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ENVIRONMENTAL IMPACT STATEMENT

FOR:
THE PRESERVE AT HOLLY RIDGE
BLOCK 582, LOTS 1, 10 & P/O 1.01
CITY OF MILLVILLE
CUMBERLAND COUNTY, NJ

APPLICANT:
MILLVILLE 1350, L.L.C.
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MC PROJECT NO. 01-0567A

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1.0 INTRODUCTION

1.1 Purpose of Document

This report has been prepared in accordance with the City of Millville's Land Use Ordinance, Section 18-17.10(e) that requires the preparation and submittal of an Environmental Impact Statement as part of an application for a General Development Plan. The proposed project includes the construction of 903 single-family, age-restricted, detached dwellings, 47 multi-family, age-restricted units, a golf course and an associated clubhouse. Ten (10) stormwater management basins will be constructed in order to manage stormwater runoff on the site.

1.2 Site Characteristics

The property is located on a parcel of land known as Block 582, Lots 1, 10, and a portion of 1.01 City of Millville, Cumberland County, New Jersey, as shown on the Official Tax Assessment Map for the City of Millville. The total site acreage is 1,339.8± acres. Access to the property will be gained via East Main Street (NJ State Route 49).

The project site is owned by Atlantic Electric and contains the Millville Holly Orchard and the Brian A. Parent Center. Adjacent land uses include the Connectiv Energy site and residentially-developed properties to the northeast, the Menantico Ponds Wildlife Management Area to the west and the Nature Conservancy's Manumuskin River Preserve to the southeast.

The portions of the site, not occupied by the Brian A. Parent Center, abandoned orchards and associated disturbed lands, contain wooded land. Ponds and associated wetlands occur in several locations on the site. Abandoned sand and gravel mining areas are present with relatively extensive open waters in the southern portion of the site and smaller ponds, including vernal pools, in the northeastern portion of the site.

1.3 Zoning

The project site is situated within the LC-Land Conservation District. The following uses are permitted uses within the LC Zone:

1. Forest, wildlife conservation areas or uses
2. Parks, playgrounds, playfields and other similar facilities
3. Public educational or cultural facilities, including museums or libraries
4. Agricultural use/purpose activities
5. Single-family detached dwelling
6. Cemeteries
7. Public utilities subs or switching stations.

The following uses are conditional uses in the LC Zone:

1. Home occupations
2. Roadside stands
3. Funeral homes
4. Parochial or private schools
5. Churches or similar places of worship
6. School bus shelters
7. Parish houses or convents
8. Hospitals, clinics, nursing and/or convalescent homes, sanitoria and philanthropic organizations
9. Marinas
10. Kennels and animal hospitals
11. Camps and Campgrounds
12. Resource extraction
13. Private clubs, such as hunting and swimming, golf courses, lodge buildings and social halls
14. Family day care homes, child care centers and child mini day care centers.
15. Planned Adult Community Development (PACD).

"The purpose of a Planned Adult Community Development is to maintain the natural, rural and scenic qualities of the LC Land Conservation Zone in accordance with the standards contained in the regulations" (City of Millville Land Use Ordinance).

The proposed project consists of the construction of 903 single-family, age-restricted, detached dwelling units and 47 multi-family, age-restricted dwelling units, for a total of 950 residential units. The project is a conditional use and the golf course is a permitted use in the PACD. The multi-family dwellings will fulfill affordable housing needs in the City of Millville.

1.4 List of Required Permits

City of Millville

- City of Millville Preliminary and Final Major Subdivision approval
- City of Millville Preliminary and Final Major Site Plan approval
- City of Millville Sewer Main Extension Permit
- City of Millville Water Main Extension Permit

Cumberland County

- Cumberland County Soil Conservation District certification

State of New Jersey

- New Jersey Department of Environmental Protection (NJDEP): Freshwater Wetland Statewide General Permits and Transition Area Waiver Averaging (if necessary)
- NJDEP Sewer Main Extension Permit
- NJDEP Water Main Extension Permit
- New Jersey Department of Transportation (NJDOT) Access Permit

Federal

- US Fish and Wildlife Review

2.0 ENVIRONMENTAL INVENTORY AND IMPACT ASESSMENT

2.1 Topography

Portions of the project site are relatively level. Other portions of the site have been significantly altered by sand and gravel mining operations and, therefore, exhibit greater contrast in topography. The lowest elevations on the site are less than 20 feet above sea level. The lowest elevations occur in the westernmost corner of the site within the "Approximate Wildlife and Scenic Conservation Limit" area shown on the project plans. Lower elevations are contained within some of the permanent ponds on the site, but these have not been measured. The highest elevations, which are between 80 and 90 feet above sea level, occur on knolls, located in the northern portions of the site.

Sand and gravel mining activities that occurred historically on the site have changed the natural topography of the site. Topography in the northwestern and western portions of the site will be altered to construct the proposed residential development. These alterations will include excavations for housing foundations and utility and roadway infrastructure, the excavation of stormwater management basins and grading to assure the proper drainage of housing lots. The topography of the site will also be altered in order to construct the proposed golf course. The golf course will be located in the north-central portion of the site, including a portion to the west of the Connectiv site on Lot 1.01 and immediately to the south of this site. Portions of the site contain wetlands and environmentally sensitive habitat and will not be altered or disturbed.

2.2 Geology

The project site is located within the Outer Coastal Plain Physiographic Province of New Jersey. The entire site is underlain by the Cohansey-Kirkwood Formation which consists of white to yellow sands, containing gravels and clays in some localities (Herman, et al 1998). Pollen dating indicates that the Cohansey was deposited in the Middle Miocene epoch. The Miocene began approximately 37.4 million years ago and ended about 3.7 million years ago (Herman, et al 1998). The Formation was laid down during episodes of sea level rise and glacial melt cycles (Wilber 1940).

With the exception of the activities mentioned in the previous section, few other alterations to geology on the project are anticipated. Impervious cover will be added to the site and excavation,

fill and grading will be conducted, which will alter the surficial geology strata of portions of the site.

2.3 Hydrology

Surface waters on the project site consist of wetlands tributary to Menantico (Manantico) Creek and Hooks Branch of the Manumuskin River. Wetlands tributary to Menantico Creek flow through the central portion of the site in a southerly or southwesterly direction. Hooks Branch and a tributary to Hooks Branch flow in an easterly and southerly direction in the eastern portion of the site. Ponds formed in a former borrow pit is located in the southerly portion of the site. Stormwater runoff is directed toward these waterbodies and associated wetlands on the site. Wetlands were delineated by Donald L. Mackay, L.S. of Taylor, Weisman & Taylor. A Letter of Interpretation was issued by the NJDEP on October 18, 1990 is # 0610-90-0015. The Letter of Interpretation expired on October 18, 1995 and a new Letter of Interpretation will now have to be obtained for the preliminary design phase of the project.

2.4 Vegetation

Several plant communities are present on the project site. On the enclosed Environmental Inventory Plan, they are identified as Coastal Plain Atlantic White Cedar Swamp, Pine Barren Hardwood Swamp, Pitch Pine Lowland Forest, Dry Oak-Pine Forest, Dry Pine-Oak Forest, Mesic Coastal Plain Mixed Oak Forest and Coastal Plain Intermittent Pond. There are some disturbed areas on the site. Some of these areas have been used for past mining on the site. These areas contain both wetland areas (State open waters and intermittent pond habitats) and uplands areas with very little vegetation or being invaded with Pitch Pine and Broomsedge. There are also developed areas containing several structures, parking lots, storage sheds, and maintained lawns. An American Holly stand is also located on the site.

The Coastal Plain Atlantic White Cedar Swamp contains the plant species listed in the following table:

Coastal Plain Atlantic White Cedar Swamp	
Scientific Name	***Common Name***
Chamaecyparis thyoides (L.) B.S.P.	Atlantic White-Cedar
Acer rubrum L.	Red Maple
Magnolia virginiana L.	Sweet-Bay
Nyssa sylvatica Marsh.	Black Tupelo
Clethra alnifolia L.	Coastal Sweet-Pepperbush
Leucothoe racemosa (L.) Gray	Swamp Doghobble
Gaylussacia frondosa (L.) Torr. & Gray ex Torr. Blue Huckleberry	Highbush Blueberry
Ilex glabra (L.) Gray	Inkberry
Rhododendron viscosum (L.) Torr.	Clammy Azalea.

The Pine Barren Hardwood Swamp contains:

Pine Barren Hardwood Swamp	
Scientific Name	***Common Name***
Magnolia virginiana L	Sweet-Bay
Nyssa sylvatica Marsh.	Black Tupelo
Clethra alnifolia L.	Coastal Sweet-Pepperbush
Vaccinium corymbosum L.	Highbush Blueberry
Rhododendron viscosum (L.) Torr.	Clammy Azalea
Chamaedaphne calyculata (L.) Moench	Leatherleaf
Leucothoe racemosa (L.) Gray	Swamp Doghobble
Gaylussacia frondosa (L.) Torr. & Gray ex Torr.	Blue Huckleberry.

The Pitch Pine Lowland Forest had the following species:

Pitch Pine Lowland Forest	
Scientific Name	***Common Name***
Pinus rigida P. Mill.	Pitch Pine
Kalmia angustifolia L.	Sheep-Laurel
Gaylussacia frondosa (L.) Torr. & Gray ex Torr.	Blue Huckleberry
Gaylussacia dumosa (Andr.) Torr. & Gray	Dwarf Huckleberry
Leucothoe racemosa (L.) Gray	Swamp Doghobble
Lyonia mariana (L.) D. Don	Piedmont Staggerbush.

The Mesic Coastal Plain Mixed Oak Forest is represented by the subtype known as the Southern Coastal Plain Mixed Oak Forest. This forest type is dominated by the following species:

Mesic Coastal Plain Mixed Oak Forest	
Scientific Name	***Common Name***
Quercus falcata Michx.	Southern Red Oak
Quercus phellos L.	Willow Oak
Liquidambar styraciflua L.	Sweet-Gum
Acer rubrum L.	Red Maple
Fagus grandifolia Ehrh.	American Beech
Ilex opaca Ait.	American Holly
Cornus florida L.	Flowering Dogwood
Viburnum dentatum L.	Southern Arrow-Wood
Clethra alnifolia L.	Coastal Sweet-Pepperbush
Rhododendron viscosum (L.) Torr.	Clammy Azalea
Smilax glauca Walt.	Sawbrier
Vaccinium corymbosum L.	Highbush Blueberry
Morella pensylvanica (Mirbel) Kartesz	Northern Bayberry
Gaylussacia baccata (Wangenh.) K. Koch	Black Huckleberry
Toxicodendron radicans (L.) Kuntze	Eastern Poison-Ivy
Parthenocissus quinquefolia (L.) Planch.	Virginia-Creeper
Mitchella repens L.	Partridge-Berry
Pteridium aquilinum (L.) Kuhn	Northern Bracken Fern
Cypripedium acaule Ait.	Pink Lady's-Slipper

Dry Oak-Pine Forest dominate the site and the following species were observed:

Dry Oak-Pine Forest	
Scientific Name	***Common Name***
Quercus velutina Lam.	Black Oak
Quercus prints L.	Chestnut Oak
Quercus cochineal Munch.	Scarlet Oak
Quercus alba L.	Northern White Oak
Pinus schemata P. Mill.	Short-Leaf Pine
Pinus rigida P. Mill.	Pitch Pine
Quercus falcata Michx.	Southern Red Oak.

Dry Pine-Oak Forests also occur on the site, but are not as dominant as Oak-Pine. The species observed in this community include:

Dry Pine-Oak Forest	
Scientific Name	***Common Name***
Pinus rigida P. Mill.	Pitch Pine
Quercus velutina Lam.	Black Oak
Quercus prints L.	Chestnut Oak
Quercus cochineal Munch.	Scarlet Oak
Quercus satellite Wangenh	Post Oak
Quercus alba L.	Northern White Oak
Gaylussacia baccata (Wangenh.) K. Koch	Black Huckleberry
Vaccinium pallidum Ait.	Early Lowbush Blueberry
Quercus ilicifolia Wangenh.	Bear Oak

A list of the vascular plant observed on the site can be found in Appendix C.

