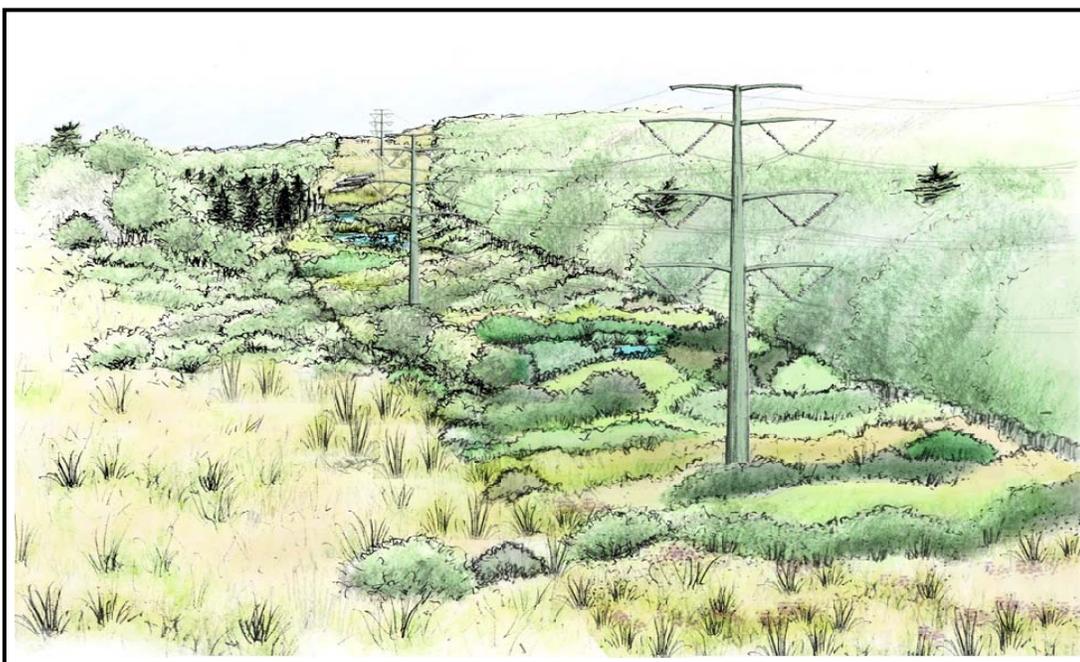


# SUSQUEHANNA-ROSELAND 500 kV TRANSMISSION PROJECT

## COMPREHENSIVE MITIGATION PLAN

PUBLIC SERVICE ELECTRIC AND GAS COMPANY



2011



Delivery Projects and Construction  
License and Permit Section



