

Before the
Pennsylvania Public Utility Commission

MONROE-JACKSON #2 138 kV RELOCATION

**Attachments in Support of the
Letter of Notification**

Application Docket No. _____

Submitted by: PPL Electric Utilities Corp.

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ATTACHMENT 1

**ATTACHMENT 1
MONROE-JACKSON #2 138 kV RELOCATION
NECESSITY STATEMENT**

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**ATTACHMENT 1
MONROE-JACKSON #2 138 kV RELOCATION
NECESSITY STATEMENT**

A. INTRODUCTION

PPL Electric Utilities Corporation (PPL Electric) seeks approval from the Pennsylvania Public Utility Commission (“Commission” or “PUC”) to relocate approximately 515 feet of the existing Monroe-Jackson #2 138 kV Transmission Line at the North Stroudsburg 138-12 kV Substation in Stroud Township, Monroe County. The purpose of the proposed relocation is to accommodate the installation of the two (2) new 138 kV 14 MVAR capacitor banks at the North Stroudsburg 138-12 kV Substation. The proposed new facilities, together with the installation of Direct Transfer Trip relay upgrades at the Monroe 230-138 kV and Jackson 138-69 kV Substations, will provide improved reliability of service and power quality for 11,350 customers in Stroud Township, Stroudsburg Borough, and East Stroudsburg Borough in Monroe County.

The total estimated cost for the proposed project is approximately \$3.0 million, which includes the costs associated with the construction of the two (2) proposed 138 kV 14MVAR capacitor banks at the North Stroudsburg 138-12 kV Substation and the installation of the Direct Transfer Trip relay upgrades at the Monroe 230-138kV and Jackson 138-69kV Substations. The transmission work associated with this project is estimated to cost approximately \$300,000.

Subject to the PUC’s approval, the project has a scheduled construction start date of June 2014 to meet a scheduled in service date of November 2014.

B. SYSTEM PLANNING PROCESS

System Planning is the process which assures that the transmission system can supply electricity to all customer loads in a manner that is reliable and economic. This System

Planning process assures that both the Bulk Electric System (BES)¹ and non-Bulk Electric System² (non-BES) are planned and constructed so that:

- They are able to accommodate forecasted system flows during summer and winter peak load;
- They can adequately serve each customer's needs with regard to capacity, voltage and reliability for all load levels throughout the daily load cycle;
- They can sustain probable contingencies and disturbances with minimal customer service interruptions;
- They are in conformance with PPL Electric's transmission planning reliability principles, practices and standards for all normal and emergency operating conditions.

The fundamental purpose of the RP&P is to provide PPL Electric planning engineers with a comprehensive set of planning practices and criteria that enable them to plan for a reliable transmission and distribution system for PPL Electric's customers. PPL Electric's RP&P is consistent with good utility practices and with the reliability criteria and standards used by similarly situated distribution and transmission utilities.

The transmission planning process begins with the development of a computer model of the future system. A specific study year is chosen, and the future system model is developed using the existing system plus any planned modifications to the transmission system scheduled to be completed prior to the study year. Load levels used in the system model are based on the latest forecast prepared annually by PJM Interconnection, LLC ("PJM"). Once the system model is complete, comprehensive power flow simulations are performed to determine the ability of the system to comply with the PPL Electric's RP&P criteria. Compliance is determined by simulating particular contingency conditions. All conditions where the system is not in conformance with the reliability

¹ Bulk Electric System (BES) - Includes transmission facilities operated at voltages of 100 kV or higher.

² Non-Bulk Electrical System (non-BES) - Includes transmission facilities operated at voltages less than 100 kV.

criteria are identified, and system reinforcements are added to bring the system into compliance.

C. PJM'S ROLE IN THE PROJECT

PJM is a Federal Energy Regulatory Commission ("FERC") approved Regional Transmission Organization charged with ensuring the reliability of the electric transmission system under its functional control and coordinating the movement of electricity in all or parts of thirteen states and the District of Columbia, including most of Pennsylvania. In order to ensure reliable transmission service, PJM prepares an annual Regional Transmission Expansion Plan ("RTEP")³ to identify system reinforcements that are required to, among other things, meet the North American Electric Reliability Corporation ("NERC") Reliability Standards,⁴ PJM reliability planning criteria, and transmission owner reliability criteria.

The proposed North Stroudsburg Capacitor Bank Project will resolve reliability criteria violations of PPL Electric's RP&P, its local planning criteria. The local transmission operator, in this case PPL Electric, is responsible for identifying the reliability violations and correcting any violations to meet its own local transmission planning criteria on the non-BES system. PJM relies on the local transmission owners to ensure the reliability of their non-BES system by meeting their own local transmission planning criteria. Projects that are necessary to resolve NERC criteria, PJM reliability criteria, or the transmission owners' own local transmission planning criteria are included as baseline projects in PJM's RTEP.

³ PJM's RTEP process is currently set forth in Schedule 6 of PJM's Amended and Restated Operating Agreement ("Schedule 6"). Schedule 6 governs the process by which PJM's members rely on PJM to prepare an annual regional plan for the enhancement and expansion of the transmission facilities to ensure long-term, reliable electric service consistent with established reliability criteria. In addition, Schedule 6 addresses the procedures used to develop the RTEP, the review and approval process for the RTEP, the obligation of transmission owners to build transmission upgrades included in the RTEP, and the process by which interregional transmission upgrades will be developed.