The proposed residential development will be located in the northwestern and western portion of the site. The golf course will be located in the central portions of the site partially including a portion of Lot 1.01 and land to the west and to the south of Lot 1.01. All buildings and pavement and grading for the development will be placed in uplands, at least 300 feet away from delineated wetlands. Although the design of the stormwater management basins is only conceptual at this time, it is anticipated that at least some of the basins will discharge to on-site wetlands. Small amounts of wetlands vegetation will be disturbed or removed to construct stormwater conveyance pipes and/or stormwater outfall structure. Stormwater management basins will need to be located near the freshwater wetlands within the transition areas (150-300 ft.). These will be the only activities that will occur in wetlands or wetlands buffers on the site. Some uplands forests will be cleared on the site. Much of the disturbed land will be converted to the golf course use.

2.5 Wildlife

Portions of the project site contain moderate to high quality wildlife habitat. The site is very rich in bird, reptile and amphibian species, including the documented presence of a number of threatened or endangered species. The NJDEP Landscape Project, version 2, mapping was reviewed. The

following habitat types are mapped for the site: Forest (Rank 2, 4, & 5), Forested Wetland (Rank 2) & 4), Emergent Wetlands (Rank 2), Grassland (Rank 2) and Bald Eagle foraging habitat.

The Rank 5 Forest habitat contains Bald Eagle Nesting Buffer, and documented sightings of the endangered/threatened Barred Owl, Red-Headed Woodpecker, Corn Snake, Cope's Gray Treefrog. This habitat is also associated with priority, bird, herptile and invertebrate species. The priority species found in the Rank 5 Forest habitat include Baltimore Oriole, Black-billed Cuckoo, Brown Thrasher, Carolina Chickadee, Eastern Towhee, Eastern Wood Pewee, Gray Catbird, Hairy Woodpecker, Hooded Warbler, Pine Warbler, Red-eyed Vireo, Scarlet Tanager, White-eyed Vireo, Wood Thrush, Yellow-billed Cuckoo, Yellow-throated Vireo, Dotted Skipper and Eastern Box Turtle.

The Rank 4 Forest habitat on the site is associated with Corn Snake, Northern Pine Snake and the herptile priority species, Eastern Box Turtle. The Rank 2 Forest on the site contains habitat for Eastern Box Turtle.

The Rank 4 Forested Wetland contains Cope's Treefrog and Fowler's Toad. The Rank 2 Forested Wetland includes habitat for Carolina Chickadee, Pine Warbler, Fowler's Toad and Carpenter Frog. The Rank 2 Emergent Wetland is associated with habitat for Fowler's Toad and Carpenter Frog. The Rank 2 Grassland contains habitat for Eastern Box Turtle.

A Habitat Conservation Plan will be prepared for the site, which will include a number of recommendations to protect wildlife habitat and sensitive species on the site. It is anticipated that many of these recommendations will be incorporated into the final design plans. A large portion of the site will be preserved in its natural state. Incorporating many of the recommendations included in the Habitat Conservation Plan will minimize impacts to wildlife in the portions of the site to be developed.

2.6 Soils

Soil classification is based on the "Soil Survey of Cumberland County, New Jersey," issued April 1987, prepared by the United States Department of Agriculture, Soil Conservation Service in cooperation with Rutgers University Agriculture Experimentation Station and the New Jersey

Department of Agriculture. According to the soil survey, the following soil types are depicted as occurring on the project site: Aura loamy sands, 0 to 5 percent slopes (AmB), Aura sandy loam, 2 to 5 percent slopes (ArB), Downer loamy sand, 0 to 5 percent slopes (DoB), Downer loamy sand, 5 to 10 percent slopes (DoC), Downer sandy loam, 2 to 5 percent slopes (DrB), Evesboro sand, 0 to 5 percent slopes (EvB), Evesboro sand, 5 to 10 percent slopes (EvC), Fallsington sandy loam (Fd), Fort Mott loamy sand, 0 to 5 percent slopes (FrA), Klej loamy sand, 0 to 3 percent slopes (KmA), Lakewood sand (LeB), Pocomoke sandy loam (Ps), Sassafras sandy loam, 0 to 2 percent slopes, (SrA), Woodstown sandy loam, 0 to 2 percent slopes (WmA).

Soil Types Found on the Project Site	
Aura loamy sands, 0 to 5 percent slopes (AmB)	The Aura soil series formed under a hardwood forest canopy. The AmB soils can be found on divides and knolls. Permeability is moderate or moderately slow in the lower part of the subsoil. The soil is subject to compaction and can develop a plowpan, during intensive cultivation. Runoff depends on the degree of compaction of the soils. The soil type is droughty. Wind and water erosion can occur on these soils if left unprotected. The seasonal high water table occurs at depths greater than 60 inches below the surface. Plant nutrients are quickly leached, due to a porous surface layer. The soils are well suited for most urban uses.
Aura sandy loam, 2 to 5 percent slopes (ArB)	The Aura soil series formed under a hardwood forest canopy. The AmB soils can be found on sideslopes. Permeability is moderate or moderately slow in the lower part of the subsoil. The soil is subject to compaction and can develop a plowpan, during intensive cultivation. Runoff depends on the degree of compaction of the soils. The soil type is droughty. Wind and water erosion can occur on these soils if left unprotected. The seasonal high water table occurs at depths greater than 60 inches below the surface. Plant nutrients are quickly leached, due to a porous surface layer. The soils are well suited for most urban uses.
Downer loamy sand, 0 to 5 percent slopes (DoB)	The Downer soil series formed mainly under a hardwood forest canopy in marine and fluvial deposits (SSCC). The DoB soils can be found on divides. The DoB soils are gently sloping and well drained. Permeability is moderate or moderately rapid in the subsoil and moderately rapid in the substratum (SSMC). Runoff is slow. The hazard of water erosion is slight (SSCC). The seasonal high water table occurs at depths greater than 72 inches below the surface. The limitations of this soil for most urban uses are poor filter and seepage (SSOMC).
Downer loamy sand, 5 to 10 percent slopes (DoC)	The Downer soil series formed mainly under a hardwood forest canopy in marine and fluvial deposits. The DoC soils can be found on sideslopes. The DoC soils are subject to moderately severe erosion, due to slope. Gully formation can occur. The surface layer of this soil type often contains 10 to 20 percent quartzose pebbles. In other cases the subsoil has been exposed by erosion. (SSCC).
Downer sandy loam, 2 to 5 percent slopes (DrB)	The Downer soil series formed mainly under a hardwood forest canopy in marine and fluvial deposits (SSCC). The DrB soils can be found on sideslopes. The DrB soils are gently sloping and well drained. Permeability is moderate in the subsoil and moderately rapid in the substratum (SSOC). Runoff is medium. The hazard of water erosion is moderate (SSCC). The seasonal high water table occurs at depths greater than 72 inches below the surface. The soils are well suited for most urban uses (SSOC).

Evesboro sand, 0 to 5 percent slopes (EvB)	The Evesboro soil series formed under an oak-pine forest canopy. The EvB soils are generally nearly level and excessively drained. The EvB soils can be found on low-lying stream terraces. Permeability is rapid. Runoff is slow in the EvB soils. The soil type exhibits a low available water capacity. Wind erosion can occur on these soils if left unprotected. The seasonal high water table occurs at depths greater than 60 inches below the surface. Sand in surface soils, rapid permeability and low available water capacity limit certain types of development.
Evesboro sand, 5 to 10 percent slopes (EvC)	The Evesboro soil series formed under an oak-pine forest canopy. The EvC soils are excessively drained and found on steeper sideslopes, Permeability is rapid. Runoff is medium in the EvC soils. The soil type exhibits a low available water capacity. Severe wind erosion can occur on these soils if left unprotected. The seasonal high water table occurs at depths greater than 60 inches below the surface. Sand in surface soils, rapid permeability and low available water capacity limit certain types of development. Erosion hazard and slope also pose a hazard in the EvC soils.
Fallsington sandy loam (Fd)	The Fd soils formed in acid, loamy Coastal Plain sediments (SSMC). They are found on flats, where the elevation is lower than 40 feet. The substratum can be up to 20 percent gravel. The soil type is moderately permeable (SSCC). The soils are poorly drained (SSMC).
Fort Mott loamy sand, 0 to 5 percent slopes (FrA)	The Fort Mott soil series formed under a mainly hardwood forest canopy in alluvial deposits that have been reworked by wind. The FrA soils are excessively drained and found at higher elevations in the area. Some areas are poorly drained, but the FrA soils are generally droughty, due to a sandy or gravelly surface layer. The soil is subject to wind erosion, with a possible sandblasting effect on plants when the soils are exposed (SSCC).
Hammonton loamy sand, 0 to 5 percent slopes (HaA)	The Hammonton soil series formed under a hardwood forest canopy in marine deposits. The HaA soils are moderately well-drained to poorly drained soils. They occur in areas with gently sloping to level topography. Permeability is rapid and available water capacity is moderate. The depth of the seasonal high water table ranges from 1.5 to 4 feet below the surface , but can be more than 5 feet during normal rain years. Wind erosion is possible in exposed soils (SSCC).
Klej loamy sand, 0 to 3 percent slopes (KmA)	The Klej soil series formed under a hardwood forest canopy in marine and fluvial deposits (SSCC). Formed on river terraces, the KmA soils are nearly level to gently sloping (SSBC). A substratum of clay is often present. Conditions in these soils are moderately well drained, but the water table fluctuates and is relatively close to the surface in the winter. Permeability is rapid in the upper portion of the soil profile. The proximity of the water table to the surface and the slow permeability in the substratum limit the use of these soils.
Lakewood sand (LeB)	The Lakewood soil series formed in uplands under a coniferous forest (SSCC). The soil series was formed in stratified water-laid Outer Coastal Plain deposits (SSBC). These soils are extremely droughty and subject to wind erosion. Permeability is rapid, and available water capacity is low. Depth to the seasonal high water table is greater than 60 inches. Fertilizer leaches rapidly, due to the sandiness of the soils. Frequent irrigation is necessary to support lawns or landscape plants.
Pocomoke sandy loam (Ps)	The Pocomoke soil series formed in fluvial and marine deposits. When these soils are adjacent to streams, they are frequently flooded. They generally receive runoff from nearby higher elevations. The Ps soils are nearly level and their elevation is usually less than 40 feet. Wetness is the main limitation of these soils to development. Permeability is moderate. The seasonal high water table is at the surface from October to May, but can drop to 2 feet below the surface in the summer.

Sassafras sandy loam, 0 to 2 percent slopes, (SrA)	The Sassafras soil series formed under a hardwood forest canopy in marine and fluvial deposits (SSCC). The SrA soils are found in uplands on sideslopes. Runoff is slow and the erosion hazard is slight. Permeability is moderate. The seasonal high water table can be found depths of greater than 60 inches unless the soil is found in a depression. These soils are suited to most urban uses.
Woodstown sandy loam, 0 to 2 percent slopes (WmA)	The WmA soils formed under a hardwood forest canopy (SSCC) in water laden sediments (SSBC). These soils occur at intermediate elevations, sometimes on terraces overlooking tidal marshes. The seasonal high water table can be found at a depth of 2 to 4 feet of are nearly level and moderately well drained. Permeability and available water capacity are moderate. Wetness is the main limitation of these soils.

The residential portion of the project will mainly be constructed on the EvB, with smaller portions of the development located on the AmB, DoB, DrB and LeB soils. The limitations associated with the EvB soils consist of sand in surface soils, potential for wind erosion, rapid permeability and low available water capacity. None of these limitations are significant for residential development, particularly since the residential development will be provided with sewer service. Wind and water erosion are the main problems for exposed AmB soils. Erosion potential is high in the DoB soils and the DrB soils are limited by poor filtering capacity. Poor filtering capacity is not a concern since septic systems will not be utilized. Erosion can be controlled by employing soil erosion and sediment control measures. Such measures will be employed at the site in accordance with the NJDEP's Soil Erosion and Sediment Control Standards (1999).

The proposed golf course will be constructed on the AmB, DoB, DoC, Fd, HaA, KmA and WmA soils. Erosion potential is the main hazard associated with the AmB, DoB, DoC and HaA, although the degree of potential erosion in exposed soils varies with the soil type. The KmA and WmA soils are limited by the proximity of the water table to the surface for portions of the year. Neither the erosion potential nor the potential for wetness in some of the soils underlying the proposed golf course site pose significant limitations to the project. Implementing the proper soil erosion and sediment control measures can prevent erosion. Such measures will be employed on the site. The golf course design can accommodate the soils with a higher water table.

An appropriate project design combined with soil erosion and sediment control measures utilized in accordance with the NJDEP's Soil Erosion and Sediment Control Standards will accommodate any potential limitations of soils on the project site.

2.7 Archaeological Resources

A request was sent to the NJ State Museum, to search their records for any archaeological resources that have been documented for the project site. The response is pending. A Preliminary Phase 1A Cultural Resource Literature Search was performed for the property by the Cultural Resource Consulting Group. The search concluded that no information currently exists indicating that the development of the property will impact historical or cultural resources.