**PSE&G**  
**ECOLSCIENCES**  
**AECOM**  
**AKRF**  
**ARCADIS**  
**ERM**  
**URS**

# COMPREHENSIVE MITIGATION PLAN

## FOR THE SUSQUEHANNA-ROSELAND 500KV TRANSMISSION LINE PROJECT

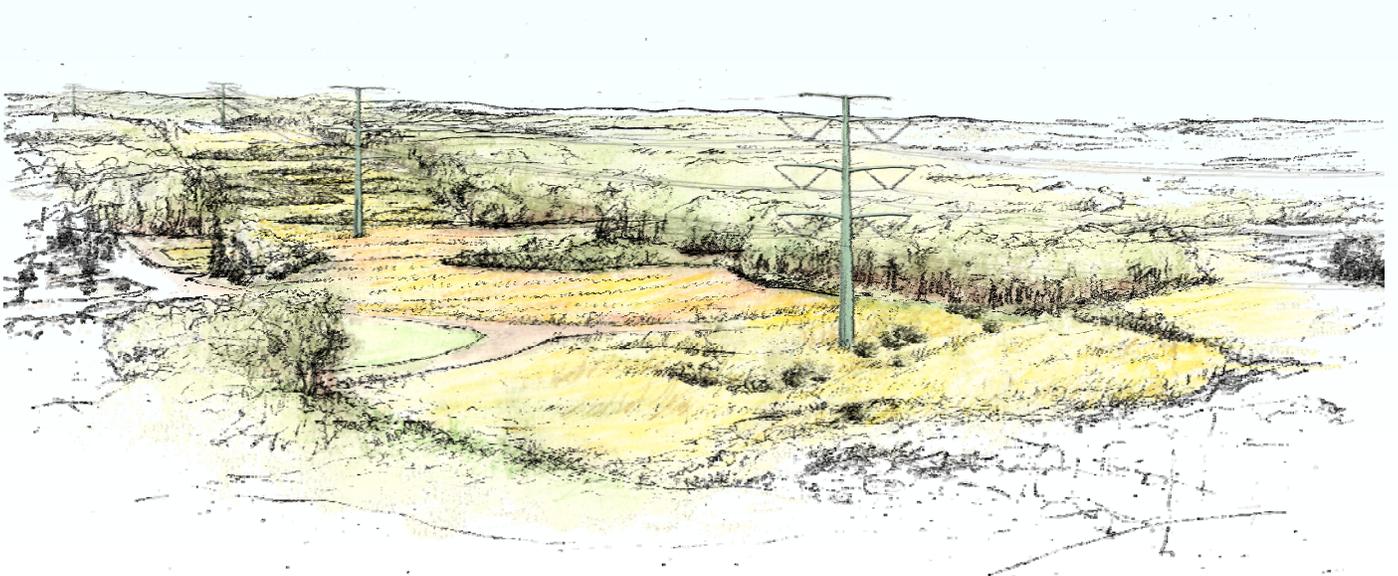
Through the New Jersey Highlands

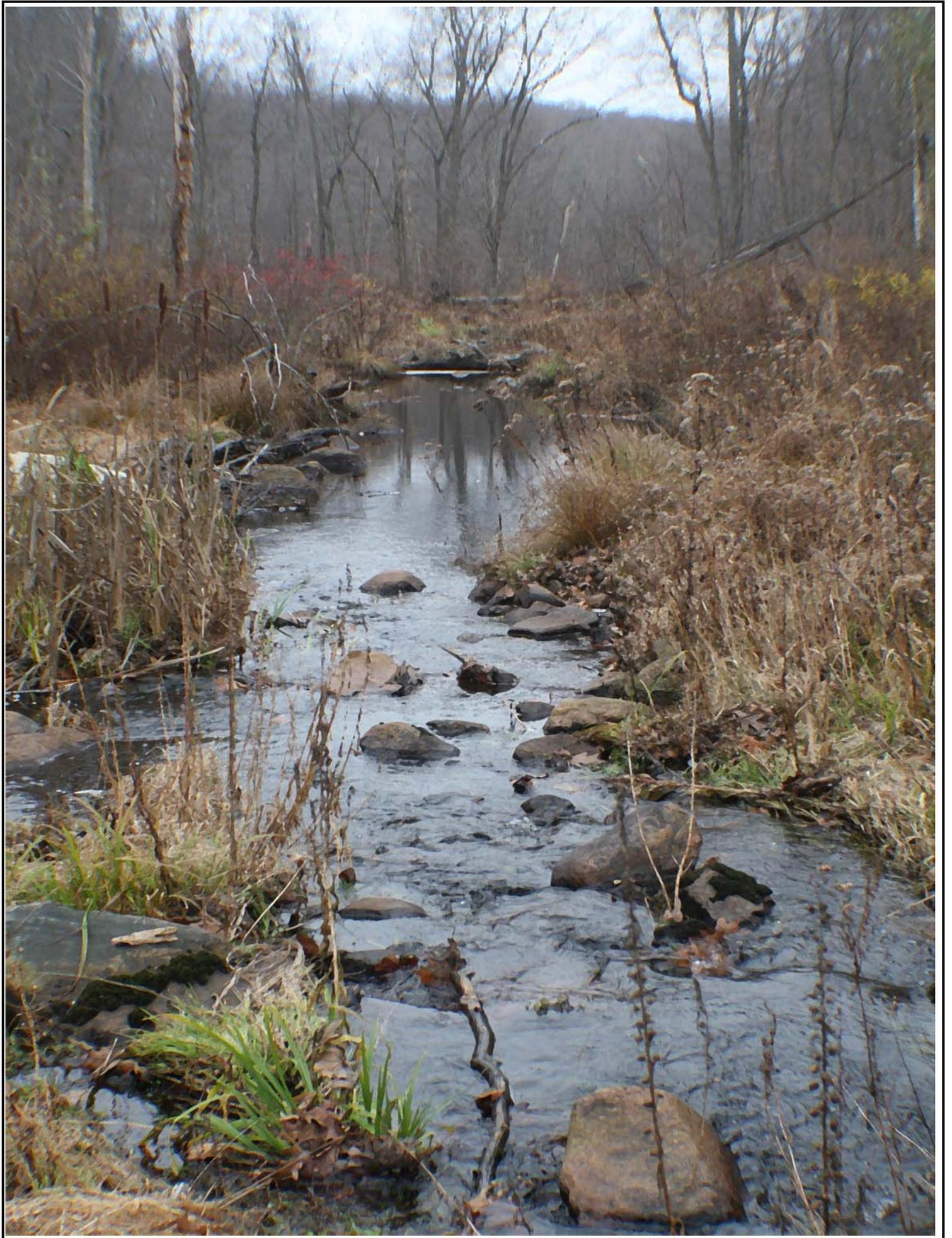
Prepared by:

SR Comprehensive Mitigation Plan Design Team

License and Permit Section  
Delivery and Construction Projects, PSE&G

June 2011





# COMPREHENSIVE MITIGATION PLAN

FOR THE SUSQUEHANNA-ROSELAND 500KV TRANSMISSION LINE PROJECT

## TABLE OF CONTENTS

INTRODUCTION

DATA COLLECTION METHODOLOGY

REGIONAL LOCATION AND ENVIRONMENTAL SETTING

PURPOSE AND GOALS OF THE CMP

DESIGN CRITERIA FOR THE SR TRANSMISSION PROJECT

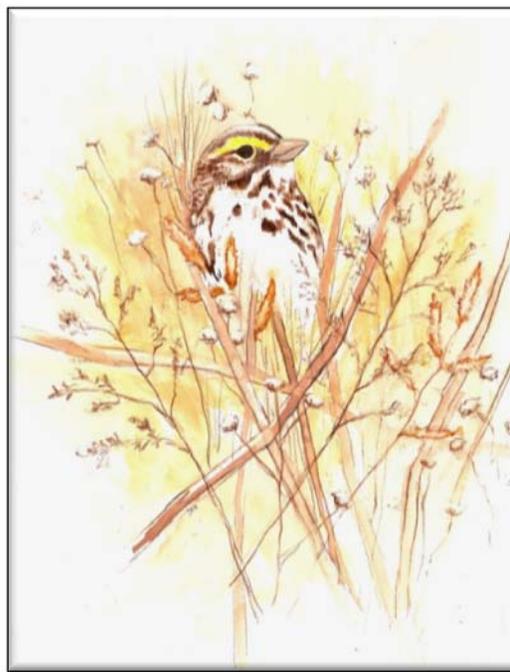
## CMP COMPONENTS

- Module 1: Construction and Restoration
- Module 2:
  - CRITICAL HABITAT/ENDANGERED SPECIES MITIGATION PLAN
  - FOREST RESTORATION PLAN
  - AVIAN PROTECTION PLAN
  - WETLANDS AND RIPARIAN ZONE RESTORATION PLAN
  - STORMWATER / SOIL EROSION AND SEDIMENT CONTROL PLAN
  - TRANSMISSION ROW VEGETATION MANAGEMENT PLAN
  - HISTORIC AND ARCHEOLOGICAL RESOURCES PLAN
  - GREEN ACRES PLAN
  - CONTRIBUTION TO THE HIGHLANDS COUNCIL
  - APPENDICES



# INTRODUCTION

New Jersey's ongoing planning initiatives recognize that the future economic viability of the state is dependent on protecting New Jersey's drinking water, as well as providing clean, safe and reliable energy. Through this Comprehensive Mitigation Plan ("CMP"), Public Service Electric and Gas Company, ("PSE&G") seeks to balance these two important goals from the proposed 500 kV upgrades associated with the Susquehanna-Roseland Transmission Line (the "Project") through the New Jersey Highlands (the "Highlands") Region.



The Highlands diverse natural communities, including its extensive forests, wetlands, rivers, and streams, are of statewide importance and provide the water supply for over half of New Jersey's families. The Highlands provides fresh air, open space, and recreation opportunities for millions of residents of the greater New Jersey metropolitan area. Recreation, eco-tourism, agri-tourism and wildlife activities continue to play an important role in the local economy of the area.

The proposed Project is an electrical service reliability project that will involve the major rehabilitation, reconstruction, repair and upgrade of an existing electrical public utility line within PSE&G's existing utility right of way that extends for approximately 26 miles through the Highlands Region. Upgrades will include new tower designs, tower heights, higher capacity conductors (electric transmission wires) and two (2) new switching stations along the existing transmission route.

The purpose and need for the Project is based on the analysis conducted and a corresponding directive by PJM Interconnection, L.L.C. ("PJM"), an independent FERC<sup>1</sup>-approved Regional Transmission Organization ("RTO") that operates the electric power grid in 13 states, and the District of Columbia. PJM's footprint includes New Jersey and Pennsylvania. The New Jersey Department of

---

<sup>1</sup> Federal Energy Regulatory Commission

Environmental Protection (NJDEP) and the New Jersey Highlands Council (HC) have determined that the proposed transmission upgrade Project is exempt from the Highlands Act, since it constitutes the “routine maintenance and operations, rehabilitation, preservation, reconstruction, repair, or upgrade of public utility lines, rights of way, or systems, by a public utility, provided that the activity is consistent with the goals and purposes of this act” subject to the successful completion of this Comprehensive Mitigation Plan (CMP).

This CMP has been prepared in order to detail the components that will provide an implementation mechanism for identifying the specific environmental resource issues, the means to avoid, reduce and minimize the specific impact and to define ways that would help to mitigate unavoidable environmental impacts. PSE&G believes that the combined effect of these components represents a comprehensive response to demonstrate the consistency of the Project with the goals and purposes of the Highlands Act.

This plan promotes the implementation of multi-objective corridor planning and design. This term has been used to describe the types of planning and design for river corridors and greenways; however this plan demonstrates that this same conservation strategy can be applied successfully to a transmission right of way.

This mitigation approach is contained in a nested planning approach where individual plans would be interwoven to meet multiple resource objectives. These plans would effectively deal with the proposed Project as a whole unit. The CMP further details the company’s commitment to a greater stewardship of the land and promotes the long-term enhancement of the environment within and along its transmission line. Implementation of the CMP will demonstrate that the Susquehanna-Roseland Project can be constructed and operated in a manner that is appropriate to the sensitive environment which it traverses.





