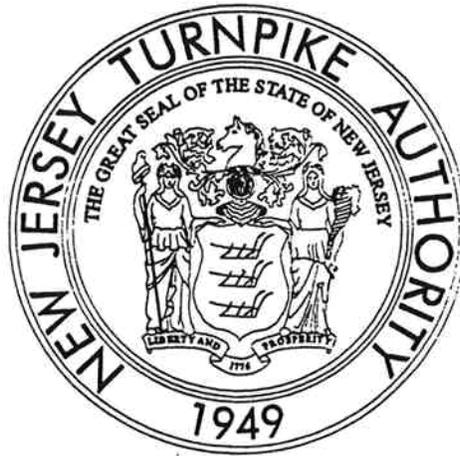


Appendix G
Excerpt from Conceptual Wetland
Mitigation Plan

PRELIMINARY

CONCEPTUAL WETLAND MITIGATION PLAN



DECEMBER 6, 1996

Submitted to:
New Jersey Department of Environmental Protection

Submitted by:
New Jersey Turnpike Authority
New Brunswick, New Jersey

Prepared by:
Frederic R. Harris, Inc.
Consulting Engineers

In association with:
Amy S. Greene Environmental Consultants, Inc.
Medina Consultants, P.C.
Gary J. Pierce, Ph.D.



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EXECUTIVE SUMMARY

This report presents the Conceptual Wetland Mitigation Plan for the proposed Route 92 project in Middlesex County. A compensatory mitigation plan will be required as a condition of the Freshwater Wetlands Individual Permit for the roadway project, if approved by the NJDEP. As presented in the Individual Permit application submitted to the NJDEP, the project is expected to result in the permanent disturbance of 32.90 acres of wetlands, of which 1.90 acres of impact would be to ordinary resource value, emergent wetlands. Another 0.85 acres of impact would occur to State open waters. The impacted forested, scrub/shrub, and emergent wetlands located within the Route 92 right-of-way are components of extensive forested wetland systems and wetlands associated with agricultural lands and roadway drainage. The majority of the impacted wetlands are located in the watershed of Devil's Brook. Lesser amounts of disturbed wetlands are located in the Shallow Brook and Heathcote Brook watersheds.

The NJDEP typically requires 2:1 mitigation, on an acreage basis for the creation of wetlands, for impacts to wetlands and 1:1 replacement for impacts to State open waters (N.J.A.C. 7:7A-14.2). We are proposing 1:1 replacement for the impacts to State open waters and ordinary resource value wetlands. Since the wetlands to be created will be intermediate resource value, they would be of higher value than the ordinary resource value wetlands that would be impacted. The remainder of the impacted wetlands will be replaced by in-kind wetland creation at a 2:1 ratio. At these ratios, the total mitigation requirement would be 64.75 acres.

Two sites, the Northern Mitigation Site (north of Friendship Road and Route 92) and the Southern Site (south of Friendship Road) have been selected for wetland creation. The replacement wetlands will be primarily located in the Devil's Brook watershed, with a small portion in the Shallow Brook watershed. The mitigation plan proposes the creation of 57.19 acres of wetlands, including 36.75 acres of forested wetlands, 8.20 acres of scrub/shrub, and 12.24 acres of emergent and wet meadow; and 0.85 acres of open waters. The proposed wetland creation plan falls short of the total mitigation requirement by 6.71 acres. As compensation for this balance, preservation of existing forested lands in the vicinity of Friendship Road and Miller Road is proposed.

1. INTRODUCTION

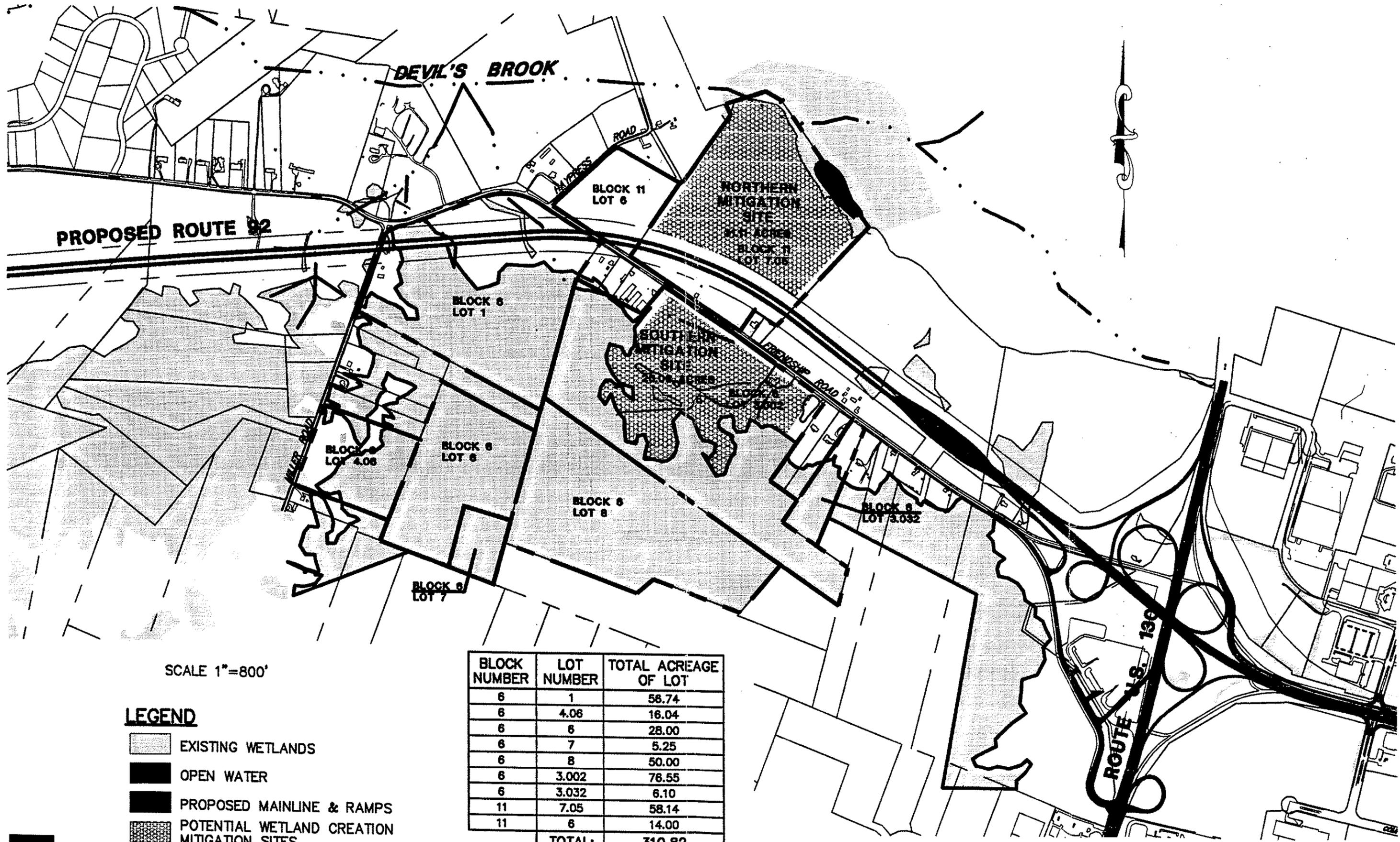
The New Jersey Turnpike Authority (NJTA) proposes the construction of a new, 6.7 mile, limited access highway (Route 92) that will serve as an east-west transportation connection for Route US 1 in South Brunswick Township and the New Jersey Turnpike at Interchange 8A. The proposed project also includes improvements to existing local roadways at interchanges with Route 92.

Wetlands were delineated within the project area. The location and extent of the wetlands are being verified by the NJDEP in a Letter of Interpretation (File #1200-95-0001.1, pending). Wetlands in the proposed mitigation areas have been delineated and surveyed, but not confirmed by NJDEP. An addendum to the LOI for the right-of-way will be submitted to include these wetlands.

The proposed Route 92 project is expected to result in 21.73 acres of impact to forested wetlands, 4.10 acres of impact to scrub/shrub wetlands, and 7.07 acres of impact to emergent wetlands associated with the proposed project (F. R. Harris, Freshwater Wetlands Individual Permit Application, September 1996). The total wetlands disturbance would be 32.90 acres. Of these impacts, 1.90 acres would be to ordinary resource value wetlands. The remaining wetlands impacted would be intermediate resource value. There would also be 0.85 acres of State open waters impacted.

The impacts to intermediate resource value wetlands will be mitigated at a ratio of 2:1, on an acreage basis for the creation of wetlands, as required by the NJDEP (N.J.A.C. 7:7A-14.2(a)2i). Impacts to ordinary resource value wetlands will be mitigated at a ratio of 1:1 because intermediate resource value wetlands that are considered to be of higher ecological value will be created as replacement. A 1:1 ratio will also be utilized for the State open water mitigation. Therefore, a total of 63.90 acres of intermediate resource value wetlands and 0.85 acres of State open water would be necessary as mitigation for the 32.90 acres of impacted wetlands and 0.85 acres of State open water associated with the proposed Route 92 project.