The potential often exists for the presence of prehistoric archaeological remains, particularly on floodplains and river valleys. 300-foot buffers will be preserved on all wetlands on the project site; therefore it is anticipated that potential archaeological sites, if present, will be preserved within these buffers. Some portions of this site have been severely disturbed by gravel and sand mining. Intact resources would not be found in these locations. If any archaeological resources are found to occur on the property as a result of future investigations, these resources will be safeguarded in accordance with the protocols and standards established by the NJDEP's Office of Historic Preservation.

2.8 Historical Resources

The *New Jersey and National Register of Historic Places: 1970 through 1995* (NJDEP 1996) lists the following site for the City of Millville:

- Millville's First Bank, Second and Main Streets
- Millville Army Air Field, Millville Municipal Airport
- Millville Historic District, roughly bounded by the Maurice River, Sharp Street, North Street, Foundry Street, Archer Street, Buck Street, Vine Street, a stepped diagonal from Vine and Fourth Streets, South Second Street and East Main Street
- R.I. Wood School, Powell and Archer Streets

None of these sites is on or adjacent to the project site. The web site for Cumberland County lists several more specific historic sites located in the City of Millville. These sites are listed below:

- Centre Grove School, Wheaton Village
- Edward C. Stokes House, 228 North Second St. (Between Mulberry & Pine)
- Issac Owen House - 1854, 157 South Second Street
- Millville Memorial High School, East Broad Street between Fifth & Sixth Streets
- Millville's First Bank, N.E. Corner of Second and East Main Streets
- Old Western School, Two Pike Street between Main & Maurice River
- Site of First School, N.E. Corner of Second and Sassafras

- Site of Joseph Buck's Home, NE Corner of High and Main Streets
- Site of the James Lee Glass Factory, Buck and Mulberry Streets
- Smith, Garrison, Ware House, 223 N. Second Street
- Southeastern School - 1872, 120 South Fourth Street
- The Working Men's Institute, Foot of South High Street (Cumberland County 2003)

None of these historic sites is located on or adjacent to the proposed project site. No historic buildings are present on the site.

2.9 Cultural Resources

Millville was known as the "Holly City, " because of the Holly Orchard in East Millville. The Holly Orchard, planted by Clarence Wolf in 1939, could be considered to be a cultural resource. The Orchard is located on the project site. The Brian A. Parent Center, which was constructed to provide space for conferences and art galleries (Cumberland County 2003). The Brian A. Parent Center has not been successful on the project site. The center building will be converted to a clubhouse for the golf course.

2.10 Scenic Sites

The National Park Service designates the Maurice River as a Wild and Scenic River. The designation of the Maurice includes several tributaries, including the Menantico and Muskee Creeks and the Manumuskin River. Tributaries and/or tributary wetlands to Menantico Creek and the Manumuskin River occur on the project site. A buffer for the Menantico Ponds Wildlife Management Area occurs in a western corner of the site. Wetlands on the project site have extensive buffers due to the presence of threatened and endangered species. The presence of these buffers will contribute to the protection of any scenic resources on or adjacent to the project site.

2.11 Groundwater Quality and Quantity

2.11.1 Existing Groundwater Conditions

The project site is underlain by the Kirkwood-Cohansey aquifer system. (Herman, et al 1998). The Cohansey is an unconfined water table aquifer made up of sands and gravel and containing lenses of silt and clay. The Kirkwood aquifers are located beneath the Cohansey Formation. The

Kirkwood aquifers include the Atlantic City 800-foot sand and the Rio Grande water-bearing zone. In some locations iron and manganese concentrations can be high. Some portions of the confined aquifers near the coast are subject to saltwater intrusion.

2.11.2 Groundwater Quantity Impacts

The City of Millville's water utility will provide water service to the proposed residential development. An extension of an existing water main located in the Route 49 Right of Way will be required. The City of Millville obtains its water supply form groundwater sources. The proposed residential development will consist of 903 single-family detached dwellings and 47 multi-family dwellings. The estimated water demand, according to the latest NJDEP standards, is 100 gallons per day (gpd) per single-family detached home and 75 gpd for each multi-family dwelling. The total water demand for the residences of the project will be approximately 93,825 gpd. The clubhouse for the residential development is expected to be visited by approximately 400 members per day. This level of use generates an estimated 60 gpd per member or 24,000 gpd. The golf course clubhouse is anticipated to have a similar level of usage to the resident's clubhouse; therefore, it will also require 24,000 gpd (Maser Consulting 2003). The total usage anticipated for the project site is then 141, 825 gpd.

A well will be drilled on the project site to provide water to the proposed golf course. The estimated water usage required for the golf course has not yet been calculated. A water allocation permit will be obtained from the NJDEP for any groundwater withdrawals.

2.11.3 Groundwater Quality Impacts

The potential for pesticide contamination of ground water from agricultural applications has been of concern for a long time. Similar concerns have arisen over the frequent use of pesticides on golf courses, as well as on home lawns in residential development. Several researchers have investigated the fate of pesticides applied to turfgrass under experimental conditions. One recent study monitored pesticide concentrations in ground water underlying golf courses. The research results indicate that, for the pesticides studied, most of the chemicals remain in the thatch layer or in the upper few inches of the soil. The presence of a thatch layer reduces the amount of pesticide leached from turfgrass (Branham and Wehner, 1985).

Some pesticides are more prone to leaching than others. For instance, bentazon and ethroprop tend to move easily in soils (Murphy and Fenske). The use of these and other leaching-prone pesticides should be avoided or minimized in managing turf on the proposed golf course.

2.12 Surface Water Quality and Quantity

2.12.1 Existing Water Quality

As mentioned, surface waters on the project site consist of wetlands and streams tributary to Menantico Creek and Hooks Branch of the Manumuskin River as well as intermittent and permanent ponds associated with borrow pits on the site. The entire site is within the watershed of the Maurice River. According to the New Jersey Department of Environmental Protection's Surface Water Quality standards N.J.A.C. 7:9B et seq. Several different surface water quality classifications are given to the Maurice River.

The main branch, which is the reach located between the source to the boundary of the Union Lake Wildlife Management Area to the north of Vineland, is given the classification of FW2-NT. The Willow's Grove reach, which includes the river from its source to the boundary of the section of the Union Lake Wildlife Management Area north of Vineland is also designated as FW2-NT. From where the river crosses the boundary of the Union Lake Wildlife Management Area to its confluence with Blackwater Branch the surface water classification is FW2-NT(C1). Downstream of the confluence of the Maurice River with Blackwater Branch to Delaware Bay the classification is FW2-NT/SE1.

The Manumuskin River and Menantico (Manantico) Creek discharge to the Maurice River downstream of Blackwater Branch. Portions of the site drain to Menantico (Manantico) Creek. The entire length of the Creek receives the FW2-NT designation, with the exception of the segment contained within the boundaries of the Manantico (Menantico) Ponds Wildlife Management Area , which is designated as FW2-NT(C1).

Saline waterways and waterbodies are classified as SE1 when they are located in the Atlantic Coastal Basin. C1 stands for "Category one waters," which are waters designated in the tables in N.J.A.C. 7:9B-1.15(c) through (h). These watercourses and waterbodies are set aside to

implement the antidegradation policies of the Surface Water Quality Standards, "for protection from measurable changes in water quality characteristics because of their clarity, color, scenic setting, other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resource(s)." Except when due to natural conditions, if the water quality characteristics of C1 waters are worse than the water quality criteria, they are to be improved so that the waters can serve the designated uses.

No SE1 or C1 waters occur on the project site. All of the waters on the site are classified as FW2, which is the general surface water classification applied to those fresh waters that are not designated as FW1 or Pinelands Waters. According to 7:9B-1.12(c) the designated uses of FW2 waters are:

1. Maintenance, migration and propagation of the natural and established biota;
2. Primary and secondary contact recreation;
3. Industrial and agricultural water supply;
4. Public potable water supply after such treatment as required by law or regulation; and
5. Any other reasonable uses.

The NJDEP Bureau of Freshwater and Biological Monitoring conducts sampling of benthic macroinvertebrates to assess water quality in streams in the State of New Jersey. The dominance and diversity of benthic macroinvertebrate families are good indicators of water quality. In 1995, the NJDEP Bureau of Freshwater and Biological Monitoring sampled Manantico (Menantico) Creek for benthic macroinvertebrates at Route 49 in the City of Millville, which is approximately 900 feet northwest of the project site along the Route 49 frontage. The Creek was rated as non-impaired, due to the macroinvertebrate assemblage encountered (NJDEP 1996). Since no activities are occurring on the project site that should degrade water quality, it is anticipated that the waterbodies and watercourses on the project site are also non-impaired.

2.12.2 Impacts to Surface Water Quantity

The proposed residential development and golf course will utilize the City of Millville Water Utility for water service. The City obtains its water supply from groundwater sources. Therefore, the proposed project will not require the use of surface waters to supply its water demands. No impacts to surface water quantity are anticipated.

2.12.2 Impacts to Surface Water Quality

The development consists of two components: a residential development and a golf course. Fertilizers used for golf course maintenance contain compounds such as nitrate, which can adversely impact groundwater and surface waters, unless properly applied. Excess nitrates and other nutrients have the potential to stimulate algal growth and thereby deplete oxygen in receiving waters, leading to disruptions of the aquatic food chain. The fate of fertilizers and pesticides in turfgrass is essentially dependent on the movement of precipitation or irrigation water from the turfgrass to the receiving surface or ground water.

Depending on the soil type, certain studies have suggested that most of the water applied to a golf course infiltrates to the soil and does not become direct runoff. Often, ground water and surface water are hydraulically connected. Soluble chemicals that enter the groundwater may be transported to the surface water depending on the flow pattern in the shallow groundwater. The effect of these chemicals on surface water quality will depend on the loading rate of the chemical to the ground water, the ground water/surface water flow regime, and chemical or physical processes in the unsaturated zone or in the ground water zone, which affect the chemical.

A vegetated buffer, adjacent to wetlands, can reduce the nitrate-nitrogen content of stormwater and irrigation runoff by as much as 85%. One study demonstrated a reduction of nitrate-nitrogen levels in shallow groundwater from 15 milligrams per liter to 2 milligrams per liter after passing through riparian vegetation. This reduction occurred within the first 30 to 50 feet of the riparian buffer areas (Evans, et al 1996). One of the means by which riparian vegetation removes nitrates is through the trapping of sediment. Many studies indicate that a large proportion of nutrients, including nitrogen, attach to sediment. Woody riparian vegetation, both trees and shrubs, also take up nitrogen and other nutrients from groundwater (Binford & Buchenau 1993). Extensive wetlands buffers will be maintained on the site These buffers will minimize the potential effects of the proposed golf course to the water quality of surface waters on and adjacent to the project site.

The most significant potential impacts to water quality from the proposed residential development are related to stormwater runoff from impervious surfaces. Increases in impervious cover can be associated with the following water quality impacts:

1. Pollutants may be introduced into ground and/or surface waters;
2. Surface waters may increase in turbidity; and
3. Aquatic productivity may become impaired.

A number of site design and management techniques can be used to minimize increases in pollutant and sediment loading. The New Jersey Stormwater Management Regulations (N.J.A.C. 7:13 et. seq.) require that water quality controls be utilized for new developments. For this project, the required water quality controls will be provided through the use of detention and /or retention basins. The basins will be designed to achieve water quality requirements.

The benefits of detention basins in providing removal of stormwater pollutants have been documented in several studies. Detention basins can be expected to retain 99 percent of sediment, 65 to 75 percent of total phosphorus, 60 to 70 percent of total nitrogen, 95 to 99 percent of trace metals and 98 percent of bacteria from the runoff of the two-year storm (NJDEP & NJDA 1994).

Due to the proposed water quality treatment systems, the large amount of land that will remain pervious, and the preservation of extensive wetlands buffers on the site impacts to water quality are expected to be minimal as a result of the proposed project.

2.13 Air Quality

The Federal Clean Air Act requires each state to attain and maintain specified air quality standards. Ambient Air Quality Standards have been promulgated by the federal government and by New Jersey for total suspended particulate (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2) and lead. The New Jersey standards are generally the same as the federal standards for these pollutants. Primary air quality standards are set to protect human health and secondary standards are set to protect human welfare.