## PURPOSE AND GOALS OF THE CMP

The CMP ensures that the Project is consistent with the goals and purposes of the Highlands Act. The CMP recommends responsible construction practices and appropriate planning and design initiatives that recognize the sensitive resources within the Highlands Region that will be traversed by the proposed upgraded electric transmission line.

The CMP provides the framework that recognizes the distinction between construction related activities and practices and the longer term environmental management techniques for the transmission ROW. These techniques, when implemented, will result in a net benefit to the regions natural resources; and will serve as a model for future transmission projects across the country, helping to define ways to bring reliable power to communities in the most environmentally responsible manner. The CMP supports the following goals:

- The protection, restoration and enhancement of the water quality of the Highlands region;
- The protection, restoration and enhancement of the natural, scenic, and other resources of the Highlands Region, including, but not limited to, contiguous forests, wetlands, vegetated stream corridors, steep slopes, and critical habitat for fauna and flora;
- To protect and preserve the resources of the natural and built environment, especially land and water resources;
- To restore and enhance those aspects of the natural and built environment which have been compromised by prior use and development;
- To maintain and enhance the fiscal and economic viability of the Region and its constituent communities;
- To support land preservation efforts and stewardship of open space throughout the Highlands region;
- The protection and preservation of the historic, cultural and archaeological resources of the Highlands region.

---

## DATA COLLECTION METHODOLOGY

Throughout the past two years, the company's consultant team has been conducting various ecological studies and field determinations. These include wetland delineations, bog turtle surveys and Indiana bat surveys as well vernal pool surveys, rare, threatened or endangered plant and animal surveys, raptor studies and timber rattlesnake habitat assessment and surveys. Coordination with the US Fish and Wildlife Service and the Division of Fish and Game, NJDEP has also taken place for specific guidance regarding these ongoing studies. These studies are continuing in spring and fall 2011.

As part of the data gathering and collection process for the CMP, a team of ecologists, wildlife biologists, ornithologists, botanists, and foresters was assembled from several environmental firms in response to a request for a proposal for professional services. These firms were collectively called the CMP Design Team. These firms were selected for their expertise in various environmental disciplines to assist with the preparation of the various CMP components.

Scientific methods were followed and existing data to date was reviewed by the CMP Design Team in preparation for on-site field assessments of the existing transmission line in October and November 2009. Existing digital data in GIS were reviewed and supplemented on aerial base maps. A database was created to record various observations, habitat characteristics, photos and CMP recommendations for the Project on a span by span basis.

This information and data collection has formed the basis for field recommendations for the CMP. Additional field work is anticipated in spring and fall 2011 to supplement the base of knowledge for the Project.



---

## REGIONAL LOCATION AND ENVIRONMENTAL SETTING

The proposed Project is located within portions of Hardwick Township in Warren County; Stillwater Township, Fredon Township, Town of Newton, Andover Township, Byram Township, Hopatcong Borough and Sparta Township in Sussex County; Jefferson Township, Rockaway Township, Kinnelon Borough, Boonton Township, Montville Township, Parsippany-Troy Hills Township and East Hanover Township in Morris County; and ends in Roseland Borough in Essex County.

