



Before the
Pennsylvania Public Utility Commission

**SUSQUEHANNA-JENKINS 230 KV
REBUILD**

**ATTACHMENTS IN SUPPORT OF THE
LETTER OF NOTIFICATION**

Application Docket No. _____

Submitted by: PPL Electric Utilities Corporation

**ATTACHMENT 1
SUSQUEHANNA-JENKINS 230 KV REBUILD PROJECT
NECESSITY STATEMENT**

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1.0 INTRODUCTION

PPL Electric Utilities Corporation (PPL Electric) is requesting Pennsylvania Public Utility Commission (PUC or the Commission) approval to rebuild approximately 24.4 miles of the 26.5-mile existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line for double-circuit operation (the Project). The proposed Project is located in Luzerne County and will traverse the following municipalities: Conyngham Township, Slocum Township, Nuangola Borough, Rice Township, Hanover Township, Bear Creek Township, Laurel Run Borough, and Plains Township. As explained below, the proposed Project is required to resolve a thermal violation identified by PJM Interconnection, L.L.C (PJM) in the 2013 Regional Transmission Expansion Plan (RTEP) analysis.

Subject to the Commission’s approval, construction is scheduled to begin in September 2016, to support the Project’s scheduled in-service date of June 2018. The estimated cost of Project is \$64.3 million.¹

2.0 SYSTEM PLANNING PROCESS

2.1 Transmission Reliability

The nation’s interconnected transmission grid serves as the backbone for the safe and reliable delivery of large amounts of electricity from generating stations over substantial distances to customers served by transmission and local distribution systems. It is critically important that this interconnected transmission system (transmission grid) be planned and designed to be highly reliable so that reliable electric service can be provided under peak and all loading conditions and when certain elements of the system are out of service (system contingencies) due to planned or unplanned outages.

¹ The estimate cost for the proposed project is an order-of-magnitude estimate developed using averages of recent costs for similar projects and without an in-depth analysis of field investigation. The cost is subject to change as the constructability of the Project, sequence of construction, and other factors that may affect cost are identified and analyzed as the Project progress.

On February 3, 2006, the Federal Energy Regulatory Commission (FERC) certified the North American Electric Reliability Corporation (NERC) as the organization required to establish and enforce reliability standards for the bulk electric system. Pursuant to this certification, NERC develops and enforces reliability standards, which define the reliability requirements for planning and operating certain transmission systems in North America. The NERC Reliability Standards apply to all users, owners, and operators of the critical transmission systems on the nation's interconnected transmission grid, including PPL Electric. The NERC Reliability Standards are monitored and enforced by NERC and the regional reliability organizations that function under its auspices. NERC achieves compliance through monitoring, audits and investigations, the imposition of financial penalties, and other enforcement actions for non-compliance. These FERC-approved NERC Reliability Standards are mandatory and failure to comply can result in penalties of up to \$1 million per day per violation.

2.2 System Planning

System Planning is the process that assures that the transmission system can supply electricity to all customer loads in a manner that is reliable and economical. This System Planning process assures that both the Bulk Electric System (BES)² and non-Bulk Electric System (non-BES)³ 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 need 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; and
- They are in conformance with NERC, PJM, and PPL Electric Utilities transmission planning reliability principles, practices and standards (RP&P) for all normal and emergency operating conditions.

² Bulk Electric System (BES) – Includes transmission facilities operated at voltages of 100 kV or higher.

³ Non-Bulk Electrical System (non-BES) – Includes transmission facilities operated at voltages less than 100 kV.

The fundamental purpose of the NERC, PJM and RP&P criteria is to provide a set of principles upon which to build a reliable transmission system.

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. Once the system model is complete, comprehensive power flow simulations are performed to determine the ability of the system to comply with the planning criteria. Compliance is determined by simulating particular contingency conditions. All conditions where the system is not in conformance with the reliability criteria are identified, then system reinforcements are added to the model to bring the system into compliance.

2.3 The PJM Planning Process

PJM is a 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 RTEP⁴ to identify system reinforcements that are required to, among other things, meet the NERC Reliability Standards, PJM reliability planning criteria, and transmission owner reliability criteria. The RTEP is a FERC-approved transmission planning process that results from a comprehensive analysis to identify existing and forecasted violations of the NERC Reliability Standards on the transmission systems within PJM’s service territory. PPL Electric, as an owner of transmission facilities in Pennsylvania, is a member of PJM and actively participates in the PJM transmission planning process.

⁴ 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.

PJM's RTEP is an annual process that encompasses a comprehensive series of detailed analyses to ensure power continues to flow reliably to customers under stringent reliability criteria set by NERC.⁵ The NERC reliability standards, transmission owner criteria, and PJM reliability planning criteria are used by PJM to analyze the system and to determine the specific transmission upgrade projects, as part of the overall reliability solution, that are needed to ensure long-term reliable electric service to customers and competitive power markets.

Through the RTEP process, PJM performs annual reliability tests, such as Baseline Thermal, Baseline Voltage, Load Deliverability, Generation deliverability and Baseline stability, to ensure safe reliable of operation of electric grid. When the studies show an inability of the transmission system to meet a specific reliability standard under these conditions, solutions such as construction of one or more new transmission lines or one or more upgrades to existing transmission facilities may be necessary.

2.4 The PPL Electric System Planning Process

PPL Electric undertakes an independent analysis of both its BES transmission facilities, which include transmission facilities operated at voltages of 100 kV or higher and are under the functional control of PJM, and its non-BES transmission facilities. Therefore, PPL Electric, as a transmission owner and member of PJM, undertakes system planning for all of its transmission facilities in concert with the PJM RTEP process.

PPL Electric actively participates in the PJM RTEP process, and through this participation PPL Electric provides the results of its independent studies of its reliability plans to PJM for consideration and inclusion in the PJM RTEP. The PPL Electric planning criteria are outlined in its RP&P document, which was developed to ensure adequate and appropriate levels of electric

⁵ PJM Manual 14B outlines the RTEP process, and is available at:
<http://www.pjm.com/~media/documents/manuals/m14b.ashx>

service to its customers consistent with good utility practice. The PPL Electric RP&P for the BES is consistent with NERC and PJM reliability criteria.

The PPL Electric planning process begins by developing a computer model of the future transmission system. A specific study year is chosen to define expected facility loadings. The future transmission system model is prepared using the existing transmission system plus any planned modifications to the transmission system that are scheduled to occur prior to the study year. Load levels used in the transmission system model are based on the latest forecast prepared by PJM Load Forecasting. Once PPL Electric's system model is complete, comprehensive power flow simulations are performed to determine the ability of the system to comply with the NERC criteria, PJM reliability criteria, and PPL Electric RP&P criteria. This is accomplished by simulating two different outage scenarios. In one scenario a single device is taken out of service (N-1) and in the second scenario two devices are taken out of service with the ability of switch moves in between the two outages (N-1-1). The following devices are used to simulate an outage on the system: a single circuit line, double circuit line, transformer, bus, generator, shunt device, or circuit breaker as outlined above. All conditions where the future system does not meet the NERC criteria, PJM reliability criteria, and PPL Electric RP&P criteria are identified.

Alternatives that can mitigate violations to the reliability criteria are then developed and analyzed to ensure that the PPL Electric transmission system meets the reliability criteria. Estimated costs and lead times to implement the reinforcements are prepared. Computer simulations of the system, considering the identified reinforcement alternatives, are completed to identify the best overall reinforcement plan that will meet the future needs of the region in a reliable and economic manner. PPL Electric then proposes solutions to PJM through an RTEP window. If the project is awarded to PPL Electric, it then becomes a baseline RTEP project⁶.

⁶ The analysis which showed the overload violation on the Susquehanna-Jenkins 230 kV line was performed in 2013 prior to the implementation of FERC Order 1000. At that time, the incumbent Transmission Owner was awarded the project to reinforce the facilities located within its own zone.

3.0 EXISTING SYSTEM

The existing Susquehanna-Jenkins 230 kV Transmission Line is a single-circuit 230 kV transmission line that extends approximately 25 miles between the Susquehanna 230-69 kV Substation in Conyngham Township to the Jenkins 230-69 kV Substation in Plains Township. The existing line was built using 1033.5 ACSR conductor and has a 1,240/1,567 Amps Summer Normal/Emergency rating. The Susquehanna-Jenkins 230 kV Transmission Line is one of the three major 230 kV lines that connect generation in the west to load in the east in PPL Electric's Central and Northeast regions. A one-line diagram and map of the existing system are provided as **Figure 1-1** and **Figure 1-2**, respectively.

4.0 NEED FOR THE PROJECT

Using the RTEP process described above, PJM identified a reliability violation on the existing Susquehanna-Jenkins 230 kV Transmission Line for the Generation Deliverability test.⁷ Specifically, the PJM 2013 RTEP identified that, by the summer of 2015, the Susquehanna-Jenkins 230 kV Transmission Line will exceed 100% of its summer emergency rating under peak conditions for following N-1-1 contingency: the loss of the Susquehanna-Lackawanna 500 kV line, followed by the loss of the Mountain-Susquehanna T10 230 kV line. The thermal overload identified in the 2013 RTEP is a violation of the mandatory reliability criteria.

5.0 PROPOSED SOLUTION

As explained above, PJM identified that, by the summer of 2015, the Susquehanna-Jenkins 230 kV Transmission Line will exceed 100% of its summer emergency rating for an N-1-1 contingency. To address this NERC violation, PPL Electric has proposed a temporary and long term solutions to address this violation.

⁷ Generation deliverability is one of the five reliability tests that PJM performs in RTEP analysis. PJM performs Generator Deliverability test in order to make sure generation can reliably be delivered to load. More information about the test is available in PJM manual 14B.

The temporary solution is a Special Protection Scheme (SPS). The SPS scheme was presented to PJM in March, 2014 and was put in service in December, 2015. The SPS scheme trips certain 230 kV lines in order to relieve loading on the Susquehanna-Jenkins 230 kV line for certain contingency conditions. However, it is not a long term solution as it trips other lines to relieve overloads and inhibits operational flexibility. Therefore, PPL Electric also proposed a long term solution to fix the problem.

1. The long term solution is to rebuild the existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line to a double circuit configuration. PPL Electric seeks Commission approval to rebuild approximately 24.4 miles of existing 26.5-mile single-circuit Susquehanna-Jenkins 230 kV Transmission Line between the Susquehanna 230-69 kV Substation in Conyngham Township to a new tap point near the Jenkins 230-69 kV Substation in Plains Township to a double-circuit configuration. The new double-circuit system will tap into the existing Jenkins-Acahela 230 kV Transmission Line located approximately 2.1 miles south of the Jenkins 230-69 kV Substation.

At the tap point, one of the two circuits will tap into and continue north on the existing Jenkins-Acahela 230 kV Transmission Line and will terminate at the Jenkins 230-69 kV Substation. This circuit will continue to be referred to as the Susquehanna-Jenkins 230 kV Transmission Line. The other circuit will tap into and continue south on the existing Jenkins-Acahela 230 kV Transmission Line and will terminate at the Acahela 230-69 kV Substation. This circuit will be referred to as the Susquehanna-Acahela 230 kV Transmission Line. A one-line diagram and map of the proposed system are provided as **Figure 1-3** and **Figure 1-4**, respectively.

The proposed Project will resolve the reliability violation identified in the 2013 RTEP.⁸ The proposed Project will provide the region with the required electric power supply reinforcement and will meet all NERC, PJM, and PPL Electric reliability criteria. The Project also will provide additional capacity for future electric system load growth in the area.⁹

⁸ The SPS scheme will be removed once the proposed line rebuild is complete.

⁹ The double circuit transmission line will provide four 230 kV sources to a planned future 230-69 kV substation that will be tapped off of the Susquehanna-Jenkins 230 kV line.

PPL Electric submitted the proposed Project to PJM in early 2013, for review and inclusion in the RTEP. The Project was presented before stakeholders at the TEAC meeting on April 11, 2014, and approved by the PJM Board. The proposed Project was included in the 2013 RTEP Report as baseline project b2269.

The total estimated cost of the Project is approximately \$64.3 million. Subject to the Commission's approval, construction is scheduled to begin September 2016 to meet an in-service date of June 2018.

