Before the
Pennsylvania Public Utility Commission

SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT

ATTACHMENTS IN SUPPORT OF THE
Letter of Notification

Application Docket No._____

Submitted by: PPL Electric Utilities Corporation

ATTACHMENT 1
SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT
NECESSITY STATEMENT

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ATTACHMENT 1
SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT
NECESSITY STATEMENT

A. INTRODUCTION

PPL Electric Utilities Corporation ("PPL Electric") requests Pennsylvania Public Utility Commission ("PUC" or "Commission") approval to rebuild approximately 6.8 miles of the existing Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines located in Lehigh and Carbon counties, Pennsylvania. This line begins as two parallel single-circuit transmission lines for 3.4 miles, then continues as a combination of double-circuit and single-circuit lines for the remaining 3.4 miles to the East Palmerton 230-69 kV Substation. The entire 6.8 miles will be rebuilt as one high capacity double-circuit 138/69 kV transmission line. In addition, PPL Electric seeks PUC approval for the reconstruction of approximately 0.1 mile of the existing Palmerton 138/69 kV Transmission Tap located in Carbon County and approximately 300 feet of the Palmerton Zinc 138/69 kV Transmission Tap located in Carbon County for 138/69 kV operation[1].

Rebuilding the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines and associated tap lines (the "Project") is the second phase of a three-phase plan to replace these aging transmission lines between the Siegfried Substation and the East Palmerton and Hauto substations. PPL Electric has divided the overall plan into three separate phases, each with a separate need, to reduce the complexity of project execution (see Figure 1-1). Each phase of the project will be the subject of a separate filing. The first phase ("Phase 1") was approved by the PUC on July 5, 2013 at Docket No. A-2013-2372112. PPL Electric anticipates submitting an updated LON for Phase 1 based on subsequent design changes that occurred since 2013, including the addition of rebuilding the South Slatington 138/69 kV Transmission Tap.

[1] The existing Palmerton 138/69 kV and Palmerton Zinc 138/69 Transmission Taps both tap the existing Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines at two separate locations.

This Joint Waiver Petition and Letter of Notification seeks the PUC's approval of the second phase ("Phase 2"), the section between a point where the existing Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Line and the existing Siegfried – Hauto #1 and #4 138/69 kV Transmission Line diverge in Washington Township ("the Split") and the East Palmerton 230-69 kV Substation. As explained below, the existing Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines have reached the end of their useful lives and the facilities must be replaced in order to continue to provide safe and reliable service. The proposed rebuild of the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines, Palmerton 138/69 kV Transmission Tap and Palmerton Zinc 138/69 kV Transmission Tap is part of PPL Electric's Asset Optimization Strategy, and involves rebuilding the lines to meet all current design and lightning protection standards. The modernization of the lines will help ensure reliable and continuous service to customers in Lehigh and Carbon counties.

In the final phase of the project, PPL Electric proposes to rebuild 15.2 miles of the Hauto – Siegfried #1 and #2 69 kV double-circuit line ("Phase 3"). **Figure 1-1** shows a schematic diagram of the area with phases of demarcation. PPL Electric will seek approval for the final phase of this project separately once preliminary engineering is complete.

The estimated cost to site, design and construct the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines, Palmerton 138/69 kV Transmission Tap and Palmerton Zinc 138/69 kV Transmission Tap ("Phase 2") is approximately $23.6 million.[2] Subject to the Commission's approval, the Project has a scheduled construction start date of August 2, 2018 to meet an in-service date of March 2019. PPL Electric will own, operate and maintain the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines, Palmerton 138/69 kV Transmission Tap and Palmerton Zinc 138/69 kV Transmission Tap. The cost for this Project will be paid by PPL Electric.

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[2] The estimated 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 estimated 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 progresses.

B. TRANSMISSION SYSTEM PLANNING PROCESS

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.

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)[3] and non-Bulk Electric System (non-BES)[4] 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 North American Electric Reliability Corporation (NERC), PJM Interconnection, LLC ("PJM"), and the Transmission Owner's reliability criteria for all normal and emergency operating conditions.

PJM is a FERC-approved Regional Transmission Organization (RTO) charged with ensuring the reliability of the electric transmission system under its functional control (100 kV and above), and coordinating the movement of electricity in all or parts of thirteen states and the District of

[3] Bulk Electric System (BES) – Includes transmission facilities operated at voltages of 100 kV or higher.
[4] Non-Bulk Electrical System (non-BES) – Includes transmission facilities operated at voltages less than 100 kV.

Columbia, including most of Pennsylvania. In order to ensure reliable transmission service, PJM prepares an annual Regional Transmission Expansion Plan (RTEP)[5] 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.

PJM conducts RTEP studies in conjunction with its Transmission Owners and applies NERC, regional, and Transmission Owner reliability criteria to specific conditions on the transmission system. 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. PJM's manual 14B[6] outlines the RTEP process and reliability criteria used for this process. As identified in manual 14B, every year PJM performs various reliability tests such as Baseline Thermal, Baseline Voltage, Load Deliverability, Generation Deliverability and Baseline Stability to ensure safe, reliable operation of the electric grid.

When the studies show an inability of the transmission system to meet specific reliability criteria under these conditions, PJM opens an RTEP Window in accordance with FERC Order 1000[7] to solicit bids and approve optimal solutions to resolve the criteria violation.

PPL Electric, as a Transmission Owner and member of PJM, undertakes an independent analysis of both its BES transmission facilities and its non-BES transmission facilities in concert with the PJM RTEP process. PPL Electric identifies all conditions where the future system does not meet the NERC criteria, PJM reliability criteria, or PPL Electric Transmission Owner criteria. In this way, PPL Electric actively participates in the PJM RTEP process, and through this participation

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[5] 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.