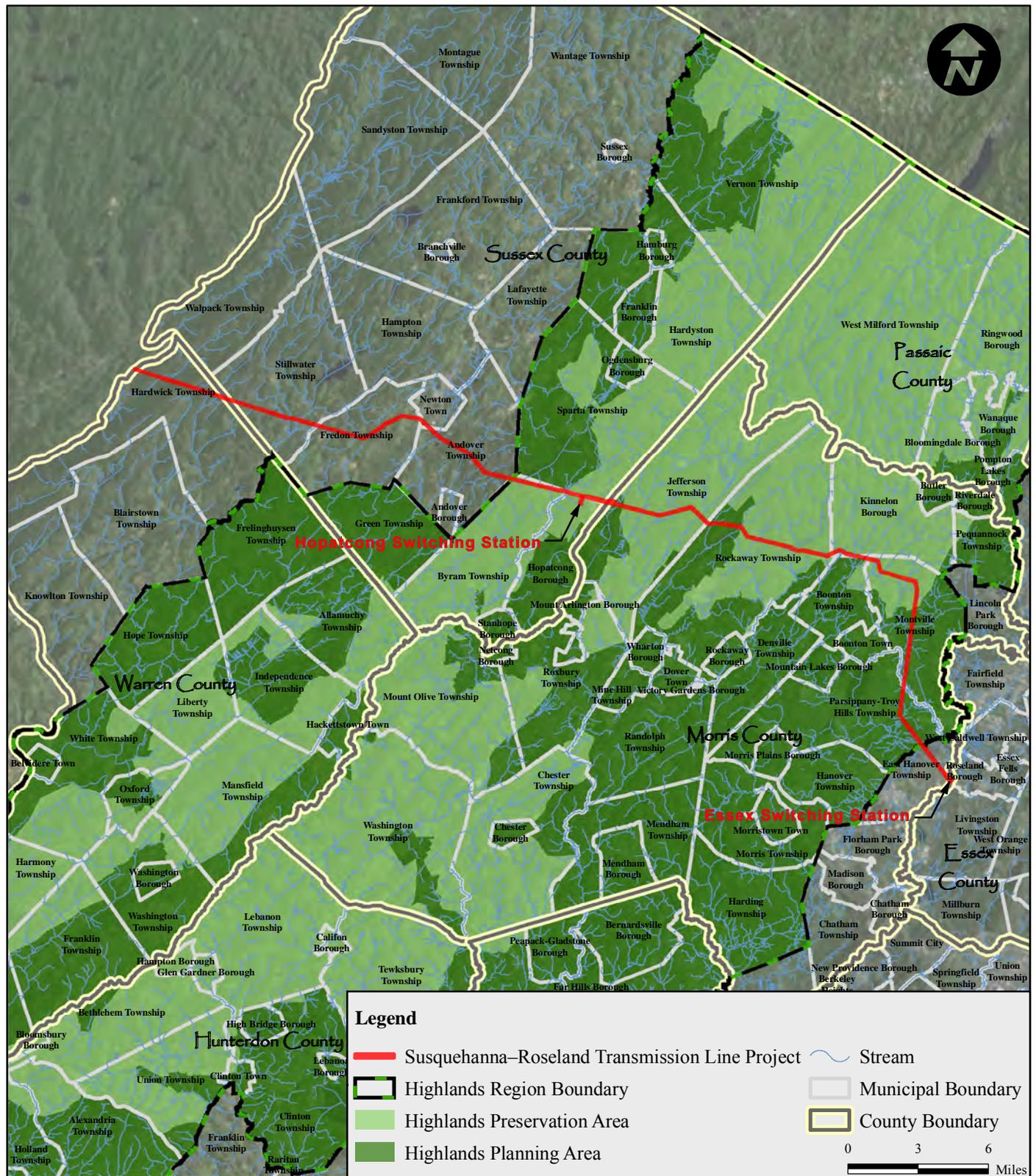
The Susquehanna to Roseland 500 kV transmission line (Project) will be constructed entirely within the existing Roseland – Bushkill 230kV transmission line ROW. This Project would cross the Delaware River within the Delaware Water Gap National Recreation Area in Hardwick Township at the crossing point of the existing Roseland – Bushkill 230kV line. It would then continue east within the existing ROW, crossing the Appalachian Trail before passing through Stillwater and Fredon Townships. In Andover Township, the line would cross portions of Kittatinny Valley State Park. Continuing east into Sparta Township, the line would enter the Highlands Planning Area and Highlands Preservation Area before interconnecting with a proposed new switching station in Hopatcong Borough.

From Hopatcong, the line would head east across the Rockaway River Wildlife Management Area (WMA) in Jefferson Township, Picatinny Arsenal and the Wildcat Ridge WMA in Rockaway Township, the Buck Mountain Forest Legacy Tract in Kinnelon Borough, and the Pyramid Mountain Natural Historical Area in Montville Township. The line would then turn south toward the Montville switching station and cross Route Interstate 287, and continue south to a crossing of Interstate-80 (I-80). On the south side of I-80, the line would turn to the southeast and cross Troy Meadows, continuing East to the existing Roseland Switching Station, which will be expanded to support the Project.

Upgrades to the existing transmission line will require the construction of new, taller structures that may be lattice structures or monopoles depending on site conditions. Some of this region consists of remote rocky, mountain ranges and low-land valleys. The project will also cross multiple streams, some designated as C1 streams, wetlands, upland forests and certain sensitive habitats, including suitable habitat for threatened or endangered species.

### The New Jersey Highlands Region

consists of 1,343 square miles in northwest New Jersey noted for its scenic beauty and environmental significance. The Region stretches from Phillipsburg in the southwest to Ringwood in the northeast, and lies within portions of seven counties (Hunterdon, Somerset, Sussex, Warren, Morris, Passaic, and Bergen) and includes 88 municipalities. The Highlands yields approximately 379 million gallons of water daily and is a vital source of drinking water for over 5 million residents of New Jersey.



## SITE LOCATION MAP

### PSE&G Susquehanna-Roseland Transmission Line Project

### Counties of Warren, Sussex, Morris and Essex

### New Jersey



Source:  
 Transmission line from PSE&G, 2009.  
 Highlands Region Boundary, Preservation Area and Planning Area from NJ Highlands Council, 2006.  
 Streams from NJDEP, 2007.  
 County and Municipal Boundaries from NJDEP, 2008.  
 Aerial Imagery from ArcGIS Online - Aerials Express, 2006.