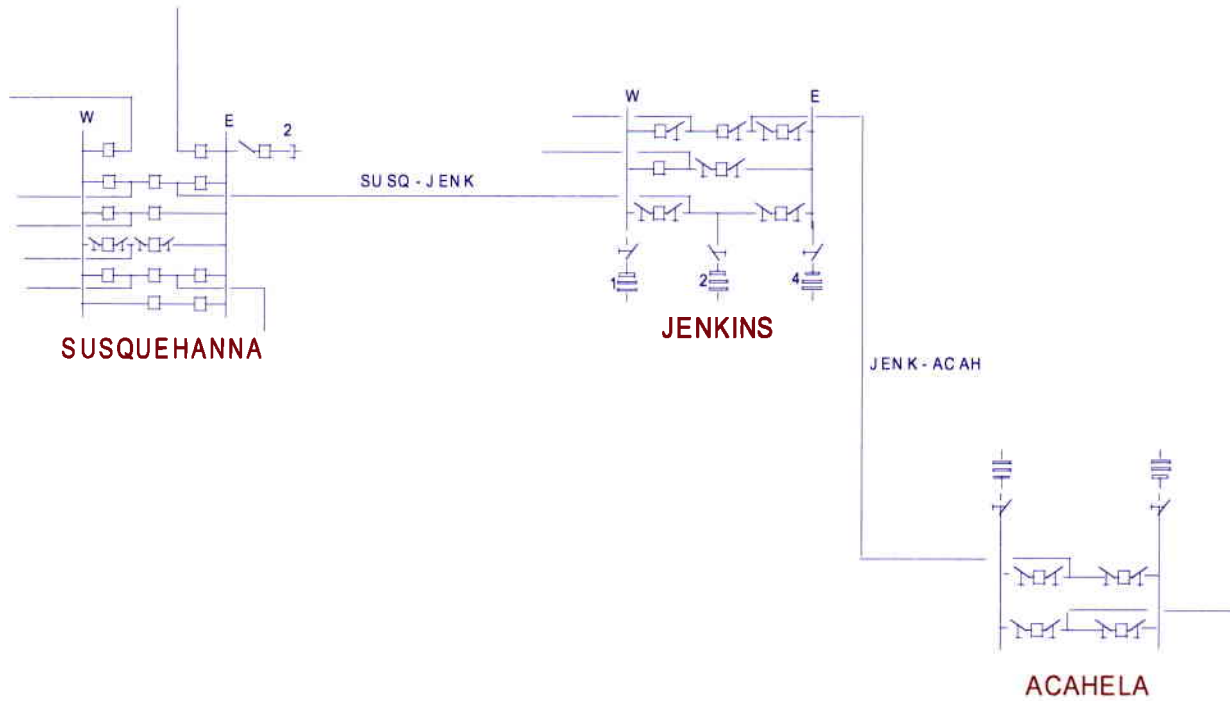


Figure 1-1 Existing configuration



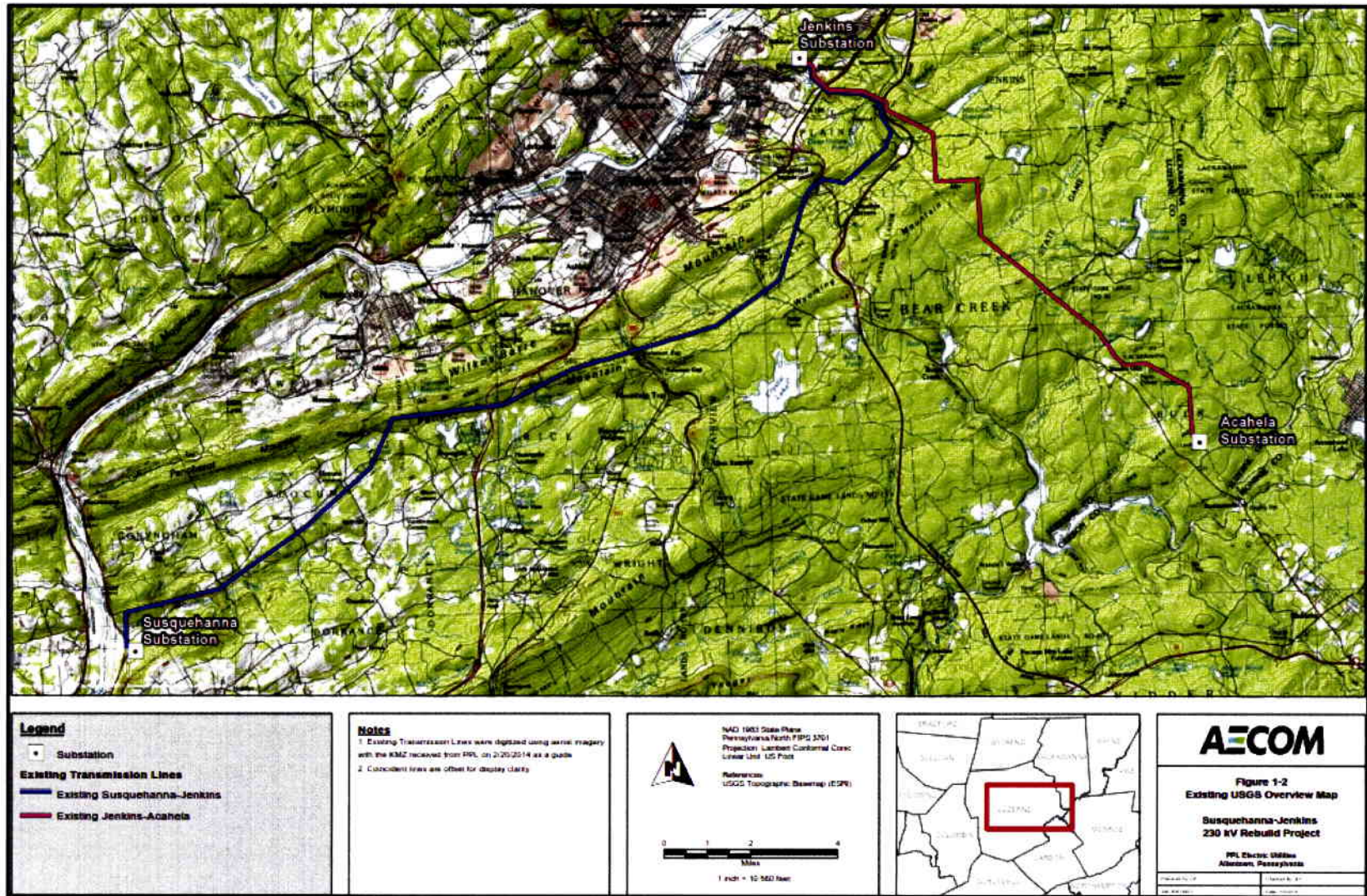


Figure 1-2 Existing System Map

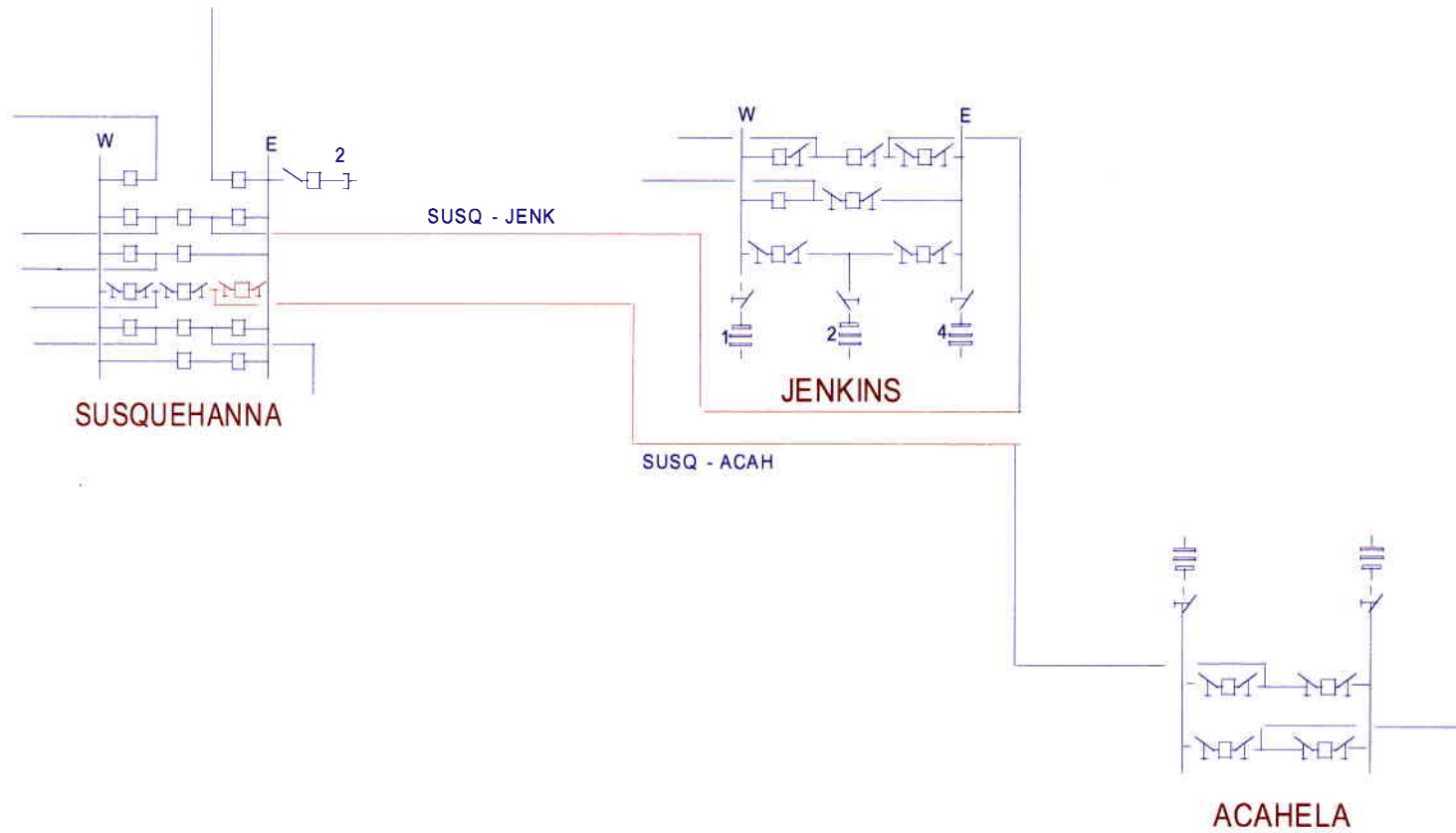


Figure 1-3 Future configuration



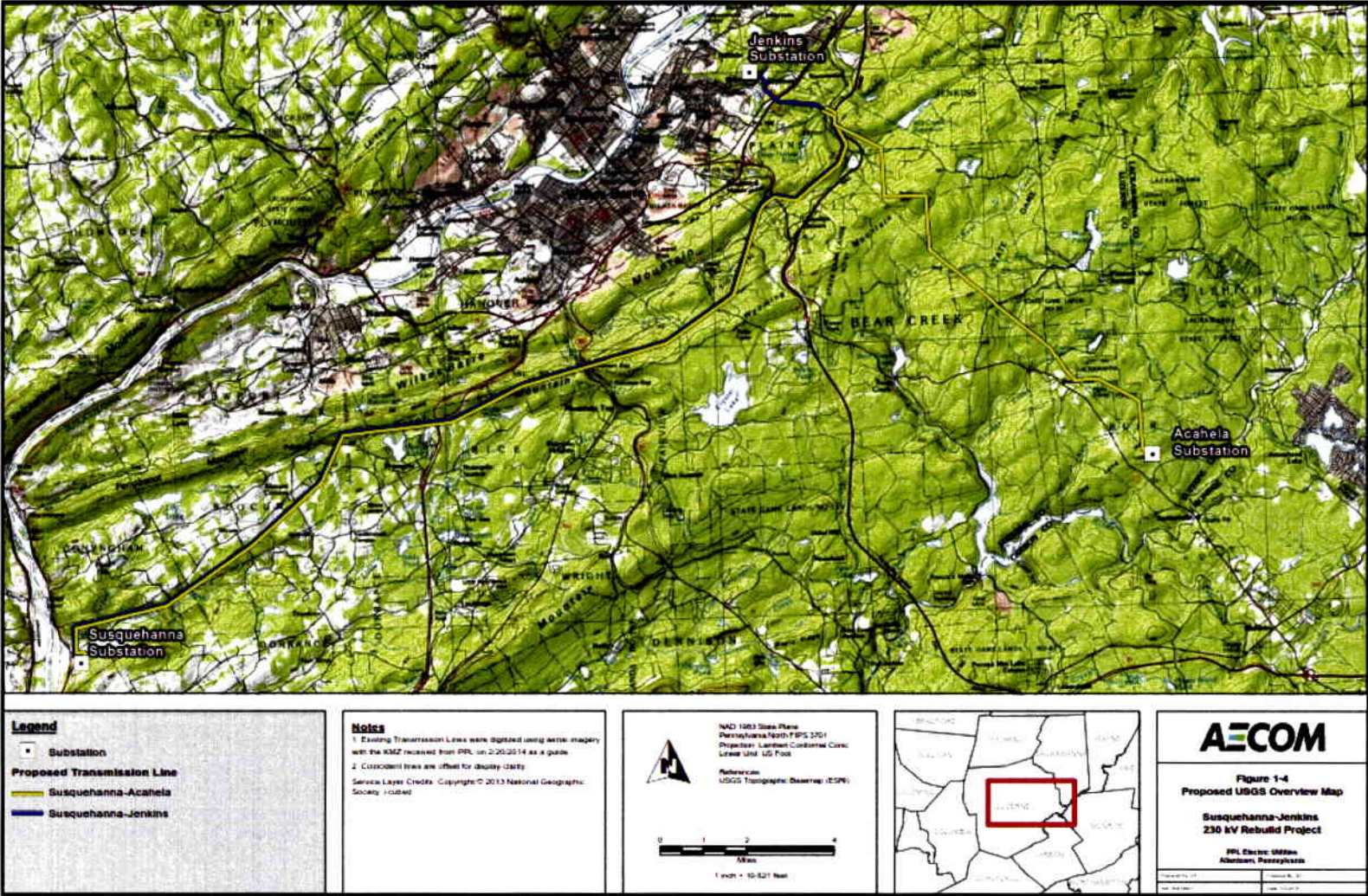


Figure 1-4 Proposed System Map



ATTACHMENT 2



**ATTACHMENT 2
SUSQUEHANNA-JENKINS 230 KV REBUILD PROJECT
DESIGN & ENGINEERING DESCRIPTION**

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Figure 2-4: Typical monopole 230 kV ROW Cross-Section

Figure 2-5: Typical two-pole 230 kV ROW Cross-Section

1.0 Introduction

PPL Electric Utilities Corporation (“PPL Electric”) seeks approval from the Pennsylvania Public Utility Commission (Commission or PUC) to rebuild approximately 24.4 miles of the existing 26.5-mile, single-circuit Susquehanna-Jenkins 230 kV Transmission Line (the Project) for double-circuit operation. As explained in Attachment 1, PPL Electric proposes to rebuild the existing single-circuit 230 kV line as double-circuit to resolve a thermal violation identified by PJM Interconnection, L.L.C (PJM) in the 2013 Regional Transmission Expansion Plan (RTEP) analysis.

The estimated cost to site, design, and construct the Project is approximately \$64.3 million¹. This cost includes the siting, design, and reconstruction of the existing single-circuit 230 kV transmission line to a double-circuit configuration. The required in-service date is June 2018. In order to meet that in-service date, subject to the Commission’s approval, construction is scheduled to commence in the September 2016.

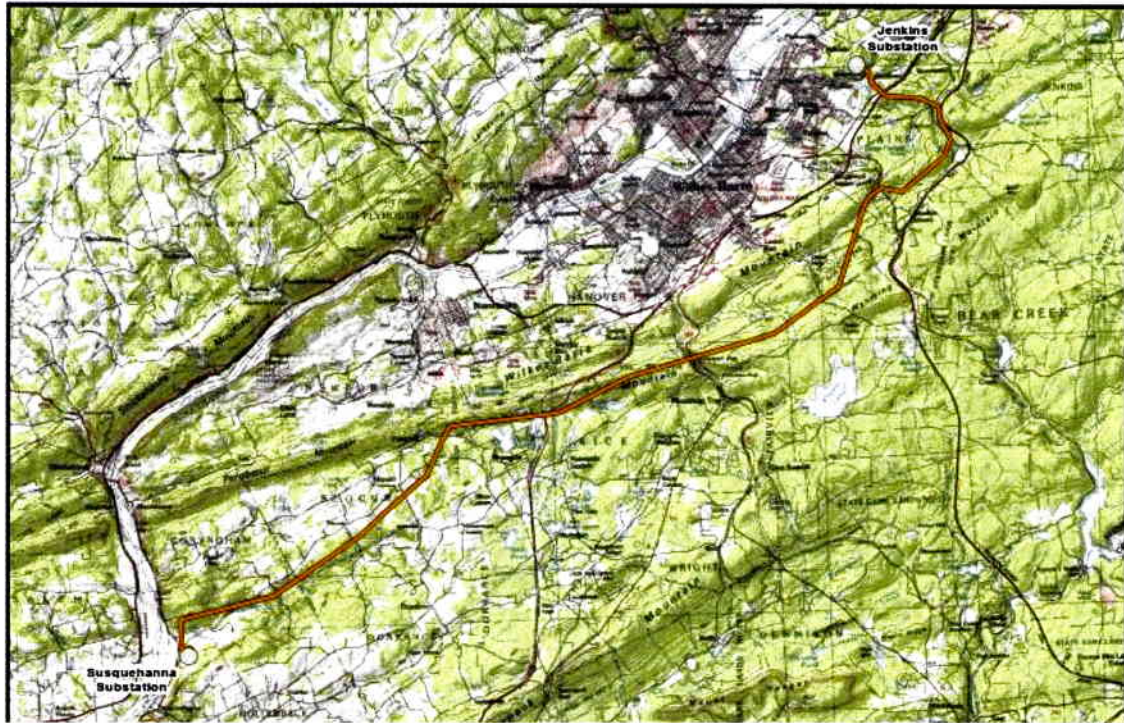
2.0 Proposed Activity

2.1 230 kV Transmission Line Work

The Susquehanna-Jenkins 230 kV Transmission Line extends approximately 26.5 miles between the Susquehanna 230-69 kV Substation in Conyngham Township and the Jenkins 230-69 kV Substation in Plains Township, Luzerne County (**Figure 2-1**). PPL Electric proposes to re-construct approximately 24.4 miles of existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line between the Susquehanna 230-69 kV Substation in Conyngham Township to a new tap point near the Jenkins 230-69 kV Substation in Plains Township. The goal of the project is to strengthen the electrical delivery system and improve reliability in Luzerne County.

¹ The estimate cost for the proposed project is an order-of-magnitude estimate developed using averages of recent costs for similar projects and without an in-depth analysis of field investigation. The cost is subject to change as the constructability of the Project, sequence of construction, and other factors that may affect cost are identified and analyzed as the Project progress.

FIGURE 2-1: Susquehanna-Jenkins 230 kV Transmission Line



The existing Susquehanna-Jenkins 230 kV Transmission Line will be upgraded from a single-circuit system to a double-circuit system. As explained in Attachment 1, the new double-circuit system will tap into the existing Jenkins-Achela 230 kV Transmission Line located approximately 2.1 miles south of the Jenkins 230-69 kV Substation. At the tap point, one of the two circuits will tap into and continue north on the existing Jenkins-Achela 230 kV Transmission Line and will terminate at the Jenkins 230-69 kV Substation. This circuit will continue to be referred to as the Susquehanna-Jenkins 230 kV Transmission Line. The other circuit will tap into and continue south on the existing Jenkins-Achela 230 kV Transmission Line and will terminate at the Achela 230-69 kV Substation. This circuit will be referred to as the Susquehanna-Achela 230 kV Transmission Line.

The rebuilt transmission line will be located within the existing right-of-way for the Susquehanna-Jenkins 230 kV Transmission Line, which is 150-feet wide for the majority of the line with several locations increasing to 250-feet or more. The rebuilt double-circuit line will be constructed on the existing centerline with each new structure located adjacent to the existing structures. No new additional right-of-way is necessary for this Project.

The first four tower structures (Structure 1 to Structure 4) from the Susquehanna 230-69 kV Substation currently are double-circuit structures. The existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line occupies one side of these four double-circuit structures, while the other side is occupied by the existing Susquehanna-Mountain 230 kV Transmission Line. The proposal to rebuild the Susquehanna-Jenkins 230 kV Transmission Line for double-circuit operation will require that the Susquehanna-Mountain 230 kV Transmission Line be removed from Structures 1 to Structure 4 and relocated onto five new steel monopoles. These new monopoles will be located entirely on PPL Electric-owned property for the Susquehanna 230-69 kV Substation.

The existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line consists of nine steel poles and 132 lattice tower structures, with an average height of 100 feet. The existing lattice towers will be replaced by self-weathering tubular steel structures equipped with straight arms and installed on concrete caisson foundations. The rebuilt Susquehanna-Jenkins 230 kV Transmission Line will require the installation of approximately 146 structures with an average height of 150 feet. The average spans between the structures will be approximately 1,100 feet. The Transmission Line will consist of approximately 74 self-weathering tubular steel tangent structures equipped with straight arms and installed on concrete caisson foundations. There will be approximately 72 strain/dead-end structures, which will consist of one-pole or two-pole steel structures, all installed on concrete caisson foundations

The new Susquehanna-Jenkins 230 kV Transmission Line will be designed and constructed for 230 kV double circuit capabilities. The 230 kV double-circuit design will utilize six power conductors and two overhead ground wires. The power conductors will be 1590 kcmil² 54/19 ACSR³ “Falcon”⁴ conductors. The overhead ground wires will be 144 count single mode fiber optical ground wires and will provide lightning protection and communication between circuit breakers that remove the line from service should a fault in the line be detected.

² kcmil stands for thousand circular mils. 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.

³ ACSR stands for aluminum conductor steel reinforced.

⁴ Falcon is the technical term for a 1590 kcmil 54/19 ACSR conductor as defined in the American Society for Testing and Materials.

The new Susquehanna-Jenkins 230 kV Transmission Line will be designed to meet, and generally exceed, National Electrical Safety Code (NESC) minimum standards. Design specifications and safety rules practiced by PPL Electric are included in **Attachment 4**. The minimum conductor to ground clearance for the proposed 230 kV line will be 32 feet, which occurs at a maximum conductor temperature of 125° C. The designed minimum conductor clearances and conductor thermal ratings are set forth in **Table 2-1** and **Table 2-2** below.