The City of Millville is located within the Delaware Bay Region of the New Jersey Pollutant Standards Index Reporting Regions. The only air quality sampling station is located in Millville. The following pollutants are monitored at this sampling station: O_3, NO_2, SO_2. In 2000, air quality in the Delaware Bay Region was good on 330 days, moderate on 30 days, unhealthy for

sensitive groups on 4 days, unhealthy on 2 days and very unhealthy on 0 days (NJDEP Bureau of Air Monitoring 2001).

The highest Daily Maximum 1-Hour Average O_3 level measured at the Millville sampling station was 0.127 ppm, which exceeds the Maximum 1-hour Primary Standard of 0.12 ppm. The highest Daily Maximum 8-Hour Average O_3 level measured at the Millville sampling station was 0.113 ppm, which exceeds the Maximum 8-hour Primary Standard of 0.08 ppm (NJDEP Bureau of Air Monitoring 2001).

The Maximum 1-hour Average level of NO_2 measured was 0.073 ppm. This level does not exceed the 1-hour Average Guideline of 0.25 ppm. The 12-month Maximum Average levels of NO_2 measured was 0.016 ppm. The 12-month Maximum Average Primary and Secondary Standards of 0.05 ppm and 0.053 ppm were not exceeded (NJDEP Bureau of Air Monitoring 2001).

The Maximum 3-Hour Average level of SO_2 was 0.036 at the Millville sampling station. This is lower than the 3-Hour Average Secondary Standard of 0.5 ppm. No Primary Standard has yet been established. The Maximum 12-Month Average level of SO_2 measured was 0.004 ppm. Neither the 12-Month Primary Standard of 0.03 ppm and the Secondary Standard of 0.02 ppm were exceeded NJDEP Bureau of Air Monitoring 2001).

The Delaware Bay Air Pollutant Reporting Index Region is not in compliance with air quality standards for ozone. Ground level ozone formed through chemical reactions with hydrocarbons and nitrogen oxides. Hydrocarbons and nitrogen oxides are pollutants associated with the use of automobiles and other gasoline-powered motors, as well as industrial sources. Ozone-forming chemical reactions occur when bright sunshine and high temperatures occur together. Due to the cool, cloudy conditions this spring, the Millville sampling station only has one day with ozone levels exceeding the Daily Maximum 8-Hour Average Standards and none exceeding the 1-Hour Standards (NJDEP 2003).

The proposed project will include the construction of 950 residential dwellings and a golf course. Passenger vehicles produce hydrocarbons at a rate of approximately 0.4 grams/kilometer (g/km) and nitrogen oxides at a rate of approximately 0.3 g/km (EPA Victoria 2003). The discharge of these

pollutants will increase at the site, from cars, the operation of lawn equipment and from furnaces used for heating homes and the clubhouses, thereby increasing the potential for increased ozone pollution in the region. These pollutant levels will decrease as older vehicles are retired and pollution control devices on cars become more efficient.

2.13 Noise

Ambient noise levels are typically measured in units of decibels (dBA) The recommended outdoor noise level is 70 dBA in residential areas (Federal Highway Administration (FHA), 1980). Variations in noise levels will depend on traffic volume, vehicular speed, distance from highway, and degree of sound shielding (e.g., trees).

The existing conditions on the site produce levels of 20 to 40 dBA, which is low level noise generated by background noise such as leaves, wind and wildlife. Traffic noise from nearby highways, such as Route 49 contributes to ambient noise levels at the site. The maximum noise emission levels for newly manufactured trucks and for in-use medium and heavy trucks engaged in interstate commerce, established by the US Environmental Protection Agency, are 80 dBA and 83 dBA to 87 dBA (dependent on speed), respectively (USDOT, FHA 2000). These standards apply to noise levels at a distance of 15 meters (approximately 49 feet) from the centerline of travel. In general, sound levels drop by 3 dBA, when distance is doubled from a line source (Minnesota Pollution Control Agency). At approximately 1,600 feet from Route 49, noise levels for even the noisiest trucks will be below the recommended 70 dBA. At approximately 400 feet from the roadway, noise from ordinary heavy traffic should measure less than the recommended level. The majority of the residential development will have noise levels lower than the recommended level of 70 dBA for residential areas. Traffic on the site will predominantly consist of passenger vehicles, traveling at low speeds. The development itself will not generate significant noise levels.

3.0 CONCLUSIONS

The 1,339.8± acre site for The Preserve at Holly Ridge is located on a parcel of land known as Block 582, Lots 1, 10, and a portion of 1.01 City of Millville, Cumberland County, New Jersey. Access to the property will be gained via East Main Street (NJ State Route 49). The project site is

owned by Atlantic Electric and contains the Millville Holly Orchard and the Brian A. Parent Center. Adjacent land uses include the Connectiv Energy site and residentially-developed properties to the northeast, the Menantico Ponds Wildlife Management Area to the west and the Nature Conservancy's Manumuskin River Preserve to the southeast.

The portions of the site, not occupied by the Brian A. Parent Center, abandoned orchards and associated disturbed lands, contain wooded land. Ponds and associated wetlands occur in several locations on the site. Abandoned sand and gravel mining areas area are present with relatively extensive open waters in the southern portion of the site and smaller ponds, including vernal pools in the northeastern portion of the site.

Topography in the northwestern and western portions of the site will be altered to construct the proposed residential development. These alterations will include excavations for housing foundations and utility and roadway infrastructure, the excavation of stormwater management basins and grading to assure the proper drainage of housing lots. The topography of the site will also be altered in order to construct the proposed golf course. The golf course will be located in the central portion of the site, including a portion of and to the west of the Connectiv site on Lot 1.01 and immediately to the south of this property.

The project site is located within the Outer Coastal Plain physiographic province of New Jersey. The Cohansey Formation crops out at the site. The Numerous soil types occur on the project site. A number of soil types are present on the site. The main limitations for these soils are related to possible erosion in exposed soils and wetness in a few soils. An appropriate project design combined with soil erosion and sediment control measures utilized in accordance with the NJDEP's Soil Erosion and Sediment Control Standards will accommodate any potential limitations of soils on the project site.

Several natural plant community types are present on the project site. On the Environmental Inventory Plan they are labeled as Area 1-Oak Forest with Scattered Pitch Pine, Area 2-Pine Barrens Community, Area 3 – Disturbed Land (includes orchards and developed areas), Area 4 – Intermittent Ponds, Area 5 – Pitch Pine Forest with Holly Understory and Area 6 – Palustrine Forested Wetlands. Plant communities in wetlands or wetlands buffers on the site will remain undisturbed with the exception of stormwater conveyance pipes and outfall structures associated

with some of the stormwater management basins. Some uplands forests will be cleared on the site to construct dwellings, a clubhouse and portions of the golf course. Much of the disturbed land will be converted to the golf course use.

Surface waters on the project site consist of wetlands tributary to Menantico (Manantico) Creek and Hooks Branch of the Manumuskin River. Wetlands tributary to Menantico Creek flow through the central portion of the site in a southerly or southwesterly direction. Hooks Branch and a tributary to Hooks Branch flow in an easterly and southerly direction in the eastern portion of the site. Ponds formed in a former borrow pit is located in the southerly portion of the site. Stormwater runoff is directed toward these waterbodies and associated wetlands on the site. Surface water quality on the site is good. Potential impacts to surface water quality associated with increased impervious cover and the operation of a golf course will be minimized by stormwater management basins, extensive vegetated wetlands buffers and proper fertilization and pest management practices on the golf course.

The Cohansey-Kirkwood Aquifer System underlies the property. Groundwater will be utilized to provide water for the site. The City of Millville will supply the residential portion of the development and an onsite well will supply the golf course with water for irrigation. The proposed project will be contingent upon receipt of the necessary water supply approvals from the City and NJDEP.

Air quality is generally good in the vicinity of the project site. The region exceeds the established standards for ozone periodically. Increased automobile usage resulting from the increases in resident on the site may slightly increase ozone levels on hot, clear summer days. As older vehicles are retired and pollution controls on passenger vehicles improve, the increase in ozone will be minimized.

Noise levels are only expected to be occasionally higher than recommended levels for residential site in proximity of Route 49. As distance increases noise levels decrease. The majority of the site will experience lower than recommended noise levels. The proposed residential development and golf course will not be a significant noise generator.

The project site contains significant amounts of varied and high quality wildlife habitat. The presence of endangered and threatened species have been documented. A large amount of the site will remain undeveloped, including wetlands with 300 foot buffers as well as tracts of uplands in the southern and Eastern portions of the site. The incorporation of measure outlined the Habitat Conservation Plan, prepared by Herpetological Associates, Inc. will minimize the impacts of the proposed project to the significant wildlife resources present.

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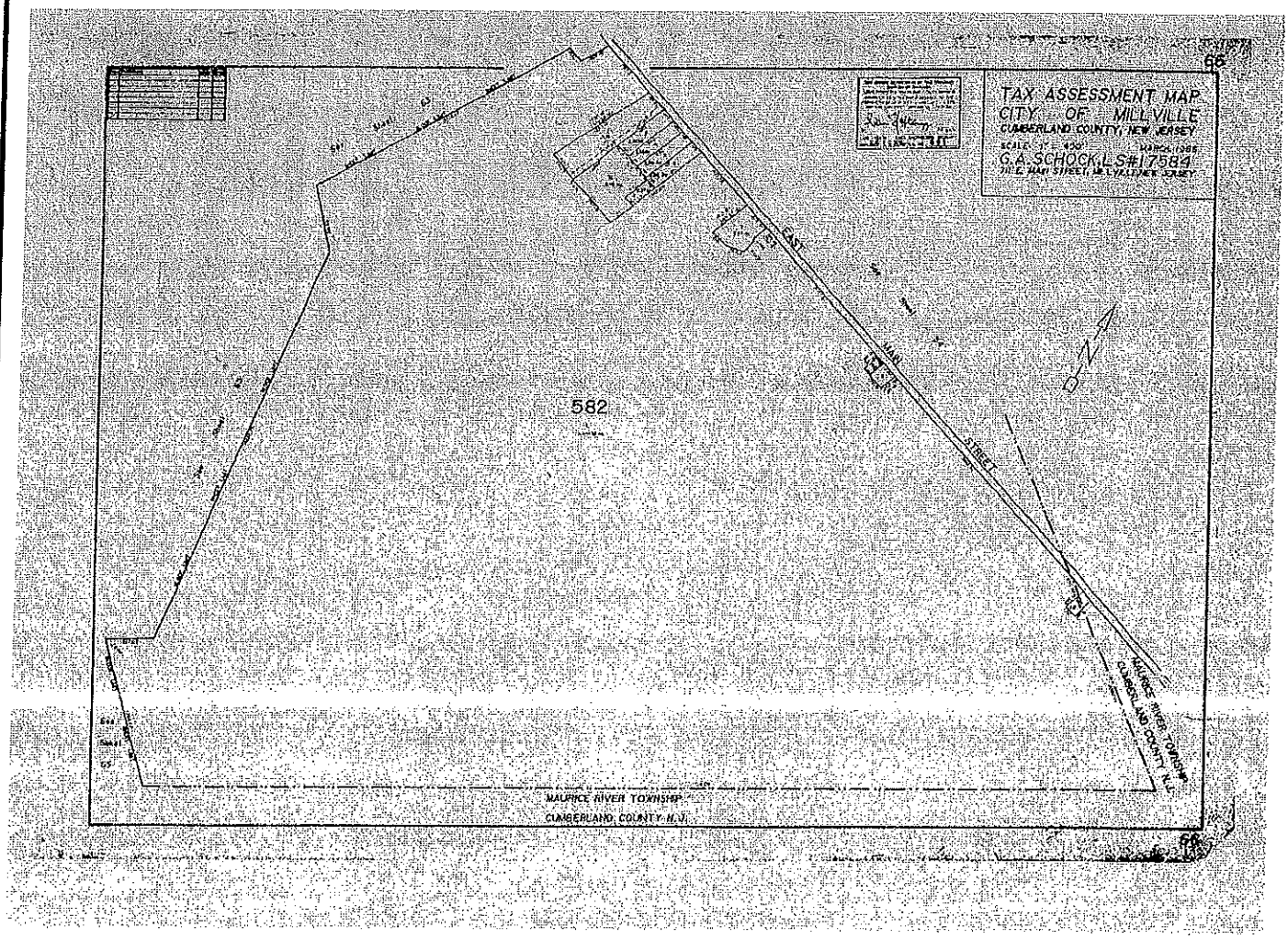
APPENDIX A