⁴ On February 3, 2006, FERC certified the North American Electric Reliability Corporation ("NERC") as the organization required to establish and enforce reliability standards for the bulk electric system. Thereafter, NERC develops and enforces reliability standards, which define the reliability requirements for planning and operating transmission systems in North America. The NERC Reliability Standards apply to all users, owners, and operators of the nation's interconnected transmission grid, including PPL Electric.

The purpose of the North Stroudsburg Capacitor Bank project is to resolve reliability violations that occur on the 138 kV system serving a portion of the Northeast Region of PPL Electric's service territory. The Monroe-Jackson #2 Line relocation, which is the subject of this filing, is required to accommodate the installation of the North Stroudsburg Capacitor Bank. PPL Electric submitted the North Stroudsburg Capacitor Bank Project to PJM for review and inclusion in the RTEP. The project was presented before stakeholders at the Mid-Atlantic Sub-Regional RTEP meeting on March 8, 2012, approved by the PJM Board, and included in the 2012 RTEP Report as a baseline project b1896.

D. EXISTING SYSTEM

The North Stroudsburg and Stroudsburg 138-12 kV Substation currently serve approximately 11,350 customers in Stroud Township, Stroudsburg Borough, and East Stroudsburg Borough in Monroe County. The North Stroudsburg and Stroudsburg 138-12 kV Substations currently are supplied from the Monroe and Siegfried 230-138 kV Substations via the double-circuit Monroe-Jackson #1 and #2 138kV Transmission Lines.

The double-circuit Monroe-Jackson #1 and #2 138 kV Transmission Lines extend approximately 15.2 miles between the Monroe 230-138 kV Substation and the Jackson 138-69 kV Substation. From the Monroe 230-138 kV Substation, the Monroe-Jackson #1 and #2 138 kV Transmission Lines extend approximately 1.4 miles to the Stroudsburg 138-12 kV Substation, then approximately 2.8 miles from the Stroudsburg 138-12 kV Substation to the North Stroudsburg Substation, and then approximately 11 miles from the North Stroudsburg 138-12 kV Substation to the Jackson 138-69 kV Substation. The Jackson 138-69 kV Substation receives normal supply from the Siegfried 230-138 kV Substation via the Siegfried-Jackson #1 and #2 138 kV Transmission Lines and the Monroe-Jackson #1 and #2 138 kV Transmission Lines. A map of the existing system is provided as **Figure 1**.

The section of the existing Monroe-Jackson #2 138 kV Transmission Line to be relocated at the North Stroudsburg 138-12 kV Substation is provided as **Figure 2**. The existing Monroe-Jackson #2 138 kV Transmission Line currently enters the property for the North

Stroudsburg 138-12 kV Substation at the southern portion of the substation site (see point (a) on **FIGURE 2**), turning to a northeasterly path (see point (b1) on **FIGURE 2**), and then turning northwesterly (see point (c) on **FIGURE 2**), before turning southwesterly to complete the route around the substation property (see point (d) **FIGURE 2**) where it interconnects with the Substation.

E. DEFINITION OF THE PROBLEM

Due to load growth in the area, transmission planning studies project for 2014 that the following losses of supply to and from the Monroe 230-138 kV Substation would violate PPL Electric's RP&P guideline for maximum allowable voltage drop for a single facility outage:

- (1) The loss of the Martins Creek-Monroe 230 kV Line and the subsequent loss of the Monroe 230-138 kV Transformer #2 supplying the Monroe 138 kV Yard would create a voltage drop in excess of 5% at PPL Electric's North Stroudsburg and Stroudsburg 138-12 kV Substations.
- (2) The loss of the Monroe 230-138 kV Transformer #2 would create a voltage drop in excess of 5% at PPL Electric's North Stroudsburg and Stroudsburg 138-12 kV Substations.
- (3) The loss of the Monroe 138 kV Bus would create a voltage drop in excess of 5% at PPL Electric's North Stroudsburg and Stroudsburg 138-12 kV Substations.
- (4) A double-circuit loss of the Monroe-Jackson #1 and #2 138 kV Transmission Lines between the Monroe 230-138kV Substation and Stroudsburg 138-12 kV Substations would create a voltage drop in excess of 5% at PPL Electric's North Stroudsburg and Stroudsburg 138-12 kV Substations.

The above described loss of the Monroe 230 kV to 138 kV power flow will affect the voltage and power quality to approximately 11,350 customers served from PPL Electric's

North Stroudsburg and Stroudsburg 138-12 kV substations.⁵ Under any of these contingencies, the entire load at the at Tannersville, Bartonsville, North Stroudsburg, and Stroudsburg 138-12 kV substations are fed from the 230 kV source at the Siegfried 230-138 kV Substation through the 138 kV yard at the Jackson 138-69 kV Substation. In this configuration, the Siegfried 230-138 kV Substation is not capable of maintaining voltage within acceptable limits at both the North Stroudsburg and Stroudsburg Substations, which are approximately 36 and 39 miles from the Siegfried Substation, respectively. As a result, a 6% voltage drop would occur on the 138 kV system at both the North Stroudsburg and Stroudsburg 138-12 kV Substations. This voltage deviation would violate PPL Electric's RP&P, which provides that the maximum allowable voltage drop is 5% for a single facility outage.