[6] PJM Manual 14B is available at http://www.pjm.com/~/media/documents/manuals/m14b.ashx

[7] http://www.ferc.gov/industries/electric/indus-act/trans-plan.asp

PPL Electric provides results of its independent studies to PJM for consideration and inclusion in the PJM RTEP.

Alternatives that can mitigate violations to the reliability criteria are 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. 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 project.

PPL Electric's Transmission Owner criteria address thermal, voltage, short circuit, and stability limits specific to the PPL Electric zone and also ensure compliance with NERC and PJM reliability criteria. These criteria ensure adequate and appropriate levels of electric service to PPL Electric customers in accordance with good utility practices. In addition to these criteria, PPL Electric plans the system according to its own Transmission System Development Standards.

In addition to NERC, PJM, and Transmission Owner criteria-based projects, PPL Electric also initiates projects based on the Transmission System Development Standards. These projects address local load growth, provide load restoration flexibility, and replace poor performing transmission assets in order to provide an advanced level of reliability on the local system.

PPL Electric has developed an Asset Optimization Strategy that is incorporated into the Transmission System Development Standards. A significant portion of the system infrastructure is either approaching the end of life or has exceeded its expected or useful life. The Asset Optimization Strategy was developed to systematically identify and modernize these aging facilities. The measures used to identify and prioritize the equipment and lines that qualify for this work include, but are not limited to: age, condition, operational issues, maintainability of the equipment, criticality of the equipment or line, line loading, and circuit performance. Once equipment has been identified and assessed under the above measures, it will be put into the Capital Budget for replacement under the Asset Optimization Strategy.

Projects created to support PPL Electric's Transmission System Development Standards are presented to PJM stakeholders at either a Transmission Expansion Advisory Committee (TEAC) or Sub-Regional RTEP meeting and are assigned a Supplemental project number in the RTEP. PJM incorporates these projects into the power flow model which they use to perform various reliability analyses for the RTEP.

As explained below, the proposed Project is necessary to replace facilities that have reached the end of their useful life and to meet PPL Electric Transmission System Development Standards.

C. EXISTING SYSTEM

Currently the Hauto – Siegfried #1 and Siegfried – East Palmerton #2 double-circuit 138/69 kV Transmission Lines extend from the Siegfried 230-69 kV Substation for approximately 8.5 miles on two, parallel single-circuit structures, west to the "Split." Similarly, the Hauto – Siegfried #4 and Siegfried – East Palmerton #1 double-circuit 69 kV Transmission Lines extend from the Siegfried 230-69 kV Substation for approximately 8.5 miles west to the "Split."

From the "Split" the lines continue in two different directions. The Siegfried – Hauto #1 and #4 138/69 kV circuits continue as a double-circuit line west towards the Hauto 69-12 kV Substation. The Siegfried – East Palmerton #1 and #2 138/69 kV circuits continue as a combination of single-circuit and double-circuit line northeast toward the East Palmerton 230-69 kV Substation. This line begins as two parallel single-circuit transmission lines for approximately 3.4 miles and then continues as double-circuit for another 2.1 miles. From here, the line transitions to single-circuit for 0.6 mile northeast of the Palmerton Zinc 138/69 kV Transmission Tap and then back to double-circuit for another 0.5 mile. For the remaining 0.2 mile, the line continues as single-circuit within PPL Electric-owned property upon entering the East Palmerton 230-69 kV Substation. Two short tap lines extend from the Siegfried – East Palmerton #1 and #2 138/69 kV circuits to the Palmerton and Palmerton Zinc Substations.

The Palmerton 138/69 kV Transmission Tap Line consists of two parallel single-circuit lines for approximately 300 feet to the Palmerton 69-12 kV Substation. The Palmerton Zinc 138/69 kV

Transmission Tap Line consists of two parallel single-circuit lines for approximately 0.1 mile to the Palmerton Zinc 69-12 kV Substation. This filing specifically includes the 6.8-mile portion of the Siegfried – East Palmerton Line from the "Split" to the East Palmerton 230-69 kV Substation, the 300-foot Palmerton 138/69 kV Transmission Tap Line and the 0.1-mile Palmerton Zinc 138/69 kV Tap Line.

The Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines serve the existing Palmerton 69-12 kV Substation, Palmerton Zinc 69-12 kV Substation and South Slatington 69-12 kV Substation, which are distribution substations serving customers located in Carbon, Lehigh and Northampton counties, as well as a transmission customer. A one-line diagram and map of the existing system is shown in **Figure 1-2** and **Figure 1-3**.

D. DEFINITION OF THE PROBLEM

As explained above, PPL Electric has adopted an Asset Optimization Strategy to address and modernize deteriorated existing facilities across PPL Electric's transmission system. The Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines have been in service since the 1950s and carry the original 250 MCM copper conductor. The Palmerton 138/69 kV and Palmerton Zinc 138/69 kV taps are of similar age and are in a similarly deteriorated condition as the Siegfried – East Palmerton #1 and #2 Transmission Lines. In addition, these taps need to be rebuilt to operate at 138 kV standards.

Based upon the age of the circuits and lines, a more detailed examination of the facilities was performed. PPL Electric hired an outside engineering consultant, DiGioia Gray and Associates (DGA) of Monroeville, PA, to perform an independent field investigation and assessment of the line components. This assessment revealed that the aging facilities were showing signs of significant deterioration. Based on its inspection of the facilities, DGA concluded that the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines are reaching the end of their reliable service life.