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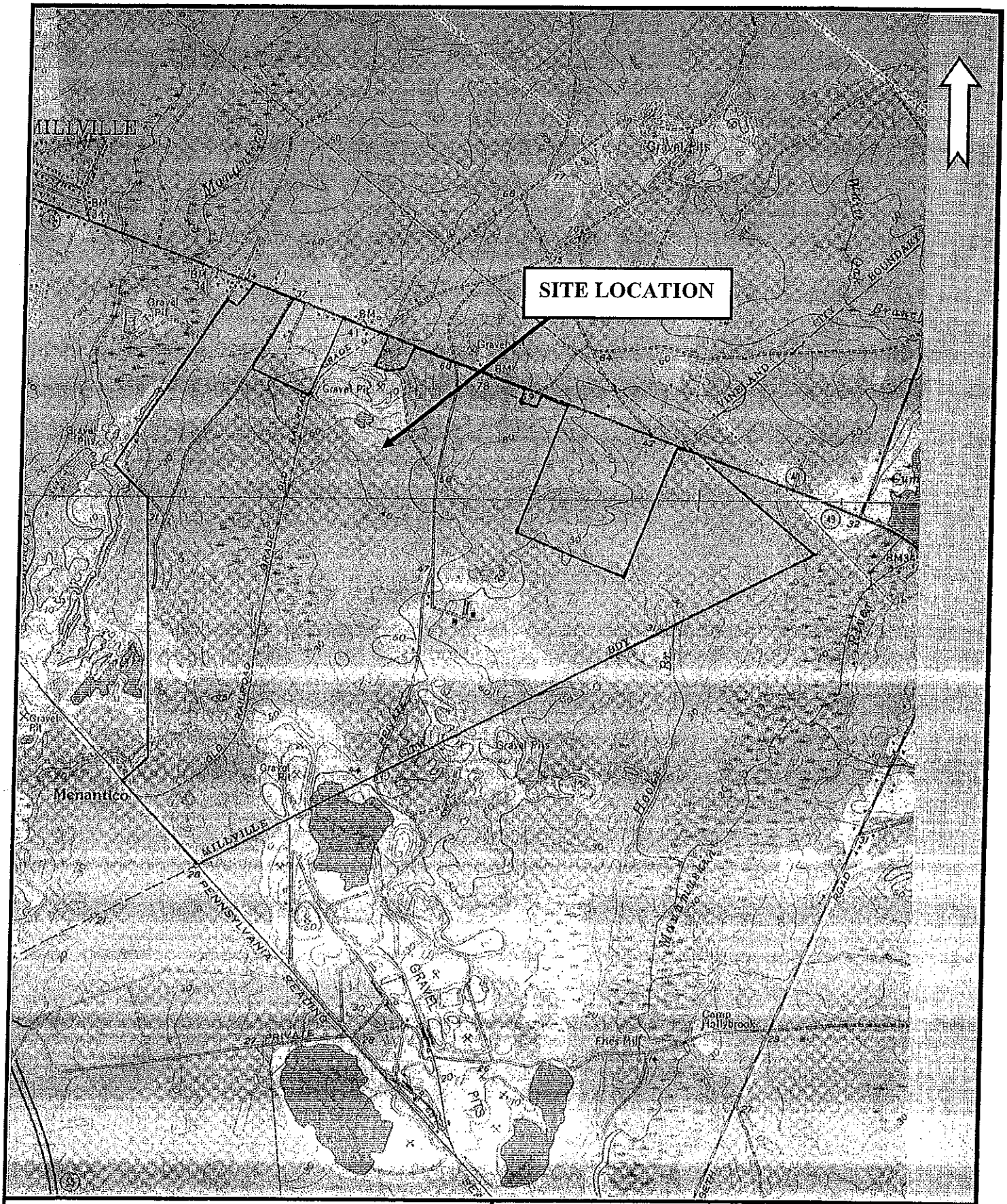
OFFICIAL TAX MAP

BASE MAP TAKEN FROM CUMBERLAND COUNTY TAX MAP
SHEET 66
CITY OF MILLVILLE, CUMBERLAND COUNTY, NEW JERSEY



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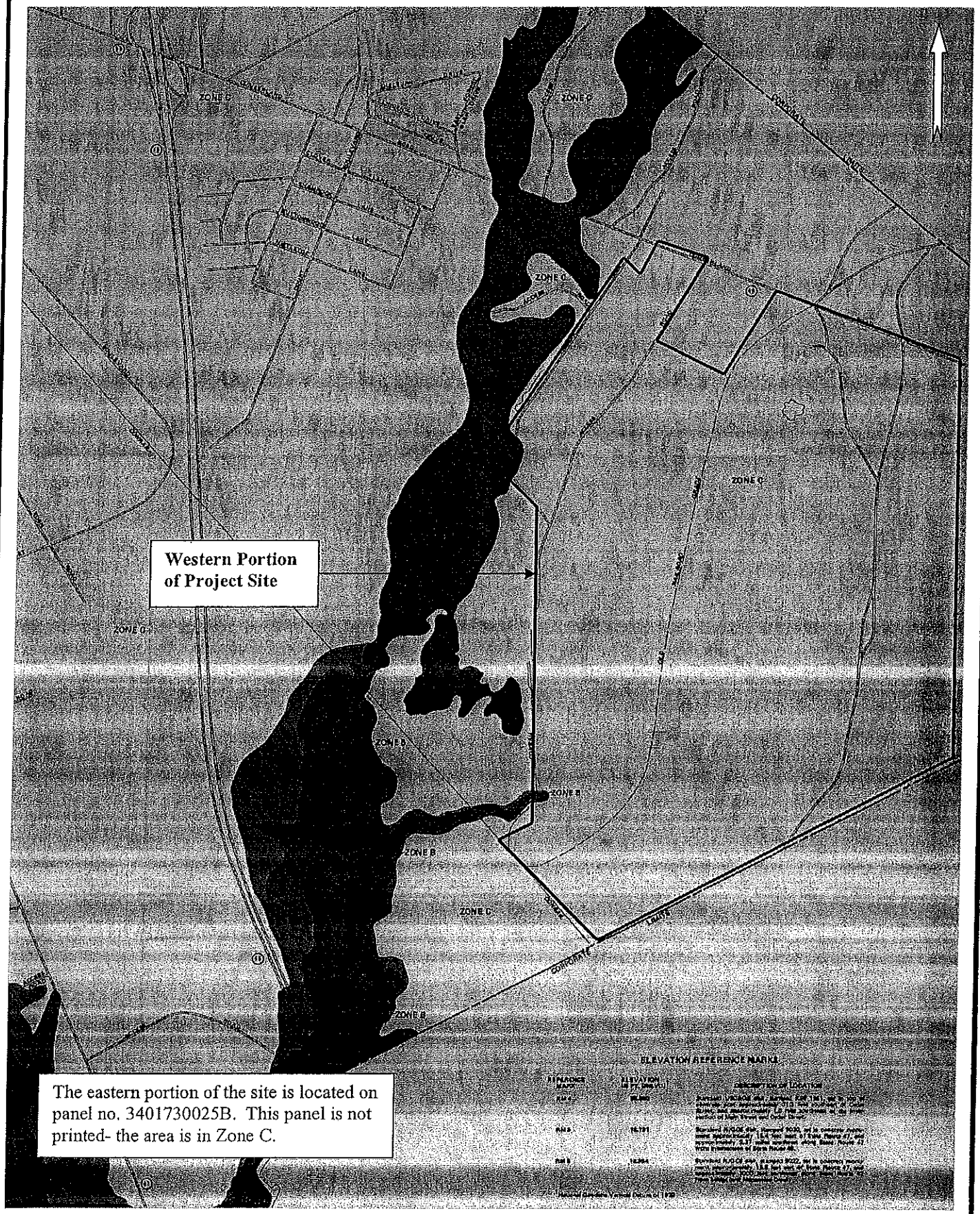
U.S.G.S. MAP

BASE MAP TAKEN FROM U.S.G.S. MAP OF NEW JERSEY
FIVE POINTS & PORT ELIZABETH, N.J. QUADRANGLES
SCALE 1" = 2,000'



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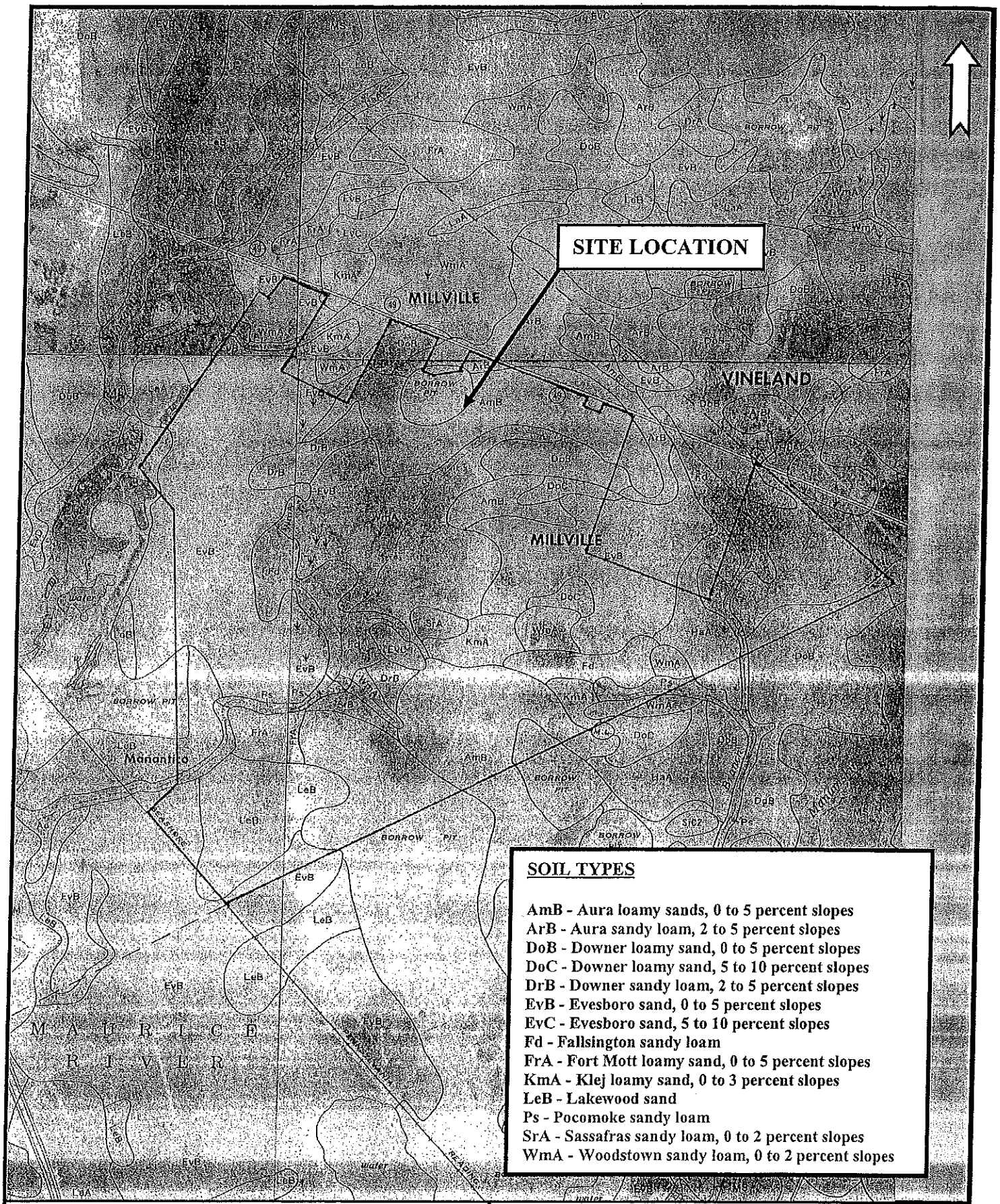
FLOOD INSURANCE MAP

BASE MAP TAKEN FROM FEMA FLOOD INSURANCE MAP
COMMUNITY PANEL NO. 3401730020B
CITY OF MILLVILLE, CUMBERLAND COUNTY, NEW JERSEY



SOIL TYPES

AmB - Aura loamy sands, 0 to 5 percent slopes
ArB - Aura sandy loam, 2 to 5 percent slopes
DoB - Downer loamy sand, 0 to 5 percent slopes
DoC - Downer loamy sand, 5 to 10 percent slopes
DrB - Downer sandy loam, 2 to 5 percent slopes
EvB - Evesboro sand, 0 to 5 percent slopes
EvC - Evesboro sand, 5 to 10 percent slopes
Fd - Fallsington sandy loam
FrA - Fort Mott loamy sand, 0 to 5 percent slopes
KmA - Klej loamy sand, 0 to 3 percent slopes
LeB - Lakewood sand
Ps - Pocomoke sandy loam
SrA - Sassafras sandy loam, 0 to 2 percent slopes
WmA - Woodstown sandy loam, 0 to 2 percent slopes