Drawn By: EB	Scale: 1" = 6 miles	Project No. 01315.0071.010
Chk'd By: PD	Date: 05/12/09	Figure No. 1

---

## DESIGN CRITERIA FOR THE SR TRANSMISSION PROJECT

### STRUCTURE ALIGNMENT

Proposed transmission structure locations have been designed in response to the natural conditions/constraints located along the ROW including: steep slopes, wetlands, rivers, valleys, roads and potential severe weather conditions. Structure designs also have considered the location of construction access and maintenance roads.

Establishing the proper alignment and configuration of a transmission line is a complex design process. Significant design efforts have been made to locate structures and the associated construction laydown areas outside of wetlands, riparian zones and other significant environment features. However, it is important to recognize that the movement of one structure often affects the necessary location of other structures.

### STRUCTURE SPANS

The spans between proposed structures will range from approximately 700 feet to 2,700 feet. Typical examples of transmission structure types are provided in Figures 1A, 1B and 1C. The proposed structures are designed to meet or exceed the National Electric

Safety Code (NESC) design conditions as well as additional design conditions established by PJM Interconnection (PJM) and PSE&G.

The structures have been designed to reliably support the weight of the conductors and shield wires under all anticipated weather conditions. This also includes the stresses on the conductor and shield wires from the forces of wind and the additional weight when coated by winter ice.

### STRUCTURE HEIGHT

Depending on site conditions, the proposed Project will consist of the placement of 165 to 195 foot-tall transmission structures within the existing ROW consisting of monopoles and/or lattice structures. Major factors influencing the height of the transmission structures include: mechanical loading, electrical insulation to ground surface and grounded objects, electrical field effects, work practices and topography.

The existing 230kV circuit's conductors are in a horizontal configuration, which allows all of the phase conductors to be at the same elevation. A double circuit structure, as proposed by this Project, will require the conductors to be placed in a vertical configuration, with the 230kV conductors on one side and the 500kV conductors on the other side of the structure.

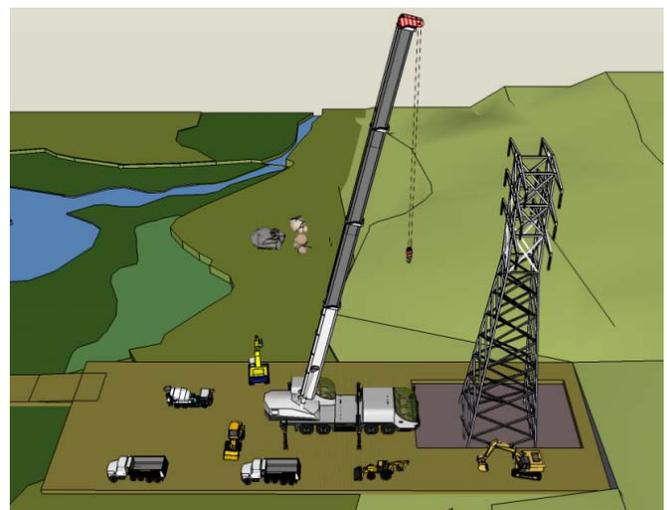
For the 500kV side of the structure, the National Electric Safety Code (NESC) - Section 232 and PJM safety criteria require a minimum clearance to ground from the lowest conductor of 32 feet resulting in a typical conductor connection point at the structure of over 85 feet. Furthermore, the NESC, Occupational Safety & Health Administration (OSHA) and PSE&G safe work practices require a clearance from conductor B to C and conductor A to B of approximately 33 feet. Accordingly, these safety and performance clearances are the driving factor in determining the height of the structures.

### MONOPOLES

Where utilized, the monopoles will represent the state of the art in design for utility support structures. They will have a reduced footprint over earlier types of monopole designs and would be constructed in a relatively short time frame thereby reducing the duration of the overall construction activities. Sections of the monopoles are assembled and bolted together. The procedure consists of placing the base assembly within the foundation excavation. Each section is lifted by a crane, fitted and bolted into the previously assembled section.

### LATTICE STRUCTURES

Lattice structures, which are similar to the existing structures, will also be used and the use may vary along the route depending on accessibility and construction feasibility. Lattice structures typically reduce construction impacts associated with access roads as the structures can be constructed on site in an "erector set" manner and machinery, such as very large cranes, will not necessarily be required.



## FOUNDATIONS

Foundations will typically consist of cylindrical, steel reinforced concrete on which the base of the lattice or steel pole structure is bolted. Each foundation is designed specifically for each structure site based on subsurface conditions. Foundation dimensions will vary from structure to structure and, depending upon local soil and rock conditions, the foundation may range from four to twelve feet in diameter and up to 40 feet deep in unconsolidated sediments. The concrete foundations require a minimum of two months to cure to the final design strength.

In general, structure locations overlying solid bedrock will require shallower foundations. Tubular steel structure types will require larger, but fewer foundations than lattice structure types. The permanent foundation footprint for a lattice tower is slightly less than that of a monopole. For tubular steel structures, the typical foundation is a 12-foot diameter cylindrical foundation (114 square feet). Lattice tower foundations typically consist of four (4), four-foot diameter cylindrical foundations with an area of 12.6 square feet for each leg foundation (approximately 50.2 square feet) per lattice tower. The legs of a typical lattice tower will have a spacing of 31 feet. Structures will be designed to comply with the Avian Power Line Interaction Committee (APLIC) "Suggested Practices for Avian Protection on Power Lines: the State of the Art in 2006."