F. PROPOSED SOLUTION

To resolve the reliability violations described above, and to ensure that customers in Stroud Township, Stroudsburg Borough, and East Stroudsburg Borough continue to receive reliable electric service, PPL Electric, with approval from the PUC, plans to construct the following:

- Relocate approximately 515 feet of the existing Monroe-Jackson #2 138 kV Transmission Line at the North Stroudsburg 138-12 kV Substation site, which will require one of the existing 138 kV poles to be moved (see point (b2) on **Figure 2**), and the addition of one new 138 kV pole at the North Stroudsburg 138-12 kV Substation site.
- Acquire approximately 0.25 acres of new right-of-way adjacent to the existing North Stroudsburg 138-12 kV Substation to accommodate the relocation of the Monroe-Jackson #2 139 kV line on the substation property (see shaded area "New ROW" on **FIGURE 2**).

⁵ As explained above, post-contingency, the 138 kV system at both the North Stroudsburg and Stroudsburg Substations will operate in a radial configuration.

- Expand PPL Electrics North Stroudsburg 138-12 kV Substation to accommodate two (2) new 138 kV 14MVAR capacitor banks.
- Install new relay upgrades at PPL Electrics Monroe 230-138 kV and Jackson 138-69 kV Substations to accommodate new Direct Transfer Trip for the new 14MVAR capacitor banks.

Figure 2 shows the functional arrangement of the existing and proposed transmission facilities in the area.

Moving the existing Monroe-Jackson #2 138 kV Line will allow for the expansion of the North Stroudsburg 138-12kV Substation and addition of the two (2) new 138 kV 14 MVAR capacitor banks.

PPL Electric determined that the installation of the two (2) new 138 kV 14 MVAR capacitor banks will resolve the RP&P violation for the four contingencies described above (loss of Martins Creek-Monroe 230 kV Line, loss of Monroe 230-138 kV Transformer #2, loss of Monroe 138 kV bus, or double-circuit loss of Monroe-Jackson #1 & #2 138 kV Lines) in the area because there will be additional voltage (VAR)⁶ support in the area.

After the project is completed, the North Stroudsburg and Stroudsburg 138-12 kV Substations, as well as the customers served from these substations, will not experience any sustained voltage drops (at the time of the fault there will initially be some voltage drop but it will not be sustained) for any of the four contingencies described above.

The total estimated cost for the proposed project is approximately \$3.0 million. The transmission work associated with this project is estimated to cost approximately \$300 thousand.

⁶ Volt-Ampere Reactive (VAR): Unit used to measure reactive power in an AC electric power system.