Given the age of the structures, foundation conditions, conductor age, and right-of-way constraints where the existing ROW is less than the standard 100 feet, DGA recommended that PPL Electric rebuild the existing lines with a more reliable and robust circuit constructed on steel monopoles. Rebuilding the existing single-circuit portion of the lines as one double-circuit line allows PPL Electric to construct the new line on the center of the existing right of way, in most areas, to increase safety and reliability by increasing the distance between the conductors and the edge of the right of way. PPL Electric requested that DGA evaluate the cost to rehabilitate the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines and concluded that the total cost to rehabilitate the lines would be greater than the cost to rebuild the lines in place.

PPL Electric requested that DGA also compare the relative costs of rehabilitating and replacing the aging lines. DGA indicated that the following would be necessary in order to rehabilitate the existing lines:

- Conduct a complete engineering assessment of each structure, including computer modeling to ensure proper safety factors and clearances.
- Replace existing conductors.
- Replace existing shield wire.
- Replace all hardware and insulators.
- Install new grounding system at each structure location.
- Repaint all steel structures.
- Have all wood poles tested for strength and repair/replace as necessary.
- Repair or replace all bent, missing or corroded structural members.
- Repair all corroded steel below ground.
- Install cathodic protection at each structure.
- Evaluate lightning strike and other fault history for the existing line to determine the cause for the extensive conductor damage. Improve lightning resistance by bonding shield wires to the structures. This work is associated with improving tower ground resistance.
- Strengthen, reinforce or replace structures based on results of the engineering assessment mentioned above.
- Repair any other issues found during engineering assessment or construction.

Based on DGA's assessment, rehabilitating the existing lines would not be economical. Replacing the existing lines and structures will allow PPL Electric to upgrade the lines to current standards.

E. PROPOSED SOLUTION

After evaluating the alternatives, PPL Electric determined that the best overall solution is to replace the existing single-circuit and double-circuit sections of the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines with one new double-circuit line. The double-circuit line will be designed to new 138 kV standards, but it will initially operate at 69 kV. The proposed reconstruction is consistent with PPL Electric's Asset Optimization Strategy.

PPL Electric also seeks PUC approval for the rebuild of approximately 0.1 mile of the existing Palmerton 138/69 kV Transmission Tap and approximately 300 feet of the Palmerton Zinc 138/69 kV Transmission Tap as 138/69 kV transmission lines, which is necessary to accommodate the rebuild of the Siegfried – East Palmerton 138/69 kV Transmission Line. A one-line diagram and a map of the proposed system are shown in **Figure 1-4** and **Figure 1-5**.

The proposed rebuild of the Siegfried – East Palmerton 138/69 kV Transmission Lines and associated tap lines will bring the lines into compliance with current design standards, including increased vertical ground clearance, increased phase spacing for galloping[8] loop consideration, and installation of steel monopole structures for optimal structure longevity. The Project will also increase the lightning protection of the transmission line to reduce the frequency of momentary outages experienced by customers. Additionally, as a part of the Project, PPL Electric will be installing MOLBAB (motor-operated load break air break) switches that will allow for remote sectionalizing of the transmission system to restore service to customers in instances of sustained outages or during maintenance scenarios.

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[8] Galloping is a wind-induced oscillation of the wires which could potentially cause the wires to come into contact or flashover causing an outage. The consequences of galloping are mitigated by providing adequate wire-to-wire and wire-to-object clearances.

After completion of this Project, the customers served from the Palmerton 69-12 kV, Ashfield 69-12 kV, South Slatington 69-12 kV, Hauto 69-12 kV and Treichlers 69-12 kV Substations, as well as Palmerton Zinc Substation, will experience improved service reliability.

The proposed Project was presented at a PJM Mid-Atlantic Sub-Regional RTEP stakeholder meeting and PJM assigned the supplemental project number s0525.

This Project is necessary to enable PPL Electric to continue to provide reliable service now and into the future. Therefore, PPL Electric requests Commission approval to complete this Project.

Siegfried - East Palmerton and Siegfried - Hauto 138/69 kV Transmission Line Rebuild

PPL Electric Utilities

Louis Berger

- City
- Substation

Project Component

- Siegfried - Split 138/69 kV
- Split - East Palmerton 138/69 kV
- Split - Hauto 138/69 kV

Existing Transmission Line

- 500kV
- 138 - 230 kV
- 69kV
- Appalachian Trail
- River
- Municipality Boundary
- County Boundary
- State Gameland or State Park
- Forested Area

0 1 2 Miles

N

Sources: ESRI (2013), PASDA (2017), USGS (2017)

Coordinate System:
State Plane Pennsylvania North
Datum: North American 1983

January 09, 2018

HAUTO SUBSTATION
LANSFORD SUBSTATION
ASHFIELD SUBSTATION
"Split"
PALMERTON ZINC SUBSTATION
EAST PALMERTON SUBSTATION
LITTLE GAP SUBSTATION
PALMERTON SUBSTATION
BLUE MOUNTAIN SUBSTATION
SO SLATINGTON SUBSTATION
TREICHLERS SUBSTATION
SIEGFRIED SUBSTATION

