Township adjacent to the Pennsauken

Creek. The slow permeability of most of the soil is a function of the amount of clay and silt.

Aquifer recharge is an essential component of the hydrologic cycle that replenishes the underground water supply. Preventing overuse of aquifers is an important environmental goal. This may occur from over pumping where more water is drawn from the aquifer than is available for replenishment by rainfall (water "mining") or when impervious surfaces prevent rainfall from percolating into the ground. As noted above, clay layers within soils may also limit the ability of water to move through the soil. Clay layers often also lead to "perched" water tables, which may create surface drainage problems.

Most of the Township is served by public water which utilizes both ground water supplies from municipal wells and water from the Delaware River. The ground water is obtained from the Potomac-Raritan-Magothy aquifer. Over-pumping from this aquifer has reached serious levels and the state Department of Environmental Protection (DEP) established Critical Area No. 2 region in the late 1980's. Critical Area No. 2 is centered in northern Camden County and restricts the amount of water that may be withdrawn from the aquifer. The Township was required by the DEP to use water from the Delaware River to reduce its reliance on well water and allow the aquifer to recover. While the Township operates the public water system and wellheads drawing groundwater on Kings Highway, N. Church Street and Hartford Road, river water is supplied by the NJ American Water Co. from a water treatment plant located in Delran.

STORM WATER MANAGEMENT AND WATER QUALITY

Water use patterns within Moorestown indicate a three-fold increase in water consumption during the summer months, which can be largely attributed to irrigation of agricultural and landscaped areas. In addition to encouraging the conservation of water supplies throughout the year, the Township should facilitate replenishment of surface and ground waters as well as improve water quality by requiring a high level of Best Management Practices (BMPs) in the site and subdivision design process and in the planning and design of storm water management systems. This is currently encouraged through the Township's adoption of the Residential Site Improvement Standards for non-residential development, too. Examples of BMPs for storm water management and non-point source pollution control include the following:

- Development that mimics, as closely as possible, pre-development hydrological conditions (such as the peak discharge, run-off volume, infiltration capacity, base flow levels, ground water recharge and water quality) will have the lowest adverse environmental effect. Lowering the allowed impervious surface coverage makes this easier to accomplish.

- Concentrating residential development on uplands will avoid stream disturbance and grade changes in natural drainageways, or in areas of the site dominated by dense vegetation, porous or erodible soils.

- The use of native or well-adapted non-native species in disturbed and open areas and limiting the use of turf will reduce the amount of fertilizers, pesticides and watering that are needed to maintain landscaping. This reduces chemical runoff into streams or percolating into aquifers and stretches water supplies farther.

- By using stormwater management techniques that are appropriate to a site, pollutants from parking lots and landscaping can be adequately treated through passive techniques. Further, relatively clean water can be infiltrated back into the ground where the soil characteristics are favorable. Such methods include retention ponds, dual purpose/extended detention basins, infiltration basins, underground sand beds, dry wells, vegetated swales, vegetative filter strips, and porous pavement (in small parking lots).

The ERI includes mapping of the different watersheds and sub-watersheds in Moorestown, using the system developed by the United States Geologic Survey, the Hydrologic Unit Code (HUC) system (see p. 29, ERI) down to the 14 digit classification level. These sub-watersheds are the reporting areal units for determining surface water quality. The sub-watersheds can be rated on a number of parameters, whether for aquatic life, use for agricultural watering, fish consumption, recreation, and so forth. Supporting aquatic life is typically used as a marker for the overall health of a stream – its water quality – within the watershed. In Moorestown, five of the sub-watersheds are impaired, one is attaining – that is improving towards meeting the water quality standard – and one has insufficient information (see pps. 37-52, ERI). This information stresses the importance of stringent storm water management, soil retention, and fertilizer application practices in the Township.