FIGURE 1

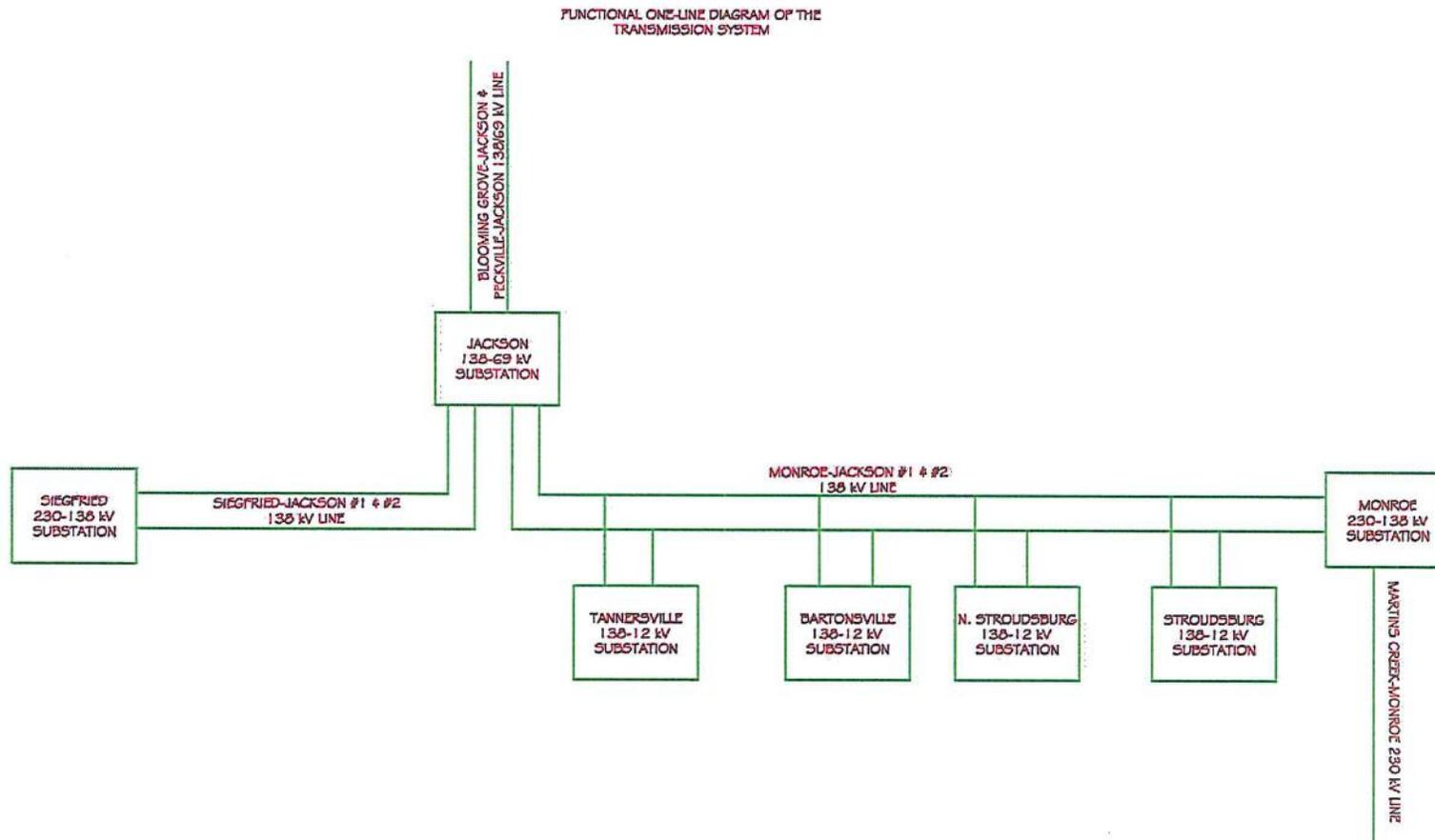
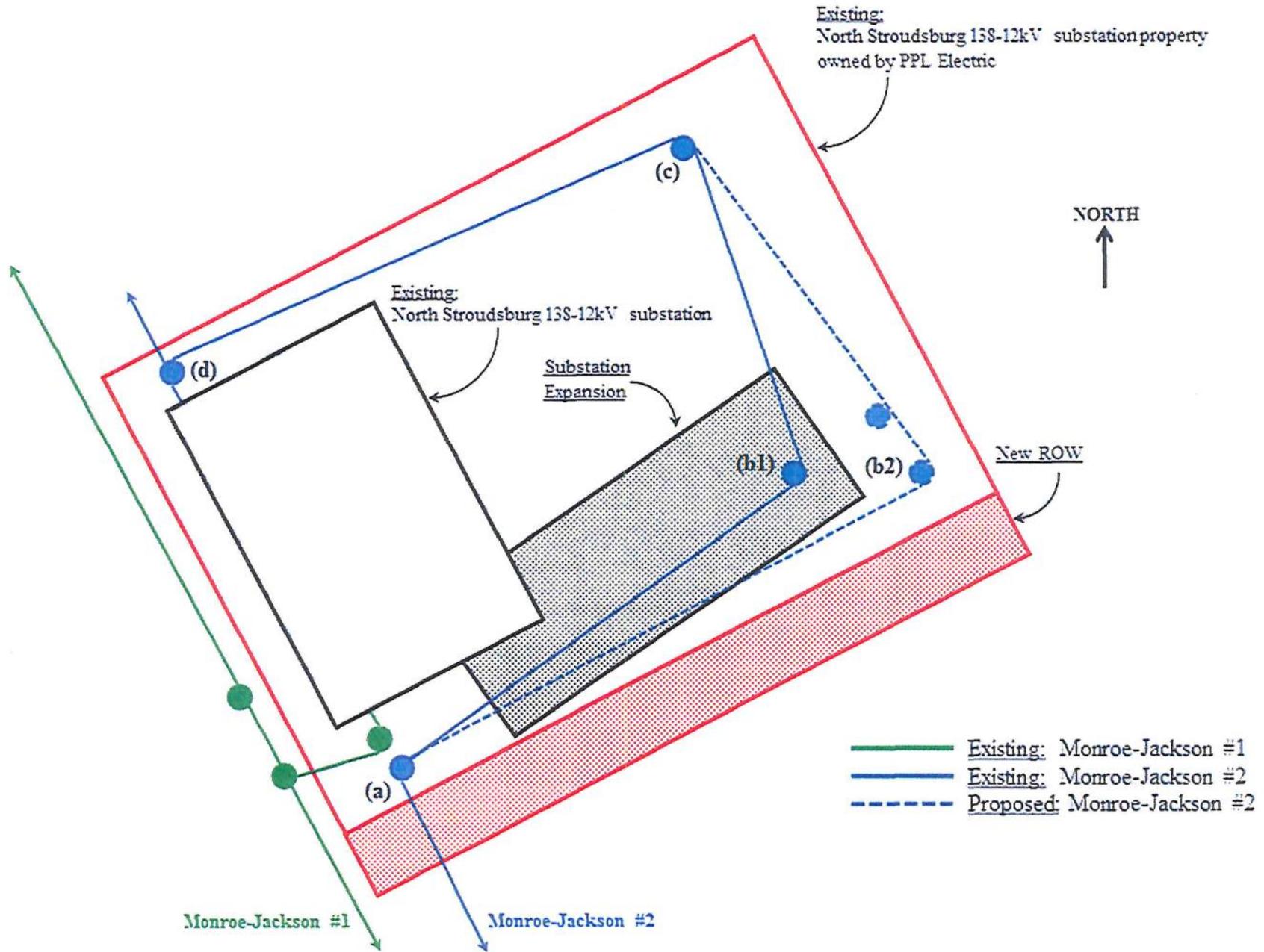


FIGURE 2



ATTACHMENT 2

**ATTACHMENT 2
MONROE-JACKSON #2 138 KV RELOCATION
ENGINEERING DESCRIPTION**

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ATTACHMENT 2
MONROE-JACKSON #2 138 KV RELOCATION
ENGINEERING DESCRIPTION

A. DESCRIPTION OF PROPOSED LINE

PPL Electric Utilities Corporation (PPL Electric) proposes to expand the existing North Stroudsburg 138-12 kV Substation in Stroud Township, Monroe County to improve reliability of service and power quality for 11,350 customers in Stroud Township, Stroudsburg Borough, and East Stroudsburg Borough in Monroe County. To accomplish these modifications, PPL Electric proposes to relocate a section of the existing Monroe-Jackson #2 138 kV Line. This project requires the relocation of one existing steel monopole, installation of one new steel monopole, and the replacement of approximately 405 feet of existing conductor with approximately 515 feet of new conductor.