This mitigation plan was prepared to address mitigation requirements of the Individual Freshwater Wetlands Permit (currently under NJDEP review) should it be approved. The NJTA recently acquired approximately 310 acres of land encompassing 9 lots near the Friendship Road/Miller Road area of the Route 92 right-of-way. These lots were investigated for their wetland mitigation potential (Figure 1). Three of these lots: Block 6, Lot 6 (28 acres); Block



ROUTE 92 WETLAND MITIGATION SITE VICINITY MAP

Figure 1

DATE: 11/17/99
 PROJECT: NAME
 50' 0"
 WET.
 WDF
 ION:



6, Lot 7 (5.25 acres); and Block 6, Lot 8 (50 acres) were deemed unsuitable for wetlands mitigation because they consist entirely of forested wetlands. Block 6, Lot 3.032 (6.10 acres) was deemed unsuitable for mitigation because most of this site is existing forested wetland. This site does include a small upland area; however, it is less than two acres and located between, and close to, two existing residences. Block 6, Lot 4.06 (16.04 acres) was deemed unsuitable for mitigation because most of this site is existing forested wetlands. There is approximately 4-6 acres of upland on this site; however, it is all forested and, as such, not suitable for wetland construction. Block 11, Lot 6 (14 acres) was deemed unsuitable for wetland mitigation due to groundwater constraints. Block 6, Lot 1 (56.74 acres) was deemed unsuitable for mitigation because most of it is either existing forested wetland or within the proposed Route 92 ROW. A small portion of this site consists of uplands outside of the ROW; however, this area is located between proposed Route 92 and Friendship Road and is too small to warrant construction of an individual mitigation site. Finally, Block 11, Lot 7.05 (58.14 acres) and Block 6, Lot 3.002 (76.55 acres) have been deemed suitable for wetland mitigation via creation. They both consist of large tracts of upland field or farmland, are adjacent to major existing wetland complexes and are of significant acreage to justify wetlands construction. In summary, of these nine NJTA sites investigated, two exhibit suitable conditions for wetlands creation.

The proposed Route 92 Northern Mitigation Site (Northern Site) is located north of Friendship Road and East of Haypress Road in South Brunswick Township. The proposed Route 92 Southern Mitigation Site (Southern Site) is located to the south of Friendship Road and the Northern Site (Figure 1). The NJTA proposes to construct 57.19 acres of wetlands and 0.85 acres of State open water within the mitigation sites. These sites maximize the use of suitable upland areas for wetland creation. A transition area of at least 50 feet is proposed around the perimeters of the created wetland areas. The wetland creation areas will be connected to wetlands in the Devil's Brook/Shallow Brook system. The Devil's Brook/Shallow Brook watershed contains the majority of the wetland impacts associated with the proposed project.

The proposed wetland creation plan falls short of the total mitigation requirement by 6.71 acres. As compensation for this balance, preservation of existing forested lands in the vicinity of Friendship Road and Miller Road is proposed. Of the 310 acres owned by the NJTA in the Friendship Road/Miller Road area, approximately 178 acres of forest could be preserved as part of the mitigation plan. These forests include areas of upland and wetland on Block 6; portions of

Lots 1 and 3.002, and entire Lots 4.06, 6, 7 and 8 (Figure 1). The preservation of 178 acres of woodland at a 25:1 mitigation ratio would provide for the approximately 7 acres of mitigation deficient from the proposed creation of 63.90 acres of wetlands. Therefore, creation and preservation components could provide the total amount of mitigation for the proposed Route 92 project.

The proposed wetland mitigation sites (portions of Block 11, Lot 7.05 and Block 6, Lot 3.002) are currently owned by the NJTA. A portion of Block 11, Lot 7.05 will be designated as the Route 92 right-of-way, while the remaining portion of the site to the north of the right-of-way will be designated as a wetlands mitigation area. It is currently undetermined whether the mitigation wetlands will remain in NJTA ownership post-construction. The NJTA will work with the NJDEP such that a mutually agreeable arrangement is reached regarding ownership of the properties.

2. MITIGATION GOALS

The constructed wetlands will be of intermediate resource value and will replace disturbed wetlands of intermediate and ordinary resource value. The primary functions of the wetlands to be impacted by the project are flood storage, nutrient removal, and sediment retention (Frederic R. Harris, Inc. Freshwater Wetlands Individual Permit application, Sept. 1996). The functions that will be provided by the created wetlands include sediment/toxicant retention, nutrient removal, and wildlife habitat. The created wetlands have been designed to incorporate certain features to provide the indicated functions.

Both wetland creation sites will be designed to provide sediment/toxicant retention and nutrient removal. The sites will have areas of permanently impounded water and low flow velocity due to the relatively flat grade proposed in the wetlands. A low berm will partially separate the created wetlands from the existing wetlands at the lower end of each site to retard water movement and enhance the time for nutrient uptake. A diversity of persistent vegetation is proposed on each site to optimize nutrient removal.

A small area in the northwestern corner of the Southern Mitigation Site is located within the 100-year floodplain of a tributary of Devil's Brook (FEMA, Flood Boundary and Floodway Map, 1985). The Northern Site is located just outside of the 100-year floodplain of Devil's Brook (See Existing Site Conditions Plans). The floodplain boundary is nearly coincident with the limit of existing wetlands on the Northern Site. Therefore, the proposed wetlands are not designed to store floodwaters. However, since they will be

located in a topographic depression and berms and deeper depressions within the wetlands will retain stormwater runoff, the wetlands will function to slowly release stormwater to the surrounding, existing wetlands.

The existing wetlands located in the vicinity of the proposed Route 92 crossing of Devil's Brook (between Friendship Road and the Amtrak line) have been reported to support a diversity of wildlife (Frederic R. Harris, Inc., E. O. 215 Response Document, 1995). A portion of the wetlands proposed to be impacted by the project are located in this area of Devil's Brook. The proposed wetland mitigation plan should compensate for some of the loss of wildlife habitat.

The created wetlands are designed to provide a diversity of habitat types and thus support a diversity of wildlife. The created wetlands should be suitable for breeding, as well as migration and wintering habitat. The created wetlands are large areas (approx. 25-30 acres each) contiguous to large expanses of existing forested wetlands. Their proximity to agricultural lands enhances their suitability for use by wildlife during migration and the winter (Adamus, Wetland Evaluation Technique, 1987). Some of the species that are targeted in the design of the created wetland sites are wild turkey, woodpeckers, owls, passerines, wading birds, and amphibians. The wild turkey can use the hard and soft mast produced by planting oaks for winter feed. Short-lived trees such as silver maple (Acer saccharinum), sycamore (Platanus occidentalis), and black willow (Salix nigra) will be planted to provide dead branches within 10 to 20 years on which woodpeckers will forage and cavities in which owls can nest. A diversity of tree and shrub plantings will provide nest sites for passerines. They can also use the mast from the plantings and forage in the tree and shrub canopy or on the forest floor. The meadow habitat fringing the wetland and intermixed with the forest will also provide food and forage sites for many birds. The existing wetlands in the vicinity of the project, particularly those south of the Southern Site, contain a number of small, seasonally flooded, emergent or open water depressions intermixed with the forested wetlands. This community structure will be recreated on the mitigation sites to enhance habitat diversity. These depressions will provide habitat for many amphibians as well as provide feeding habitat for wading birds. These target species will not necessarily inhabit the constructed wetlands, but the wetlands are designed to incorporate their habitat requirements.

3. DESCRIPTION OF EXISTING CONDITIONS

3.1 Proposed Areas of Wetland Disturbance

Construction of the proposed Route 92 project will result in the permanent loss of approximately 32.90 acres of freshwater wetlands along the project alignment, which extends from Interchange 8A to Route 1 near Ridge Road. Of the 32.90 acres of impacted wetlands, the majority are forested wetlands with lesser amounts of scrub/shrub and emergent wetlands affected. Approximately 0.85 acres of State open waters will also be impacted (See table below).

Permanent Wetland Impacts by Wetland Type

<u>WETLAND TYPE</u>	<u>IMPACT (ACRES)</u>
PFO1	21.73
PEM	7.07 *
PSS1	4.10
POW	0.85

* 1.90 acres of these impacts are to ordinary resource value wetlands

The majority of freshwater wetland disturbance will occur in the Devil's Brook watershed, although impacts to wetlands in the watersheds of Heathcote Brook and Shallow Brook will also occur. Each of these watercourses is located within the Millstone River Drainage Basin. Approximately 80% of the wetland impacts resulting from the construction of the proposed Route 92 occur in the Devil's Brook watershed, 10% in the Heathcote Brook watershed, and 10% in the Shallow Brook watershed. Of these wetland impacts, approximately 69%, 95%, and 50% occur in forested wetlands associated with the aforementioned watercourses, respectively. The remaining wetland impacts occur in emergent and scrub/shrub wetlands associated with each of these watercourses.