Jim Thorpe
Lansford
Lehighton
Palmerton
Slatington
Northampton
Catasauqua

BANKS TWP
PACKER TWP
LEHIGH TWP
Lehigh Gorge State Park
State Gameland 141
JIM THORPE BORO
PENN FOREST TWP
POLK TWP
TOWAMENSING TWP
Beltzville State Park
MONROE
CARBON
ELDRED TWP
NESQUEHONING BORO
FRANKLIN TWP
RUSH TWP
LANSFORD BORO
SUMMIT HILL BORO
MAHONING TWP
LEHIGHTON BORO
PARRYVILLE BORO
LOWER TOWAMENSING TWP
COALDALE BORO
BOWMANSTOWN BORO
PALMERTON BORO
State Gameland 168
TAMAQUA BORO
MOORE TWP
State Gameland 257
EAST PENN TWP
SLATINGTON BORO
WALNUTPORT BORO
LEHIGH TWP
WEST PENN TWP
WASHINGTON TWP
State Gameland 217
HEIDELBERG TWP
ALLEN TWP
Lehigh River
NORTH WHITEHALL TWP
NORTHAMPTON BORO
EAST BRUNSWICK TWP
LYNN TWP
COPLAY BORO
NORTH CATASAUQUA BORO
State Gameland 106
ALBANY TWP
State Gameland 205
LOWHILL TWP
WHITEHALL TWP
WEISENBERG TWP
SOUTH WHITEHALL TWP

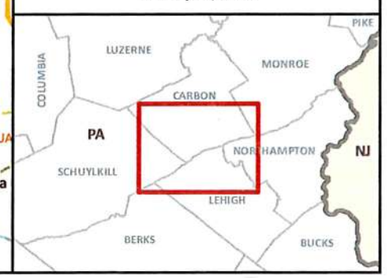
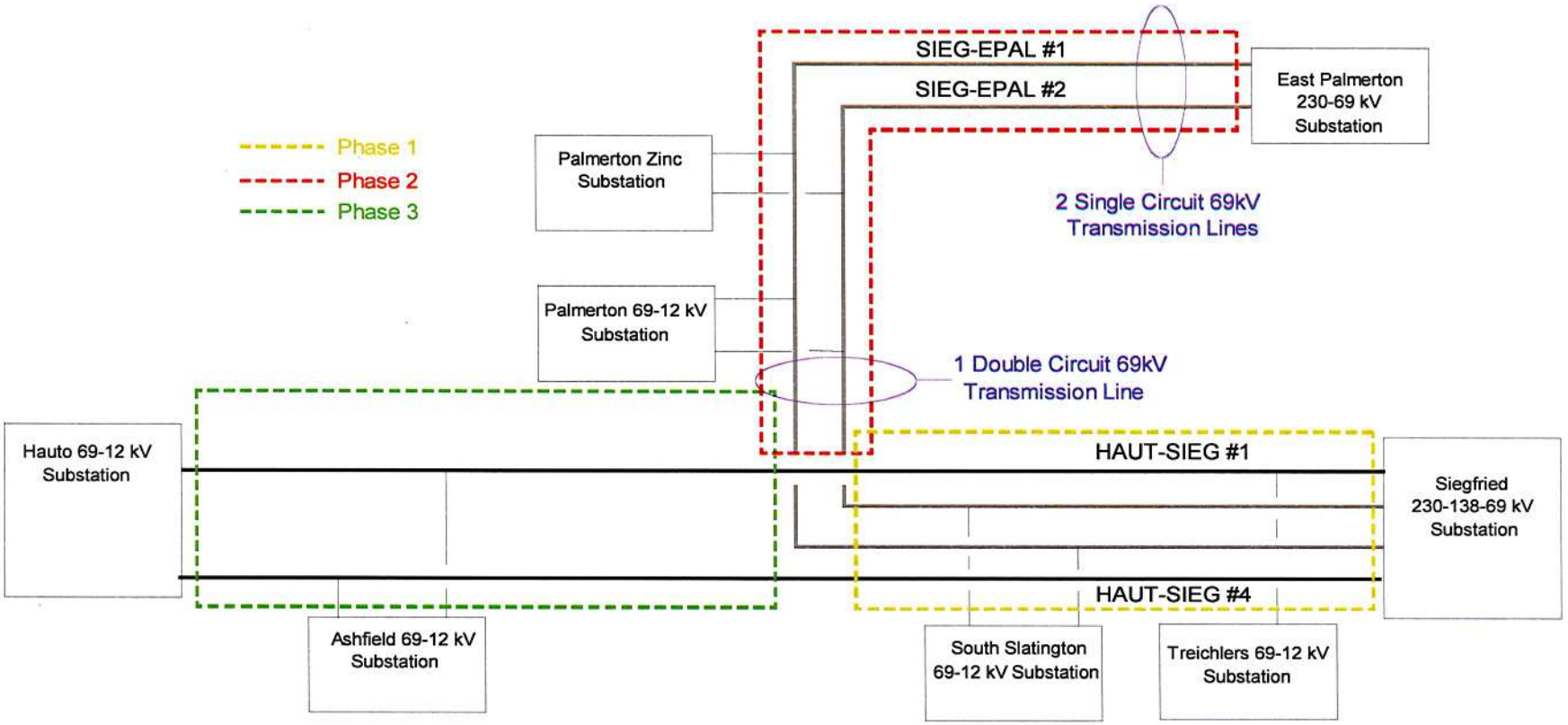