## CONSTRUCTION ACCESS ROADS

New temporary access roads will be required where necessary to access the proposed Project sites. Existing access roads will be used to the extent practicable. Providing construction access to proposed structure locations has been an ongoing design issue that has required the careful evaluation of slopes, neighboring communities, and environmentally sensitive features such as forests, wetlands and riparian zones. The construction plans show a limit of disturbance for each access road. These plans also identify the locations where both existing gravel and paved roads will be used, rather than having to create new access roads, in an effort to further reduce the potential overall impacts on environmental resources.

PSE&G is continuing with a feasibility analysis to evaluate potentially eliminating several long access roads that would have involved significant steep slope and other impacts through the use of a helicopter or the use of other alternate construction techniques for such work. These analyses are still ongoing and may

be incorporated into the proposed Project construction approach at a later date and depending on the contractor selection process for the Project.

The proposed access roads need to be sixteen (16) feet wide in most cases. Mature trees will be avoided to the maximum extent practicable but there may be some circumstances where mature trees must be removed. Many existing trails and paths now measure at least twelve (12) feet wide and may only require the selective removal of specific trees, the movement of obstructions like significant boulders, fallen trees and/or the cutting back of existing limbs. Gravel or wooden marsh mats may be required to be placed within the access roads depending upon existing site conditions. To the maximum extent practical, these access roads would be designed and sited along forest edges or within disturbed portions of forest land.

Temporary access roads located in upland areas may be excavated to a depth of approximately 12 inches and backfilled with a 12-inch layer of gravel aggregate surface course over geotechnical stabilization fabric. Temporary access roads located within wetlands, transition areas and riparian zones will have geotextile fabric overlain onto the existing ground surface, followed by the addition of timber marsh matting. This will allow for future restoration of disturbed areas. Grubbing and excavation of stumps, roots and topsoil will be prohibited in these areas.

### **SWITCHING STATIONS**

Two (2) Switching Stations are proposed to service the proposed Susquehanna-Roseland transmission line. Construction of the Hopatcong Switching Station will consist of a Gas Insulated Switchgears (GIS) switching station, including a four-position, breaker-and-a-half (six breakers) switchyard configuration. All switching station equipment will be located inside of an architectural finished building within a secure fenced area. The GIS building will have a low profile design and will be monitored and controlled remotely. A permanent access driveway road is provided to enable necessary maintenance and regular inspections of the facility. This driveway has been sited and designed to follow an existing narrow pathway and is the only permanent driveway proposed for the entire and is integral to the safe and secure operation of the switching station.

The proposed Roseland Switching Station also will consist of a GIS switching station, including a four position, breaker-and-a-half (six breakers) switchyard

configuration. All switching station equipment will be located inside of an architectural finished building within a secure fenced area. This facility will be located to the rear of the existing switching station and will not be readily visible from any main street within the Borough. Both switching stations were chosen based on extensive alternative site evaluations. The Hopatcong Switch was moved from its originally planned location within Jefferson Township to avoid significant additional clearing of both upland and wetlands forests needed to reach the junction of the New York/Ramapo 500 kV line. In addition, locating the switching station at the Jefferson Township location would have required at least nine new transmission structures around Lake Winona, which is an existing residential lake community.

The currently proposed locations for both the proposed Hopatcong and Roseland switching stations represent the most feasible and prudent locations for these facilities. Efforts to reduce and minimize the environmental impacts from these facilities have been demonstrated by the entire site selection process to date for structure locations, temporary access roads and for the proposed switching stations.

---



## COMPONENTS OF THE CMP

The full implementation of the CMP contains two modules. The combined effect of these two modules represents a comprehensive response to the issue of consistency with the goals and purposes of the Highlands Act and for environmentally responsible development within the limits of the Highlands Region and beyond these limits as required by sound planning practices and regulatory requirements:

---

### MODULE 1: CONSTRUCTION AND RESTORATION

This module details very specific requirements aimed at avoiding, reducing and minimizing the impacts of the Project before and during construction and for the restoration of the impacted areas immediately after construction.

This Project is a major construction project that extends across some of the most significant and sensitive environmental resources in Northern New Jersey, including approximately 26 miles through the New Jersey Highlands Region. This requires environmentally responsible construction methods and standards to be used within and in proximity to sensitive environmental resources for the Project. These standards were derived from the individual components of the CMP and assembled into a single set of documents and plans to be used for the construction and restoration of the Project. Collectively, these standards and plans constitute the construction-related activities of the Project. Implementation of these standards will avoid, minimize and restore the short-term environmental impacts associated with the Project during construction.