FRESHWATER WETLANDS

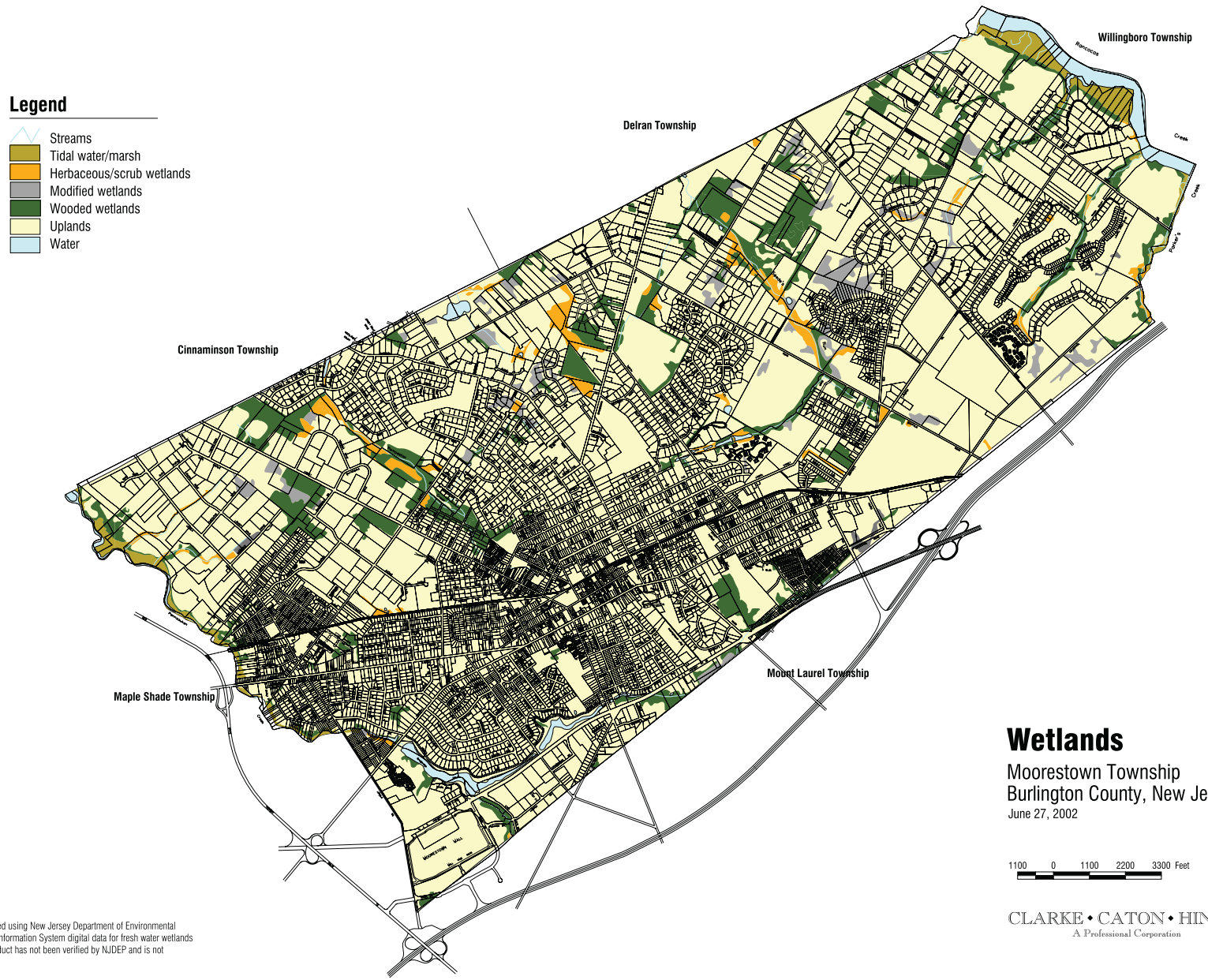
Jurisdiction for the regulation of freshwater wetlands was transferred from the U.S. Army Corps of Engineers to the New Jersey Department of Environmental Protection on July 1, 1988. Transitional buffer standards (after legal challenge from several quarters) were instituted on July 1, 1989. The final transfer from federal to state control of Section 404 permits, pertaining to the federal Clean Water Act, occurred in 1994, thereby completing New Jersey's assumption of wetlands protection. As part of this process, the New Jersey Department of Environmental Protection developed wetlands mapping. This mapping identifies wetlands more definitively than the National Wetlands Inventory mapping that it replaced (*see* Freshwater Wetlands Map, next page). Wetlands include three criteria: 1), the land at least periodically and predominantly supports hydrophytes (vegetation characteristically found in saturated soils); 2), the soil substrate is primarily undrained hydric soil characterized by at least long periods of oxygen starvation; and 3), the substrate is a non-soil and is saturated or covered by shallow water at some time during the growing season[2].

In Moorestown, the Adelphia, Colemantown, Donlonton, Fallsington, Freshwater Marsh, Klej, Loamy Alluvial, and Tidal Marsh soils, as well as the more common series of the Holmdel, Keyport and Woodstown soils, are all indicative of freshwater wetlands.

The NJDEP continues to use the U.S. Fish and Wildlife's classification system based on Cowardin, et al[3]. This consists of a hierarchical nomenclature encompassing a wide variety of wetlands' ecologies. Five systems are defined: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (*see* Wetlands Illustration, page III-15). The Marine system consists of the open ocean and its associated coastline. The Estuarine system includes salt and brackish marshes and the brackish waters of coastal rivers and bays. These two classifications are salt water wetlands.

[2] - The three parameter approach to classifying wetlands is from the definition of a wetland by the U.S. Fish and Wildlife Service.

[3] - L. M. Cowardin, V. Carter, F.C. Golet and E.T. La Roe, *Classification of Wetlands and Deep-water Habitats of the United States*, 1979, U. S. Fish and Wildlife Service.



This Map was developed using New Jersey Department of Environmental Protection Geography Information System digital data for fresh water wetlands but this secondary product has not been verified by NJDEP and is not state-authorized.