Figure 1-2. One-Line Diagram of Existing Transmission Facilities



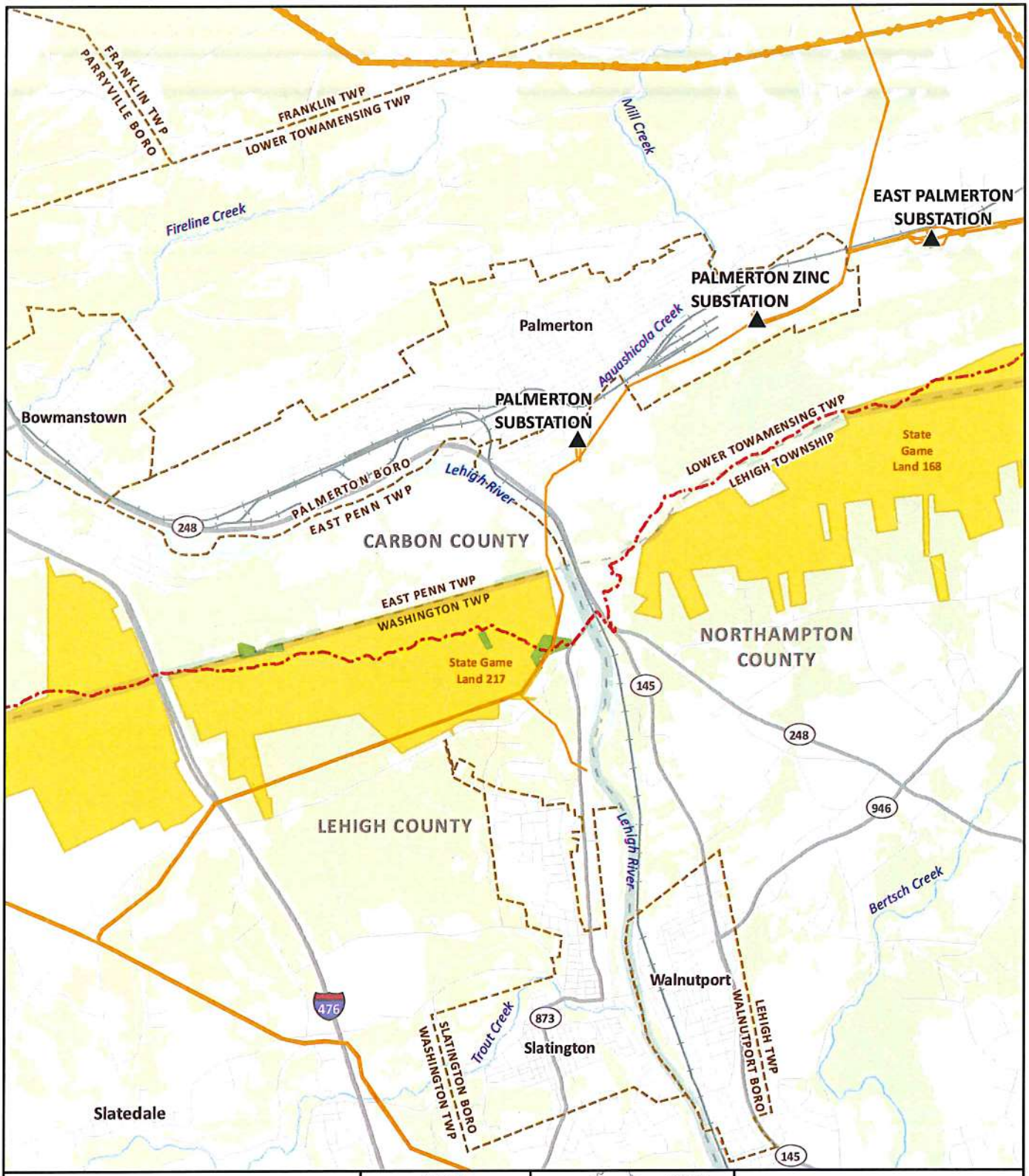
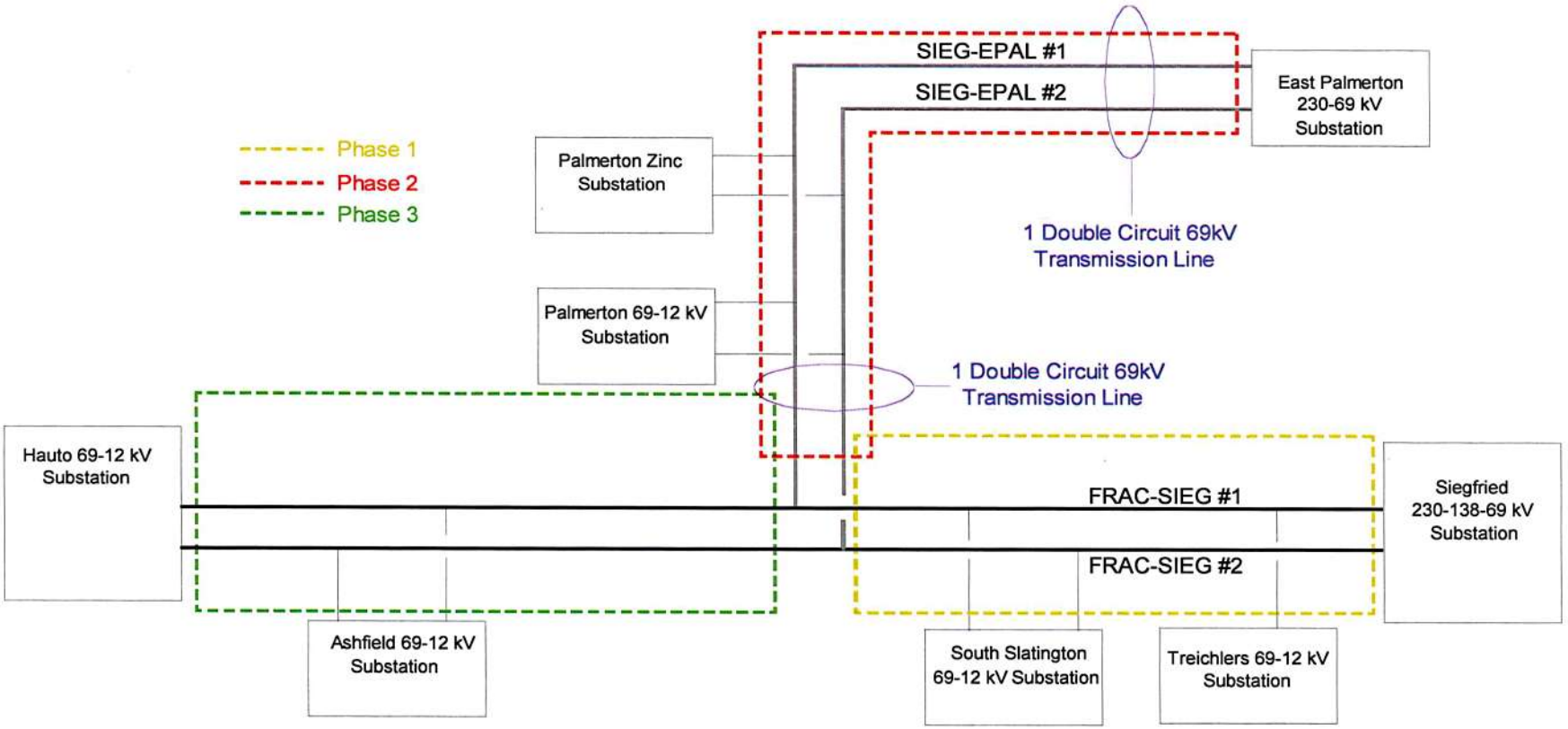
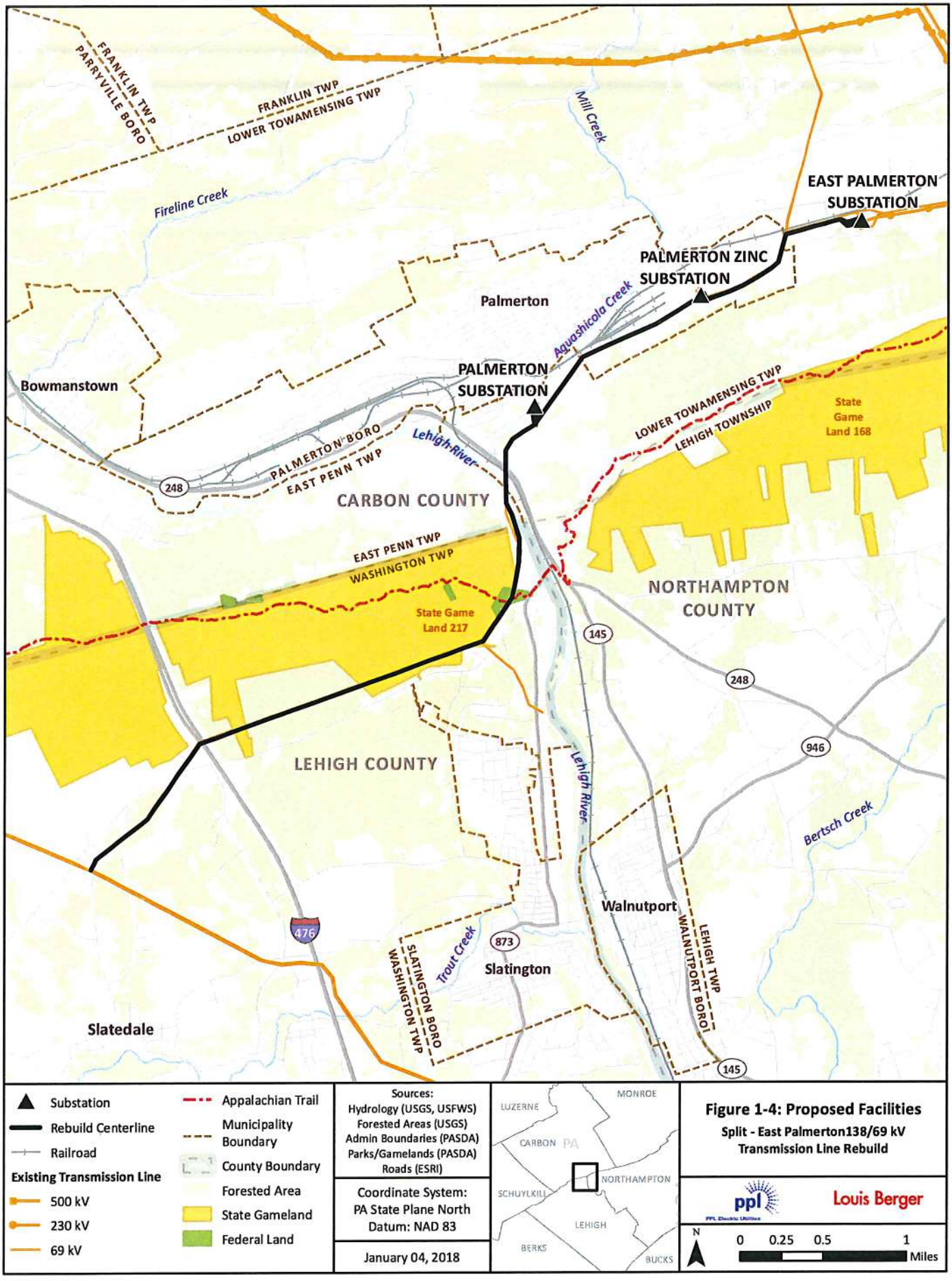