The wetland systems in the areas of the proposed roadway alignment are generally characterized by a vegetative community consisting of the canopy species red maple (Acer rubrum, FAC), sweet gum (Liquidambar styraciflua, FAC), pin oak (Quercus palustris, FACW), and green ash (Fraxinus pennsylvanica, FACW). Shrub species include spicebush (Lindera benzoin, FACW-), sweet pepperbush (Clethra alnifolia, FAC+), highbush blueberry (Vaccinium corymbosum, FACW-), arrowwood (Viburnum dentatum, FAC), and swamp azalea (Rhododendron viscosum, FACW+). Greenbrier (Smilax rotundifolia, FAC) is a common woody vine in the area. The herbaceous vegetation includes skunk cabbage (Symplocarpus foetidus, OBL), cinnamon fern (Osmunda cinnamomea, FACW),

sensitive fern (Onoclea sensibilis, FACW), and spotted jewelweed (Impatiens capensis, FACW). Man-made ditches consist of cattail (Typha latifolia, OBL) and woolgrass (Scirpus cyperinus, FACW+). For a complete description of the wetlands within the project area, refer to the "Wetlands Delineation Report for Proposed Route 92 in Monroe, South Brunswick, and Plainsboro Townships, Middlesex County, NJ" (Harris, 1995).

The soils in the existing wetlands are primarily Fallsington loam and Elkton loam soils. A high water table within 18 inches of the surface is present in the wetlands. The wetlands appear to receive hydrologic inputs from several sources, primarily groundwater, overflow from adjacent waterways, and stormwater runoff.

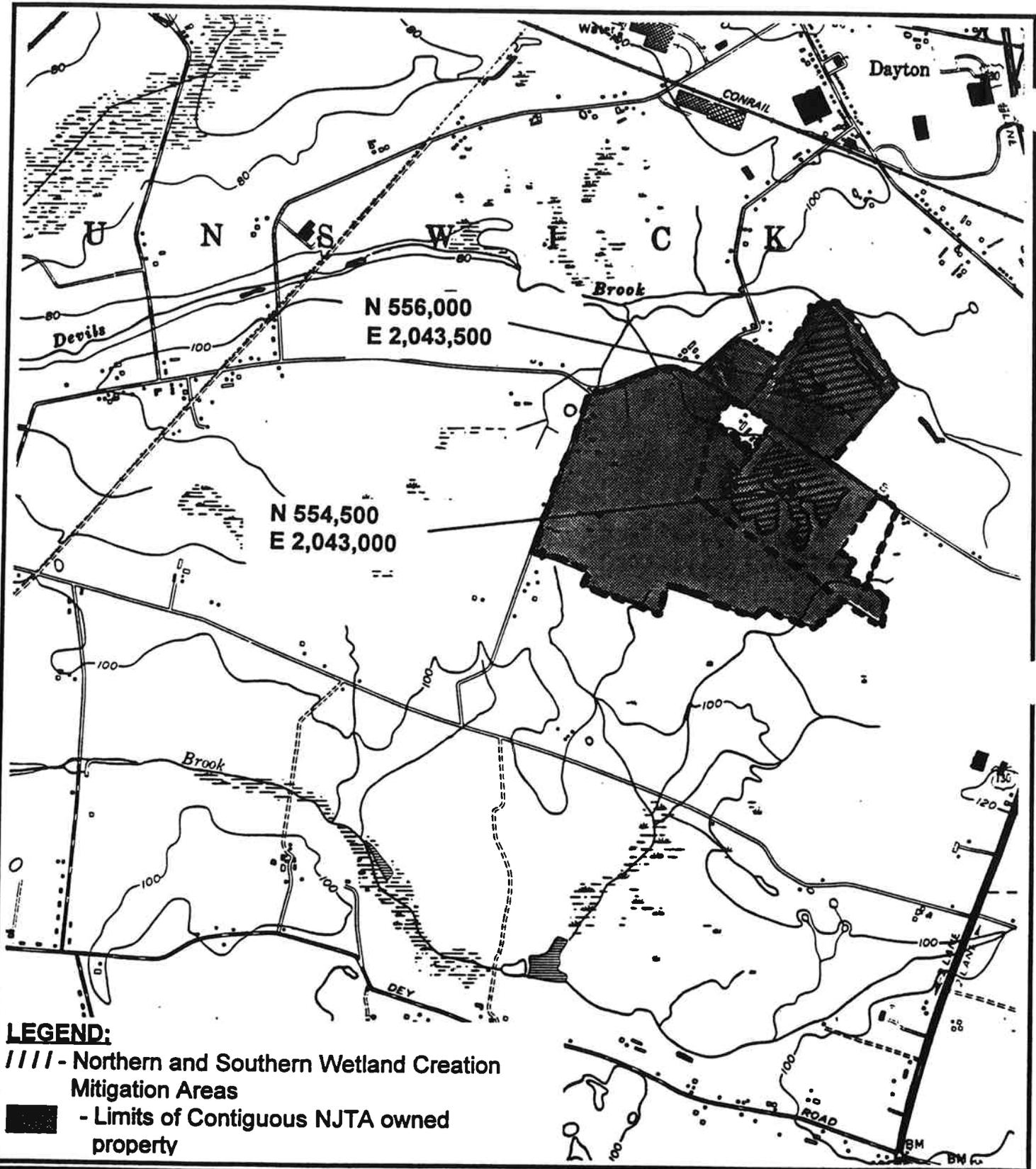
3.2 Proposed Areas of Wetland Creation

Wetlands are proposed to be created in two areas adjacent to Friendship Road in South Brunswick Township, Middlesex County, New Jersey. These sites are referred to as the Northern Site (north of Friendship Road) and the Southern Site (south of Friendship Road) (Figure 2).

Land use in areas surrounding both wetland creation sites includes roadways, agricultural land, and residences. Wildlife utilization of the areas proposed for wetland construction is limited to species that can utilize monospecific cropland, old field communities and those that live in close association with human activities. Animals commonly found in such areas include deer, raccoons, opossums, and various rodents as well as grassland birds, raptors, and common reptiles and amphibians. For a more detailed list of wildlife common to the project area, refer to the Draft Environmental Impact Statement dated April, 1994, and prepared by Frederic R. Harris, Inc.

3.2.1 Northern Mitigation Site

The Northern Site is located on Block 11, Lot 7.08 which consists of 58.14 acres. During 1996, the majority of the site was planted with an agricultural crop (soybean). The northernmost portion of the site contains forested wetlands associated with Devil's Brook (Photo #14 and #15, Appendix B). The site has a gently rolling topography (See Existing Site Conditions Plan). The elevations onsite range from 118 feet N.G.V.D. in the southern portion to 94 feet in the northern portion at an existing pond. The entire site lies within the Devil's Brook watershed. Wetlands within the forested area on this site have been delineated (See Existing Site Conditions Plan). Wetland creation is proposed within the upland portion of the site presently under agricultural production (Photo #11 and #12, Appendix



**NEW JERSEY TURNPIKE AUTHORITY
 PROPOSED ROUTE 92
 Hightstown, NJ USGS Quadrangle (Topographic)**

Scale 1"=2,000'
 November 1996

Frederic R. Harris, Inc.
 Consulting Engineers
 485 US Route 1 South, Building B
 Iselin, NJ 08830

U.S.G.S. SITE LOCATION MAP

FIGURE 2

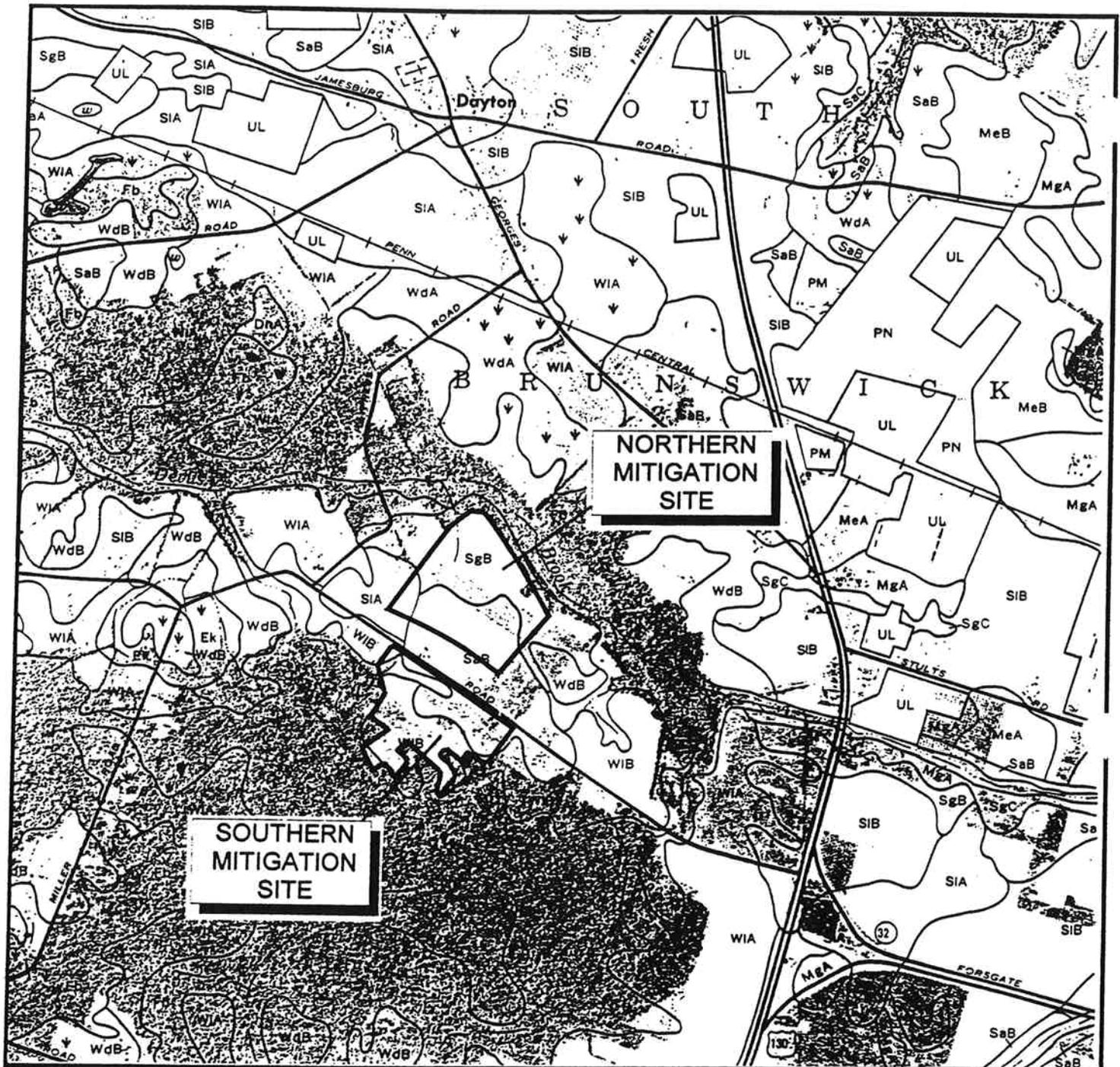
B). Approximately 31.11 acres of wetlands are proposed to be created. Two areas of mature upland forest between the creation site and the existing wetlands will be left intact to create a berm and provide habitat diversity. Drainageways are proposed to provide a surface water connection to the existing wetlands. Construction of these drainageways will disturb 0.09 acres of existing wetlands which will be restored.