Base Map Source: Mapping Technologies, Moorestown, NJ, 2001

Freshwater wetlands and deep water habitats (water over two meters in depth) are either classified as river or stream based (Riverine); lake, reservoir or large pond wetlands (Lacustrine); or Palustrine which encompasses forested wetlands, marshes, swamps, bogs, and small ponds[4]. In Moorestown, tidal marsh areas are classified as Riverine, and the remaining freshwater wetlands are classified as Palustrine. In addition to these natural systems, there are other wetlands that have been disturbed by human actions, such as wetlands that have been drained and plowed for agriculture. The major undisturbed wetlands types are described as follows:

RIVERINE

Riverine wetlands are restricted to non-persistent emergent wetlands, aquatic beds, and unvegetated shallow water or exposed areas. These wetlands are most extensive in tidal freshwater areas, such as those contained within the Delaware River and its tributaries, and consist of low marsh and high marsh. The low marsh is flooded at least once daily by tides. High marsh areas are flooded less often by tides and may also be classified as palustrine wetlands. In Moorestown, high marsh areas are located along the Pennsauken and Parkers Creeks, whereas low marsh areas are located along the Rancocas Creek. Vegetation types characterizing the majority of riverine tidal marshes are pure and mixed stands of wild rice, spatterdock and arrow arum.

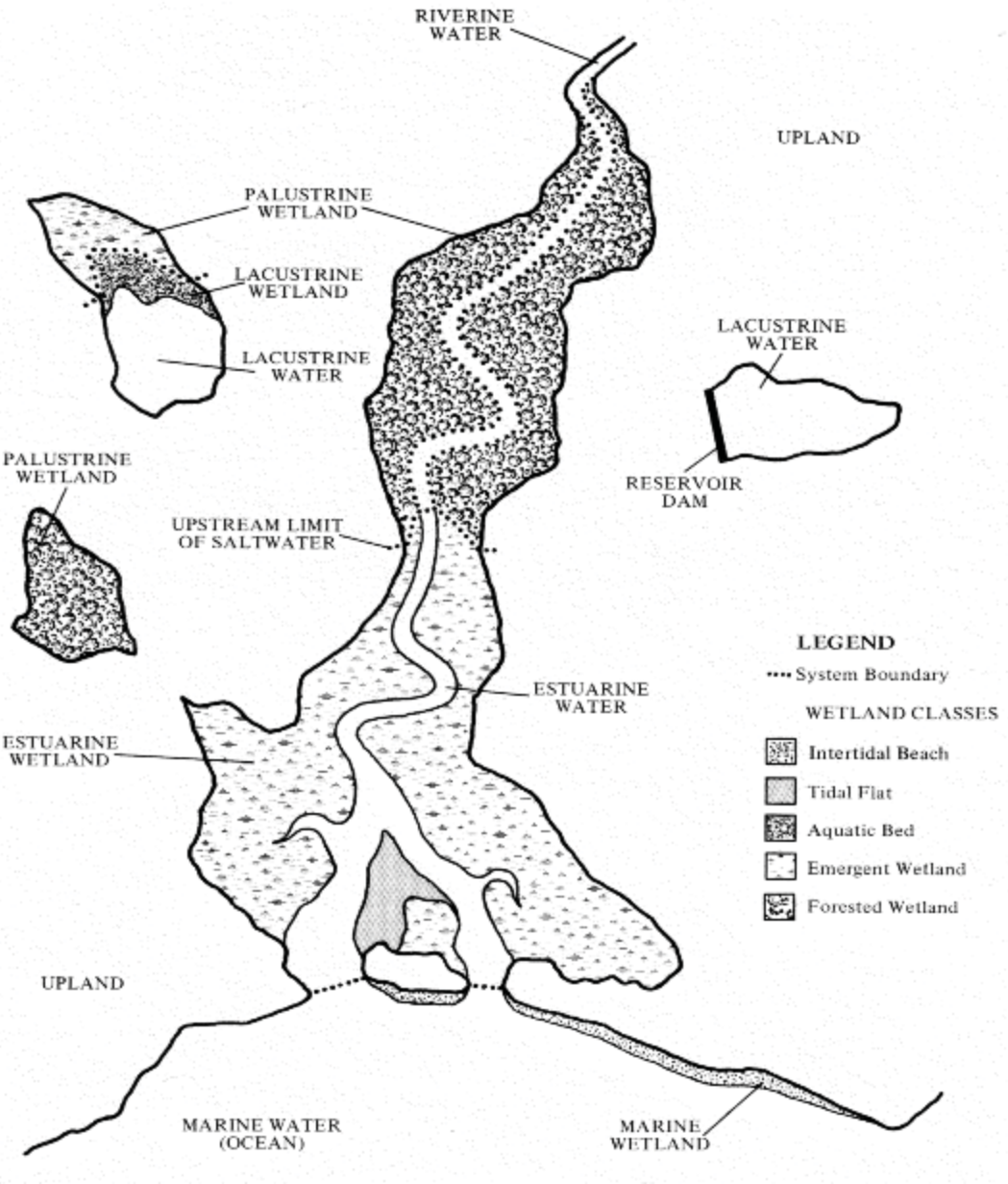
PALUSTRINE

Palustrine wetlands are the most diverse of the five classifications in terms of the type of vegetation found and of the amount of water saturation. Water saturation ranges from permanently flooded to seasonal and temporarily flooded. There are two major Palustrine types of wetlands that occur in Moorestown.