FRANKLIN TWP
PARRYVILLE BORO
FRANKLIN TWP
LOWER TOWAMENSING TWP
Mill Creek
Fireline Creek
EAST PALMERTON SUBSTATION
PALMERTON ZINC SUBSTATION
Palmerton
Aquashicola Creek
PALMERTON SUBSTATION
Bowmanstown
LOWER TOWAMENSING TWP
LEHIGH TOWNSHIP
State Game Land 168
PALMERTON BORO
EAST PENN TWP
Lehigh River
248
CARBON COUNTY
EAST PENN TWP
WASHINGTON TWP
State Game Land 217
NORTHAMPTON COUNTY
145
248
946
LEHIGH COUNTY
Lehigh River
Bertsch Creek
Walnutport
LEHIGH TWP
WALNUTPORT BORO
476
873
Trout Creek
Slatington
SLATINGTON BORO
WASHINGTON TWP
Slatedale
145
Substation
Railroad
Existing Transmission Line
500 kV
230 kV
69 kV
Appalachian Trail
Municipality Boundary
County Boundary
Forested Area
State Gameland
Federal Land
Sources:
Hydrology (USGS, USFWS)
Forested Areas (USGS)
Admin Boundaries (PASDA)
Parks/Gamelands (PASDA)
Roads (ESRI)
Coordinate System:
PA State Plane North
Datum: NAD 83
January 04, 2018
LUZERNE
MONROE
CARBON
PA
NORTHAMPTON
SCHUYLKILL
LEHIGH
BERKS
BUCKS
Figure 1-2: Existing Facilities
Split - East Palmerton138/69 kV
Transmission Line Rebuild
ppl
Louis Berger
N
0
0.25
0.5
1
Miles