The relocated line section will require the installation of two weathering steel monopole structures which will be approximately 105 feet in height. Three power conductors and one steel overhead ground wire (OHGW) will be installed in the relocated section. The power conductors will be 556 thousand circular mills (kcmil)¹, 24/7 stranding, aluminum conductor steel reinforced (ACSR), and one 3/8 inch OHGW. All new poles for the proposed relocated section of the Monroe-Jackson #2 138 kV Line will be direct embedded and guyed.

This project is located in Stroud Township, Monroe County. An aerial exhibit showing the location of the proposed facilities is provided at the end of Attachment 3.

The proposed line will be designed to comply with National Electrical Safety Code (NESC) standards. Design specifications and safety rules practiced by PPL Electric are included in Attachment 4. The minimum conductor-to-ground clearance will be 30 feet, which occurs at a maximum conductor temperature of 125° C.

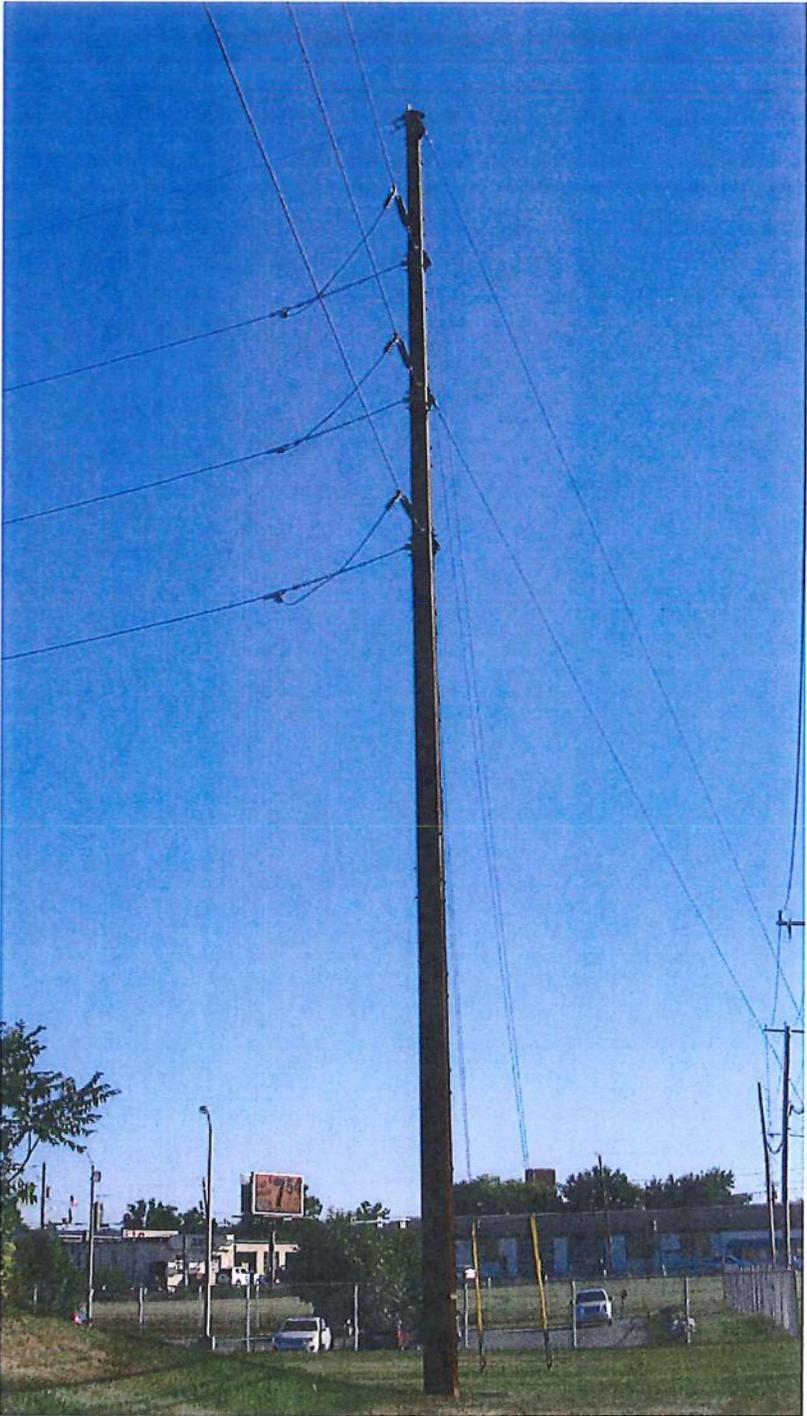
¹ KCMIL wire size is the equivalent cross sectional area in thousands of circular mils. A circular mil is the area of a circle with a diameter of one thousandth (0.001) of an inch.

B. MAGNETIC FIELD MANAGEMENT

PPL Electric's Magnetic Field Management Program is applied to new and reconstructed transmission line projects. The company does not believe that the current scientific evidence demonstrates that magnetic fields cause any adverse health effects or pose a health or safety danger to the public. Nevertheless, PPL Electric has determined, as a matter of policy, to design its new and rebuilt transmission lines to reduce magnetic fields when that can be done at low or no cost and consistent with functional requirements. PPL Electric's Magnetic Field Management Program has been developed to implement that policy decision. To reduce magnetic field exposures, the program generally prescribes the use of a line design that provides five feet higher ground clearance than NESC standards and reverse phasing of new double-circuit lines where it is feasible to do so at low or no cost.