TABLE 2-1 DESIGN MINIMUM CONDUCTOR CLEARANCES FOR 1590 KCMIL 54/19 STRANDING ACSR "FALCON"	
Condition	Double-Line Design Clearance-to-Ground
Normal load; average weather (16°C ambient temperature)	39.0 feet
Predicted extreme thermal load (125°C conductor temperature)	32.0 feet
Predicted PPL Extreme wind load (100 mph, 16°C)	38.4 feet
Predicted extreme weather conditions (1inch ice, 8 lbs. wind, -18°C)	37.6 feet
*Clearances based on a maximum tension of 21,900 pounds at 1 inch ice, 0° F, 8# wind and a ruling span of 1100 feet.	

TABLE 2-2 CONDUCTOR THERMAL RATING 1590 KCMIL 54/19 STRANDING ACSR "FALCON" (257°F) 125°C MAXIMUM CONDUCTOR			
Condition	Ambient Temperature °C	Wind Speed ft/sec	Ampacity Amps
Summer Normal	35	0	1788
Winter Normal	10	0	2010
Summer Emergency	35	2.533	2172
Winter Emergency	10	2.533	2399



2.2 Construction Techniques and Execution for Typical Single Pole 230 kV Transmission Structures

The following is a summary, non-technical explanation of the typical construction activity that is associated with new transmission line construction for single poles, which are either directly embedded into the ground or installed on a concrete foundation. This is not to be misconstrued as all-encompassing and may vary based on specific site/service conditions at each project. Actual construction steps may not necessarily occur in this particular order:

- The project manager will review the construction plans with PPL Electric personnel that will be constructing the line, including all permits and conditions that apply (such as erosion and sediment control, wetland encroachments, and storm water management), as well as any agreements made with specific property owners for work done on their lands.
- Professional land surveyors will stake the locations of all poles to be constructed, as well as the edge of right-of-way and locate any wetland or streams previously sited during field work.
- All wetlands/waters are delineated in the field, located by land surveyors, and specifically shown to the construction manager prior to work commencing.
- During the installation of access roads, poles, and hanging of the wire, approved “best management practices” are implemented to assure that the soil will be stabilized and not erode during storm events while the Project is under construction. Any temporary wetland encroachments (usually roads) will be removed according to the permit conditions. Whenever practical, PPL Electric will utilize timber matting in wetland areas to minimize disturbance to the wetland vegetation and topography.
- Construction roads will be constructed, approximately 14 to 16 feet in width, with a stone surface to support the equipment that will be transporting materials to the pole sites. Those vehicles are usually cranes, concrete trucks (if foundations are involved), boom trucks, and pickups. The roads will be built as provided for in the construction drawings as per the erosion and sediment control plan, the NPDES permit plan, and/or the wetland encroachment permit plan. The plan may require these roads to be temporary in nature, returning to vegetative cover when the work is complete. Landowners may wish to have the roads

remain intact for shared use between PPL Electric for line inspection and maintenance and property owner use. Much of the routine maintenance to the line, once built, will be by helicopter or 4 wheel drive pickup truck.

- The direct embedded poles will be installed by the use of auger and then a crane. After the hole is drilled, usually 4 to 6 feet in diameter, the bottom section of pole is placed directly into the hole and backfilled with native soil or engineered material, then the remaining sections are installed along with any cross arms. A pole that is at an angle in the line, or for another specialized reason, may be required to have a concrete foundation. These foundations are seldom more than 12 feet in diameter and are filled with reinforced concrete. The top of the foundation may extend an average of 1 foot above the ground.
- Once the poles are in place along the line route, the wires will be installed using bucket trucks to attach the wires to each pole and equipment and manpower will be used to pull the wires along from pole to pole. Helicopter stringing/pulling may be utilized in restricted access or environmental sensitive areas.
- The project manager will oversee the stabilization of the site including the successful establishment of vegetation on all previously disturbed areas during construction.

Typical examples of the proposed structures are depicted in **Figure 2-2** to **Figure 2-5**.

3.0 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 with ground clearance that is five feet higher than NESC

standards and reverses phasing of new double-circuit lines where it is feasible to do so at low or no cost.

The Project will be designed with structures that have a ground clearance that is five feet higher than NESC standards. The existing Susquehanna-Jenkins 230 kV Transmission Line is a single-circuit and, therefore, cannot currently be reverse phased. The rebuilt Susquehanna-Jenkins 230 kV Transmission Line, however, will be a double-circuit that will use reverse phasing. These measures will further reduce the potential for exposure to magnetic fields.



FIGURE 2-2: Typical 230 kV ROW Cross-Section: near Susquehanna Substation with Susquehanna-Harwood #1 and Susquehanna-Mountain

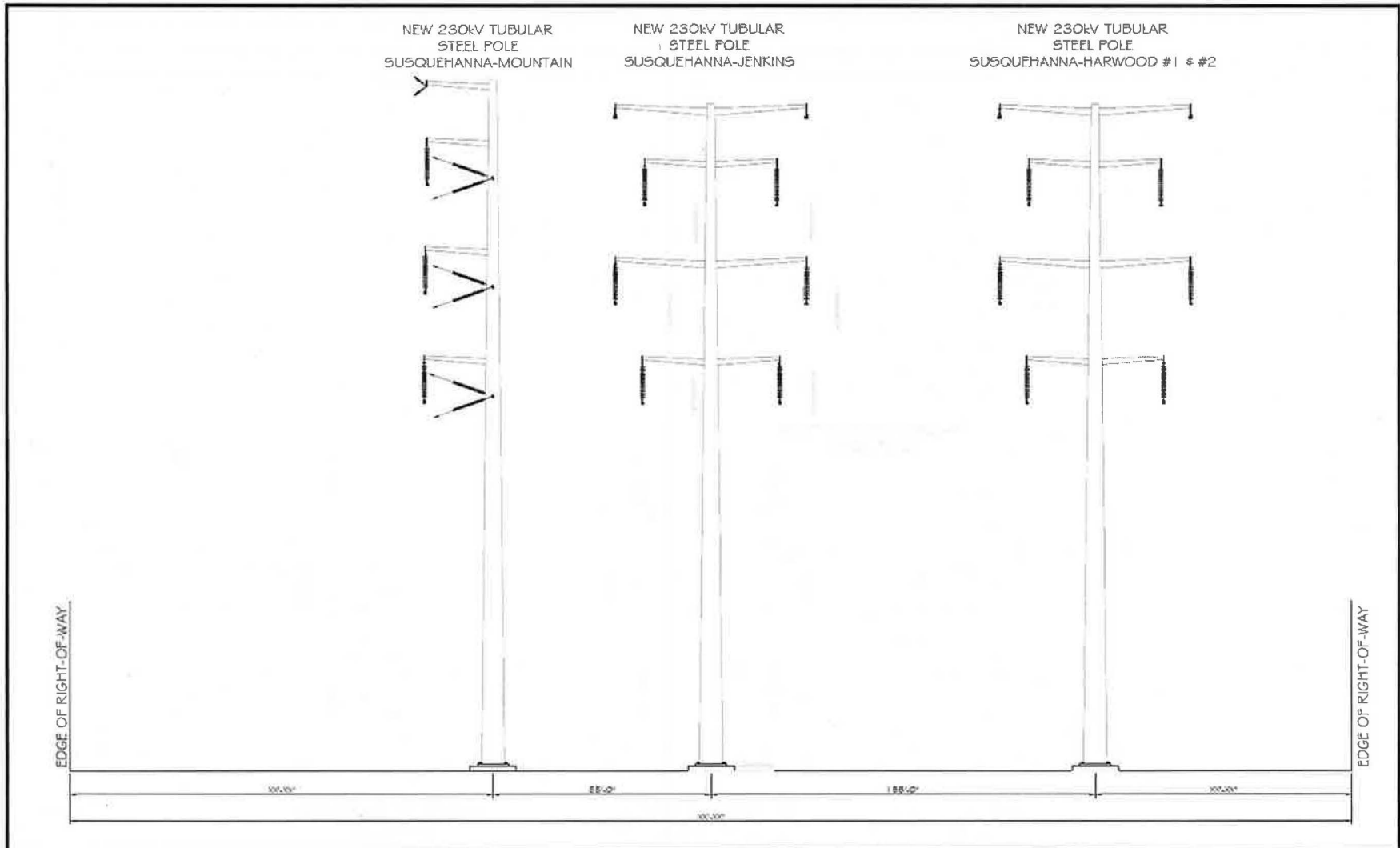


FIGURE 2-3: Typical 230 kV ROW Cross-Section near Susquehanna Substation with Susquehanna-Mountain

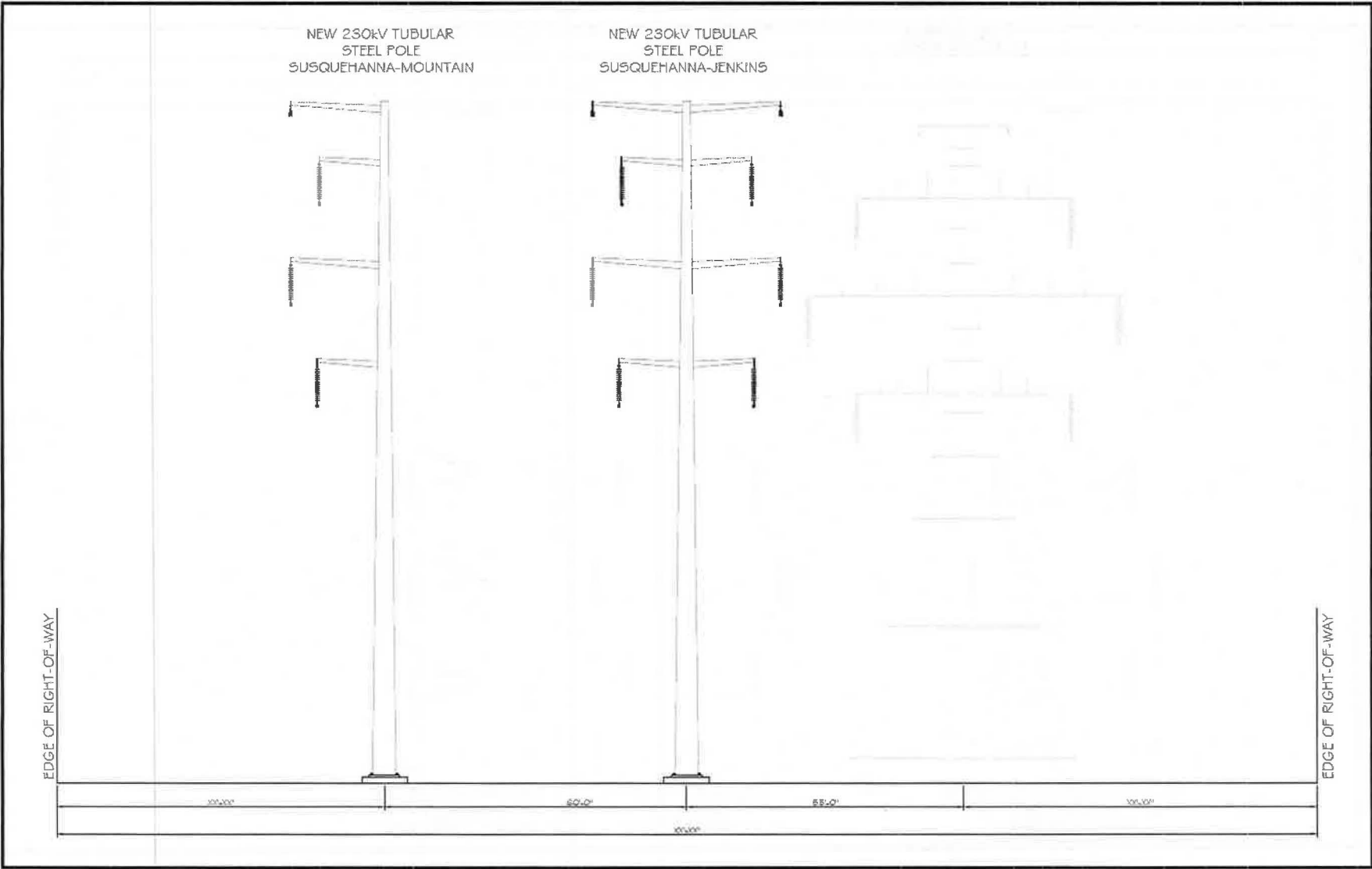


FIGURE 2-4: Typical monopole 230 kV ROW Cross-Section

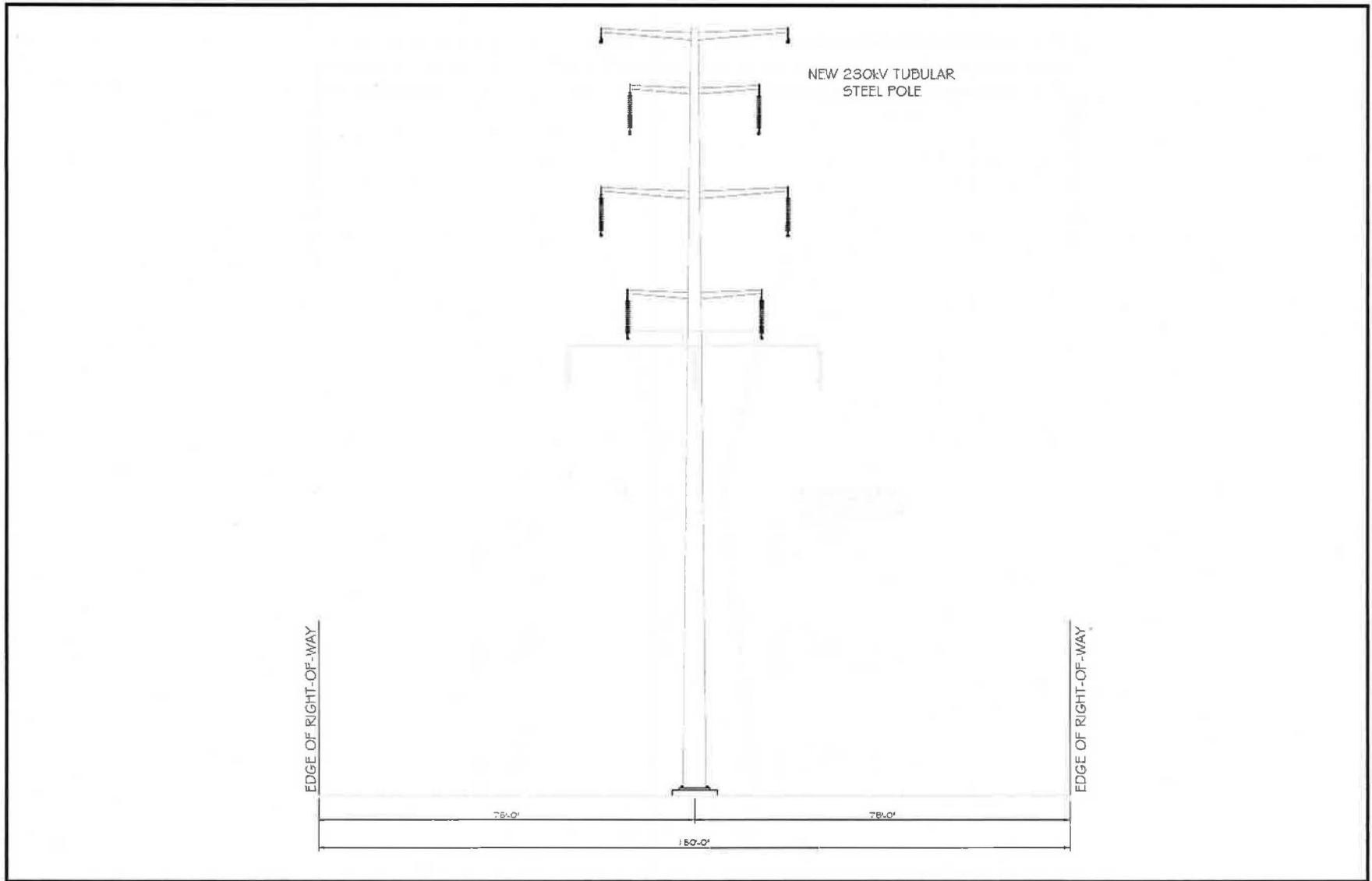
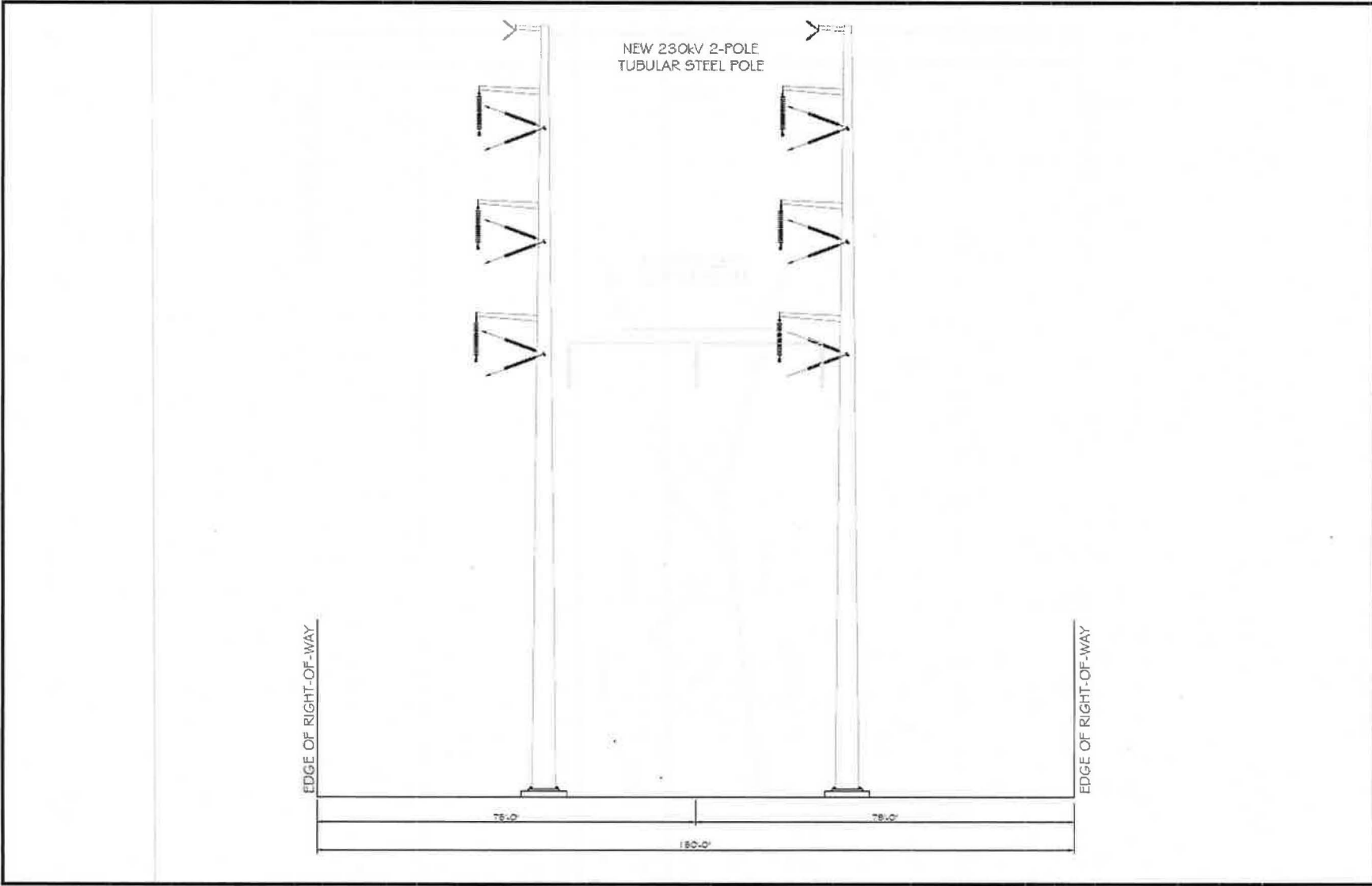