Palustrine Emergent - On the Freshwater Wetlands Map these are identified as Herbaceous/Scrub Wetlands and in the Township are located immediately adjacent to flowing streams. They are tidally influenced but are protected behind natural levees so inundation is occasional rather than constant. They are dominated by grasses, sedges, forbs and rushes. Scattered trees include red maple and willow.

[4] - This description is based on *Wetlands of New Jersey,* by Ralph W. Tiner, Jr., U.S. Fish and Wildlife Service, U.S. Department of the Interior, July 1985.

Wetlands Illustration



Typological Characteristics of Wetlands

Source: *Wetlands of New Jersey*, 1985.

Palustrine Forested - The mapping indicates these wetlands under the heading of Wooded Wetlands. This is the most common type of wetland in Moorestown. Freshwater swamps are this type of wetland. Deciduous trees are commonly red maple, sweetgum, black gum (tupelo), and holly. Coniferous trees only include pitch pine - other evergreens require drier soil. The understory vegetation in forested wetlands typically includes pepperbush, high bush blueberry, swamp azalea, and arrowwood.

Additional information on wetlands and potential vernal pools is found in the ERI under the Wetlands, Vernal Pools and Natural Vegetation sections.

REGULATORY BASIS AFFECTING WETLANDS

The delineation of wetlands noted on the Freshwater Wetlands Map are not "regulatory" in the sense of being accepted as definitive for the placement of buildings or establishing wetlands transition areas. Each individual site must be surveyed and the results submitted for a "Letter of Interpretation" (LOI) which is a formal acceptance of the mapping by DEP. This is a common practice in the site design and approval process.

State law preempts any local freshwater wetlands regulation, including determining or regulating transition areas or buffers. State law sets up three categories of wetlands, "exceptional resource value", "intermediate resource value", and "ordinary resource value". Exceptional resource value wetlands typically harbor endangered species or are related to trout production (not a factor in Moorestown) and require a 150 foot buffer. Intermediate resource value wetlands are all wetlands which are neither exceptional nor ordinary. Intermediate wetlands require a 50 foot buffer. Ordinary wetlands are generally man-made and have no transition area. Bodies of water and water courses with no fringe of associated wetlands are called "state open waters" and also require no transition area. It has been estimated that 47% of the water courses in the state do not have a wetlands transition area requirement. State regulations allow certain limited types of fill in wetlands and averaging of transition areas.

Municipalities have been pre-empted by the state from regulating freshwater wetlands. However, setback requirements from a stream or pond for aesthetic purposes may be implemented locally to provide greater protection for natural resources as well as to promote a better visual environment.