The existing soils on the Northern Site include Sassafras gravelly sandy loam, 2 to 5 percent slopes (SgB); Sassafras sandy loam, 2 to 5 percent slopes (SaB); and Sassafras loam, 0 to 2 percent slopes (SlA) (Figure 3). Sassafras series soils are described in the Middlesex County Soil Survey (Powley, 1987) as deep, well drained soils that formed in acid, moderately fine textured Coastal Plain sediments. The depth to the seasonal high water table is listed as greater than 5 feet and the permeability is moderate to moderately rapid. Soil log information is provided in Appendix A and the locations of the soil logs are shown on the Existing Site Conditions Plan (Sheet 1 of 3). The soil textures reported in the logs are consistent with those mapped in the soil survey.

Monitoring wells have been installed on the Northern Site and water level data has been gathered for a year at biweekly intervals (See Existing Site Conditions Plan and Table 1). Information from this monitoring indicates that groundwater in the northern portion of the site is at an average of approximately 94 feet elevation (N.G.V.D.), corresponding to the level in the adjacent wetlands. The groundwater table rises toward the southern portion of the site to an elevation of approximately 98 feet (annual average). The groundwater monitoring was performed during a wet year. Records from the Rutgers University Weather Station in New Brunswick indicated that precipitation between May to September 1996 was 20% above normal. As seen in Figure 4, the groundwater levels at most of the well locations are higher in the November 1996 readings than in November 1995.

3.2.2 Southern Mitigation Site

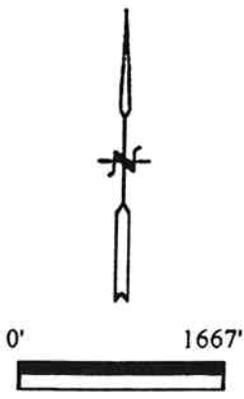
The Southern Site is located on Block 6, Lot 3.002 which consists of 76.55 acres (Figure 1). It contains an old field community in the northern portion (Photo #1, #2 and #6, Appendix B). The vegetation in this field includes goldenrod (Solidago spp.), bushy aster (Aster dumosus, FAC), motherwort (Leonurus cardiaca, NL), soft rush (Juncus effusus, FACW+), yarrow (Achillea millefolium, FACU), wild garlic (Allium vineale, FACU), hardtack (Spirea tomentosa, FACW-), pearly everlasting (Anaphalis margaritacea, NL), blackberry (Rubus allegheniensis, FACU), foxtail (Setaria



LEGEND:

- Fb - Fallsington loam
- SaB - Sassafras sandy loam, 2-5% slopes
- SgB - Sassafras gravelly sandy loam, 2-5% slopes
- SIA - Sassafras loam, 0-2% slopes
- WIB - Woodstown loam, 2-5% slopes

SOURCE: USDA SCS, Middlesex County Soil Survey, Powley, 1987, sheet #23.



**FIGURE 3
SOILS MAP**

Proposed Route 92
Northern and Southern Mitigation Sites
South Brunswick Township
Middlesex County, New Jersey

ASGECI Project #1244

AMY S. GREENE
ENVIRONMENTAL CONSULTANTS, INC.

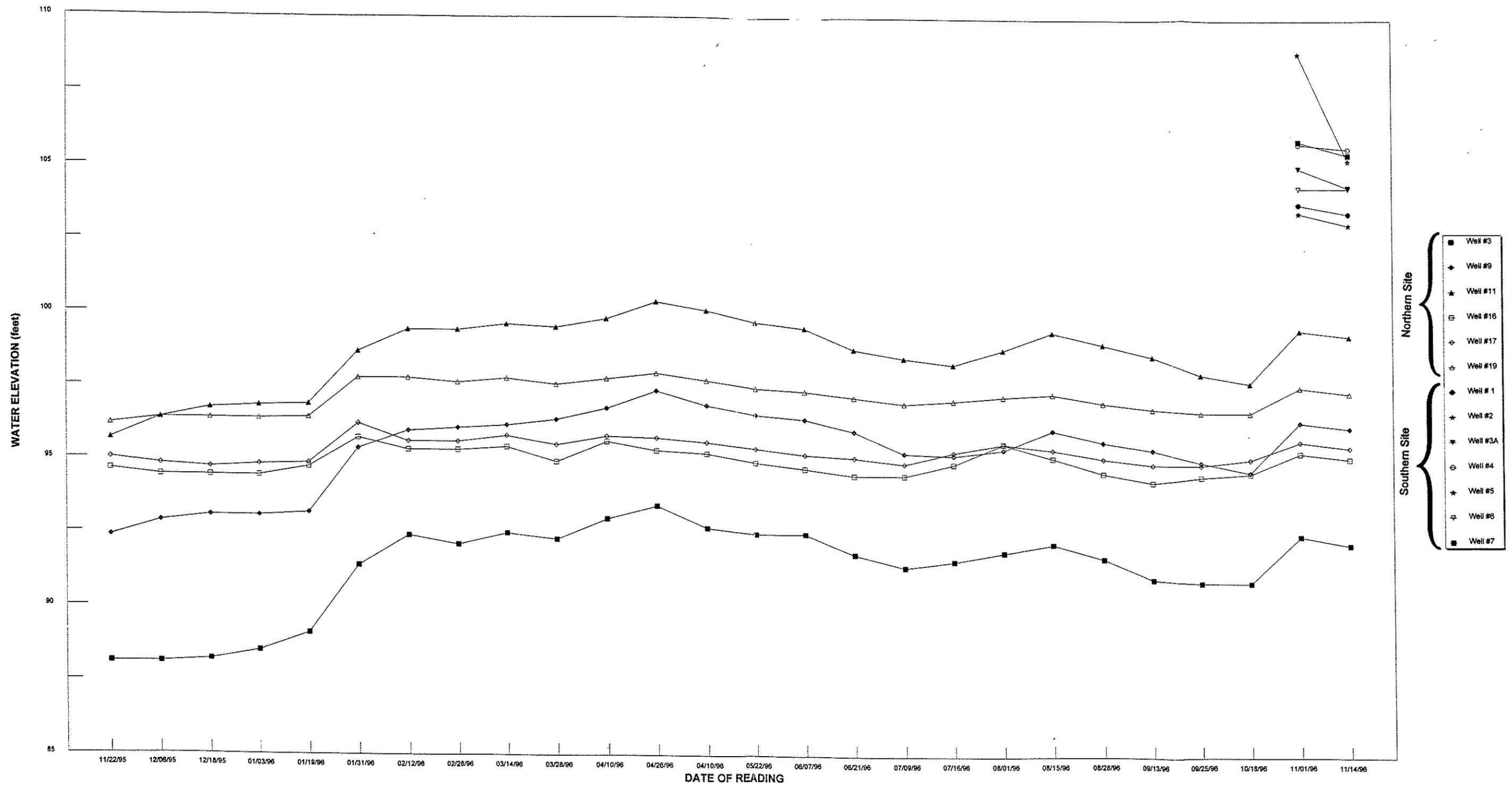
**TABLE 1:
Groundwater Level Records at Monitoring Wells on the Route 92 Northern
and Southern Mitigation Sites**