FIGURE 2-5: Typical two-pole 230 kV ROW Cross-Section



ATTACHMENT 3

**ATTACHMENT 3
SUSQUEHANNA-JENKINS 230 KV REBUILD PROJECT
DESCRIPTION OF RIGHT-OF-WAY**

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1.0 Introduction

PPL Electric Utilities Corporation (PPL Electric) is requesting Pennsylvania Public Utility Commission (PUC or the Commission) approval to rebuild approximately 24.4 miles of the existing 26.5-mile, single-circuit Susquehanna-Jenkins 230 kV Transmission Line (Project) for double-circuit operation (the Project). As described in Attachment 1, the proposed Project is required to resolve a thermal violation on the Susquehanna-Jenkins 230 kV line identified by PJM Interconnection, L.L.C (PJM) in the 2013 Regional Transmission Expansion Plan (RTEP) analysis

2.0 Description of the Right-of-Way

The existing Susquehanna-Jenkins 230 kV Transmission Line extends for approximately 26.5 miles from the Susquehanna 230-69 kV Substation in Conyngham Township to the Jenkins Substation in Plains Township, Luzerne County. The proposed Project will traverse the following municipalities: Conyngham Township, Slocum Township, Nuangola Borough, Rice Township, Hanover Township, Bear Creek Township, Laurel Run Borough, and Plains Township.

From the Susquehanna 230-69 kV Substation, the Project travels in a northeasterly alignment across rolling hills and rurally developed sections of Conyngham and Slocum Townships before climbing up the south-facing slope of Penobscot Mountain. From this point, the Project turns to the east and stretches across the rocky, undeveloped slopes of the mountain through Nuangola Borough and Rice Townships, spanning Interstate-81 (I-81) along the way. Crossing over to the north-side of Penobscot Mountain, the Project then extends across rocky, undeveloped sections of Hanover Township, spanning Solomon Run and State Route 309 (SR 309) in the central portion of the township. Turning to the northeast, the Project continues through undeveloped sections of Bear Creek Township and Laurel Run Borough before spanning over Laurel Run and climbing up Wilkes-Barre Mountain in Plains Township. At this point, the Project turns sharply east and then southeast spanning Laurel Run a second time and over SR 115 in quick succession before turning northeast again and crossing undeveloped hills in Plains Township. After spanning Mill Creek, the Project turns north and extends through a modernly developed area that parallels the Pennsylvania Turnpike (I-476). Turning to the northwest, the Project crosses undeveloped lands, spans I-81 a second time, and traverses through a mixed residential and industrial portion of Plains Township

before extending into the Jenkins Substation. Most of this last section between I-476 and the Jenkins 230-69 kV Substation (approximately 2.1 miles) will be removed and will not be rebuilt. **Figure 3-1** is an aerial map of the Project that identifies the location and the properties crossed by the Project.

The rebuilt double-circuit 230 kV transmission line will be located in the existing right-of-way for the Susquehanna-Jenkins 230 kV Transmission Line, which is 150-foot wide for the majority of the line with several locations increasing to 250-foot or more. As explained in Attachment 2, PPL Electric has designed the line to fit within the existing right-of-way and meet the National Electric Safety Code (NESC) standards. No new right-of-way is required for the construction, operation, or maintenance of the rebuilt double-circuit 230 kV transmission line.

The rebuilt double-circuit line will be constructed on the existing centerline for the Susquehanna-Jenkins 230 kV Transmission Line, with each new structure located adjacent to the existing structures. As explained in Attachment 2, the existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line consists of nine steel poles and 132 lattice tower structures, with an average height of 100 feet. The existing lattice towers will be replaced by self-weathering tubular steel structures equipped with straight arms and installed on concrete caisson foundations. The new steel monopole structures are expected to range between 120 and 197 feet in height, with an average height of approximately 150 feet. Although the new structures will increase in height, impacts will be minimal because the monopoles have a smaller footprint compared to lattice structures and the new structures will be placed in close proximity to the existing structures. Further, no new poles will be placed on any property that currently does not have an existing pole.

As explained in Attachment 2, the first four tower structures (Structure 1 to Structure 4) from the Susquehanna 230-69 kV Substation currently are double-circuit structures that are occupied by the existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line and the existing Susquehanna-Mountain 230 kV Transmission Line. The proposal to rebuild the Susquehanna-Jenkins 230 kV Transmission Line for double-circuit operation will require that the Susquehanna-Mountain 230 kV Transmission Line to be removed from Structures 1 to Structure 4 and relocated

onto five new steel monopoles. These new monopoles will be located entirely on PPL Electric-owned property for the Susquehanna 230-69 kV Substation.

3.0 Existing Land Use

Evaluation of the existing land uses reviewed the uses within the existing 150-foot wide right-of-way and within 0.25 mile (1,320 feet) outside of the right-of-way. This broader area was reviewed to provide a sense of the landscape in which the Project is located. Land uses were determined based on review of the 2011 National Land Cover Data (NLCD) (Homer 2015).

Assessment of the data shows that forested land is the dominant land use accounting for over 88% of the review area. Developed land accounts for 6% of the review area with the primary component being developed open space (rural farms), which is predominantly noted in Conyngham and Slocum Townships. Low and medium density development is noted sporadically across the review area but is most prevalent in Plains Township, which is also the location of all of the high density development and most of the barren lands. Agricultural lands account for 3%, also predominantly noted in Conyngham and Slocum Townships, and the remaining 3% of land use consists of open waters, barren lands, scrub lands, fields/meadows, and wetlands.

Impacts to land use are anticipated to be minimal because the proposed Project will be constructed within the existing right-of-way, and no additional property will be required to complete the proposed Project. This Project will be constructed from the existing right-of-way and surrounding state and secondary roads. New temporary access roads will be necessary in a few locations within the right-of-way to reach several new pole locations. PPL Electric will use and update previously established access roads for construction to the extent practical to further reduce interference with existing land uses.

State and Conserved Lands

State-owned lands managed by the Pennsylvania Game Commission (PGC) that are crossed by the Project include a 3.6 mile section of State Game Lands #207 (SGL #207), located in Rice and Hanover Townships, and a 1.5 mile section of SGL #292, located in Bear Creek Township. A 1.2

mile section of Gifford Pinchot State Forest, which is managed by the Pennsylvania Department of Conservation and Natural Resources (PADCNR), is crossed in portions of Hanover and Bear Creek Townships. A 1.0 mile portion near the Seven Tubs Natural Area in Plains Township is located on lands currently owned by Luzerne County as public open space, but which is anticipated to be turned over to PADCNR. In terms of privately conserved lands, a 0.5 mile section in Hanover Township crosses over lands managed by Earth Conservancy, a nonprofit organization that addresses the impacts of abandoned coal mining lands in Luzerne County, Pennsylvania.

Impacts to these state and conserved lands are anticipated to be minimal because the proposed Project will be constructed within the existing right-of-way for the Susquehanna-Jenkins 230 kV Transmission Line. Through each of these state and conserved lands, the rebuilt double-circuit line will be constructed on the existing centerline with each new structure located adjacent to the existing structures. PPL Electric will coordinate with the PGC, PADCNR, and the Earth Conservancy regarding the construction of the Project, use of existing access roads, as well as any new temporary access roads needed to access specific tower locations.

Airports

The Wilkes-Barre/Scranton International Airport is located approximately 5 miles northeast of the Jenkins Substation and the Wilkes-Barre/Wyoming Valley Airport is located 2 miles to the northwest. Rosenzweig Airport is located 3.6 miles south of the transmission line right-of-way near Mountain Top, Pennsylvania.

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.

4.0 Cultural Resources

A desktop survey of archaeological and historic architectural resources within the right-of-way for

the existing Susquehanna-Jenkins 230 kV Transmission Line was completed. The survey consisted of accessing the Pennsylvania Historical and Museum Commission (PHMC) Cultural Resources Geographic Information Systems (CRGIS) to review available information on previously-recorded archaeological and historic agricultural sites on and near the transmission right-of-way (PHMC CRGIS 2015).

Based on this review three National Register of Historic Places (NRHP) –listed or –eligible resources were identified within the existing right-of-way for the Susquehanna-Jenkins 230 kV Transmission Line: the Lehigh Valley Railroad Allentown to Wilkes-Barre Segment (Key No. 112381, NR Eligible, 09/14/1993); the Ashley Planes (Key No. 000742, NR Listed, 01/25/1980); and the Lehigh and Susquehanna Railroad/ Central Railroad of New Jersey (Key No. 125837, NR Eligible, 08/21/2003). These three resources are all railroad resources that consist solely of trackage in the Project area, with no ancillary features present.

Two of the railroad right-of-ways are to be used as access roads for the Project. Near SR 309, the right-of-way for the NRHP-eligible Lehigh Valley Railroad is currently used as an access road by the PGC for access to state game lands. Near SR 115, an arrangement will be made with the Earth Conservancy to use an undetermined section of the Central Railroad of New Jersey right-of-way as an access road to specific structures. These railroad right-of-ways are not expected to be altered other than potentially adding rock to stabilize the road where necessary. No trackage or ancillary features exist along either of these railroad right-of-ways will be altered or impacted.

A review of CRGIS also indicates over 30 archaeological resources within one mile of the proposed project area. However, none of the archaeological resources identified are located within the existing right-of-way for the Susquehanna-Jenkins 230 kV Transmission Line.

Requests for PHMC review of these resources have been submitted. PPL Electric will continue to coordinate with the PHMC and will obtain any approvals/clearances necessary for the Project.

5.0 Natural Features

The proposed Project will not affect any unique geological, scenic, or natural areas that may be located within the Project review area.

Soils

Erosion and sedimentation control plans will be developed and implemented for the Project that will minimize the displacement of soils. These plans will require prior approval from the local county conservation district. National Pollutant Discharge Elimination System (NPDES) permits will also be required from the Pennsylvania Department of Environmental Protection (PADEP) as needed. Any conditions of the NPDES permit will be adhered to as part of the construction process. As such impacts to local soil resources are anticipated to be minimal.

Waterways

The existing Susquehanna-Jenkins 230 kV Transmission Line spans 16 waterways as it extends from the Susquehanna 230-69 kV Substation in the west to the Jenkins 230-69 kV Substation termination point in the east. Several of these waterways are crossed multiple times by the existing Susquehanna-Jenkins 230 kV Transmission Line. Seven of these streams are named streams and nine are unnamed tributaries (UNT) of the named streams.

Solomon Creek has a PADEP designated classification of High Quality-Cold Water Fisheries (HQ-CWF) water, which is an anti-degradation special protection classification for surface waters having quality which exceeds levels necessary to support propagation of fish, shellfish, and wildlife (PADEP 2013). Wheelbarrow Run, a tributary to Laurel Run, has an existing use classification of High Quality (HQ). The Pennsylvania Fish and Boat Commission (PFBC) also classifies Solomon Creek and Wheelbarrow Run, a tributary to Laurel Run, as Class “A” Wild Trout Streams (PFBC 2015a). These streams support a population of wild (natural reproduction) trout of sufficient size and abundance to support long-term sport fishery and are not stocked by PFBC. Additionally, six of the seven named streams and Wheelbarrow Run are also classified as Wild Trout (Natural Reproduction) Streams (PFBC 2015b), which are flowing waters in Pennsylvania that support naturally reproducing populations of trout.

These streams currently are spanned by the existing single-circuit Susquehanna-Jenkins 230 kV right-of-way and will be spanned by the proposed rebuilt double-circuit 230 kV line in their current locations. Minor permanent impacts to several of these streams are anticipated through the installation of several new culverts required to cross the streams with improved access roads. Permits to construct these permanent stream crossings will be obtained from PADEP. Reconstruction activities will also be conducted using a state approved erosion and sedimentation control plan to minimize the effects of stormwater runoff. PPL Electric will obtain all approvals and permits necessary for the construction of the Project, and will comply with any conditions placed on those permits.

Wetlands

Based on review of the U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI), the existing Susquehanna-Jenkins 230 kV Transmission Line right-of-way crosses several wetland systems (USFWS 2015). These systems are characterized as palustrine forested (PFO) and palustrine scrub-shrub (PSS) wetlands. Most of these wetlands are located within the Little Wapwallopen Creek watershed along stream corridors.

The NWI only provides a general overview of the potential wetlands that may be located within an area. For federal and state permitting purposes, the wetlands and waterways within the Project area will be delineated, surveyed, and illustrated according to regulatory standards. This information will be used minimize wetland impacts where feasible. PPL Electric will avoid impacts to wetlands and streams where possible by aerially spanning these features. PPL Electric will obtain all necessary permits from the PADEP and the United States Army Corps of Engineers and will comply with all of the terms and conditions placed on those permits.

Minor temporary impacts to several of these wetlands are anticipated through the installation of timber matting needed to access some existing or proposed structure locations. Permits to install the matting across these wetlands will be obtained from PADEP. Reconstruction activities will also be conducted using a state approved erosion and sedimentation control plan to minimize the effects of

stormwater runoff to these wetlands.

100-year Floodplains

The National Flood Hazard Layer (NFHL) for Pennsylvania was obtained through the Pennsylvania Spatial Data Access (PASDA) database and analyzed for 100-year floodplains within the Project area and surrounding landscape. The NFHL data incorporates all Flood Insurance Rate Map (FIRM) databases published by the Federal Emergency Management Agency (FEMA), and any Letters of Map Revision (LOMRs) that have been issued against those databases since their publication date (FEMA 2015).

The existing Susquehanna-Jenkins 230 kV Transmission Line spans the 100-year floodplains associated with several streams along the alignment. Presently, one existing tower is located in the 100-year floodplain of Little Wapwallopen Creek that will be replaced by a new monopole structure. The new structure will be located further away from the stream edge but will still be within the defined 100-year floodplain. However, the new structure will have a smaller footprint relative to the tower and will be presented to PADEP as a replacement of an existing obstruction.

Vegetation

Vegetative cover in the western section of the Project area has been influenced by the agricultural and rural residential development noted in the Little Wapwallopen Creek valley. Moderate sections of the natural vegetative cover in the valley have been removed as part of the conversion to farms and pastures and some of this conversion is still on-going due to the slow expansion of the residential development. Similarly, the eastern end of the Project area has also been influenced by development but primarily due to the commercial and industrial influence of Wilkes-Barre. Central portions of the Project area are located within a dense deciduous forest.

Limited vegetation management will be required to rebuild the existing single-circuit Susquehanna-Jenkins 230 kV Transmission Line for double-circuit operation. The existing Susquehanna-Jenkins 230 kV Transmission Line right-of-way currently is maintained in accordance with PPL Electric's Vegetation Management Program. Only minimal vegetation removal is anticipated because the

Project is being completed entirely within existing PPL Electric right-of-way, which is currently cleared of trees for safety and maintenance reasons, or on PPL Electric's property for the Susquehanna 230-69 kV Substation. In areas where vegetation management is required, PPL Electric will apply its "*Specifications for Transmission Vegetation Management LA-79827*" to minimize any potential impacts.