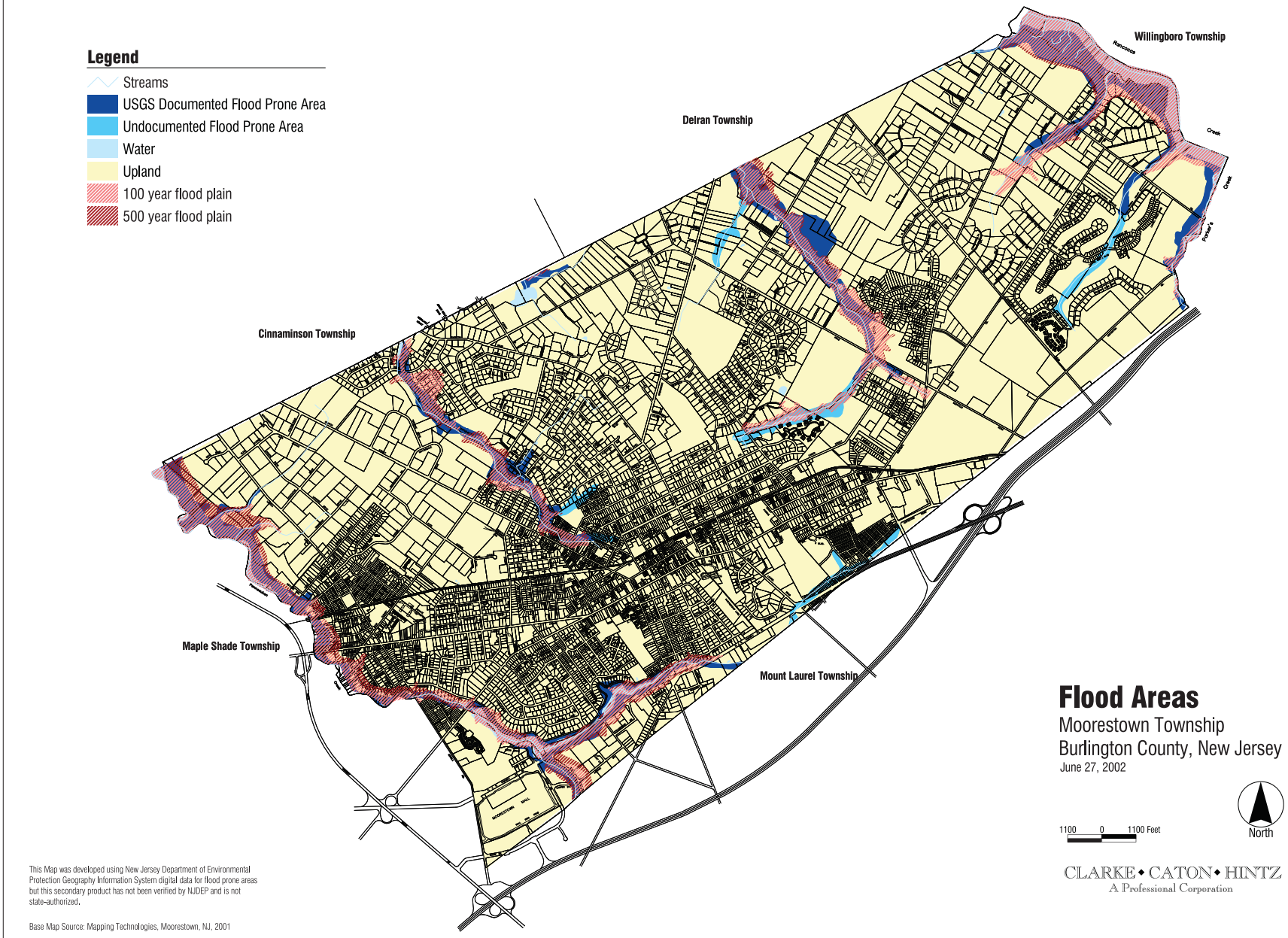
FLOOD PRONE AREAS

"Flood Prone" is a measurement of the danger or probability of flooding. This can result from the overflowing of a body of water onto adjacent land, but can also occur as the result of a rise in the water table, so that land becomes soaked at the subsurface level. The level or nearly level areas on either side of a water course or body created by successive and cyclical inundation and erosion is typically classified as a flood prone area. The DEP uses the "flood prone" description to include the flood plains that have been the subject of detailed engineering studies plus those areas outside of the study region that would likely flood based on aerial photography and topography. Flood prone areas in Moorestown are depicted on the Flood Area map on the following page.

For purposes of measuring hazards in flood prone areas, 100-year and 500-year flood plains are determined. The flood plains are based on a probability that a storm of a certain magnitude will occur once every 100 years or 500 years, respectively, and cover the land to the extent shown on the flood prone map. The delineation of these regulatory boundaries is based on the engineering studies noted above that examine the specific watershed. The study analyzes the land area of the drainage basin, the amount of impervious cover, slope, and the capacity of the stream channel. The flood hazard area is composed of three parts: 1) the stream channel, which is the normal stream bed of the stream and contains normal flows; 2) the floodway, which is the area on either side of the stream which must be kept free of obstruction in order to contain 100-year flood flows; and 3) the flood fringe or 500-year level.

The State allows a certain amount of fill or construction in flood fringe areas – flood prone areas outside of the flood hazard corridor – but otherwise has established a policy of no construction in flood prone areas. Municipalities are required to adopt ordinances that enforce the state statutes, including engineering details to minimize flood damage and adhere to net fill requirements. Moorestown has adopted a flood damage prevention ordinance that also meets the criteria for inclusion in the federal flood insurance program.

In areas outside of flood prone areas, provision need only be made for adequate drainage of each site to prevent local flooding (ponding). Flood prone areas are best suited for conservation and passive recreational purposes and many of these areas are identified as existing or proposed open space sites in the Township's Open Space and Recreation Plan Element. See also, p. 35 of the ERI.



Flood Areas

Moorestown Township
Burlington County, New Jersey
June 27, 2002

1100 0 1100 Feet

North

CLARKE • CATON • HINTZ
A Professional Corporation

This Map was developed using New Jersey Department of Environmental Protection Geography Information System digital data for flood prone areas but this secondary product has not been verified by NJDEP and is not state-authorized.