Well #	Ground Surface Elevation	Date of Reading																												Average Water Elevation
		11/22/95	12/06/95	12/18/95	01/03/96	01/19/96	01/31/96	02/12/96	02/28/96	03/14/96	03/28/96	04/10/96	04/26/96	05/10/96	05/22/96	06/07/96	06/21/96	07/09/96	07/16/96	08/01/96	08/15/96	08/28/96	09/13/96	09/25/96	10/18/96	11/01/96	11/14/96			
Northern Site	Well #3	102.39	14.8/88.1	14.3/88.09	14.2/88.19	13.9/88.49	13.8/89.1	11/91.39	10.5/92.4	10.3/92.09	9.9/92.49	10.1/92.29	9.4/92.99	8.95/93.44	9.7/92.69	9.9/92.49	9.9/92.49	10.5/91.8	11/91.39	10.8/91.6	10.5/91.9	10.2/92.19	10.7/91.7	11.4/91	11.5/90.9	11.5/90.9	9.9/92.49	10.2/92.19	91.34	
	Well #9	110.86	18.5/92.36	18/92.86	17.8/93.06	17.8/93.06	17.7/93.16	15.5/95.36	14.9/95.96	14.8/96.06	14.7/96.16	14.5/96.36	14.1/96.76	13.5/97.36	14/96.86	14.3/96.56	14.4/96.4	14.8/96	15.6/95.26	15.7/95.2	15.5/95.4	14.8/96.06	15.2/95.66	15.5/95.4	15.9/95	16.2/94.66	14.5/96.36	14.7/96.16	95.37	
	Well #11	118.21	22.5/95.6	21.8/96.3	21.5/96.71	21.4/96.81	21.35/96.86	19.55/98.66	18.8/99.41	18.8/99.41	18.6/99.61	18.7/99.51	18.4/99.81	17.7/100.4	18.1/100.1	18.5/99.71	18.7/99.51	19.4/98.8	19.7/98.51	19.9/98.3	19.4/98.8	18.8/99.41	19.2/99.0	19.6/98.6	20.2/98	20.5/97.71	18.7/99.51	18.9/99.31	98.63	
	Well #16	101.42	6.8/94.62	7/94.42	7/94.42	7/94.42	6.7/94.72	5.7/95.72	6.1/95.32	6.1/95.32	6/95.42	6.5/94.92	5.8/95.62	6.1/95.32	6.2/95.22	6.5/94.92	6.7/94.72	6.9/94.5	6.9/94.5	6.5/94.9	5.8/95.6	6.3/95.12	6.8/94.6	7.1/94.3	6.9/94.5	6.8/94.62	6.1/95.32	6.3/95.12	94.93	
	Well #17	105	10/95	10.2/94.8	10.3/94.7	10.2/94.8	10.15/94.85	8.8/96.2	9.4/95.6	9.4/95.6	9.2/95.8	9.5/95.5	9.2/95.8	9.25/95.75	9.4/95.6	9.6/95.4	9.8/95.2	9.8/95.1	10.1/94.9	9.7/95.3	9.4/95.6	9.6/95.4	9.9/95.1	10.1/94.9	10.1/94.9	9.9/95.1	9.3/95.7	9.5/95.5	95.31	
	Well #19	107.66	11.5/96.16	11.3/96.36	11.3/96.36	11.3/96.36	11.25/96.41	9.9/97.76	9.9/97.76	10.05/97.61	9.9/97.76	10.1/97.56	9.9/97.76	9.7/97.96	9.95/97.71	10.2/97.46	10.3/97.36	10.5/97.16	10.7/96.96	10.6/97.06	10.5/97.2	10.4/97.3	10.7/97	10.9/96.8	11/96.7	11/96.7	10.1/97.56	10.3/97.36	97.16	
Southern Site	Well #1	106.01																									2.2/103.81	2.5/103.51	103.66	
	Well #2	106.37																									2.85/103.52	3.25/103.12	103.32	
	Well #3A	109.29																									4.25/105.04	4.85/104.4	104.72	
	Well #4	107.76																									1.9/105.86	2.1/105.7	105.78	
	Well #5	112.24																									3.35/108.89	6.9/105.3	107.1	
	Well #6	107.91																									3.55/104.36	3.55/104.36	104.36	
	Well #7	108.6																									2.65/105.95	3.05/105.5	105.73	

WEATHER CONDITIONS

11/22/95	Brisk, clear and chilly approximately 35 degrees F.	05/22/96	Sunny and clear approximately 70 degrees F.
12/06/95	Brisk, clear and chilly approximately 38 degrees F.	06/07/96	Sunny and clear approximately 75 degrees F.
12/18/95	Brisk, clear and cold approximately 32 degrees F.	06/21/96	Sunny and clear approximately 80 degrees F.
01/03/96	Cold and overcast with freezing rain approximately 28 degrees F.	07/09/96	Mostly sunny, slight breeze and humid approx. 78 degrees F.
01/19/96	Mild and overcast with light rain approximately 55 degrees F.	07/16/96	Sunny and clear approximately 82 degrees F.
01/31/96	Cold and overcast with light snow approximately 24 degrees F.	08/01/96	Overcast, foggy with a light breeze approx. 70 degrees F.
02/12/96	Cold, clear and sunny approximately 25 degrees F.	08/15/96	Sunny and clear approx. 75 degrees F.
02/28/96	Mild and overcast approximately 56 degrees F.	08/28/96	Sunny and clear approx. 85 degrees F.
03/14/96	Mild and cloudy approximately 55 degrees F.	09/13/96	Sunny and clear approximately 75 degrees F.
03/28/96	Mostly cloudy approximately 35 degrees F.	09/25/96	Sunny and clear, with a slight breeze, approximately 65 degrees F.
04/10/96	Partly cloudy approximately 35 degrees F.	10/18/96	Overcast and breezy approximately 58 degrees F.
04/26/96	Clear and sunny approximately 75 degrees F.	11/01/96	Cool and overcast approximately 45 degrees F.
05/10/96	Overcast, light drizzle approximately 54 degrees F.	11/14/96	Cold and overcast approximately 38 degrees F.

FIGURE 4:
Groundwater Levels Recorded on the Route 92 Northern and Southern Mitigation Sites



sp.), broom sedge (Andropogon virginicus, FACU), switchgrass (Panicum virgatum, FAC), and other grasses. A southeastern field is planted with a small grain grass (not identified). The remainder of the Southern Site contains similar old field species as well as seedlings of sweet gum (Liquidambar styraciflua, FAC). An area in the western portion of the site is an abandoned agricultural field devoted to Christmas trees (Photo #10, Appendix B). Saplings of various conifers and sweet gum are dominant. The northeastern corner of the site contains an abandoned residential lot. There is a slight east/west trending rise through the center of the proposed creation area. To the north of this slight rise, drainage is to the west, within the watershed of Devil's Brook. To the south of the rise, drainage is to the south, toward Shallow Brook, which is a tributary of Devil's Brook. The highest elevations on the site (113.4 feet N.G.V.D.) occur on the ridge near Friendship Road in the northeastern portion of the site (See Existing Site Conditions Plan).

A wetland delineation was performed on the Southern Site in November 1996. The southern portion of this site contains forested wetlands (Photo #4 and #8, Appendix B). Three emergent wetland areas totalling 0.45 acres were also identified in the north central portion of the site, within the area proposed for mitigation. These wetlands will be unavoidably disturbed during construction, but will be replaced with wetlands of equal or greater value. No mitigation credit will be sought for these areas. The locations of the wetland areas will be verified by the NJDEP prior to construction. The total area of wetland creation on the Southern Site is 26.08 acres. Wetlands will be created in the old field and agricultural portions of the site.

The soils identified on the Southern Site by the Middlesex County Soil Survey (Powley, 1987) include Sassafras sandy loam, 2 to 5 percent slopes (SaB); Woodstown loam, 2 to 5 percent slopes (WlB), and Fallsington loam (Fb) (Figure 3). The Sassafras sandy loam is mapped in the northern portion of the site. Woodstown loam is described as a gently sloping, moderately well drained soil. It is mapped in the southern portion of the section of the site proposed for wetland creation. The seasonal high water table is at a depth of 1.5 feet to 2.5 feet from February to April and the permeability is moderate. Fallsington loam is mapped in the northwestern corner of the site and in the forested wetlands in the southern portion of the site. It is described as a level to nearly level, poorly drained soil. The seasonal high water table is at a depth of 0 feet to 1 foot from December to May and the permeability is moderate to moderately rapid. Fallsington loam is the only soil type that is classified as a hydric soil by the Natural Resources Conservation Service. Except for an area of wetland that

protrudes into the field along a drainageway, no other areas of wetlands were identified in the portion of the field mapped as Fallsington.

Soil log information is provided in Appendix A and the locations of the soil logs are shown on the Existing Site Conditions Plan (Sheet 1 of 3). The soil borings for the Southern Site indicate areas of fine texture (silt loam, clay loam) soils in the western portion of the site. This finer material appears to be discontinuous and is generally below the levels of proposed excavation. Therefore, it should not interfere with wetland creation.