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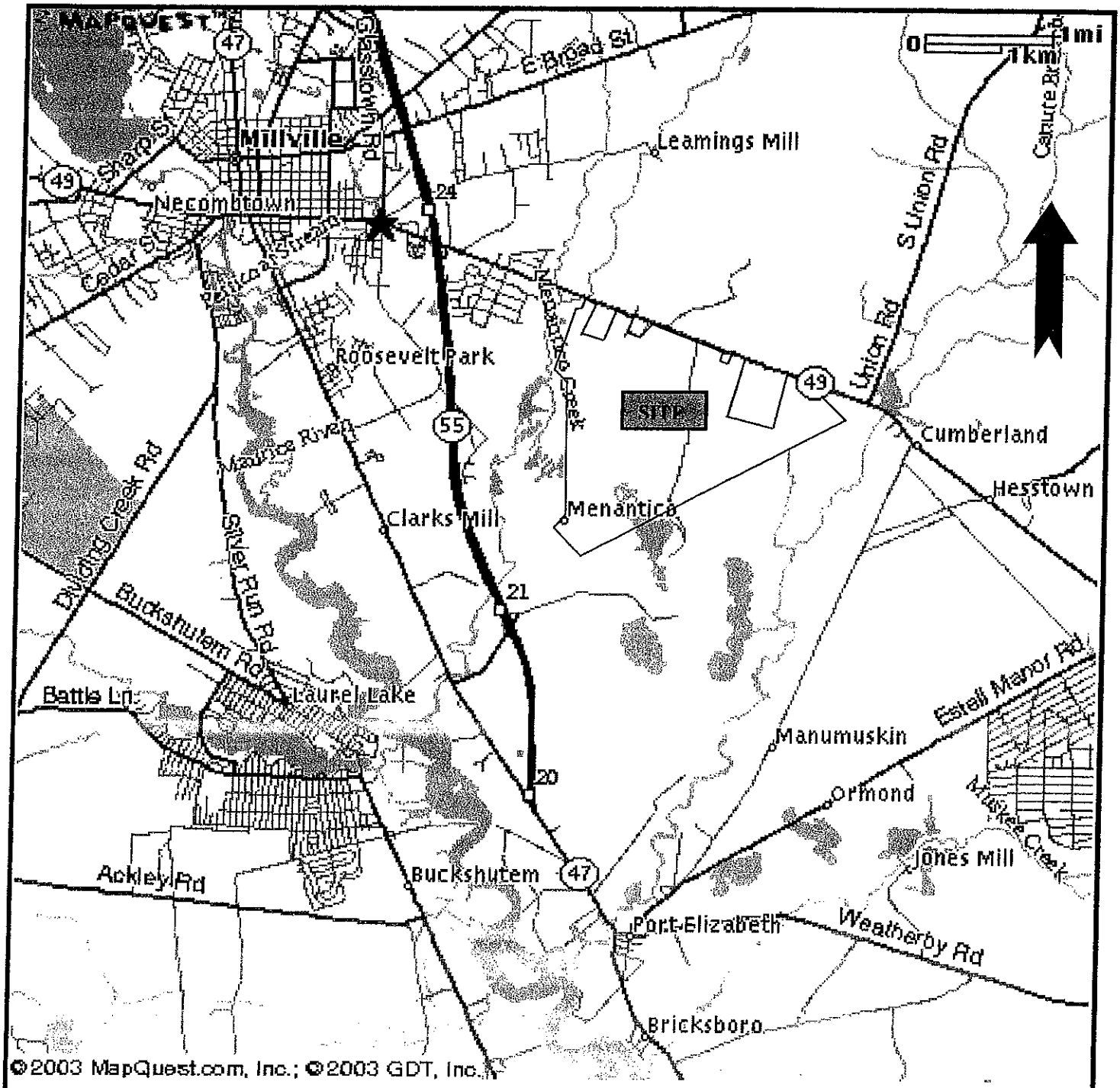
SOILS MAP

BASE MAP TAKEN FROM CUMBERLAND COUNTY SOIL SURVEY
SHEETS 19, 20, 26 & 27
CITY OF MILLVILLE, CUMBERLAND COUNTY, NEW JERSEY



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ROAD MAP

BASE MAP TAKEN FROM MAPQUEST
CITY OF MILLVILLE, CUMBERLAND COUNTY, NEW JERSEY

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GEOLOGY MAP

BASE MAP TAKEN FROM BEDROCK GEOLOGICAL MAP OF
CENTRAL & SOUTHERN NEW JERSEY
SHEET 2
CITY OF MILLVILLE, CUMBERLAND COUNTY, NEW JERSEY

APPENDIX B

Plant species observed on site

Acer platanoides L. Norway Maple
Acer rubrum L. Red Maple
Achillea millefolium L. Common Yarrow
Agalinis purpurea (L.) Pennell Purple False Foxglove
Agrostis scabra Willd. Rough Bent
Aletris farinosa L. White Colicroot
Alnus serrulata (Ait.) Willd. Brookside Alder
Andropogon gerardii Vitman Big Bluestem
Andropogon virginicus L. Broom-Sedge
Anthoxanthum odoratum L. Large Sweet Vernal Grass
Arabidopsis thaliana (L.) Heynh. Thalecress
Aristida longispica Poir. Red Three-Awn
Aristida tuberculosa Nutt. Seaside Three-Awn
Aureolaria pedicularia (L.) Raf. Fern-Leaf Yellow False Foxglove
Bartonia virginica (L.) B.S.P. Yellow Screwstem
Betula nigra L. River Birch
Betula populifolia Marsh. Gray Birch
Bromus japonicus Thunb. Ex Murr. Japanese Brome
Bromus tectorum L. Cheat Grass
Calamagrostis coarctata (Torr.) Eat. Nuttall's Reed Grass
Carex lurida Wahlenb. Sallow Sedge
Carex pensylvanica Lam. Pennsylvania Sedge
Carex striata Michx. Walter's Sedge
Carya pallida (Ashe) Engl. & Graebn. Sand Hickory
Catalpa bignonioides Walt. Southern Catalpa
Centaurea biebersteinii DC. Spotted Knapweed
Chamaecyparis thyoides (L.) B.S.P. Atlantic White-Cedar
Chasmanthium laxum (L.) Yates Slender Wood-Oats
Chimaphila maculata (L.) Pursh Striped Prince's-Pine
Chionanthus virginicus L. White Fringetree
Chondrilla juncea L. Hogbite
Chrysopsis mariana (L.) Ell. Maryland Golden-Aster
Cirsium discolor (Muhl. Ex Willd.) Spreng. Field Thistle
Clethra alnifolia L. Coastal Sweet-Pepperbush
Comandra umbellata (L.) Nutt. Bastard-Toadflax

Desmodium strictum (Pursh) DC. Pine-Barren Tick-Trefoil
Dichanthelium clandestinum (L.) Gould Deer-Tongue Rosette Grass
Dichanthelium scoparium (Lam.) Gould Broom Rosette Grass
Digitaria cognata (J.A. Schultes) Pilger Carolina Crab Grass
Diodia teres Walt. Poorjoe
Diospyros virginiana L. Common Persimmon
Drosera intermedia Hayne Spoon-Leaf Sundew
Dulichium arundinaceum (L.) Britt. Three-Way Sedge
Echinochloa walteri (Pursh) Heller Long-Awn Cock's-Spur Grass
Elaeagnus umbellata Thunb. Autumn-Olive
Eleocharis acicularis (L.) Roemer & J.A. Schultes Needle Spike-Rush
Eleocharis microcarpa Torr. Small-Fruit Spike-Rush
Eleocharis olivacea Torr. Bright-Green Spike-Rush
Eleocharis tuberculosa (Michx.) Roemer & J.A. Schultes Cone-Cup Spike-Rush
Epigaea repens L. Trailing-Arbutus
Eragrostis spectabilis (Pursh) Steud. Petticoat-Climber
Eupatorium album L. White Thoroughwort
Eupatorium hyssopifolium L. Hyssop-Leaf Thoroughwort
Euphorbia cyparissias L. Cypress Spurge
Eurybia spectabilis (Ait.) Nesom Purple Wood-Aster
Euthamia caroliniana (L.) Greene ex Porter & Britt. Slender Goldentop
Euthamia graminifolia (L.) Greene Flat-Top Goldentop
Gaultheria procumbens L. Eastern Teaberry
Gaylussacia baccata (Wangenh.) K. Koch Black Huckleberry
Gaylussacia dumosa (Andr.) Torr. & Gray Dwarf Huckleberry
Gaylussacia frondosa (L.) Torr. & Gray ex Torr. Blue Huckleberry
Gratiola aurea Pursh Golden Hedge-Hyssop
Helianthemum canadense (L.) Michx. Long-Branch Frostweed
Helianthemum propinquum Bickn. Low Frostweed
Heteotheca subaxillaris (Lam.) Britt. & Rusby Camphorweed
Hieracium caespitosum Dumort. Meadow Hawkweed
Hudsonia ericoides L. Pine-Barren Golden-Heather
Hudsonia tomentosa Nutt. Sand Golden-Heather
Hypericum canadense L. Lesser Canadian St. John's-Wort
Hypericum gentianoides (L.) B.S.P. Orange-Grass
Hypericum hypericoides (L.) Crantz ssp. *multicaule* (Michx. Ex Willd.) Robson St. Andrews Cross
Hypoxis hirsuta (L.) Coville Eastern Yellow Star-Grass

Juncus scirpoides Lam. Needle-Pod Rush
Juncus tenuis Willd. Poverty Rush
Juniperus virginiana L. Eastern Red-Cedar
Kalmia angustifolia L. Sheep-Laurel
Kalmia latifolia L. Mountain-Laurel
Krigia virginica (L.) Willd. Virginia Dwarf-Dandelion
Lechea intermedia Leggett ex Britt. Round-Fruit Pinweed
Lechea mucronata Raf. Hairy Pinweed
Leersia oryzoides (L.) Sw. Rice Cut Grass
Lepidium campestre (L.) Ait. f. Cream-Anther Field Pepperwort
Lespdeza angustifolia (Pursh) Ell. Narrow-Leaf Bush-Clover
Lespedeza cuneata (Dum.-Cours.) G. Don Chinese Bush-Clover
Lespedeza procumbens Michx. Trailing Bush-Clover
Lespedeza virginica (L.) Britt. Slender Bush-Clover
Leucothoe racemosa (L.) Gray Swamp Doghobble
Liatris pilosa (Ait.) Willd. Shaggy Gayfeather
Liquidambar styraciflua L. Sweet-Gum
Lobelia nuttallii J.A. Schultes Nuttall's Lobelia
Lonicera japonica Thunb. Japanese Honeysuckle
Ludwigia palustris (L.) Ell. Marsh Primrose-Willow
Lycopodiella alopecuroides (L.) Cranfill Fox-Tail Club-Moss
Lyonia ligustrina (L.) DC. Maleberry
Lyonia mariana (L.) D. Don Piedmont Staggerbush
Magnolia virginiana L. Sweet-Bay
Malva neglecta Wallr. Dwarf Mallow
Medicago lupulina L. Black Medick
Melampyrum lineare Desr. American Cow-Wheat
Morella pensylvanica (Mirbel) Kartesz Northern Bayberry
Morus alba L. White Mulberry
Muhlenbergia uniflora (Muhl.) Fern. Bog Muhly
Nyssa sylvatica Marsh. Black Tupelo
Oenothera biennis L. King's-Cureall
Onoclea sensibilis L. Sensitive Fern
Opuntia humifusa (Raf.) Raf. Devil's-Tongue
Osmunda cinnamomea L. Cinnamon Fern
Osmunda regalis L. Royal Fern
Panicum dichotomiflorum Michx. Fall Panic Grass
Panicum rigidulum Bosc ex Nees Red-Top Panic Grass