Figure 1-4. One-Line Diagram of Proposed Transmission Facilities




FRANKLIN TWP
PARRYVILLE BORO
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EAST PALMERTON SUBSTATION
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WALNUTPORT BORO
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873
Trout Creek
Slatington
SLATINGTON BORO
WASHINGTON TWP
Slatedale
145
Substation
Rebuild Centerline
Railroad
Existing Transmission Line
500 kV
230 kV
69 kV
Appalachian Trail
Municipality Boundary
County Boundary
Forested Area
State Gameland
Federal Land
Sources:
Hydrology (USGS, USFWS)
Forested Areas (USGS)
Admin Boundaries (PASDA)
Parks/Gamelands (PASDA)
Roads (ESRI)
Coordinate System:
PA State Plane North
Datum: NAD 83
January 04, 2018
MONROE
LUZERNE
CARBON
PA
NORTHAMPTON
SCHUYLKILL
LEHIGH
BERKS
BUCKS
Figure 1-4: Proposed Facilities
Split - East Palmerton138/69 kV
Transmission Line Rebuild
ppl
PPL Electric Utilities
Louis Berger
N
0 0.25 0.5 1
Miles

ATTACHMENT 2

SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT

ENGINEERING DESCRIPTION

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ATTACHMENT 2

SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT

ENGINEERING DESCRIPTION

A. INTRODUCTION

PPL Electric Utilities Corporation ("PPL Electric") proposes to rebuild approximately 6.8 miles of the existing Siegfried – East Palmerton #1 138/69 kV Transmission Line for double-circuit 138/69 kV operation, along with approximately 0.1 mile of the existing Palmerton 138/69 kV Tap Line and approximately 300 feet of the existing Palmerton Zinc 138/69 kV Tap Line (the "Project"). The new lines will be designed using 138 kV standards for higher capacity operation, but will be operated initially at 69 kV. As explained in Attachment 1, the existing 138/69 kV lines have exceeded their useful life and the facilities must be replaced to continue to provide reliable service into the future.

B. DESCRIPTION OF THE PROPOSED LINE[1]

The existing transmission line operates as two parallel single-circuit 138/69 kV transmission lines for the first 3.4 miles and continues as a combination of single-circuit and double-circuit transmission lines for the remaining 3.4 miles to the East Palmerton 230-69 kV Substation. The entire line will be reconstructed as a double-circuit 138/69 kV transmission line on a set of new self-weathering steel monopoles with high capacity conductors and two fiber optic ground wires (OPGW). As explained in Attachment 3, the existing right-of-way (ROW) varies between centerline rights and 150 feet but is generally 100 feet in width. PPL Electric has designed the rebuilt Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines to fit within the existing ROW. Although PPL Electric can rebuild the Project entirely within the existing ROW, PPL Electric acquired new ROW adjacent to the D&L Trail and the Lehigh River at the request of Lehigh Gap Nature Center to reduce impacts on their properties. By shifting the centerline in

[1] Description of the proposed transmission line is based on preliminary engineering. Design details may change while finalizing engineering.

this area, ROW on two additional properties also had to be shifted. All three property owners[2] agreed to the shifts and granted PPL Electric the newly acquired ROW. No additional ROW is needed to construct the Project. All new structures will be located in close proximity to the existing double-circuit structures. There are 36 proposed structures which will be relocated more than 10 feet from the existing single-circuit structure locations in order to avoid wetlands and other areas of concern. No new structures will be located on any property that currently does not have an existing structure.

The Project originates at the location where the existing Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines diverge from the existing Siegfried – Hauto #1 and #4 69 kV Transmission Lines (the "Split"). The Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines head in a generally northeast direction to the East Palmerton Substation. Two short tap lines extend from the Siegfried – East Palmerton #1 and #2 138/69 kV lines to the Palmerton and Palmerton Zinc Substations. For the first approximately 3.4 miles, the existing Siegfried – East Palmerton #1 and #2 138/69 kV lines are supported on two, parallel single-circuit H-frame structures, spaced approximately 50 feet apart. In this section, each of the proposed double-circuit monopole structures will be placed along the center of the existing ROW, in most areas, replacing two existing H-frame structures.