Monitoring wells were installed in late October 1996 on the Southern Site. Groundwater levels are being gathered on a biweekly basis to assist with design of the wetland creation area (See Table 1). Groundwater monitoring will continue for at least one year. The readings obtained up until November 14, 1996 range from 103.12 feet to 105.95 feet N.G.V.D. elevation. A reading of 108.89 feet was recorded in Well #5 on November 1, 1996. This reading is being viewed as an anomalous reading or error of transcription since it is inconsistent with other well readings. The water elevations of three ponds were measured on November 14, 1996. The ponds are located within the adjacent forested area to the south (Photo #3, #5 and #7, Appendix B). The elevations range from 102.23 feet to 104.08 feet N.G.V.D., comparable to the monitoring well readings since the ponds are down gradient of the wells.

4. WETLAND & OPEN WATER CONSTRUCTION

This conceptual wetland mitigation plan has been designed to create 57.19 acres of forested, scrub/shrub, wet meadow and emergent wetlands on two sites. Approximately 31.11 acres of forested, scrub/shrub, emergent, and wet meadow wetland communities and 0.85 acres of open waters will be created on the Northern Site. On the Southern Site, 26.08 acres of similar wetland communities will be constructed (see Conceptual Wetland Communities Plans, Sheet 3 of 3). Small wetland areas impacted during mitigation area construction (approximately 0.54 acres) will be replaced. No mitigation credit will be sought for these areas.

Initially, there will be little vertical structure to the created, forested wetlands because it will take years for the trees to form a closed canopy. The sites will be rough graded with hummocks. This will provide additional species diversity (microhabitats) and will also increase survival rates of woody plantings in case of unusually wet seasons. In addition, depressional areas of varying shapes and sizes will be created within the forested portions of the created wetlands. These emergent wetland areas will serve as

sanctuaries for amphibians and other water-dependent creatures during unusually dry seasons. These small vernal pools will mimic existing depressions in the surrounding forested wetlands. Various vegetative communities will be provided with a diversity of species which will provide fruit, seeds and nuts for numerous species of wildlife.

The created wetlands will be primarily groundwater driven. The sites will be excavated into the groundwater. The created wetlands will be hydrologically connected to the existing wetlands by one or more shallow drainageways to provide an outlet for excess water. Proposed grading of the mitigation sites, particularly the Southern Site, is tentative and will be refined and modified in the final plan. Options for obtaining topsoil and the selection and quantities of plant species are being examined for refinement in the final plan.

4.1 Excavation

The initial phase of the proposed mitigation plan is the removal of soil in the wetland and open water creation areas. The excavation will not enter the tree line of the surrounding forested areas of either site. Most of the excavated material will be stockpiled in upland areas at the Route 92 construction site and used as fill for the roadway construction in accordance with NJTA standard specifications. Topsoil on both sites will be stripped and stockpiled separately while the subsoil is excavated for use in constructing the roadway.

The areas of wetland and open water creation will be excavated down to 6-12 inches below 94.5-95 feet N.G.V.D. in the Northern Site and 102-104 feet N.G.V.D. in the Southern Site. After backfilling with 6-12 inches of topsoil, the site will be at the elevation of the groundwater in the existing wetlands at each site, in order to achieve a hydrologic regime for wetland establishment (See Conceptual Grading Plans, Sheet 2 of 3). The Southern Site will not require as much excavation as the Northern Site because groundwater is closer to the ground surface at the Southern Site. The sites will be graded with a slight slope to provide positive drainage. Two drainageways on the Northern Site will be excavated between the created and existing wetlands to provide an outlet for excess water. On the Southern Site, overflow will be facilitated in two areas by grading to existing contours. These outlets may require removal of some existing trees. On the Northern Site, 0.09 acre of existing wetlands will be disturbed for grading of the outlet. The side slopes in the transition areas will be graded to 3:1 on both sites.

A 0.85-acre area of open water will be provided in the Northern Site. This open water area will serve as mitigation for the 0.85 acres of impacted State open water associated with the project.

The communities that will be created include forested wetland, scrub/shrub wetland, emergent wetland, wet meadow, and open water. During rough grading of the sites, hummocks will be created to provide additional variability within the communities. In general, the forested, scrub/shrub, and wet meadow communities will be graded such that the soil will be saturated to the surface during most of the growing season. From -2.0 to 0 feet below the ground surface, emergent wetlands will be created. Water deeper than 2.0 feet will be considered State open water (See Conceptual Wetland Communities Plan, Sheet 3 of 3).

4.2 Topsoil Spreading

Since the existing subsoils are low in organic content, they are not desirable for use in wetland creation without supplemental topsoil. On the Southern Site, the existing topsoil will be stockpiled and then re-spread on the site. On the Northern Site, the existing topsoil is not suitable for use in the created wetlands due to the probable presence of herbicide residue in the agricultural area. Topsoil for this site may be obtained from forested wetlands disturbed for construction of Route 92 or from non-agricultural uplands. Any topsoil trucked in from an upland source must be free of noxious weeds and uncontaminated.

The topsoil will be spread to a minimum depth of 6-12 inches throughout the constructed wetlands, except in the State open water area of the Northern Site. If practicable, the stumps of wetland trees removed from the impacted wetlands may be salvaged. These stumps can be implanted into the soils of the created forested wetland areas to provide additional habitat and a native seed source. Basal shoots may also sprout from the stumps if the stumps are not too desiccated.

The final elevations and hydrology of the mitigation areas will be evaluated prior to planting to determine if changes in grading or planting are required to achieve the desired elevations and replacement wetland vegetation communities. If necessary, grading adjustments or placement of additional topsoil will be evaluated and performed during construction.

4.3 Soil Erosion and Sediment Control

To avoid erosion and topsoil loss during construction activities, soil erosion and sediment control measures will be utilized. Erosion control measures will remain in effect until vegetation is established. These techniques will meet

the appropriate Soil Erosion and Sediment Control Standards of New Jersey except that no grasses may be planted in areas proposed for woody wetland communities. Measures will also be taken to stabilize the toe of slope where groundwater seepage is expected. Silt fencing will be placed around the perimeter of the wetland creation sites to prevent the washing of sediments from adjacent uplands into the wetlands. If planting cannot commence immediately upon completion of topsoil spreading, the mitigation areas will be seeded with the appropriate wetland seed mix to stabilize the area until planting can occur. It should be noted that there are two wetland seed mixes. The seed mix for the woody wetland communities does not contain turf grasses (See Section 5).

4.4 Hydrology

The created wetlands will receive their hydrologic input from groundwater and, to a limited extent, surface runoff and precipitation. The created wetlands will have seasonally saturated soil areas (forested and scrub/shrub wetlands and wet meadows), shallow water (emergent wetland), and non-vegetated, open water. The open water area will have a minimum water depth of 2 to 3 feet to prevent emergent vegetation establishment and provide overwintering habitat for amphibians and turtles. Water depths will decrease toward the edges of the numerous, small, emergent wetland creation areas so that vegetative zonation will be achieved.

Groundwater monitoring has been performed for the past year on the Northern Site and since early November 1996 on the Southern Site (Table 1). The data from the monitoring indicates that groundwater can be a reliable and consistent source of hydrology for the created wetlands. Although a minimal amount of data is available for the Southern Site, the initial groundwater readings are consistent with the expected elevation of groundwater in the adjacent wetlands and appear to fluctuate in a pattern consistent with that observed on the Northern Site (Figure 4). Monitoring on both sites will continue up until wetland construction so that any changes in groundwater levels that may affect the proposed plan can be observed and the plan adjusted, if necessary. Planes of groundwater elevations shown on the conceptual plans were determined by interpolation between the monitoring wells.

The groundwater monitoring to date has been performed during a wet year; however, the levels observed are not higher than the anticipated groundwater level in the wetlands adjacent to both sites, as evidenced by water elevations in nearby ponds. Since groundwater elevations in drier years are

apparently high enough to support the adjacent wetlands, groundwater should be available to drive the created wetlands even during these drier years.

The created wetlands on both sites will be excavated into or at the water table but not below the elevation of the adjacent wetlands. At the presently higher topographic elevations on the site, particularly the Northern Site, groundwater will seep from the side of the creation area. Seep wetlands will likely form on the slope; however, their extent will probably fluctuate with variations in the water table between wet and dry years. The majority of the created wetlands will be at the elevation of the adjacent wetlands (groundwater at the surface). Hummocks and micro-variations in the topography formed during rough grading of the sites will provide planting sites for trees so that they can establish roots above the water table. This will increase the potential for tree survival. Some areas below groundwater will be constructed to create aquatic emergent or open water habitat. The wetlands will be constructed with slight positive drainage and outlets to the adjacent wetlands to allow the discharge of excess water.

4.5 Temporary Impacts

Temporary impacts to freshwater wetlands resulting from the Route 92 project total 3.36 acres. These impacts are to emergent and scrub/shrub wetlands and will be mitigated through restoration upon completion of construction activities. The impacts result from installation of a right-of-way fence and construction of stormwater management facilities and temporary construction roads. Locations of areas of temporary impacts are shown on the Freshwater Wetlands Individual Permit Plans prepared by Frederic R. Harris, Inc. dated August 1996. Restoration activities will include removal of any temporary fill placed for construction purposes and regrading of the area to meet pre-existing contours and elevations. Scrub/shrub wetlands will be planted with selected shrubs from the scrub/shrub planting list in Table 2. Emergent wetlands will be seeded with the wetland seed mix described in Table 3.