Base Map Source: Mapping Technologies, Moorestown, NJ, 2001

VEGETATION

NATIVE VEGETATION

Although most of Moorestown is now developed, some areas with natural vegetative cover still remain, primarily within wooded wetlands located along stream corridors. The two largest areas of woodland remaining are South Valley Woods between South Valley Elementary School and Marter Avenue, and the Hundred Acre Wood in the vicinity of Swede Run and Garwood Road. These two areas also contain a significant amount of Palustrine wetlands. Trees found in these two woodlands include sweetgum, willow oak, red maple, pin oak, tulip poplar, beech, swamp white oak, yellow poplar, ash, elm, and sassafras. Shrubs growing in more mature swamp and floodplain areas include arrowwood, spicebush, highbush blueberry, sweet pepperbush, and swamp azalea. Additionally, poison ivy and honeysuckle are abundant in certain areas, frequently making dense thickets. Non-native invasive species have also contributed to the underbrush, such as multi-flora rose and common reed in open wetland areas. Additional species are listed in Appendix B of the ERI.

URBAN FOREST

In addition to natural vegetative cover, trees located along streets and within parks and yard areas create an "urban forest" in the Township, which is an important natural resource. Moorestown is noted for its tree-lined streets and high branching canopy. The Tree Planting and Preservation Committee completed a survey of street trees and trees in public parks in 2012, finding nearly 7,700 trees. The Township has been recognized nationally since 1990 as a Tree City, USA by the National Arbor Day Foundation. Many of the Township's street trees were planted in the 1920s through efforts of the Moorestown Improvement Association. As these trees approach the end of their natural life span and as many oaks succumb to bacterial leaf scorch disease, efforts to maintain and enhance the Township's urban forest resources have become increasingly important.

The environmental, aesthetic, financial and social benefits of the urban forest have been well established. In particular, urban trees have a positive influence on climate. Trees help reduce global warming, and they modify local climate by reducing urban "heat island" temperatures in summer, while admitting sunlight for heating in the cooler months. Urban trees also provide significant benefits by improving air quality, reducing noise, and by providing habitat for birds and other wildlife. Studies have consistently shown that a

well-established street tree canopy supports property values and positive perceptions of a town's quality of life.

The Tree Planting and Preservation Committee was established by Township Council to protect and preserve the Township's tree resources. In addition to conducting educational outreach activities and promoting tree planting through efforts such as the Tree Remembrance Program, assuring their proper maintenance and promoting the planting of a diverse selection of trees. Extending mapping efforts beyond street right-of-ways and park areas to identify significant tree resources throughout the Township should be considered, given the importance that the tree cover has in the values of its citizens. As an aid to tree retention, consideration should be given to establishing a landscape ordinance that would include limits on tree removal, require provisions for tree replacement, tree protection, and appropriate tree planting as part of the development process.

LAND FOR CONSERVATION PURPOSES

The imposition of environmental regulations over the past two decades has greatly reduced or eliminated the development of certain types of environmentally sensitive land. Most of the regulation of environmentally sensitive land has reverted to the state level, including stream encroachment (development within the flood plain), freshwater wetlands, water withdrawals and effluent disposal. Some municipalities also administer complementary requirements that prohibit development or site disturbance next to streams, open bodies of water, net fill in floodplain areas and other types of environmental regulation. In 1998, the Township established stream setbacks regulations that fall within this category.

With these restrictions already in place, attention to other desirable site characteristics that are not protected by existing regulations become more important in the preservation of environmentally sensitive land. Protection of environmentally sensitive land is a prudent investment for the municipality to make. Once lands are developed, retrofitting a neighborhood or commercial complex becomes exceedingly expensive. Preventing the use of inappropriate lands for construction purposes eliminates future problems and preserves substantial ecological benefits. The Open Space and Recreation Element discusses several techniques, including cluster development, sale or donation of development rights, transfer of development rights, conservation easements and site design techniques that should be considered to enhance preservation of open space and environmentally sensitive lands.

The Open Space and Recreation Plan Element also describes recent efforts by the Open Space Advisory Committee to identify specific properties within Moorestown that should be preserved and protected from development. The Committee has recommended to the Township Council a number of properties that it considers worthy for open space retention, based on various criteria including the need to retain natural features and environmentally sensitive areas. A list of the specific site characteristics for ranking the value of open space for conservation purposes is provided below.

SITE CHARACTERISTICS IN THE RANKING OF CONSERVATION LAND

The following characteristics are considered positive factors in the ranking of land for conservation purposes:

1) Its environmentally sensitive nature which may include the following categories:

   a. stream corridors and adjacent upland sites
   b. aquifer recharge areas
   c. freshwater wetlands
   d. unique wildlife and plant habitats
   e. mature woodlands
   f. headwaters of streams
   g. wellhead protection zones
   h. steep slopes

2) The site's historic significance;

3) The extent of aesthetic views and vistas;

4) The proximity of the land to other conservation land or other open space;

5) The demand for conservation land in the area based on current or future projected population;

6) Its accessibility to the public;

7) Whether the land may be suitable for multiple types of open space; and

8) The ability of the site to sustain its intended use.