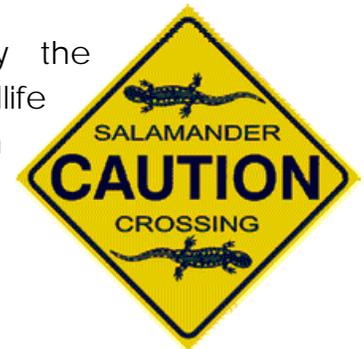
**Construction and Restoration Standards:** The construction of the Project anticipates the selection of a General Contractor (GC) who will be required to understand compliance with all environmental standards and regulations. All subcontractors employed by the GC are required to adhere to the same requirements of the General Contractor. The construction of the Project will be guided by the Construction and Restoration Standards, the Pollution Prevention Plan, the Certified Soil Erosion and Sediment Control Plans and the NJDEP approved plans and established permit conditions. There is intentional redundancy among these documents to reinforce the significance of how important it will be for the GC to understand their role in the responsible construction and restoration of the temporary impacts associated with the Project.

**Environmental Compliance Firm:** An Environmental compliance firm, separate and distinct from the GC, will be hired by PSE&G for the Project to oversee compliance and adherence to all environmental standards and regulations by the GC. This firm shall employ environmental field inspectors, environmental compliance officers as well as specialists in wetlands, herpetology, botany, ornithology, soil erosion and sediment control and other environmental disciplines. These individuals will maintain logs and compliance schedules for the Project and will interface with the GC in a professional manner to ensure that all environmental standards and regulations of permits and other documents, including the CMP are met. In the absence of a direct PSE&G representative, then the EC firm shall interface with inspectors from regulatory agencies who arrive on site.

**Environmental Restoration Firm:** A separate environmental restoration firm will be selected for implementing the enhancement and mitigation opportunities of the CMP and to fully restore the impacts of the Project to the required specifications following the construction and basic stabilization by the GC. This firm will be selected based upon their experience completing the restoration of similar jobs with a high degree of success and sensitivity to the environmental resources in the region.

**Module 1 consists of the following documents and plans:**

- The Construction and Restoration Standards, last revised June 18, 2010 and any subsequent amendments
- The Pollution Prevention Plan and its appendices, dated \_\_\_\_ and any subsequent amendments
- The Certified Soil Erosion and Sediment Control Plans
- All permits, plans and conditions approved by the Highlands Council, the NJDEP, the US Fish and Wildlife Service and other regulatory agencies with jurisdiction over the Project.



---

## MODULE 2: ENHANCEMENT AND MITIGATION OPPORTUNITIES

This module consists of nine (9) components that have been collectively brought together. These components will provide the means for identifying the specific resource issues, the means to avoid and minimize the specific impact and ultimately the ability to define ways that would help to enhance resources and to mitigate unavoidable environmental impacts.

The CMP contains the following components:

**CRITICAL HABITAT/ENDANGERED SPECIES MITIGATION PLAN:** Based upon field surveys and other available information, this plan recognizes the potential impacts to various threatened or endangered species and recommends various construction methods, timing restrictions and habitat enhancements to preclude or minimize these impacts on these resources to the extent practicable.

**FOREST RESTORATION PLAN:** This plan is directed at enhancing forest habitats specific company owned parcels as well as minimizing the initial impacts and restoring forest resources that would be impacted with the construction of access roads outside of the ROW, but which are required for the Project.

**AVIAN PROTECTION PLAN:** This plan focuses on the specific strategies and elements as recommended within technical documents for reducing bird mortalities from transmission lines and improving avian habitat functions of the ROW.

**WETLANDS AND RIPARIAN ZONE RESTORATION AND MITIGATION PLAN:** This plan provides the mechanism for restoring and mitigating the functions and values of wetlands and riparian zones, which are impacted by the Project, and in response to the regulatory requirements of NJDEP, Division of Land Use Regulation.

**TRANSMISSION ROW VEGETATION MANAGEMENT PLAN:** This plan focuses on the overall management practices of the existing ROW to enable them to adapt through directed succession and incorporating integrated vegetation management techniques. This will improve their function as habitat for various species of wildlife and reduce the cost of ROW maintenance.

**STORMWATER, EROSION CONTROL PLAN:** This plan provides the mechanism for protecting water quality from runoff associated with the Project during

construction and for restoring stable soil profiles and for the protection of steep slopes. This plan is also in response to the regulatory requirements of the Stormwater Management rules.

**HISTORIC AND ARCHEOLOGICAL RESOURCES PLAN:** This plan provides the analysis and recommendations to reduce and minimize the impacts of the Project on these resources, as required by the State Historic Preservation Office within NJDEP.

**GREEN ACRES PLAN:** Several properties are encumbered by the Green Acres rules administered by NJDEP, Green Acres Program. This plan recommends the compensation strategy to remedy the impacts of these diversions.

**CONTRIBUTION TO THE HIGHLANDS COUNCIL** As part of the CMP for the Project, PSE&G would make a contribution to the Highlands Council to be used to protect the existing character of the Highlands Region to ensure the continued economic activity in the form of agri-tourism, eco-tourism and heritage tourism in support of the Highlands Act with the Project.