5. WETLAND PLANTING PLAN

Forested, scrub/shrub, and emergent wetlands will be disturbed for construction of the proposed Route 92 project. The majority of the wetlands in the immediate vicinity of the project area and the proposed mitigation sites are forested wetlands. The planting plan has been designed to replace areas of emergent, forested, and scrub/shrub wetlands while creating diverse and intermixed vegetation communities. Wet meadow (seasonally saturated herbaceous

Table 2: Proposed Species for Planting in the Vegetation Communities

Proposed Community	Scientific Name (1)	Common Name	Regional Indicator (2)
Forested Wetlands	<i>Acer rubrum</i>	red maple	FAC
	<i>Acer saccharinum</i>	silver maple	FACW
	<i>Quercus palustris</i>	pin oak	FACW
	<i>Quercus bicolor</i>	swamp white oak	FACW+
	<i>Quercus michauxii</i>	swamp chestnut	FACW
	<i>Fraxinus pennsylvanica</i>	green ash	FACW
	<i>Nyssa sylvatica</i>	black gum	FAC
	<i>Salix nigra</i>	black willow	FACW
	<i>Betula nigra</i>	river birch	FACW
	<i>Betula populifolia</i>	grey birch	FAC
	<i>Platanus occidentalis</i>	sycamore	FACW-
	<i>Vaccinium corymbosum</i>	highbush blueberry	FACW-
	<i>Viburnum dentatum</i>	southern arrowwood	FAC
	<i>Ilex verticillata</i>	winterberry	FACW+
	<i>Alnus rugosa</i>	speckled alder	FACW
<i>Alnus serrulata</i>	smooth alder	OBL	
<i>Amelanchier canadensis</i>	shadberry	FAC	
Scrub/Shrub Wetlands	<i>Cornus amomum</i>	silky dogwood	FACW
	<i>Cornus stolonifera</i>	red-osier dogwood	FACW+
	<i>Vaccinium corymbosum</i>	highbush blueberry	FACW-
	<i>Viburnum dentatum</i>	southern arrowwood	FAC
	<i>Ilex verticillata</i>	winterberry	FACW+
	<i>Aronia melanocarpa</i>	black chokeberry	FAC
	<i>Aronia arbutifolia</i>	red chokeberry	FACW
	<i>Alnus rugosa</i>	speckled alder	FACW
	<i>Alnus serrulata</i>	smooth alder	OBL
	<i>Amelanchier canadensis</i>	shadberry	FAC
<i>Sambucus canadensis</i>	elderberry	FACW-	
Emergent Wetlands	<i>Hibiscus moscheutos</i>	swamp rose mallow	OBL
	<i>Iris versicolor</i>	wild flag	OBL
	<i>Acorus calamus</i>	sweet flag	OBL
	<i>Polygonum hydropiperoides</i>	smartweed	OBL
	<i>Asclepias incarnata</i>	swamp milkweed	OBL
	<i>Carex lurida</i>	lurid sedge	OBL
	<i>Carex vulpinoidea</i>	fox sedge	OBL
	<i>Carex lupulina</i>	hop sedge	OBL
	<i>Carex crinita</i>	fringed sedge	OBL
	<i>Carex stricta</i>	tussock sedge	OBL
	<i>Scirpus cyperinus</i>	woolgrass	FACW+
	<i>Eleocharis palustris</i>	creeping spikerush	OBL
	<i>Eleocharis obtusa*</i>	blunt spikerush	OBL
	<i>Elodea canadensis**</i>	waterweed	OBL
	<i>Glyceria canadensis</i>	rattlesnake grass	OBL
	<i>Glyceria striata</i>	fowl mannagrass	OBL
	<i>Puccinellia pallida</i>	pale mannagrass	OBL
	<i>Osmunda regalis</i>	royal fern	OBL
	<i>Alisma subcordatum</i>	water plantain	OBL
	<i>Saururus cernuus</i>	lizard tail	OBL
<i>Sparganium americanum</i>	burreed	OBL	
<i>Peltandra virginica</i>	arrow arum	OBL	
<i>Pontederia cordata</i>	pickerel weed	OBL	
<i>Vaccinium macrocarpon</i>	cranberry	OBL	
<i>Cephalanthus occidentalis</i>	buttonbush	OBL	
Note:	<i>Buttonbush will be planted (densely spaced cuttings) at the edges of some of the emergent wetlands to add shrub cover.</i>		
	* Will be utilized if planting occurs in the spring.		
	** Will be planted in the State open water only.		

Table 2, continued

Proposed Community	Scientific Name (1)	Common Name	Regional Indicator (2)
Wet Meadow	<i>Aster novae-angliae</i>	New England aster	FAC
	<i>Cyperus esculentus</i>	nutsedge	FACW
	<i>Lobelia cardinalis</i>	cardinal flower	FACW+
	<i>Eupatoriadelphus maculatus</i>	spotted joe-pye weed	FACW
	<i>Vernonia noveboracensis</i>	New York ironweed	FACW+
	<i>Asclepias incarnata</i>	swamp milkweed	OBL
	<i>Pycnanthemum tenuifolium</i>	slender mountain mint	FACW
	<i>Juncus effusus</i>	soft rush	FACW+
	<i>Chelone glabra</i>	turtlehead	OBL
	<i>Andropogon glomeratus</i>	bushy broomsedge	FACW+
	<i>Ludwigia alternifolia</i>	seedbox	FACW+
	<i>Scirpus atrovirens</i>	green bulrush	OBL
	<i>Spiraea latifolia</i>	meadowsweet	FAC+
	<i>Penstemon digitalis</i>	foxglove beardtongue	FAC
	<i>Epilobium coloratum</i>	purple willowweed	FACW+
<i>Verbena hastata</i>	blue vervain	FACW+	
<i>Rubus hispidus</i>	bristly blackberry	FACW	
<i>Note:</i>	<i>Chokeberry and red-osier dogwood will be spaced at approximately 30-foot intervals. Species planted will depend upon availability.</i>		
Transition Areas	<i>Acer rubrum</i>	red maple	FAC
	<i>Quercus rubra</i>	red oak	FACU-
	<i>Quercus alba</i>	white oak	FACU
	<i>Betula populifolia</i>	grey birch	FAC
	<i>Cornus racemosa</i>	grey dogwood	FAC-
	<i>Prunus virginiana</i>	choke cherry	FACU
	<i>Myrica pensylvanica</i>	bayberry	FAC

Notes:

1. Nomenclature conforms to that of the National List of Plant Species That Occur in Wetlands: Northeast (Region 1), Reed (1988).
2. Wetland indicator status according to Reed (1988) as amended by NEIRP (1995).

Table 3: Proposed Seed Mixes

Proposed Community	Scientific Name (1)	Common Name	Regional Indicator (2)
Woody Community Seed Mix	<i>Verbena hastata</i>	blue vervain	FACW+
	<i>Scirpus atrovirens</i>	green bulrush	OBL
	<i>Asclepias incarnata</i>	swamp milkweed	OBL
	<i>Juncus effusus</i>	soft rush	FACW+
	<i>Carex lurida</i>	lurid sedge	OBL
	<i>Carex vulpinoidea</i>	fox sedge	OBL
	<i>Aster novae-angliae</i>	New England aster	FAC
Wetland Seed Mix	<i>Polygonum pennsylvanicum</i>	smartweed	FACW
	<i>Aster novae-angliae</i>	New England aster	FAC
	<i>Eupatoriadelphus maculatus</i>	spotted joe-pye weed	FACW
	<i>Veronia noveboracensis</i>	New York ironweed	FACW+
	<i>Asclepias incarnata</i>	swamp milkweed	OBL
	<i>Pycnanthemum tenuifolium</i>	slender mountain mint	FACW
	<i>Glyceria canadensis</i>	rattlesnake grass	OBL
	<i>Panicum clandestinum</i>	deertongue grass	FAC+
	<i>Panicum virgatum</i>	switchgrass	FAC
	<i>Euthamia graminifolia</i>	flat-topped goldenrod	FAC
	<i>Juncus effusus</i>	soft rush	FACW+
	<i>Chelone glabra</i>	turtlehead	OBL
	<i>Andropogon glomeratus</i>	bushy broomsedge	FACW+
	<i>Ludwigia alternifolia</i>	seedbox	FACW+
	<i>Scirpus atrovirens</i>	green bulrush	OBL
	<i>Spiraea latifolia</i>	meadowsweet	FAC+
<i>Penstemon digitalis</i>	foxglove beardtongue	FAC	
<i>Epilobium coloratum</i>	purple willowweed	FACW+	
<i>Verbena hastata</i>	blue vervain	FACW+	
<i>Note:</i>	<i>Species planted will depend upon availability.</i>		
Transition Area Seed Mix	<i>Lolium multiflorum</i>	annual rye grass	FACU-
	<i>Asclepias syriaca</i>	common milkweed	FACU-
	<i>Achillea millefolium</i>	yarrow	FACU
	<i>Rudbeckia hirta</i>	black-eyed susan	FACU-
	<i>Festuca ovina</i>	sheep fescue	NL
	<i>Verbena hastata</i>	blue vervain	FACW+
	<i>Aster novae-angliae</i>	New England aster	FAC
	<i>Monarda fistulosa</i>	wild bergamot	UPL
<i>Euthamia graminifolia</i>	flat-topped goldenrod	FAC	

Notes:

1. Nomenclature conforms to that of the National List of Plant Species That Occur in Wetlands: Northeast (Region 1), Reed (1988).
2. Wetland indicator status according to Reed (1988) as amended by NEIRP (1995).

community) and emergent (permanently inundated aquatic rooted-plant community) wetlands will be created to replace emergent wetlands impacted by the Route 92 project. Numerous plant species have been proposed for planting based on the objective of creating diverse plant communities and wildlife habitat. Many of the plant species have been selected due to the food source and nesting habitat they can provide. A total of 36.75 acres of forested, 8.20 acres of scrub/shrub, and 12.24 acres of emergent/wet meadow wetlands will be created on the two sites.