6.0 Threatened and Endangered Species

Review of the threatened and endangered species that may be encountered within and along the Susquehanna-Jenkins 230 kV right-of-way includes evaluation of the natural areas identified in the Project area, as well as the Project related responses provided by federal and state agencies that have protective jurisdiction over the surrounding animals, plants, and ecological communities.

Natural Areas Inventory

The *Natural Areas Inventory for Luzerne County*, prepared by the Pennsylvania Natural Heritage Program (PNHP), identified eight sites within the Susquehanna-Jenkins 230 kV Rebuild Project area (PNHP 2006). From west to east, these areas include the following:

- Folstown Mud Pond – a glacial wetland that has been dammed to create a pond, which has a good population of two plant species of concern. No impacts to this pond are anticipated.
- Penobscot Mountain Ridgetop – consists of an Ephemeral/Fluctuating Pool Natural Community in a matrix of dry oak-heath forest that provide habitat for two plant species of concern. No impacts are anticipated to the ephemeral pools located along the right-of-way.
- Nuangola Lake – large glacial lake that supports two species of special concern. No impacts to this lake are anticipated.
- Nuangola Railroad Tunnel – site is on SGL #207 property and is home to a known bat species of concern. No impacts to the tunnel are anticipated.
- Nuangola Station Swamp – a mixed broadleaf-conifer swamp bisected by a meandering stream. An abandoned railroad grade also bisects this swamp that will be used as an access road during construction. Impacts to the swamp are not anticipated.
- Haystack Mountain – a high elevation Northern Appalachian Acidic Rock Summit Natural Community that supports six plant species of concern. A botanical survey of the area was conducted that identified several of these species along the access road – protective measures will be implemented during construction to avoid impacts to these species.
- Arbutus Peak – site of a Ridgetop Dwarf Tree Forest Natural Community that has four plant species of concern. A botanical survey of the area was conducted that identified several of these species along the access road – protective measures will be implemented during

construction to avoid impacts to these species.

- The Tubs – is a significant geologic feature (Whirlpool Canyon) that consists of a series of falls over sandstone and conglomerate rock of the Pocono Formation. An access road that crosses an upper section of this natural area but will have no effect on this geological feature.

Three additional contiguous natural areas are crossed in Bear Creek Township and Laurel Run Borough that are not clearly defined by PNHP but are the general locations of several plant species of concern identified by PADCNr during the threatened and endangered species review process. These areas will be surveyed and protective measures will be implemented during construction to avoid impacts to any protected species identified.

Threatened and Endangered Species

A Large Project Review of the Pennsylvania Natural Diversity Inventory (PNDI) database was conducted for the Project area (PNDI #022422).

The PFBC noted that there is vernal pool habitat within the Project area suitable for the Northern Cricket Frog (*Acris crepitans*), an endangered species in Pennsylvania. However, since project modifications will be made to avoid impacts to these potential habitats, PFBC concluded that the Project would not result in adverse impacts to this species. The PFBC also noted that the timber rattlesnake (*Crotalus horridus*), a candidate species of concern in Pennsylvania, may forage within the Project area. PFBC concluded that the proposed Project would not have any direct adverse impacts on the timber rattlesnake, but also noted the importance of alerting workers to the potential presence of rattlesnakes and advising them that rattlesnakes are a protected species and should not be harmed (PFBC 2015c).

The USFWS noted that the proposed Project is located within habitat areas for both the federally endangered Indiana bat (*Myotis sodalists*) and the federally threatened long-eared bat (*Myotis septentrionalis*). USFWS concluded that, as no new forest clearing is anticipated, the effects of the Project are not likely to affect these bat species (USFWS 2015b).

The PGC noted that portions of the Project may include potential day roost habitat for the eastern

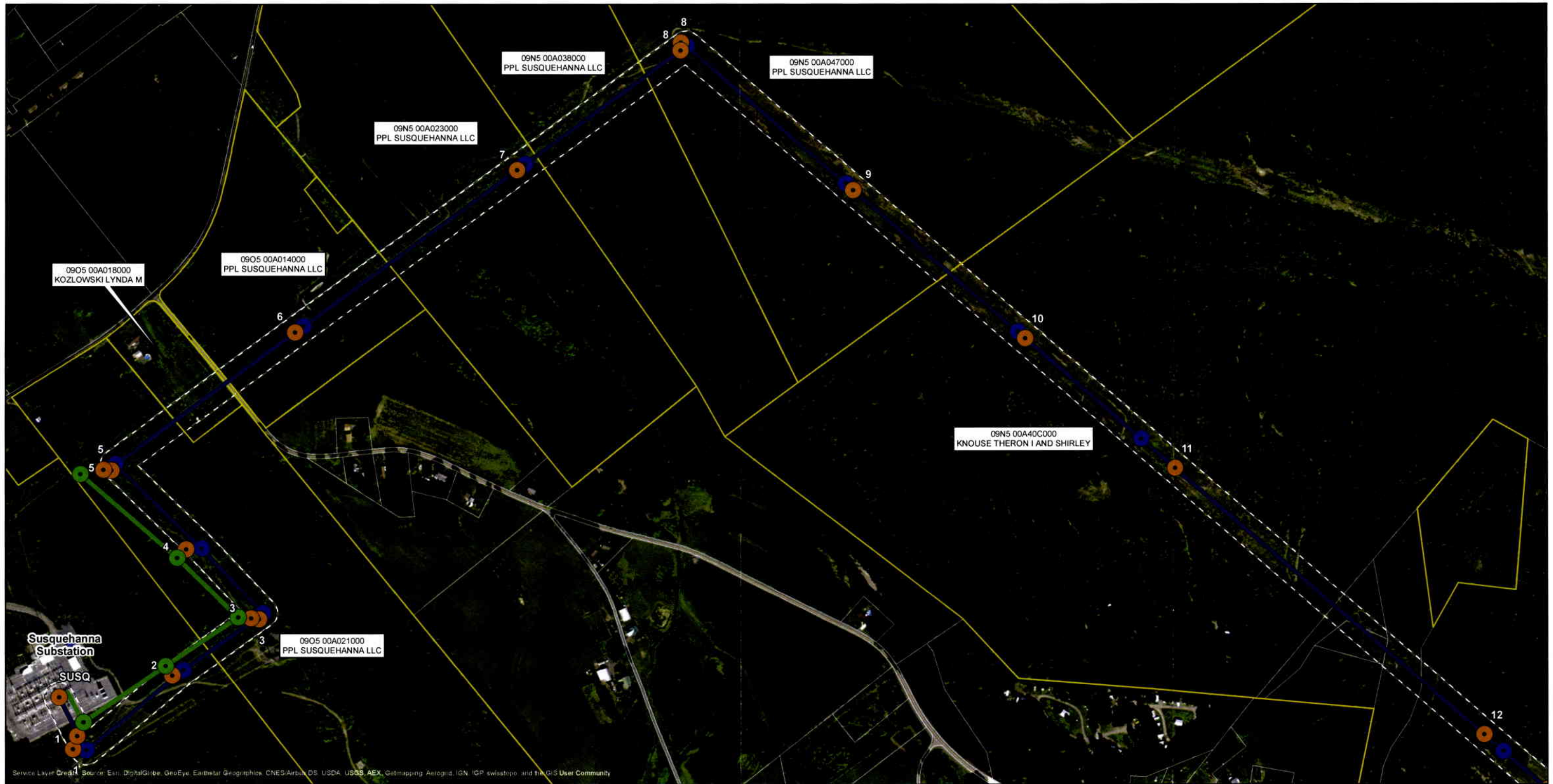
small-footed bat (*Myotis leibii*), a threatened species in Pennsylvania. The PGC requests that all potential eastern small-footed bat day roost habitat be assessed and delineated by a qualified biologist (PGC 2015). PGC also noted that portions of the Project are located on two state game lands, SGL #207 and #292 that will require coordination during the permitting and construction process.

The PNDI review also further indicated the potential presence of six plant species of concern identified by the PADCNR. The PADCNR requires that a qualified botanist conduct a botanical survey of the Project area for each plant species (PADCNR 2015). PPL Electric will conduct the required botanical survey and coordinate with PADCNR to implement measures to avoid impacts to any plant species of concern identified.

PPL Electric will continue to consult with the jurisdictional agencies regarding potential impacts to protected species. PPL Electric will obtain all approvals and permits necessary for the construction of the Project, and will comply with any conditions placed on those permits.



FIGURES



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Proposed Structures (Mountain Line)
- Existing Structures
- Transmission Centerline
- Proposed Mountain Line Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

Notes

- Existing Project Centerline and Existing Poles digitized from files received from PPL in June 2014.
- Proposed Pole locations digitized from files received from PPL on 9/4/2015

NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

1 inch = 500 feet



AECOM

**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 1 of 18
 Luzerne County, Pennsylvania







PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

-  Proposed Structures
-  Existing Structures
-  Transmission Centerline
-  Right-of-Way (150')
- Luzerne County Parcels (2015)**
-  Parcels Crossed by ROW
-  Other Parcel Boundary

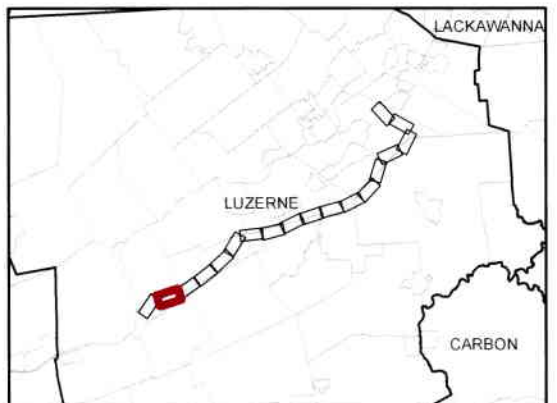
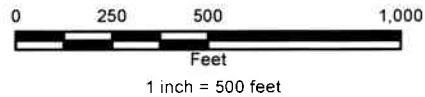
Notes

- Existing Project Centerline and Existing Poles digitized from files received from PPL in June 2014.
- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

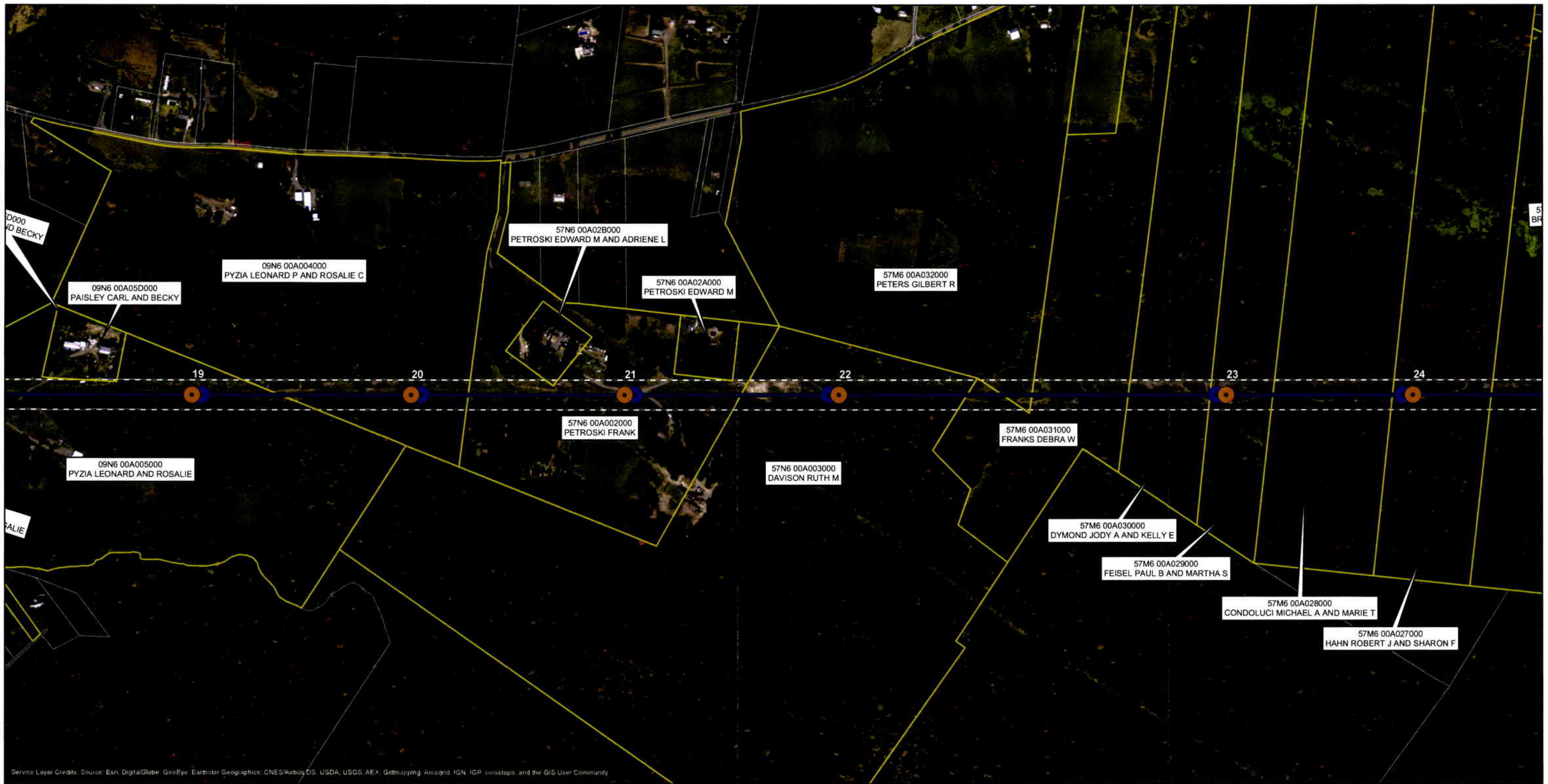


**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 2 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

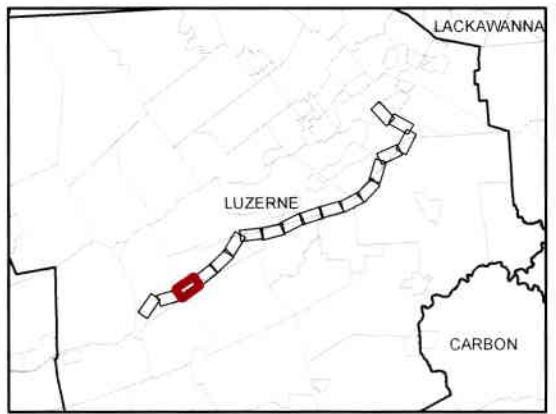
Notes

- Existing Project Centerline and Existing Poles digitized from files received from PPL in June 2014.
- Proposed Pole locations digitized from files received from PPL on 9/4/2015

NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

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 Feet
 1 inch = 500 feet



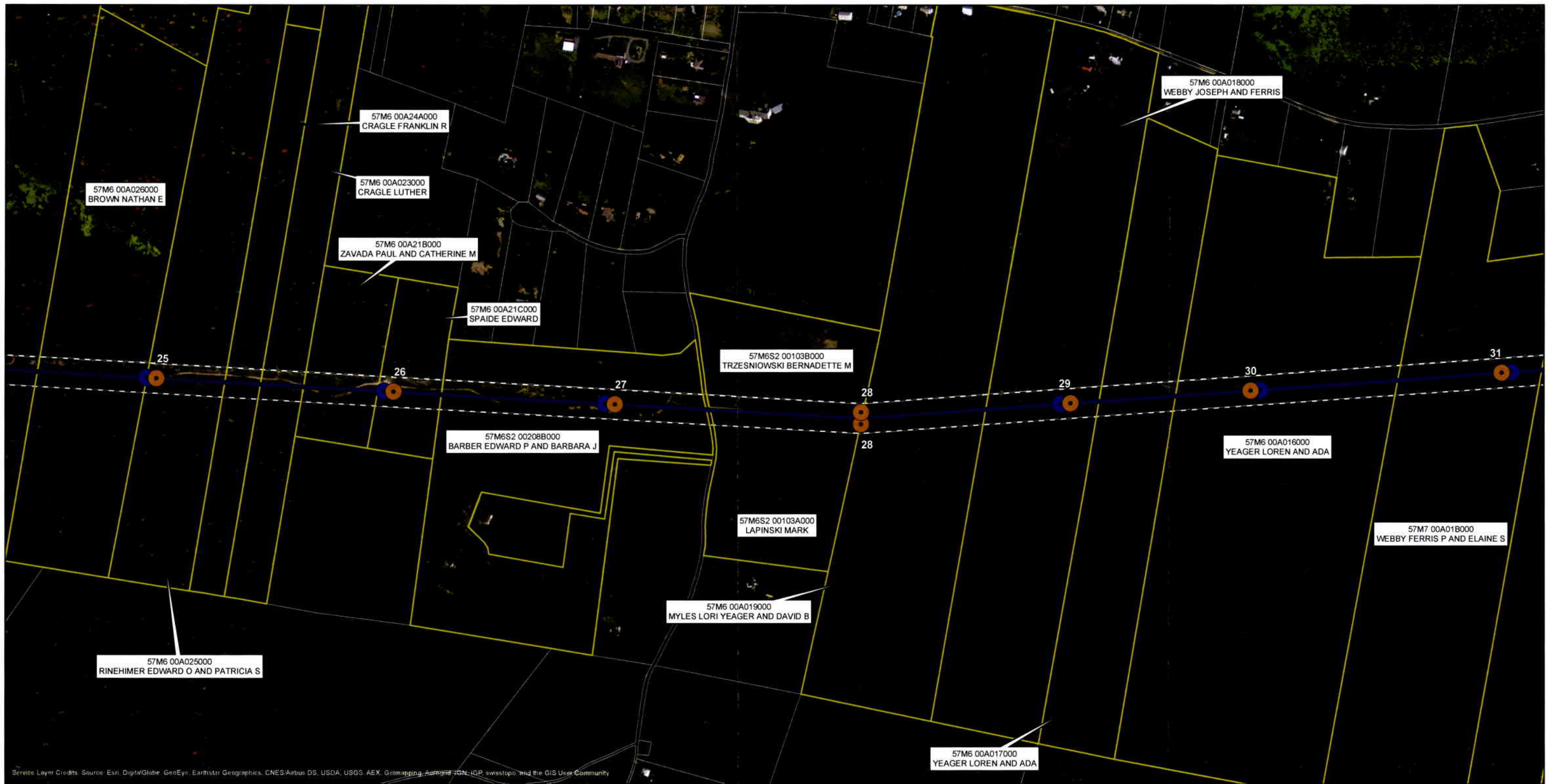
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**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**