Reverse phasing will not be possible for the relocated section as it is only single circuit in this area. Reverse phasing requires a double circuit line. However, pursuant to PPL Electric's Magnetic Field Management Program, five feet higher ground clearances than NESC standards can be maintained to reduce magnetic field exposures.

FIGURE 1 - TYPICAL 138 kV POLE



ATTACHMENT 3

**ATTACHMENT 3
MONROE-JACKSON #2 138 kV RELOCATION
DESCRIPTION OF THE RIGHT OF WAY**

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ATTACHMENT 3
MONROE-JACKSON #2 138 kV RELOCATION
DESCRIPTION OF THE RIGHT OF WAY

A. INTRODUCTION

PPL Electric Utilities Corporation (PPL Electric) proposes to expand the existing North Stroudsburg 138-12 kV Substation in Stroud Township, Monroe County to improve reliability of service and power quality for 11,350 customers in Stroud Township, Stroudsburg Borough, and East Stroudsburg Borough in Monroe County. To accommodate these modifications, PPL Electric is proposing to relocate an approximately 515 foot section of the existing Monroe-Jackson #2 138 kV Line, which will require one of the existing 138 kV poles to be moved and the addition of one new 138 kV pole at the North Stroudsburg 138-12 kV Substation site.

PPL Electric has discussed the proposed project with representatives from Stroud Township and Monroe County, which had no objection to the project.

B. RIGHT OF WAY DESCRIPTION

The section of the existing Monroe-Jackson #2 138 kV Line to be relocated currently is located entirely on the North Stroudsburg 138-12 kV Substation property owned in fee by PPL Electric. To accommodate the substation modifications and transmission line relocation, PPL Electric has reached an agreement in principle with the neighboring property for an approximately 0.25 acre right-of-way to the southeast of the existing substation site. No additional property rights are required to complete this project.

Both the moved and new 138 kV poles required to relocated the Monroe-Jackson #2 138 kV Transmission Line will be located entirely on the North Stroudsburg 138-12 kV Substation site owned in fee by PPL Electric. Both the existing property owned in fee and the new right of way to be acquired are located in areas that contain existing electrical facilities and industrial buildings within Stroud Township, Monroe County.

C. ENVIRONMENTAL ASSESSMENT

Land use impacts are anticipated to be minimal due to the fact that the project is located in areas that contain existing PPL Electric facilities which will be upgraded. In addition, the surrounding properties are currently used for industrial operations. Interference with existing land uses will be further minimized because, where possible, PPL Electric will use previously established access roads for construction.

No nearby communication towers, pipelines, or other utilities will be affected by the proposed project. The closest point of the Stroudsburg-Pocono Airport is located approximately two (2) miles east of the proposed project. PPL Electric does not anticipate any interference with airport operations because the project is located in an area where there are existing electrical facilities and because the new facilities will be a similar height as the existing facilities. However, PPL Electric will file any required documentation with both the Federal Aviation Administration and the Pennsylvania Department of Transportation Bureau of Aviation.

The project was reviewed by the Pennsylvania Historical and Museum Commission (PHMC) and their response is documented in correspondence dated November 5, 2013. The PHMC has determined that the project will not affect any historic buildings, structures, districts, or objects. However, the PHMC has requested a Phase I archaeological survey of the project area. PPL Electric has retained Dr. Frank Vento to complete the Phase I archaeological survey and will continue corresponding with the PHMC to resolve any required archaeological concerns prior to the start of construction.

The project will not affect any unique geological, scenic, or natural areas. There are no anticipated impacts to these features due the fact that the project is located in an area which contains existing electrical facilities.