In addition to the physical features and location that distinguish a particular site, there are often other considerations that may affect the desire of the municipality to pursue conservation efforts. These factors are listed below.

1) The property owner's willingness to sell or preserve land;

2) The amount of development pressure;

3) The cost of preservation;

4) The expected operating expenses and potential for liability claims.

Timely governmental action can be critical to an effective land preservation strategy. Accordingly, it is important for the Township to maintain an open dialogue with land owners and developers with interests in land identified for conservation and other types of open space. Early identification of potential lands for acquisition, easement purchase, or donation is essential because of the deliberative approach that governmental agencies must take in considering the public interest. These factors affect the cost and means to preserve specific parcels.

GREENWAYS

The greenways concept has gained prominence in recent years in planning for recreation and conservation lands. Originally greenways were linear parks along rivers, interconnected open space in planned unit developments such as Laurel Creek, or trails converted from abandoned railroad lines. The original concept has been broadened to encompass the linking of recreational areas, civic institutions and residential districts with open space corridors and walking paths. This approach has gained new adherents as residents and government officials alike have discovered the benefits of greenways. Benefits include creating new recreational opportunities, increasing public awareness of the area's natural resources and their need for conservation, and retaining scenic vistas.

On a parallel track, environmental awareness and the evolving understanding of the importance of natural areas in controlling pollution and

other man-made impacts have greatly increased over the past 25 years. For example, providing more than one means of reaching a recreational attraction reduces passenger vehicle travel and hence air pollution. The necessity for conserving environmentally sensitive land is now well established by the scientific community.

The benefits of interconnection and reducing environmental impacts converge in greenways, which may be defined as any of the following [5]:

1) A linear open space established along either a natural corridor, such as a river front, stream valley, or ridge line, or overland along a railroad right-of-way converted to recreational use, a canal, a scenic road, or other route;

2) Any natural or landscaped course for pedestrian or bicycle passage;

3) An open space connector linking parks, natural reserves, cultural features, or historic sites with each other and with populated areas; or

4) Locally, certain strip or linear parks designated as a parkway or greenbelt.

Much of the recent emphasis on creating greenways has focused on the preservation of stream corridors, and similarly, this has been emphasized as part of the Township's open space preservation efforts. Stream corridors include the water course or body, flood plain and flood fringe area, and often include freshwater wetlands and in some cases associated uplands. Establishing greenways along stream corridors allows the creation of an interconnected open space system. While no specific plan for a Greenway Network currently exists, a significant amount of the Township's existing preserved open space is located along the Pompeston and Pennsauken Creek stream corridors and future open space preservation efforts by the Township and County focus on the stream corridor areas associated with the Rancocas Creek and Swede Run. Additionally, connections between these open space areas, parks and population centers in the Township have been partly established through the Township's extensive bikeway network. Expanding and enhancing these linkages as part of a Greenway Network could enhance the value of the Township's open space areas. This would create a comprehensive passive recreation system throughout the Township that would provide a natural counterpoint to the built environment characterized by the existing street network.

[5] - From *Greenways for America*, Charles E. Little, The John Hopkins University Press, Baltimore, 1990.

Since greenways by definition frequently encompass environmentally sensitive lands, the institution of a trail or bicycle system must be designed to minimize disturbance. Most stream corridors in the municipality also support adjacent wetlands within the flood plain. If the construction of a trail system entails crossing wetlands, a state permit is required. When this occurs, the criteria for the issuance of a permit limits a path to 6 feet constructed of gravel or wood chips or a boardwalk to elevate the path above the ground. The trail alignment is also inspected for any endangered or threatened species. Greenway Network trails work best where there is an established organization or organizations that can assist in maintaining the system.

STREAM CORRIDOR BUFFER ZONE

Even though the regulation of certain environmentally sensitive land is preempted by state law, separating buildings from stream corridors also has aesthetic benefits. Setback requirements from a stream or pond can be used to regulate the relationship between buildings and natural resources. Additionally, a purchaser of residential property, for example, has certain expectations about the use of the parcel which include outdoor household activities. A usable yard area that is free of wetlands, wetlands transition areas and flood plain will lower the potential for encroachments into regulated land. As a secondary benefit, the stream corridor can be preserved for its ecological benefits, as well. A Greenway Network may be seen as a method for managing stream corridors, often with a primary focus on water quality. Horizontal distance from a stream permits filtering of storm water that may carry sediment and pollutants from urbanization and farming.

Stream corridor management also has an important role in wildlife management. Stream shading, for example, is important in controlling water temperature and maintaining the fish population. Deer and other fauna use stream corridors as migration routes, as well as water sources.

Two methods of determining setbacks from streams follow from this approach of using environmental factors for greenways. One is to use a fixed boundary with a set distance from a stream. This is the approach taken with the first generation regulation adopted by the Township. The second is to use a variable setback depending on site specific characteristics. The latter method, while incorporating all of an area necessary for stream corridor management, is much more difficult to administer, particularly at the local level. Therefore, the former method of a fixed distance is the most practical initial approach even if

in some circumstances not all environmentally sensitive land is included. As resources permit, stream corridors may be inspected and the fixed distance line adjusted to take individual natural features into account which would then be mapped and placed on an official map.