Extent Map 3 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Legend

-  Proposed Structures
-  Existing Structures
-  Transmission Centerline
-  Right-of-Way (150')
- Luzerne County Parcels (2015)**
-  Parcels Crossed by ROW
-  Other Parcel Boundary

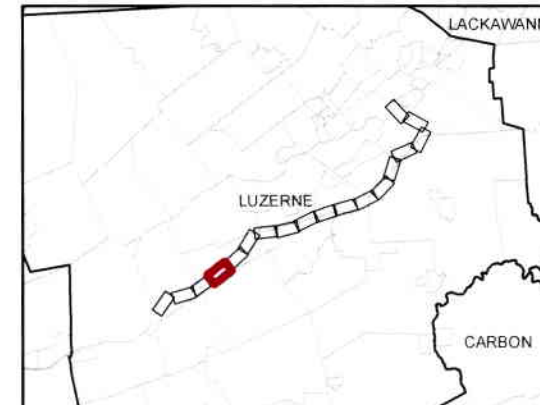
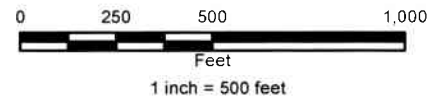
Notes

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- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

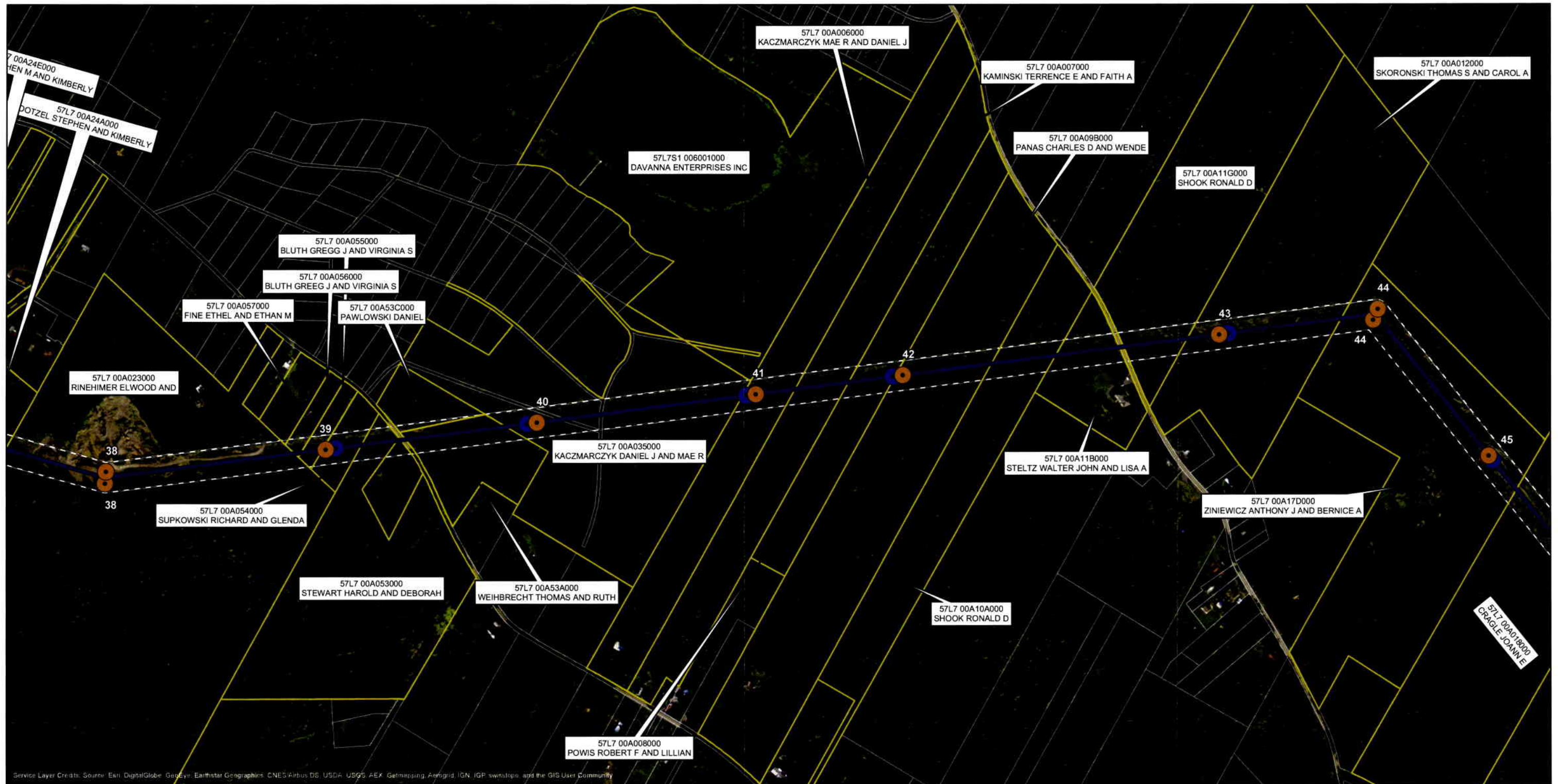


**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 4 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



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Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

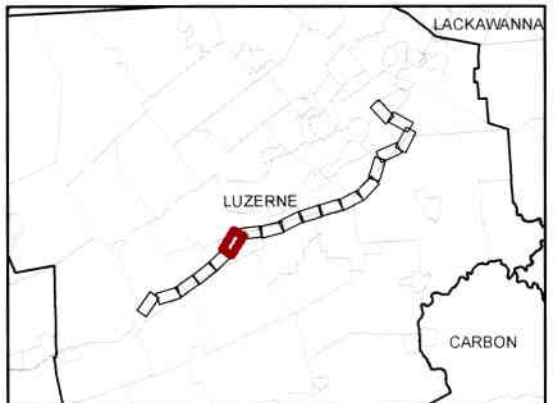
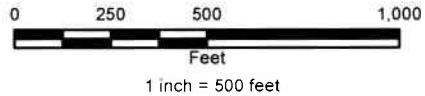
Notes

- Existing Project Centerline and Existing Poles digitized from files received from PPL in June 2014.
- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

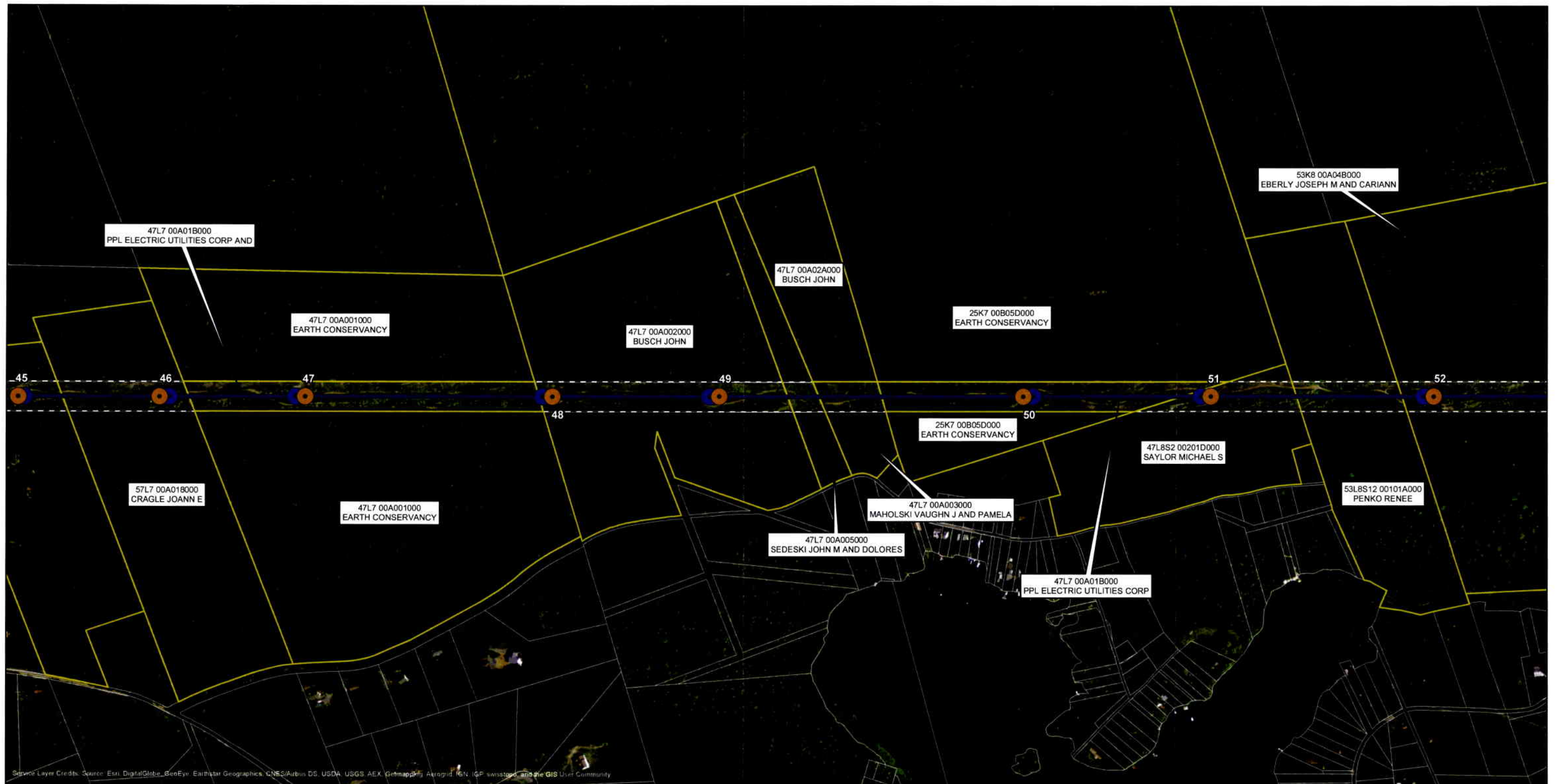


**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 6 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aergrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

Notes

- Existing Project Centerline and Existing Poles digitized from files received from PPL in June 2014.
- Proposed Pole locations digitized from files received from PPL on 9/4/2015

NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

1 inch = 500 feet



AECOM

**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**







Extent Map 7 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Legend

-  Proposed Structures
-  Existing Structures
-  Transmission Centerline
-  Right-of-Way (150')
- Luzerne County Parcels (2015)**
-  Parcels Crossed by ROW
-  Other Parcel Boundary

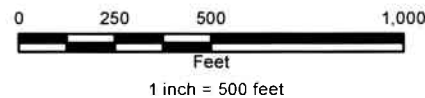
Notes

- Existing Project Centerline and Existing Poles digitized from files received from PPL in June 2014.
- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)



**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 8 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

Notes

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- Proposed Pole locations digitized from files received from PPL on 9/4/2015

NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

1 inch = 500 feet



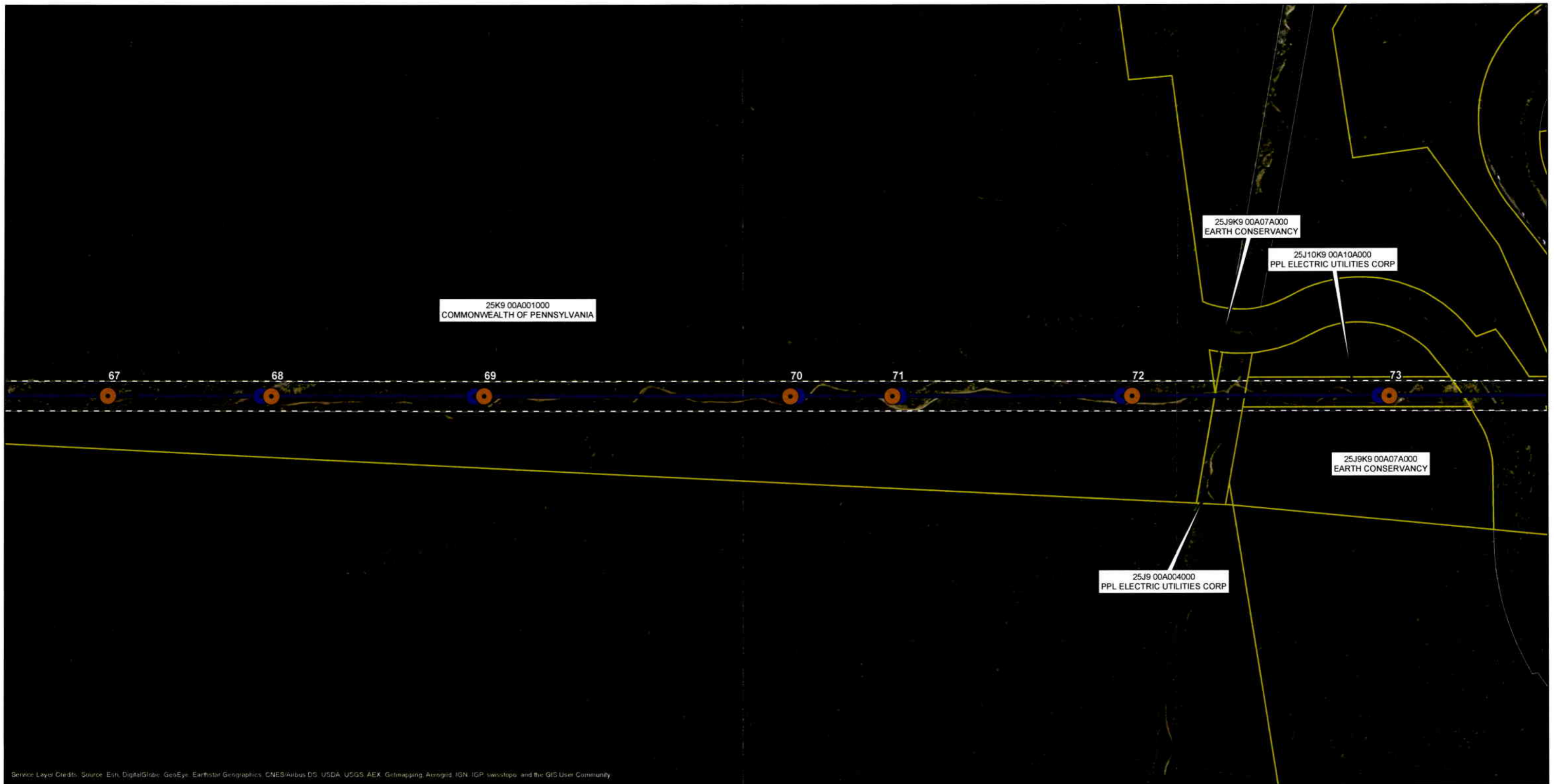
AECOM

**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 9 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

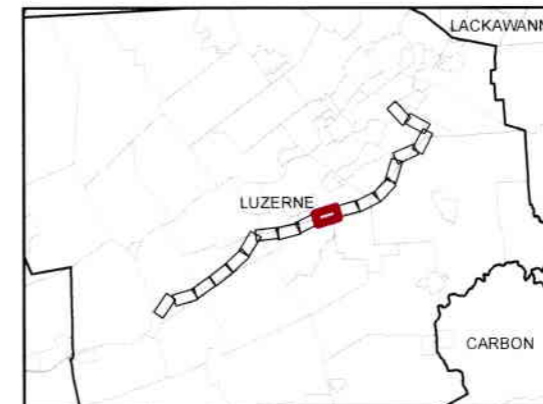
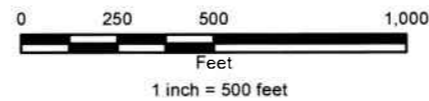
Notes

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NAD 1983 State Plane
Pennsylvania North FIPS 3701
Projection: Lambert Conformal Conic
Linear Unit: US Foot

References:
World Imagery Basemap (ESRI)
Luzerne County Parcel Data (2015)