All phases of planting are anticipated to occur in the fall. However, if the construction schedule is altered, planting may instead be done in the spring. Woody species will be planted in their dormant condition. The woody vegetation will be bare root seedling and small caliper stock only (no trees > 3 feet in height) to assure that they can adapt to the hydrologic regime of the mitigation area. All vegetation will be obtained from commercial sources. The species proposed for planting and the quantities and stock types of each will be provided in the Final Landscaping Plans. Two wetland seed mixes are proposed to be utilized in the creation areas. The woody community seed mixture that will be utilized in the forested and scrub/shrub communities will not contain grass species due to competition. This seed mix will provide vegetative cover until the woody vegetation becomes established. All seeding will be done at a rate of 3.5 lbs per acre. Table 2 contains a complete list of species proposed for the wetland creation areas. A secondary species list will be provided for substitutions if necessary. No substitutions will be accepted by the contractor. The selected planting firm must be experienced in wetland plantings. A wetland ecologist experienced in wetland planting should be onsite during planting to assure success.

Planting, seeding, fertilizing, and mulching will be done according to contract specifications prepared for the Final Plan. Fertilizer with a commercial designation of 10-20-10 will be used in the transition areas only. In the woody wetland communities, only timed release fertilizer tablets or granules deposited directly into the planting hole may be used. No fertilizer will be used in ponded or flooded areas. Following planting, the saturated soil portions of the mitigation areas will be mulched with straw.

Forested and Scrub/shrub Wetlands

The tree and shrub species will be planted in the zone of seasonal soil saturation (0 to 1 foot above the water table) in their respective forested and scrub/shrub areas. (See Conceptual Wetland Communities Plans). Shrub species such as highbush blueberry (Vaccinium corymbosum), shadberry (Amelanchier canadensis), winterberry (Ilex verticillata),

and southern arrowwood (Viburnum dentatum), and alders (Alnus spp.) will be included in the forested areas (Table 2). No tree species will be planted in the scrub/shrub wetland communities. The areas will also be seeded with the woody community seed mix (Table 3).

Emergent Wetland

Herbaceous vegetation will be planted in the emergent wetlands where the depth of water will be 0-2 feet (Table 2). The plants will be planted in zones according to their hydrologic tolerances. Plants will be bare root, tubers, or potted where appropriate. Buttonbush (Cephalanthus occidentalis, OBL) will be planted (densely spaced cuttings) at the edges of some of the emergent wetlands to add shrub cover. At water depths greater than 2 feet, open water will be created. Only Elodea canadensis will be planted in these areas to prevent the growth of Myriophyllum or other noxious aquatic weeds.

Wet Meadow

The wet meadow areas will be planted with herbaceous species that can tolerate saturated soil conditions (Table 2). Species from the emergent wetland list that will tolerate drier conditions can be utilized in the wet meadow and species from the wet meadow list that will tolerate wetter conditions can be utilized in the emergent wetland. Shrubs such as red-osier dogwood (Cornus stolonifera) and red chokeberry (Aronia arbutifolia) may be included at 30+ foot intervals within the wet meadow to provide perching/feeding habitat. The proposed herbaceous species may be planted in peat pots (Table 2) or seeded with the wetland seed mix (Table 3), depending upon availability.

Transition Areas

A minimum 50-foot transition area will be provided between the created wetlands and adjacent properties. Wetland transition areas will be planted and seeded with the species indicated in Tables 2 and 3.

6. POTENTIAL PROBLEMS AND SOLUTIONS

The planting plan has been designed to minimize the growth of undesirable species in the created wetlands, to provide wildlife habitat, and to stabilize the soil. Mitigation sites can become contaminated by common reed grass (Phragmites australis), cattail (Typha latifolia) and/or purple loosestrife (Lythrum salicaria). The proposed

mitigation plan will attempt to eliminate the introduction of these nuisance species by innovative construction practices thereby enhancing the ecological value of the entire area.

Prior to any earth-moving activities at the mitigation site (this includes the mass excavation for roadway fill), any equipment to be utilized at the mitigation site or utilized to handle any soil proposed for the mitigation site, must be thoroughly cleaned of foreign soil and plant material (particularly roots) prior to entering the mitigation site. The transfer and introduction of undesirable vegetation such as common reed grass is often due to contamination by construction equipment.

Since the existing subsoils are loams and sandy loams, they have a low organic content and variable permeability. Therefore, the subsoils on the site are unsuitable for use in the constructed wetlands without supplemental topsoil. Every effort must be made to assure that unwanted invasive species are not introduced with the topsoil. To avoid the establishment of such species in the mitigation wetlands, no topsoil should be obtained from sites, wetlands or uplands, containing common reed grass, cattails, or purple loosestrife.

During the first year after planting, a regular maintenance program should be implemented to check the sites for noxious plants and hand-weed any that are observed. Following the first year, the sites should be checked at minimum twice a year and any undesirable plants removed by hand.

There will be vegetation losses due to herbivory at the mitigation sites. Deer and other animals will utilize the newly planted areas for food. To prevent this damage, the sites can be fenced. This would require an eight-foot fence, unless the fence was electrified, in which case a shorter fence (six foot) would be adequate. If fencing is not an acceptable solution, due to cost, aesthetics, or practicability, then overplanting is recommended. Overplanting will ensure a greater survival rate.

7. SCHEDULE OF COMPLETION

Construction of the Route 92 project is expected to begin in the spring of 1997 and is estimated to last approximately 56 months. At this time, dates of completion of the various aspects of the project are not accurately known. Construction scheduling is still being reviewed to arrive at an efficient working schedule. The road contractor will probably strip and stockpile the topsoil and perform mass excavation of the sites to remove the subsoil for use as fill for the roadway as one of the first steps. Following,

the mitigation contractor will perform the fine grading of the sites. Construction of the Northern Mitigation Site is expected to begin prior to construction of the Southern Mitigation Site.

Construction of the wetland will begin immediately prior to disturbance of any existing wetlands in the project area. The wetland creation sites are scheduled for completion before the construction portion of the project is completed. Planting of the trees/shrubs and herbaceous vegetation will be performed in the fall (October 15 to December 1) of 1998 following grading. All work required for construction of the wetlands is expected to be completed by the end of December, 1999.

8. MONITORING AND MAINTENANCE PLAN

The NJDEP requires a monitoring and maintenance plan to ensure 85% survival and 85% coverage of the mitigation sites for up to five years following planting. The creation sites will be planted with stands of various woody species and herbaceous plants and seeded as specified in the Landscaping Plan.

For determining the success of the mitigation plan, 85% survival will be based on the number of woody plantings per acre. A minimum of 400 trees and/or shrubs per acre will be planted. Following the first year and each subsequent year of monitoring required by the NJDEP, a minimum of 340 woody plants per acre with indicator classifications of facultative or wetter must be alive. These 340 plants may include planted and volunteer species. Trees must be a minimum of 24 inches in height to be counted. The criteria of 85% cover will be applied to each planted community as a whole. The mitigation will be considered a success if each community has a minimum of 85% total aerial coverage of facultative or wetter trees, shrubs, or herbaceous plants excluding noxious weeds and non-native species. No plants, other than Elodea, are expected to be present in the area designated as open water and no minimal coverage of this plant is required.

In the first growing season following completion of planting within the mitigation sites, planted species will be inspected to determine survival and coverage. If visual observation of each planted area is not sufficient to verify whether or not an 85% or greater survival rate or cover has been attained, then a quantitative sampling plan will be initiated for those areas where it is required. Quadrat areas of known dimensions will be established, and live plants will be counted (for trees and shrubs) or percent cover estimated to determine the density of plantings for that area. If the calculated density of live woody plants

is less than 85% of the original, planted density or each community does not have 85% cover of vegetation, then replanting to obtain the desired success rate will be initiated, if considered necessary after consultation with the NJDEP. NJTA typically requires a one-year guarantee from its landscape contractor.

An annual report with photographs documenting the survival and coverage of the wetland plantings will be submitted to NJDEP no later than November 15th in each of the five years following construction of the mitigation site. An onsite review meeting with the NJDEP representatives will be held in the final year to evaluate the success of the wetland mitigation sites. If 85% or better success is not evident at that time, the NJTA will coordinate with the permit agency to develop and implement a plan to ensure the desired success of the wetland.