The State Planning Commission examined the distance requirements for various stream functions as part of its technical background for the first State Plan[6]. A review of research reports resulted in the establishment of these guidelines:

Stream Function	Buffer Width
Stream bank stabilization	25-50 feet
Sediment control	65-150feet
Nutrient removal	65-150 feet
Food energy	25-50 feet
Temperature control	50-80 feet
Fish cover	25-50 feet
Wildlife habitat	100-330 feet

These and other related technical standards can provide an additional basis for the establishment of setbacks of development from stream corridors. The Township's zoning ordinance requires a 25 foot wide strip of land, or buffer, landward from the 100-year flood plain where no development may occur. Further, buildings, paved surfaces and leaching fields from an individual septic disposal system are not permitted within 50 feet of the top of bank of a stream or pond found on U.S.G.S. topographic maps and from any other stream which has a continuous flow of water.

[6] - *The New Jersey Freshwater Wetlands Protection Act As It Relates to Stream Corridor Buffer Considerations in the State Development and Redevelopment Plan*, January 11, 1988, Rogers, Golden & Halpern, Philadelphia, PA

SEPTIC FIELD IMPACTS

In Moorestown, a number of the soil series (*see* p. III-7) present moderate to severe constraints to development due to a high water table and/or the presence of clay layers in the subsoil. Soils with clay layers in the substratum are primarily located in the northern and western portions of the Township. These soils limit the ability to dispose of septic effluent. Adequate percolation for septic systems is often difficult to obtain. To help address this issue, the Township reduced the density of permitted development in 1991 to two-thirds unit per acre, or a minimum lot size of one-and-a-half acres in the R-1 district which occupies most of the non-sewered area. Then in September 2008 the Township Council passed the Conservation Design Subdivision requirements in the R-1 Residence District to further mandate lower densities and to encourage clustering of houses as a response to soil limitations, aesthetic considerations, and the semi-rural character of the area.

ADDITIONAL INFORMATION

The Environmental Resource Inventory contains additional information on air quality, the fauna of Moorestown and the built environment, including known contaminated sites.

SUMMARY OF RECOMMENDATIONS

GEOLOGY AND SOILS

- Additional study of soils should be undertaken to predict the cumulative impact on ground and surface water quality from septic systems resulting from future development.

SURFACE AND GROUNDWATER REPLENISHMENT

- A local manual to incorporate Best Management Practices (BMPs) for storm water facilities design, infiltration and water quality should be developed. The manual should become part of the technical references for subdivision and storm water design. In the alternative, incorporate any appropriate state manuals or guidelines instead of a local manual.

- The Township's landscape design standards should be amended to encourage the use of plants native to New Jersey, or in the alternative, well-adapted non-native species to reduce the need for water and chemical applications.

- Special standards for aquifer recharge tailored to soil types should be developed and adopted in the Township's land development regulations.

LAND PROTECTION

- Encourage cluster development in locations where soil types or public infrastructure permit.

- Encourage sale or donation of development rights to preserve existing open space and environmentally sensitive lands.

- Preserve additional conservation and other open space by encouraging developer contributions and dedication of conservation easements.

- Site design should maximize the quantity and quality of open space. The Planning Board shall continue to protect aesthetic views and environmentally sensitive land in the development review process.

PRESERVATION OF VEGETATION AND THE URBAN FOREST

- Develop specific standards in the form of a development regulation to minimize tree clearing.

- Require new trees to be planted to replace those removed by construction activities.

- Require planting of native and well-adapted non-native species of trees and promote good installation practices.

- Request of the Tree Planting and Preservation Committee an effort to map other significant tree resources in the Township as resources permit.

- Maintain existing street trees along with other aspects of street infrastructure.

- Encourage citizens to replant street trees utilizing the Tree Remembrance Program or other means to raise public awareness of the need.

- Examine the feasibility of establishing a municipal tree farm for transplantation purposes.

GREENWAY NETWORK AND PRESERVATION OF STREAM CORRIDORS

- Support additional open space preservation along stream corridors and add connections between parks and other open space as part of a Greenway Network.

- The stream buffer zone has both aesthetic and environmental benefits and could be enhanced by imposing greater horizontal distances between the stream and buildings to allow for usable yards.

Conservation Plan

Moorestown Township
Burlington County, New Jersey
August 1, 2013

0 1,000 2,000 4,000 6,000 Feet

This Map was developed using New Jersey Department of Environmental Protection Geography Information System digital data for flood prone areas but this secondary product has not been verified by NJDEP and is not state-authorized.

NJOIT/ NJDEP, Tax Parcels for Burlington County, 2013

Clarke Caton Hintz
Architecture
Planning
Landscape Architecture