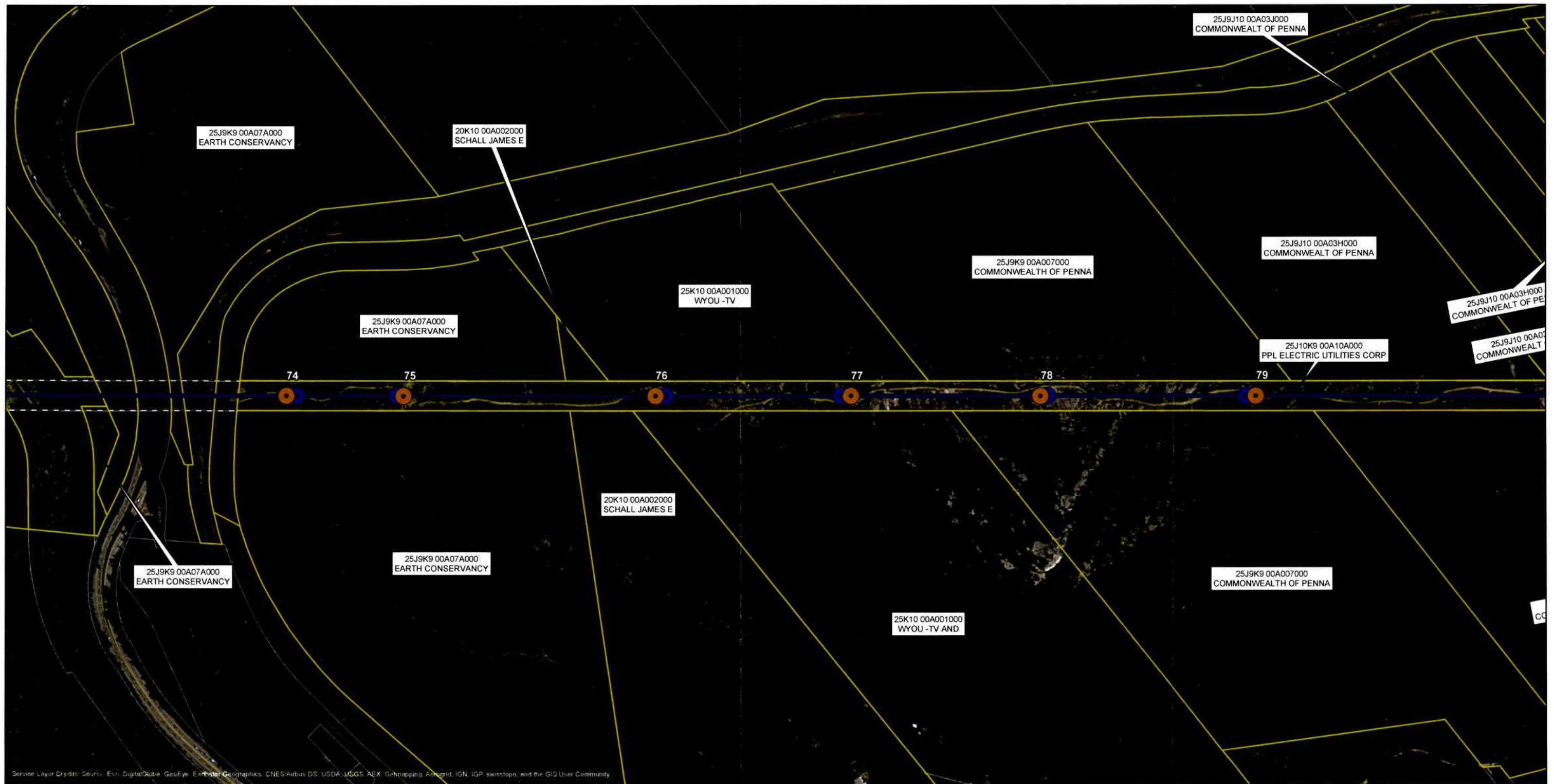


**Figure 3-1: Aerial Overview Map
Susquehanna-Jenkins
230 kV Rebuild Project**

Extent Map 10 of 18
Luzerne County, Pennsylvania

PPL Electric Utilities
Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geoplanning, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

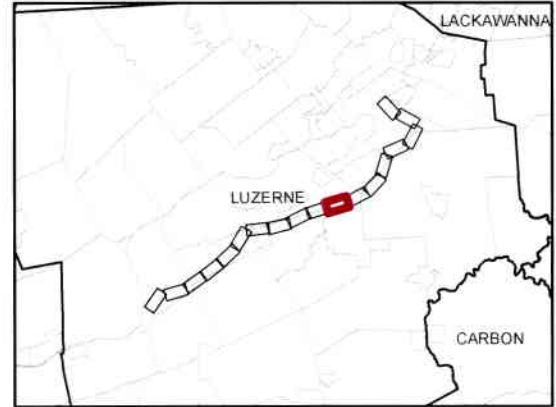
Notes

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NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

1 inch = 500 feet



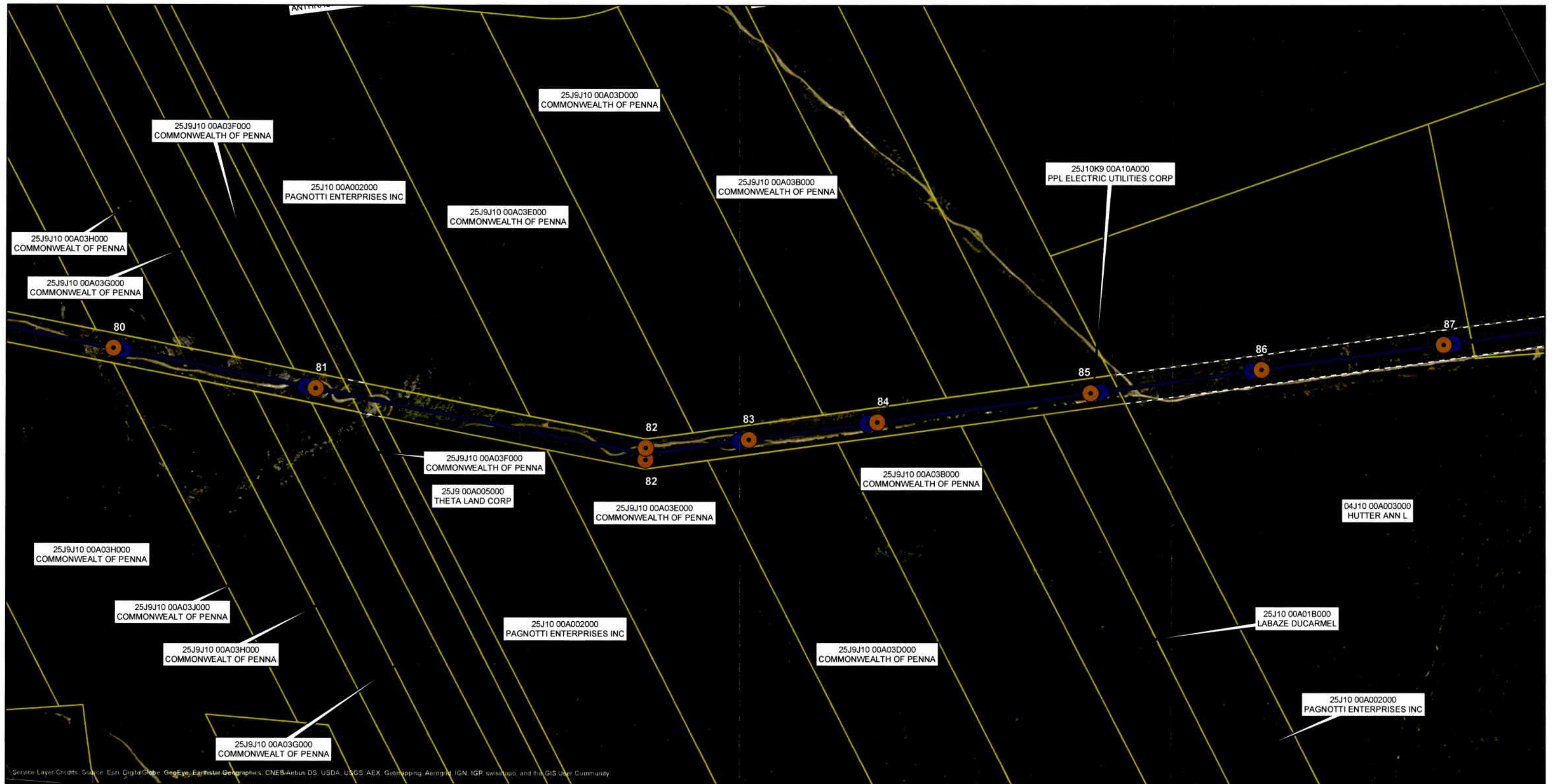
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**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 11 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

Notes

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NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

1 inch = 500 feet



AECOM

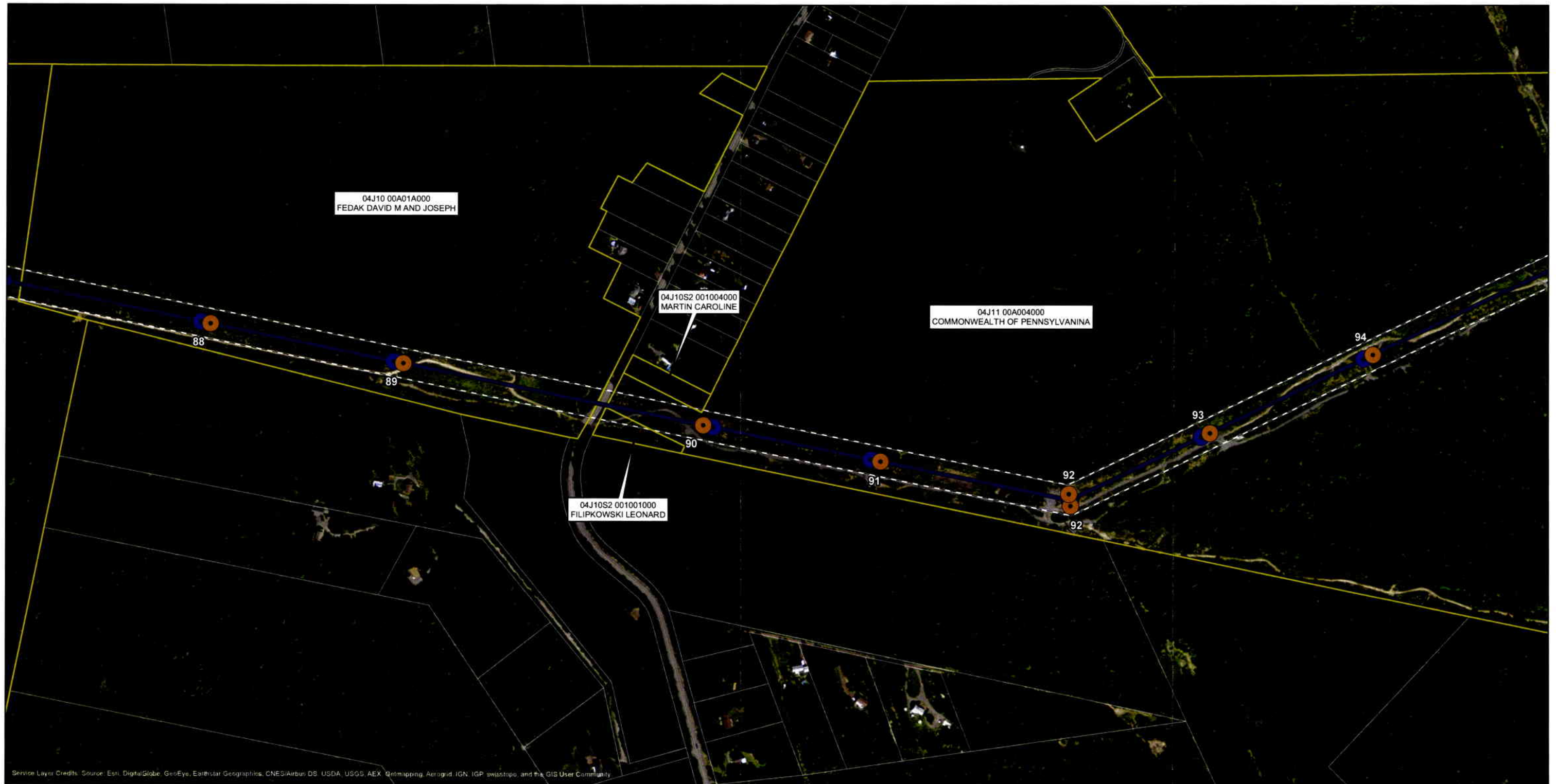
**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 12 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016

Service Layer Credits: Source: Earth DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aergrid, IGN, IGP, swisstopo, and the GIS User Community



Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

Notes

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- Proposed Pole locations digitized from files received from PPL on 9/4/2015

NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

1 inch = 500 feet



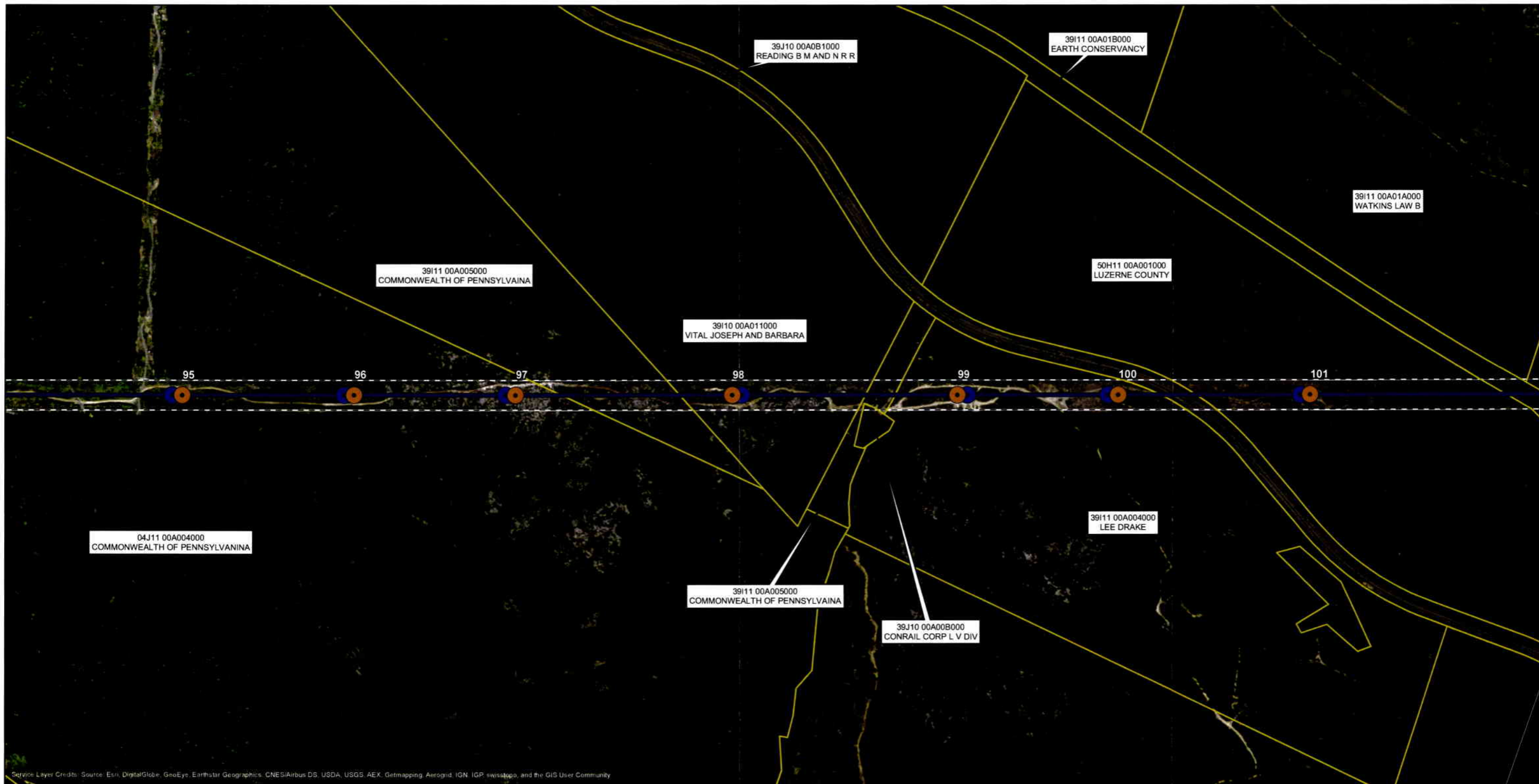
AECOM

**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 13 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

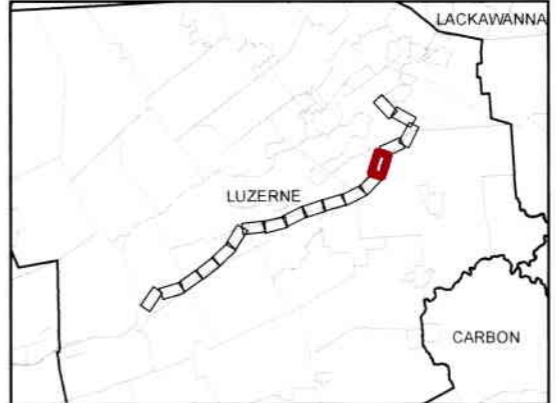
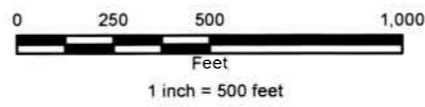
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- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