Pinus echinata P. Mill. Short-Leaf Pine
Pinus rigida P. Mill. Pitch Pine
Pinus virginiana P. Mill. Virginia Pine
Polygonatum biflorum (Walt.) Ell. King Solomon's-Seal
Polygonella articulata (L.) Meisn. Coastal Jointweed
Polygonum punctatum Ell. Dotted Smartweed
Populus grandidentata Michx. Big-Tooth Aspen
Potentilla canadensis L. Dwarf Cinquefoil
Proserpinaca pectinata Lam. Comb-Leaf Mermaidweed
Prunus serotina Ehrh. Black Cherry
Pteridium aquilinum (L.) Kuhn Northern Bracken Fern
Quercus ×*saulii* Schneid. [*alba* × *prinus*]
Quercus alba L. Northern White Oak
Quercus coccinea Muenchh. Scarlet Oak
Quercus falcata Michx. Southern Red Oak
Quercus ilicifolia Wangenh. Bear Oak
Quercus marilandica Muenchh. Blackjack Oak
Quercus prinoides Willd. Dwarf Chinkapin Oak
Quercus prinus L. Chestnut Oak
Quercus rubra L. Northern Red Oak
Quercus stellata Wangenh. Post Oak
Quercus velutina Lam. Black Oak
Rhexia mariana L. Maryland Meadow-Beauty
Rhexia virginica L. Handsome-Harry
Rhododendron viscosum (L.) Torr. Clammy Azalea
Rhus copallinum L. Winged Sumac
Rhynchospora alba (L.) Vahl White Beak Sedge
Rhynchospora capitellata (Michx.) Vahl Brownish Beak Sedge
Rosa multiflora Thunb. Ex Murr. Rambler Rose
Rubus cuneifolius Pursh Sand Blackberry
Rubus flagellaris Willd. Whiplash Dewberry
Rubus hispidus L. Bristly Dewberry
Rumex acetosella L. Common Sheep Sorrel
Sambucus nigra L. ssp. *canadensis* (L.) R. Bolli Elderberry
Sassafras albidum (Nutt.) Nees Sassafras
Schizachyrium scoparium (Michx.) Nash Little False Bluestem
Schizachyrium scoparium (Michx.) Nash Little False Bluestem
Scirpus cyperinus (L.) Kunth Cottongrass Bulrush

Solidago odora Ait. Anise-Scented Goldenrod
Sorghastrum nutans (L.) Nash Yellow Indian Grass
Sparganium americanum Nutt. American Burr-Reed
Spiraea tomentosa L. Steeplebush
Strophostyles helvula (L.) Ell. Trailing Fuzzy-Bean
Symphyotrichum dumosum (L.) Nesom Rice Button American-Aster
Symphyotrichum lateriflorum (L.) A.& D. Löve Farewell-Summer
Symphyotrichum patens (Ait.) Nesom Late Purple American-Aster
Tephrosia virginiana (L.) Pers. Goat's-Rue
Tephrosia virginiana (L.) Pers. Goat's-Rue
Toxicodendron pubescens P. Mill. Atlantic Poison-Oak
Toxicodendron radicans (L.) Kuntze Eastern Poison-Ivy
Triadenum virginicum (L.) Raf. Virginia Marsh-St. John's-Wort
Tridens flavus (L.) A.S. Hitchc. Tall Redtop
Trifolium repens L. White Clover
Vaccinium angustifolium Ait. Late Lowbush Blueberry
Vaccinium corymbosum L. Highbush Blueberry
Vaccinium pallidum Ait. Early Lowbush Blueberry
Vaccinium pallidum Ait. Early Lowbush Blueberry
Verbascum thapsus L. Great Mullein
Viburnum dentatum L. Southern Arrow-Wood
Viola lanceolata L. Bog White Violet
Viola lanceolata L. Bog White Violet
Woodwardia virginica (L.) Sm. Virginia Chain Fern
Xyris difformis Chapman Bog Yellow-Eyed-Grass
Xyris torta Sm. Slender Yellow-Eyed-Grass

APPENDIX C

RAYMOND WALKER, Ph.D., P.W.S.

Director, Environmental Services

EDUCATION

Rutgers University, Ph.D., Ecology (Special Emphasis in Wetland Ecology), 1981
Manhattan College, B.S., Environmental Biology, 1974

HONORS SOCIETY/AWARDS

Sigma Xi
Department of the Army Official Commendation, Customer Care Award, December 22, 1986
Department of the Army Official Commendation, Special Act Award, May 12, 1987
Department of the Army Official Commendation, Special Act Award, December 3, 1987

PROFESSIONAL REGISTRATION & AFFILIATION

Society of Wetland Scientists - Professional Wetland Scientist (# 000639)
U.S. Army Corps of Engineers - Certified Corps Wetland Delineator (WDCP93MD100101B)

Dr. Walker has over 22 years experience in the field of environmental science with special emphasis in the areas of environmental impact analysis, resource evaluation, wetland delineation and mitigation. Dr. Walker also has special expertise in environmental permitting issues related to private development and public works projects. He acts as project manager for all environmental matters related to permitting and regulatory compliance on the local, state and federal levels for these projects.

Maser Consulting P.A., Director of Environmental Services, 1992 to Present. Environmental Scientist responsible for directing and supervising professional and administrative staff engaged in performing technical and regulatory tasks associated with environmental issues. This includes Phase I Site Assessments, Phase II Site Investigations, UST closures, wetland delineations, federal, state, and local permit applications, environmental impact statements, and environmental inventories including rare and endangered species inventories.

Najarian Associates, L.P., Director of Ecological Sciences Section., 1987-1992. Primary contact between industry, regulatory agencies and the engineering and research divisions at Najarian Associates, L.P. Supervised a small group of professional and administrative employees engaged in performing technical and regulatory tasks associated with wetland and ecological issues. This included wetland delineations, federal, state, and local permit applications, environmental impact statements, and environmental inventories including rare and endangered species inventories.

Army Corps of Engineers, Regulatory Branch, GS-12 Supervisory Biologist, 1986-1987. Surveillance and Enforcement Section. Supervised a small group (5-7) of professional, technical and administrative employees engaged in the investigation and review of work activities and structures affecting the navigable waters and wetlands within the District. Functions of the unit included ongoing surveillance within District boundaries; monitoring of specific projects; and enforcement of regulatory controls governing waters of the United States and

reference sources in order to determine specific capacities and characteristics of waters of the District and make recommendations concerning the necessity of exercising regulatory jurisdiction over them.

Trenton State College, Trenton, NJ and **Mercer County College**, West Windsor, NJ, 1982-1984. Adjunct Assistant Professor of Biology, Responsible for teaching undergraduate courses in the biological sciences.

Rider College, Adjunct Assistant Professor of Biology, 1980-1982. Responsible for teaching undergraduate courses in the ecobotanical sciences, performing administrative duties, supervising and advising undergraduate research projects, and conducting original research projects in the field of wetland ecology.

Rutgers University, Graduate Research Assistant, 1979-1980. Responsible for supervising and conducting a research project on the ability of freshwater tidal wetlands to assimilate pollutants from nonpoint source surface runoff. Duties included project design, data collection and analysis, summary report preparation, and oral and written presentation of results.

Rutgers University, Graduate Research Teaching Assistant, 1977-1979. Responsible for teaching general biology laboratories to undergraduate students and conducting a literature review on the effects of nonpoint source pollution on ground water supplies in the Pine Barrens of New Jersey.

RELEVANT EXPERIENCE

Pine Hill Golf Club, Borough of Pine Hill, Camden County, New Jersey. Dr Walker served as the environmental consultant for Bergstol Enterprises and the Borough of Pine Hill in securing an Individual Freshwater Wetlands permit from the NJDEP to construct an 18 hole golf course. This included services related to delineating wetlands, protection/enhancement of the only trout production water in southern New Jersey, protection of Federally threatened Swamp pink, the identification and protection of archaeological sites, and the development and implementation of a wetlands mitigation plan.

Newton's Landing Residential Development, Delanco, Burlington County, New Jersey. Dr. Walker served as the environmental consultant for the Pennington Westrum Group in securing environmental approvals for the development of an aged restricted residential development adjacent to the Rancocas River. This included services related to the delineation of wetlands, securing a Waterfront Development Permit from the NJDEP, and securing approvals from the U.S. Army Corps of Engineers.

Oxy USA, Inc. Site, South Brunswick Township, Middlesex County, New Jersey. Dr. Walker served as environmental consultant to Oxy USA, Inc. in remediating the former Mapico Iron Oxide Plant site. This included work associated with delineating wetlands, preparation of Site Investigation documents, Remedial

Cherry Valley Country Club, Montgomery Township, Somerset County, NJ. (600+ acres) Since 1988, Dr. Walker has served as the environmental consultant for Cherry Valley Country Club. This has included services related to delineating wetlands, securing a Letter of Interpretation, securing regulatory approvals for wetland encroachments, and developing wetland mitigation plans for wetland encroachments.

AT&T Overseas Transmission Site, Lawrence & Hopewell Township, Mercer County, NJ. Dr. Walker was responsible for delineating wetlands, securing a Letter of Interpretation and performing threatened and endangered species studies for this 800 ± acre tract of land which was recently purchased by Mercer County.

Bromley at Burlington, Burlington Township, Burlington County, New Jersey. Dr. Walker served as the environmental consultant for J.S. Hovnanian & Sons, Inc. for their 500± acre mixed use development in Burlington Township, NJ. This included services related to delineating wetlands, safeguarding wetland approvals, securing new wetland approvals including an Individual Freshwater Wetlands Permit for an access road, and designing wetland mitigation plans.

The Hills Development Company and New Jersey National Golf Club, Bernards and Bedminster Townships, Somerset County, NJ. Dr. Walker served as the environmental consultant for The Hills Development, a 1200± acre residential development in Bernards and Bedminster Townships. This included services related to delineating wetlands, securing various Letters of Interpretation and securing numerous federal and state wetland permits for the construction of the community. An 18 hole golf course known as New Jersey National Golf Club, was located within the residential community. Dr. Walker provided services to Bergstol Enterprises associated with obtaining the necessary wetland approvals for the construction of the golf course.

Entron, Marlboro Township, Monmouth County, New Jersey. Dr. Walker served as environmental consultant to the Township of Marlboro in remediating a contaminated property under the NJDEP's Hazardous Discharge and Site Remediation Fund Program (HDSRF). This included work associated with the preparation of Site Investigation documents, Remedial Action Reports, and Remedial Action Work Plans.

LaMer Residential Development, Borough of Sayreville, Middlesex County, New Jersey. Dr. Walker served as the environmental consultant for Kaplan Companies in resolving an alleged violation of the Federal Clean Water Act and the New Jersey Freshwater Wetlands Protection Act. This included services associated with designing a wetlands restoration plan for a 15 acre site, overseeing the construction of wetlands at the site, and monitoring the success of the project.

SEMINARS/LECTURES

Government Institutes, Inc. Wetlands and Real Estate Development Course, Philadelphia, PA; "Army Corps of Engineers' Role in Wetlands Regulation," Guest Lecturer, 3/91.

New York State Wetland Seminar Series held in Buffalo, Syracuse and Albany; "Wetlands and Development in New York State,.", Guest Lecturer, 2/91.

New Jersey State Bar Association's Wetland Roundtable, New Brunswick, NJ, Guest Panelist, 11/90.

Rutgers University's Graduate Course "Studies-Wetland Communities and Ecosystems"; "Practical Applications of Wetland Ecology," Guest Lecturer, 10/90.

Guest Lecturer for **Seminar Sponsored by Gloria Nilson Realtors**, Monmouth Beach, NJ entitled "Wetlands and Real Estate Transactions," Guest Lecturer, 8/90.

Guest Lecturer for **Rutgers University's Continuing Education Program "Introduction to Wetland Ecology"**; "Freshwater Marshes," Guest Lecturer, 5/90.

EXPERT WITNESS SERVICES

Army Corps of Engineers, Philadelphia District Regulatory Branch; Philadelphia, PA.

Office of the U.S. Attorney, Federal Building, Suite 309, P.O. Box 309; Scranton, PA.

Pitney, Hardin, Kipp & Szuch, 200 Campus Drive; Florham Park, NJ.

Giordano, Halleran & Ciesla, 270 State Highway 35; Middletown, NJ.

Collier, Jacob & Sweet, 580 Howard Avenue, Corporate Park III; Somerset, NJ.

Jamieson, Moore, Peskin & Spicer, 300 Alexander Road, CN5276; Princeton, NJ.

Carella, Byrne, Bain, Gilfillan, Cecchi & Stewart, 6 Becker Farm Road; Roseland, NJ.

Greenbaum, Rowe, Smith, Ravin, Davis & Himmel, Metro Corporate Campus One, P.O. Box 5600, Woodbridge;

Scarinci & Hollenbeck, 500 Plaza Drive, P.O. Box 3189, Secaucus, N.J. 07096-3189

EXPERT TESTIMONY VENUES

Federal District Courts in Camden and Trenton, NJ

NJ Law Division in Camden, NJ

NJ Office of Administrative Law; Hamilton Township, NJ

Numerous Planning/Zoning Boards in NJ.