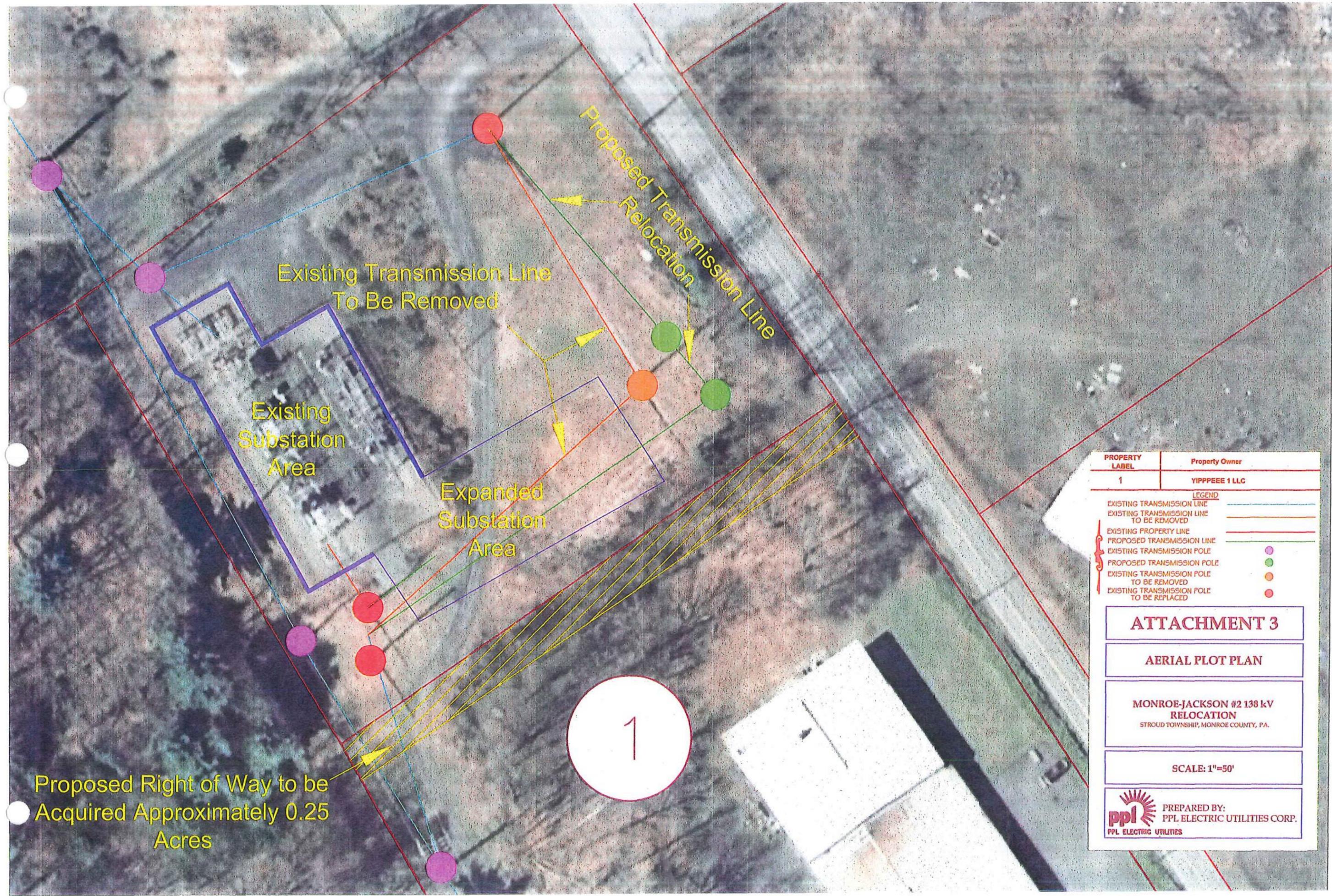
PPL Electric has retained Woodland Design Associates, Inc. to identify and delineate all wetlands and watercourses within the project area. Woodland Design Associates completed the

wetland and watercourse delineation and has determined there are no wetlands or watercourses in the vicinity of the project area. PPL Electric will acquire any required soil erosion and sedimentation control permits and comply with any required conditions placed on those permits.

PPL Electric has coordinated with state and federal agencies to obtain information regarding threatened and endangered species in close proximity to the project area. A review of the Pennsylvania Natural Diversity Inventory (PNDI) records indicates that there is a potential impact to threatened and endangered species and/or special concern species and resources which fall under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). However, the identified species requires wetlands or watercourses for habitat and, as mentioned above, Woodland Design Associates completed a field review of the project area and determined that there are no wetlands or watercourses within the project area. As a result, the PPL Electric received a clearance for the potential impact under the jurisdiction of the USFWS.

D. VEGETATION MANAGEMENT

The project is being completed in an area that has already been cleared of vegetation for the existing electrical facilities. As a result, limited vegetation management will be required for this project. In areas where vegetation management is required to complete the project, PPL Electric will apply its “Specifications for Initial Clearing and Control of Vegetation On or Adjacent to Electric Line Right-of-Way Through Use of Herbicides, Mechanical and Hand Clearing Techniques” to mitigate any impacts.



Proposed Right of Way to be Acquired Approximately 0.25 Acres

PROPERTY LABEL	Property Owner
1	YIPPEEE 1 LLC

LEGEND

- EXISTING TRANSMISSION LINE —
- EXISTING TRANSMISSION LINE TO BE REMOVED —
- EXISTING PROPERTY LINE —
- PROPOSED TRANSMISSION LINE —
- EXISTING TRANSMISSION POLE ●
- PROPOSED TRANSMISSION POLE ●
- EXISTING TRANSMISSION POLE TO BE REMOVED ●
- EXISTING TRANSMISSION POLE TO BE REPLACED ●

ATTACHMENT 3

AERIAL PLOT PLAN

**MONROE-JACKSON #2 138 kV
RELOCATION**
STROUD TOWNSHIP, MONROE COUNTY, PA.

SCALE: 1"=50'

PREPARED BY:
 PPL ELECTRIC UTILITIES CORP.
 PPL ELECTRIC UTILITIES

ATTACHMENT 4

PPL DESIGN CRITERIA AND SAFETY PRACTICES

The National Electrical Safety Code (NESC) is a set of rules to safeguard people during the installation, operation, and maintenance of electric power lines. The NESC contains the basic provisions considered necessary for the safety of employees and the public. Although it is not intended as a design specification, its provisions establish minimum design requirements. PPL Electric Utilities Corp. (PPL) has developed design specifications and safety rules which meet or surpass all requirements specified by the NESC.

Engineering Design Criteria and Parameters

The NESC includes loading requirements and clearances for the design, construction, and operation of power lines. The "loads" on conductors and supporting structures are the mechanical forces that develop from the weight of the conductors, the weight of ice on the conductors, plus wind pressure on the conductors and supporting structures. Loading requirements are the loads on the conductors and structures that are anticipated assuming certain ice and wind conditions. Loading requirements always contain "safety factors" to allow for unknown or unanticipated contingencies. The clearances and loading requirements contained in the NESC were developed to ensure public safety and welfare.