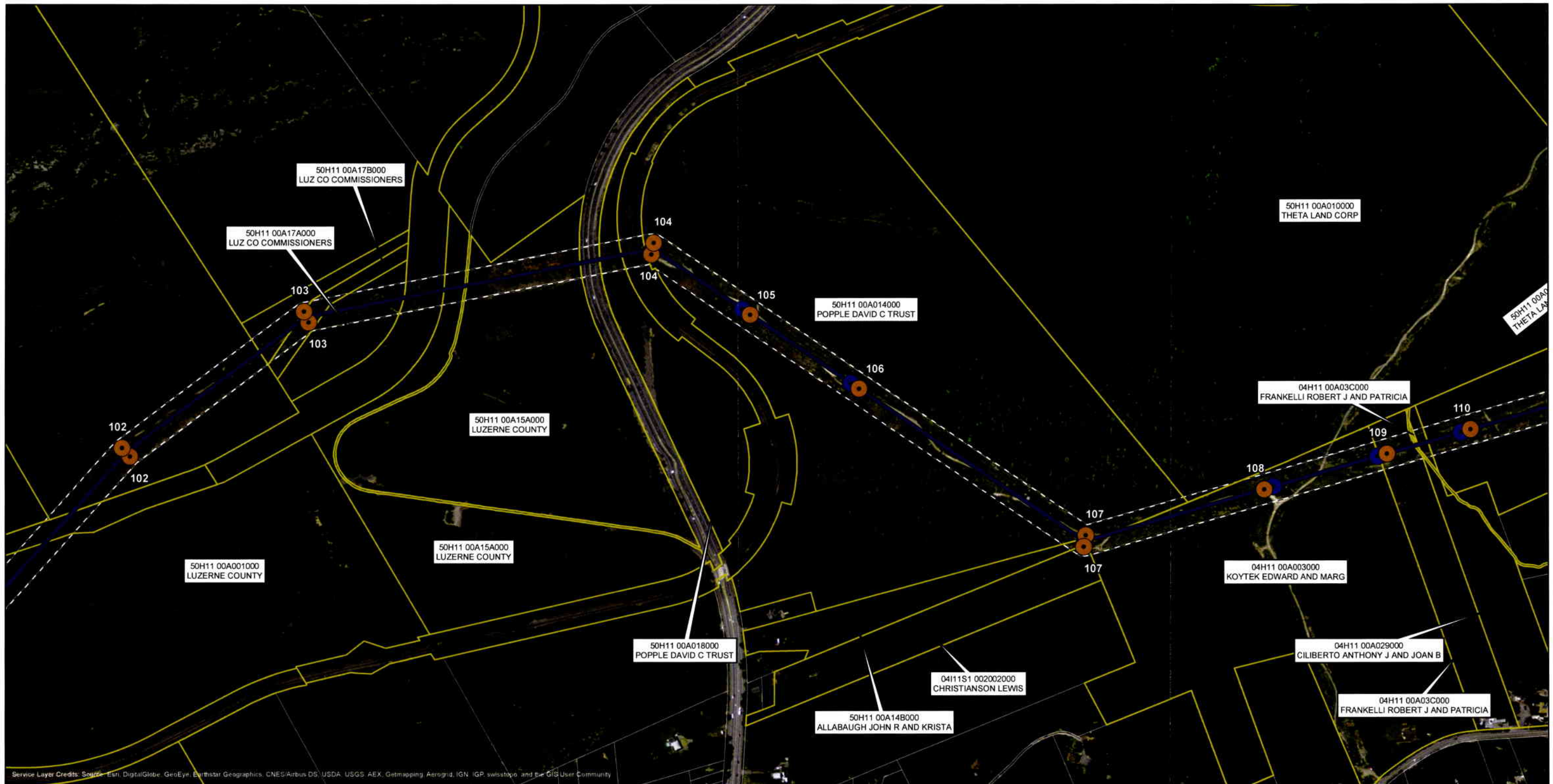


**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 14 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

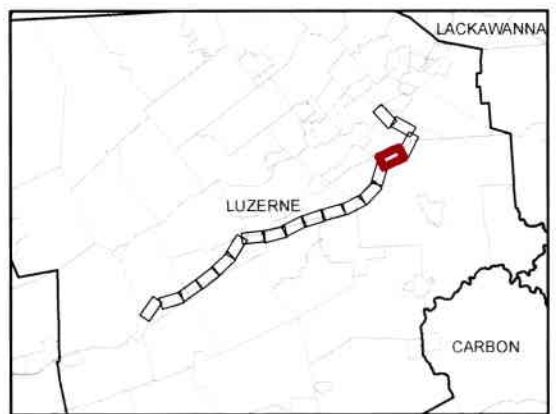
Notes

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NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

1 inch = 500 feet

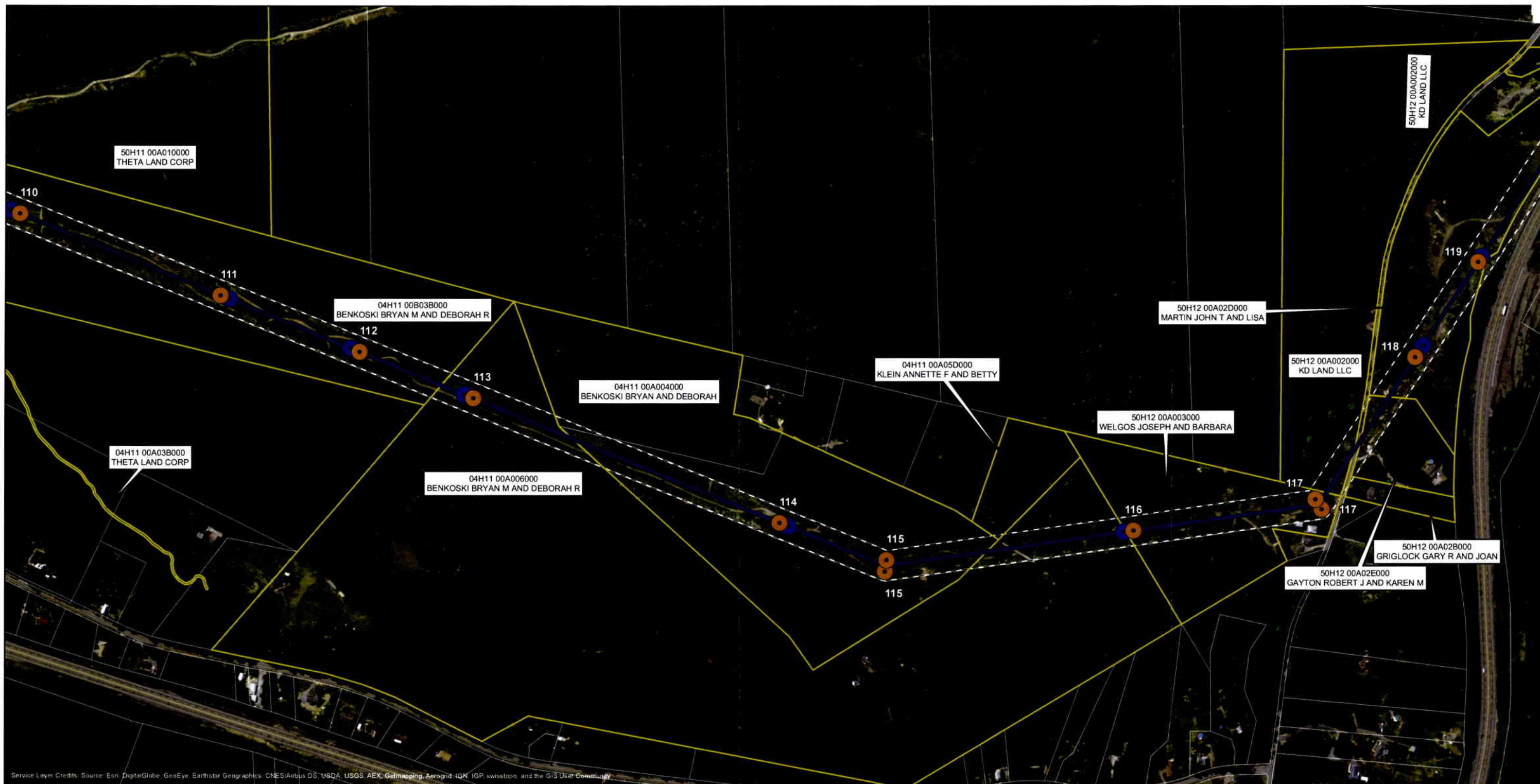


**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 15 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

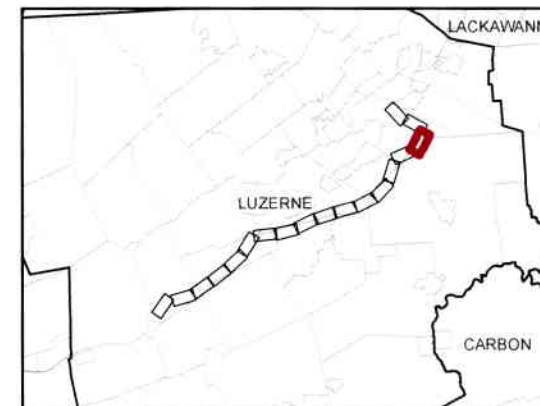
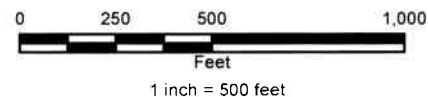
Notes

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- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)



**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 16 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Proposed Structures
- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

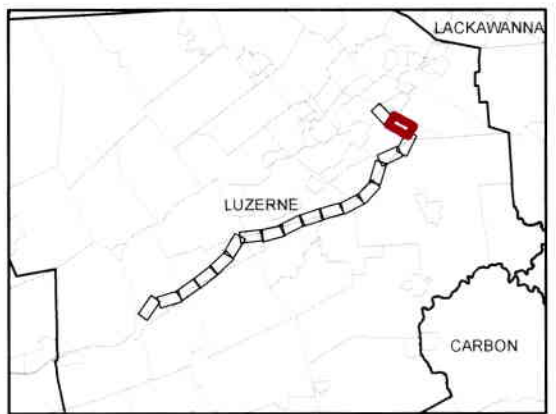
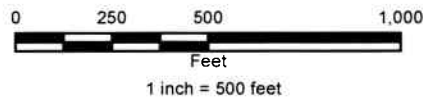
Notes

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- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)

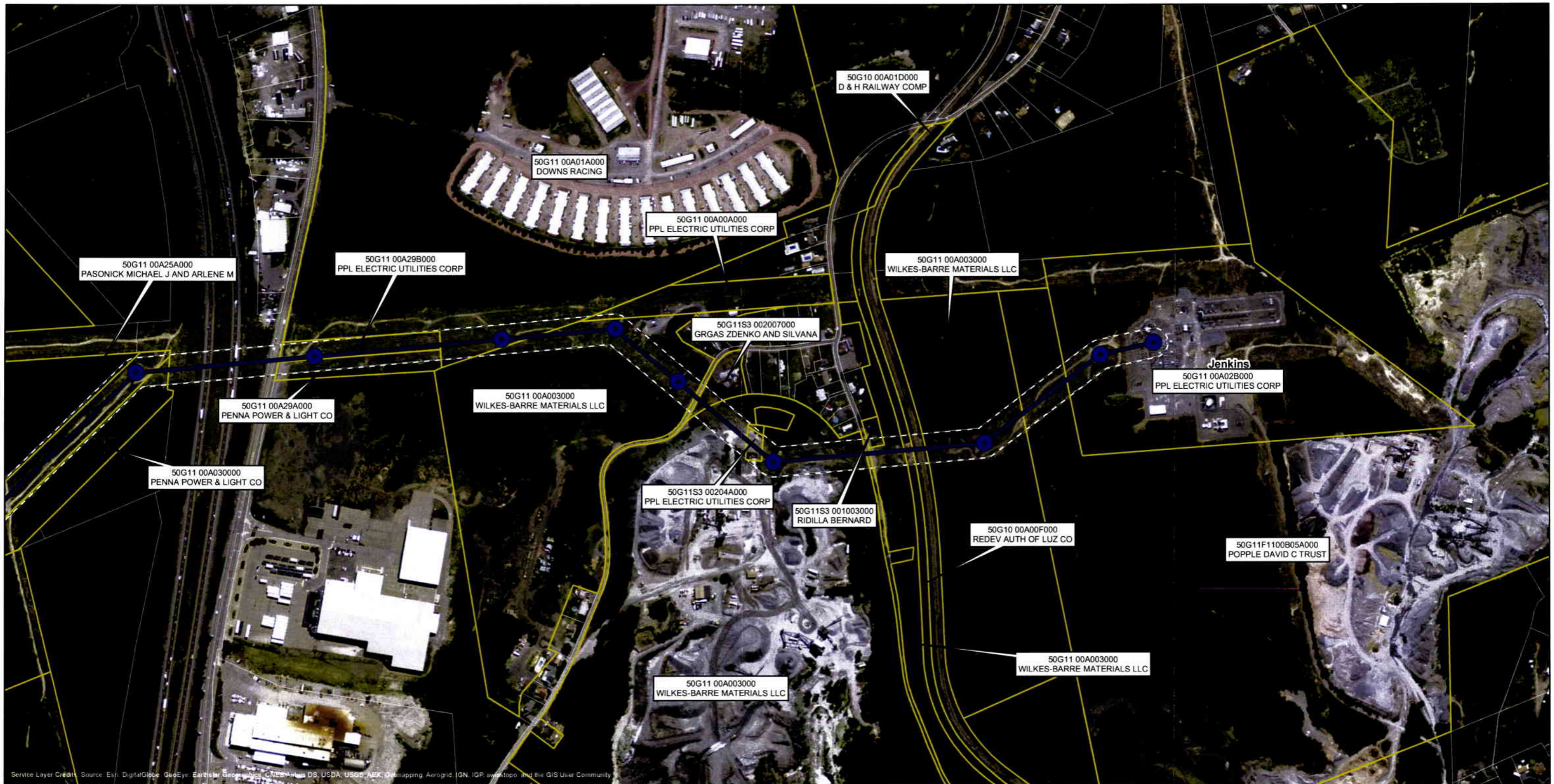


**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 17 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNR Aero, USDA, USGS, AEX, DeLorme, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

Legend

- Existing Structures
- Transmission Centerline
- Right-of-Way (150')
- Luzerne County Parcels (2015)**
- Parcels Crossed by ROW
- Other Parcel Boundary

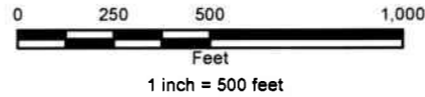
Notes

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- Proposed Pole locations digitized from files received from PPL on 9/4/2015



NAD 1983 State Plane
 Pennsylvania North FIPS 3701
 Projection: Lambert Conformal Conic
 Linear Unit: US Foot

References:
 World Imagery Basemap (ESRI)
 Luzerne County Parcel Data (2015)



**Figure 3-1: Aerial Overview Map
 Susquehanna-Jenkins
 230 kV Rebuild Project**

Extent Map 18 of 18
 Luzerne County, Pennsylvania

PPL Electric Utilities
 Allentown, Pennsylvania

Prepared By: NB	Checked By: DY
Job: Susquehanna-Jenkins	Date: 1/7/2016

ATTACHMENT 4

**ATTACHMENT 4
SUSQUEHANNA-JENKINS 230 KV REBUILD PROJECT
DESIGN CRITERIA AND SAFETY**

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3.0 Personnel Safety Rules 3

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Table 4-1: 230 kV Vertical Clearance to Ground

Table 4-2: Required Minimum Clearance for Nonconductive Working Stick

1.0 Design Considerations

The re-built line described above will be designed according to, and generally exceed, all NESC minimum standards. The 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 has developed design specifications and safety rules which meet or surpass all requirements specified by the NESC.

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 Electric 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 Electric designs all of its transmission lines for Grade B construction. The use of Grade B design and construction specifies enhancements such as larger-minimum cross-arm 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 Electric 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 Electric 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 Electric lines are designed to operate safely and reliably during inclement weather even more severe than assumed by the NESC. In addition, PPL Electric transmission lines are designed with more clearance to the ground than required by the NESC. **Table 4-1** compares PPL Electric and NESC ground clearances for lines of various voltages.

TABLE 4-1 230 kV Vertical Clearance to Ground		
Surface Underneath Conductors	NESC Standard	PPL Electric Design
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.	34 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.

2.0 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.

3.0 Personnel Safety Rules

The following are a few of the PPL Electric 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 required minimum clearances (**Table 4-2**) is used to test that the line has been de-energized and to apply temporary safety grounds:

TABLE 4-2 Required Minimum Clearance for Nonconductive Working Stick	
Voltage-kV	Minimum Clearance
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.

4.0 Magnetic Field Management Plan

PPL Electric’s Magnetic Field Management Program is applied to new and reconstructed transmission line projects. In order to lower magnetic field exposures, the program generally prescribes the use of a line design that provides ground clearances of five feet higher than the required minimum NESC ground clearance and reverses phasing of new double circuit lines where it is feasible to do so at low or no cost. The implementation of additional modifications will be considered, provided those modifications can be made at low or no cost and will not interfere with the operation of the line.

Consistent with its Magnetic Field Management Program, PPL Electric will rebuild the existing 230

kV transmission line for ground clearances that are a minimum of five feet higher than the required NESC minimum ground clearance for 230 kV lines. The rebuilt Susquehanna-Jenkins 230 kV double-circuit line will have reverse phasing to help reduce the magnetic field.