PUBLICATIONS

Endo, M., K. Nakanishi, U. Naf, W. McKeon and R. Walker. 1972. **Isolation of the antheridiogen of** *Anemia phyllitidis*. Physiol. Plant. 26:183-185.

Simpson, R.L., D.F. Whigham and R. Walker. 1978. **Seasonal patterns of nutrient movement in a freshwater tidal marsh**. In: R.E. Good, D.F. Whigham and R.L. Simpson (eds.) Freshwater Wetlands: Ecological Processes and Management Potential. Academic Press, NY.

Merrill, L.G., G.A. Bares, R. Walker, E. Russell, P.A. Buckley, N.P. Psuty, B. Liggett, R. Regensburg, C. Mizobe, F.P. McManamon, M. Bartlett and S. Berg. 1978. **A Plan for the Pinelands National Preserve**. Center for Coastal and Environmental Studies Tech. Report No. 78-6, Rutgers University, 110 pp.

Douglas, L.A. and R. Walker. 1979. **Nonpoint sources of pollution and the soils of the Pine Barrens of New Jersey**. Dept. Soils and Crops, N.J. Agricultural Experimental Sta., Rutgers University, New Brunswick, New Jersey.

Simpson, R.L., R.E. Good, R. Walker and B. Frasco. 1981. **Dynamics of nitrogen, phosphorus and heavy metals in Delaware River freshwater tidal wetlands**. Center for Coastal and Environmental Studies, Rutgers University, New Brunswick, New Jersey and the United States Environmental Protection Agency, Corvalis, Oregon.

Ferren, W.R., R.E. Good, R. Walker and J. Arsenault. 1981. **Vegetation and flora of Hog Island, a brackish**

Frasco, B., R.E. Good and R. Walker, 1978. **Biomass and decomposition for 3 macrophytes from a brackish and saltwater tidal marsh in New Jersey.** Amer. Assoc. Adv. Sci. Publ. 78-2, p. 123.

Walker, R. and R.E. Good. 1979. **Seasonal nitrogen dynamics for *Peltandra virginica* in a freshwater tidal marsh**. Bull. N.J. Acad. Sci. 29:81.

Walker, R., R.E. Good and R.L. Simpson. 1980. **Heavy metals in freshwater wetlands**. 14th Middle Atlantic Regional Meeting of the American Chemical Society, p. 77.

Simpson, R.L., R.E. Good, R. Walker and J.J. Pasquale. 1981. **Patterns of heavy metal distribution in several compartments of a freshwater tidal marsh**. Estuaries 4:271.

Walker, R. and R.E. Good. 1981. **Nitrogen, phosphorus and primary production of *Peltrandra virginica* (L.)Kunth in a freshwater tidal marsh**. Bull. Ecol. Soc. Amer. 62:93.

BARBARA EDELHAUSER

Environmental Scientist

EDUCATION

Ocean County College, A.A., Liberal Arts, 1993
Richard Stockton College of New Jersey College, B.S. with Program Distinction, Environmental Studies, 1996
Georgian Court University, Enrolled in M.S. Biology Program

PROFESSIONAL SOCIETIES

North American Benthological Society
Barnegat Bay Watershed and Estuary Foundation

EXPERIENCE

Ms. Edelhauser has expertise in environmental sciences with emphasis on environmental impact analyses for coastal and inland projects, vegetation surveys, wetlands delineation, baseline ecological evaluations for contaminated sites, essential fish habitat assessment, integrated pest management plans for golf courses, nitrate dilution modeling, Pinelands Buffer Delineation modeling, the preparation of mitigation plans/reports, freshwater wetlands and coastal permitting, including New Jersey Department of Environmental Protection, Department of the Army and Tidelands approvals.

Environmental Impact Analyses

Prepare environmental impact statements for numerous projects, including residential subdivisions, commercial and public developments, as well as Executive Order 215 Environmental Assessments for school projects. These environmental impact analyses include the preparation of narratives describing the following environmental features: geology, soils, landforms, groundwater and surface water hydrology, aquifers and aquifer recharge potential, biological characteristics, such as wildlife, vegetation, endangered and threatened species, parks and recreational facilities, historical and archaeological resources

Ecological Risk Assessment

Conducted Baseline Ecological Evaluations for several industrial sites and former farm/orchard sites. This included wildlife and plant inventories, plant cover mapping and evaluation of contamination onsite in terms of toxicological benchmarks for wildlife.

Environmental Permitting

Prepared numerous permit applications for private residential, commercial, and industrial projects to the following agencies: New Jersey Department of Environmental Protection (Land Use Regulation Program), US Army Corps of Engineers, New Jersey Pinelands Commission and the Bureau of Tidelands. Permits applied for include: Department of the Army Permits, CAFRA Permits, Waterfront Development Permits, Statewide General Permits, Individual Freshwater Wetlands Permits, Transition Area Averaging Plans and Tidelands Conveyances.

Integrated Pest Management Plan

Prepared Integrated Pest Management Plans as a permit condition for golf courses to be constructed on environmentally sensitive sites.

/etland Delineation

Involved in the identification and delineation of wetlands (over 400 acres) in New Jersey. A variety of wetland types were delineated in the Coastal Plain and Piedmont regions of New Jersey, including Palustrine Freshwater Wetlands, Tidal Freshwater Wetlands and Tidal Saltmarshes.

Nitrate Dilution Modeling

Determined golf course area required to meet Pinelands water quality standards based on types and amounts of fertilizer used on an existing golf course in the Pinelands using the Pinelands Nitrate Dilution Model. Also used the model to assess the impacts of fertilization to trout-producing waters on a proposed golf course site.

Essential Fish Habitat Assessment

Assessed essential fish habitat (as required by the 1996 Sustainable Fisheries Act amendments to the Magnuson-Stevens Fishery Conservation and Management Act) for a Department of the Army Permit for a dredging project in a Municipal Harbor and the Bayshore Trail in the Borough of Atlantic Highlands. Habitat for the following species was assessed: red hake, winter flounder, windowpane flounder, Atlantic sea herring, bluefish, Atlantic butterfish, Atlantic mackerel, summer flounder, scup, black sea bass, king mackerel, Spanish mackerel, cobia, dusky shark and sandbar shark.

Environmental Phase I Assessment

Conducted several Phase I field investigations and associated research for Phase I Assessment reports for presently undeveloped properties.

/etlands Mitigation/Restoration

Assisted in preparation of Wetland Mitigation Plans and Reports for coastal wetlands mitigation sites. Assisted with thalweg and stream cross-section survey for stream restoration project. Prepared conceptual streambank bioengineering details for future tidal creek restoration project.

Continuing Education

- *Fundamentals of Ecosystem Ecology,* Winter 2004, Institute for Ecosystem Studies, Millbrook, NY
- Graduate level courses in *Estuarine Ecology, Evolution and Systematics, Environment and Ecology of New Jersey, Conservation Ecology, Seashore Ornithology,* Fall 2001-Summer 2003, Georgian Court College
- *Practical Field Ecology*, Summer 2004, Rutgers University, Camden, NJ
- *Ecological Risk Assessment Course,* March 2000, Cook College, Continuing Professional Education Program
- *Wetland Delineation Course*, June 1999, Cook College, Continuing Professional Education Program
- *Volunteer Monitoring of Lakes and Ponds*, September 1998, Cook College, Continuing Professional Education Program
- *Stream Restoration Workshop,* November, 1998, sponsored by NJ State Council of Trout Unlimited, North Jersey R C & D Council, NJ Division of Fish Game & Wildlife, USDA-NRCS & others
- *Introduction to Aquatic Entomology for Stream Health*, September 1998, Cook College, Continuing Professional Education Program
- *Grasses, Sedges and Rushes,* September 1998, Cook College, Continuing Professional Education Program
- *Planning Hydrology for Constructed Wetlands,* March 1998, Cook College, Continuing Professional Education Program

WILLIAM OLSON

Environmental Scientist

EDUCATION

Keystone Junior College, A.A., Biology, 1977
Slippery Rock State College, B.S., Biology, 1979
Rutgers University, Camden Campus. Have finished course work in Master's degree program in Biology (Plant Ecology).

PROFESSIONAL SOCIETIES

Philadelphia Botanical Club (Life Member)
Torrey Botanical Club
New England Botanical Club
Long Island Botanical Club
Southern Appalachian Botanical Club
American Fern Society
American Bryological and Lichenological Society
New Jersey Native Plant Society
Brandwein Institute (Fellow)
Natural Areas Association
Society of Ecological Restoration
The Nature Conservancy
New Jersey Audubon Society
National Audubon Society
American Littoral Society

Mr. Olson has expertise in environmental sciences with emphasis on threatened and endangered species, wetland delineation, wetland evaluation, wetland mitigation, natural resource evaluations and environmental impact analysis. Mr. Olson is trained in field botany and wetland ecology with an emphasis on the identification, cataloging, mapping, monitoring and management of native flora and natural plant communities. He has a background in identification of difficult plant groups (vascular and nonvascular), rare plant and animal searches, plant identification workshops and native flora field trips.

Rare and Endangered Species

Mr. Olson has conducted field investigations to determine presence or absence of rare and endangered species for numerous projects. He has accomplished contract field surveys for the Commonwealth of Pennsylvania's Wild Resource Conservation Fund project, the Federal Government (National Park Service), and The Nature Conservancy. Species investigated include: Swamp Pink (*Helonias bullata*), Knieskern's Beaked Rush (*Rhynchospora knieskernii*), Bog Asphodel (*Narthecium americanum*), American Chaffseed (*Schwalbea americana*), Sensitive Joint-Vetch (*Aeschynomene virginica*), Curly Grass Fern (*Schizaea pusilla*), Mud Sedge (*Carex limosa*), Oakes Pondweed (*Potamogeton oakesianus*), Robbins Pondweed (*Potamogeton robbinsii*), Bog Turtle (*Clemmys muhlenbergi*), Pine Snake (*Pituophis melanoleucus*), Pine Barrens Treefrog (*Hyla andersoni*), Great Blue Heron (*Ardea herodias*), Red-shouldered Hawk (*Buteo lineatus*), Bald Eagle (*Haliaeetus leucocephalus*), Barred Owl (*Strix varia*), Grasshopper Sparrow (*Ammodramus savannarum*) and Savannah Sparrow (*Passerculus sandwichensis*). In addition, non-vascular plants species have been investigated such as: *Sphagnum angustifolium, S. austinii, S. carolinianum, S. cyclophyllum, S. fuscum, S. macrophyllum, S. perichaetiale, S. portoricense, S. riparium, S. squarrosum, S. strictum, S. tenellum* and *S. warnstorfii.*

Wetland Delineation and Assessment

Responsible for ecological work dealing with wetlands, including delineation, assessment, restoration and mitigation. Wetland delineation projects involve field delineation, data collection, technical writing, production of wetland report, and submittal to various regulatory agencies. Other responsibilities include field investigations and technical writing for environmental impact statements, natural resource inventories, rare plant and animal searches and native flora research projects.

Permit Applications

Prepared numerous permit applications for private residential, commercial, and industrial projects to the following agencies: U.S. Army Corps of Engineers, New Jersey Department of Environmental Protection and Energy (Land Use Regulation Program), New Jersey Pinelands Commission, and New York Department of Environmental Conservation. Permits applied for include individual and Nationwide Permits, Statewide Permits, and Transition Area Averaging Plans.

Environmental Impact Assessments

Prepared the ecological sections of numerous environmental impact statements and assessments for a wide variety of projects.

Environmental Education

Has been involved in numerous seminars, workshops, slide presentations, etc. dealing with environmental topics such as plant identification, wetland community types, as well as other ecological and botanical subjects.

Herbarium Development

Have developed of a vascular plant, lichen and bryophyte herbarium collection associated with the Rutgers Creek Wildlife Conservancy, part of the Brandwein Institute in Orange County, New York. This work involves the collection, identification, documentation, pressing, mounting, and curation of the specimens.

ADDITIONAL EXPERIENCE

Conducted floristic inventory of vascular plant species historically, as well as presently, found at Bennett Bogs Preserve, a Coastal Plain intermittent pond community, located in Cape May County, New Jersey.

Conducting plant and ecological community inventories for a 337-acre site in Cape May County, and a 90-acre site and 182-acre site in Sussex County, New Jersey for the New Jersey Chapter of The Nature Conservancy.

PUBLICATIONS

Olson, William. 1992. The Flora of Bennett Bogs Preserve: Past and Present. Bartonia No. 57: 75-81.