PPL transmission line design standards meet or surpass the NESC standards. For example, the relative order of grades of construction for conductors and supporting structures is B, C, and N; Grade B being the highest. According to the NESC standards, construction Grades B, C, or N may be used for transmission lines (except at crossings of railroad tracks and limited access highways where Grade B construction is specified). However, PPL designs all of its transmission lines for Grade B construction. The use of Grade B design and construction specifies enhancements such as larger-minimum crossarm dimensions, larger-minimum conductor size, and increased safety factors.

Another example is the design parameters utilized to account for ice and wind loadings on the overhead ground wire (OHGW) and power conductors. The NESC standard ice and wind design magnitudes for the PPL territory are 0.5 inch thickness of radial ice combined with four pounds per square foot horizontal wind pressure (equivalent to 40-mile per hour wind velocity). The conductor sags and tensions used in line designs are the result of various ice and wind combinations, depending on the elevation at the line location and line design voltage. The conductor sags and tensions used in the design of all PPL transmission lines are at least 0.5-inch ice combined with eight pounds wind pressure (equivalent to 57 miles per hour wind velocity). This means that PPL lines are designed to operate safely and reliably during inclement weather even more severe than assumed by the NESC. In addition, PPL transmission lines are designed with more clearance to the ground than required by the NESC. The tables below compare PPL and NESC ground clearances for lines of various voltages.

138 kV

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u>	<u>PPL Design</u>
Roads, streets, alleys	21 Ft.	30 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	21 Ft.	30 Ft.
Spaces accessible to pedestrians only	17 Ft.	30 Ft.
Railroad tracks	31 Ft.	35 Ft.

230 kV

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u>	<u>PPL Design</u>
Roads, streets, alleys	23 Ft.	32 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	23 Ft.	32 Ft.
Spaces accessible to pedestrians only	19 Ft.	32 Ft.
Railroad tracks	31 Ft.	36 Ft.

500 kV

<u>Surface Underneath Conductors</u>	<u>Vertical Clearance to Ground</u>	
	<u>NESC Standard</u>	<u>PPL Design</u>
Roads, streets, alleys	28 Ft.	53 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	28 Ft.	53 Ft.
Spaces accessible to pedestrians only	24 Ft.	53 Ft.
Railroad tracks	38 Ft.	53 Ft.

A relay protection system is used to protect the public safety and welfare as well as equipment and the transmission system. Relay protection is installed for all transmission lines to automatically de-energize the line in the unlikely event that the line or supporting structure fails and the line contacts the ground.

Periodic Maintenance Program on All Transmission Lines

To ensure continued public safety and integrity of service, a periodic maintenance and inspection program is implemented for every transmission line. The program is administered through the use of helicopter patrols, with supplemental foot and structure

climbing patrols. A number of helicopter patrols are performed on all lines annually. The two-man helicopter crew flies parallel, to the left, and above the line so that the observer can look for signs of line damage or deterioration and observe clearances between vegetation and conductors. The observations are included in a report that is forwarded to the appropriate department for corrective action.

Foot and structure climbing patrol programs for a transmission line begin approximately three to five years after the line is energized, unless a helicopter patrol reports a need for earlier action. The frequency of foot patrols varies from once every year to once every several years depending on line type and age.

An assigned foot patroller checks right-of-way conditions, including access roads, bridges, pole washouts, tower footers, vegetation height and clearance to conductors, pole and tower deterioration and, with the use of binoculars, insulators, and condition of hardware. Identified problems are included in a report that is forwarded to the appropriate department for corrective action.

A scheduled line outage is required to perform an overhead patrol because of "hands-on" inspection of hardware. Overhead patrols are conducted on a schedule determined by line age, operating record, and observed general condition. The necessary repairs are also done during the inspection outage.

Personnel Safety Rules

The following are a few of the PPL safety rules that demonstrate the Company's concern for employee safety:

- Work procedures have been developed to allow work to be performed on energized facilities in a safe manner. When lines or apparatus are removed from service to be worked on, the Energy Control Process system is applied. This system provides that a red tag must be physically placed on the control handle of the de-energized equipment. The red tag may be removed only after proper authorization to energize the equipment. Various other tags are used for limited operations and informational purposes.

Employees will not apply or remove a tag or change the status of tagged equipment unless authorized.

- Temporary safety grounds are used on de-energized facilities for employee safety during maintenance, construction, or reconstruction work. Safety grounds are wires connecting the de-energized facility to an electrical ground. If the facility should be energized, the safety grounds will divert the current directly to ground and reduce the likelihood of personal injury. The conductor size and attachment clamps of temporary safety grounds must be capable of conducting anticipated fault currents. Rubber gloves, rubber sleeves, and additional rubber protective equipment are used as required when applying or removing temporary safety grounds to or from the lines or apparatus to be grounded. An approved nonconductive working stick of sufficient length to allow workers to maintain the following required minimum clearances is used to test that the line has been de-energized and to apply temporary safety grounds:

<u>Voltage-kV</u>	<u>Minimum Clearance</u>
138	3'-7"
230	5'-3"
500	11'-3"

Before applying grounds, a test is done to confirm that the line is de-energized. The voltage test device is checked before and after use to assure reliability. When ground pins are used to establish proper ground points, they are driven to a depth of not less than four feet as near vertical as possible.

- Poles or structures are inspected and examined for structural integrity before climbing. If there is any reason to believe that a pole is unsafe, it is stabilized before work is performed. Appropriate safety gear in the form of body belts, safety straps, hard hats, gloves, etc., is worn by linemen during line work activity.