After the first 3.4 miles, the existing line continues on double-circuit lattice structures for 2.1 miles until reaching the Palmerton Zinc 138/69 kV Tap Line. As explained in more detail in Attachment 3, the proposed line will be rebuilt on a shifted centerline entirely within existing/recently acquired ROW for approximately 0.4 mile. PPL Electric recently acquired approximately 0.4 mile of new 100-foot-wide ROW, adjacent to the Delaware and Lehigh ("D&L") Trail, before rejoining the existing ROW and crossing the Lehigh River. In this section, new structures along the existing line will be placed in close proximity to existing structure locations. Additionally, one new structure will be installed to maintain required 138 kV clearances along the north side of Red Hill Drive. The proposed structure is located on a property that contains an existing pole.

[2] Properties are owned by Lehigh Gap Nature Center, Lehigh County and East Penn Township.

From the Palmerton Zinc 138/69 kV Tap, the existing Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines are supported on single-circuit monopole structures for 0.6 mile, which will be replaced with new double-circuit monopole structures. From this point, approximately 0.5 mile of the existing line is supported by double-circuit lattice structures, which will be replaced with new double-circuit monopole structures on the existing centerline. The last three spans are located entirely within property owned by PPL Electric. These three spans into the East Palmerton 230-138-69 kV Substation will be rebuilt on parallel single-circuit alignments to match the existing configuration.

The Palmerton and Palmerton Zinc 138/69 kV Taps are both two parallel single-circuit taps off the Siegfried – East Palmerton #1 and #2 Transmission Lines. The Palmerton 138/69 kV Tap consists of three spans into the Palmerton 69-12 kV Substation which are supported by single-circuit H-frame structures. The Palmerton 138/69 kV Zinc Tap consists of two spans into the Palmerton Zinc 69-12 kV Substation which are supported by single-circuit monopole structures. Both taps will be replaced structure for structure on steel single-circuit monopole structures.

Currently, there are a total of 124 existing structures along the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines. A majority of the existing Siegfried – East Palmerton #1 and #2 138/69 kV lines are carried on separate single-circuit structures, while a few short portions of the lines are carried on double-circuit structures. The existing structures consist of a mix of single-circuit wooden H-frame, single-circuit wooden single-pole, double-circuit wooden single-pole, and double-circuit steel lattice structures.

The entire Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Line will be rebuilt as a double-circuit line. The new line will be constructed with 74 double-circuit tubular steel monopoles with glass 138 kV insulator assemblies. This reduces the total number of existing transmission structures in the right-of-way by 50.

The existing Palmerton Zinc Tap consists of two single-circuit wooden single-pole structures and the existing Palmerton Tap consists of four single-circuit wooden H-frame structures and one wooden single-pole structure. The new Palmerton Zinc 138/69 kV Tap will consist of two

single-circuit steel MOLBAB (motor-operated load break air break) switch structures and two single-circuit steel monopoles and the new Palmerton 138/69 kV Tap will consist of five single-circuit steel monopoles.

The existing Siegfried – East Palmerton #1 and #2 138/69 kV lines structures range in height from approximately 35 to 110 feet with an average height of 65 feet. The new steel monopoles are expected to range between 65 and 145 feet in height, with an average height of approximately 95 feet. The existing tap structures range in height from approximately 45 to 90 feet with an average height of 55 feet. The new tap steel monopoles are expected to range between 65 and 75 feet in height, with an average height of 70 feet. All new poles will be self-supported, either direct embedded or on concrete caisson foundations. No guyed poles will be used as part of this Project.

Figures 2-1 through 2-5 depict typical structure types that will be used for the Project.

The Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines will utilize six power conductors and two overhead ground wires, while each branch of the taps will utilize three power conductors and a single overhead ground wire. The power conductors will be 556.5 kcmil,[3] 24/7 stranding, aluminum conductor steel reinforced (ACSR) conductors. The overhead ground wires will be 0.791-inch-diameter optical ground wire (OPGW).

The replacement lines will be designed according to, and generally exceed, all 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 will be 31 feet which occurs at a maximum thermal conductor temperature of 125°C (257°F). The design minimum conductor clearances and conductor thermal ratings for the reconstructed lines are shown in Tables 2-1 and 2-2.

[3] A kcmil is a thousand circular mils. A circular mil is the cross-sectional area of a wire one mil in diameter, where 1 kcmil = 0.5067 mm².

Table 2-1. Design for Minimum Conductor Clearances for 556.5 kcmil 24/7 strand ACSR[4]	
Condition	**Transmission Double-Circuit Design Clearance-to-Ground**
Heavy Ice (1" ice at 0°C ambient temperature)	31 feet
Predicted extreme thermal load (125°C conductor temperature)	31 feet
Predicted blowout (6 lbs., 16°C, ambient temperature)	31 feet

Table 2-2. Conductor Thermal Rating 556.5 kcmil 24/7 Stranding ACSR 125°C Maximum Conductor			
Condition	**Ambient Temperature (°C)**	**Wind Speed (Ft./sec)**	**Ampacity (Amps)**
Summer Normal	35	0	806
Winter Normal	10	0	929
Summer Emergency	35	2.533	1054
Winter Emergency	10	2.533	1187

The estimated cost to design and construct the Project is approximately $23.6 million. Subject to the Commission's approval, the Project has a scheduled construction start date of August 2, 2018.

C. 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 higher ground

[4] Clearances based on an initial maximum tension of 6,000-10,000 pounds at ½ inch ice, 0°F, 4# wind and maximum ruling span of 200-1,250 feet.

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

The Project will be designed with clearances that are at least 5 feet higher than NESC standards and typically 10 feet above NESC minimum.

Figure 2-1. Typical Double-Circuit 138 kV Tension Structure

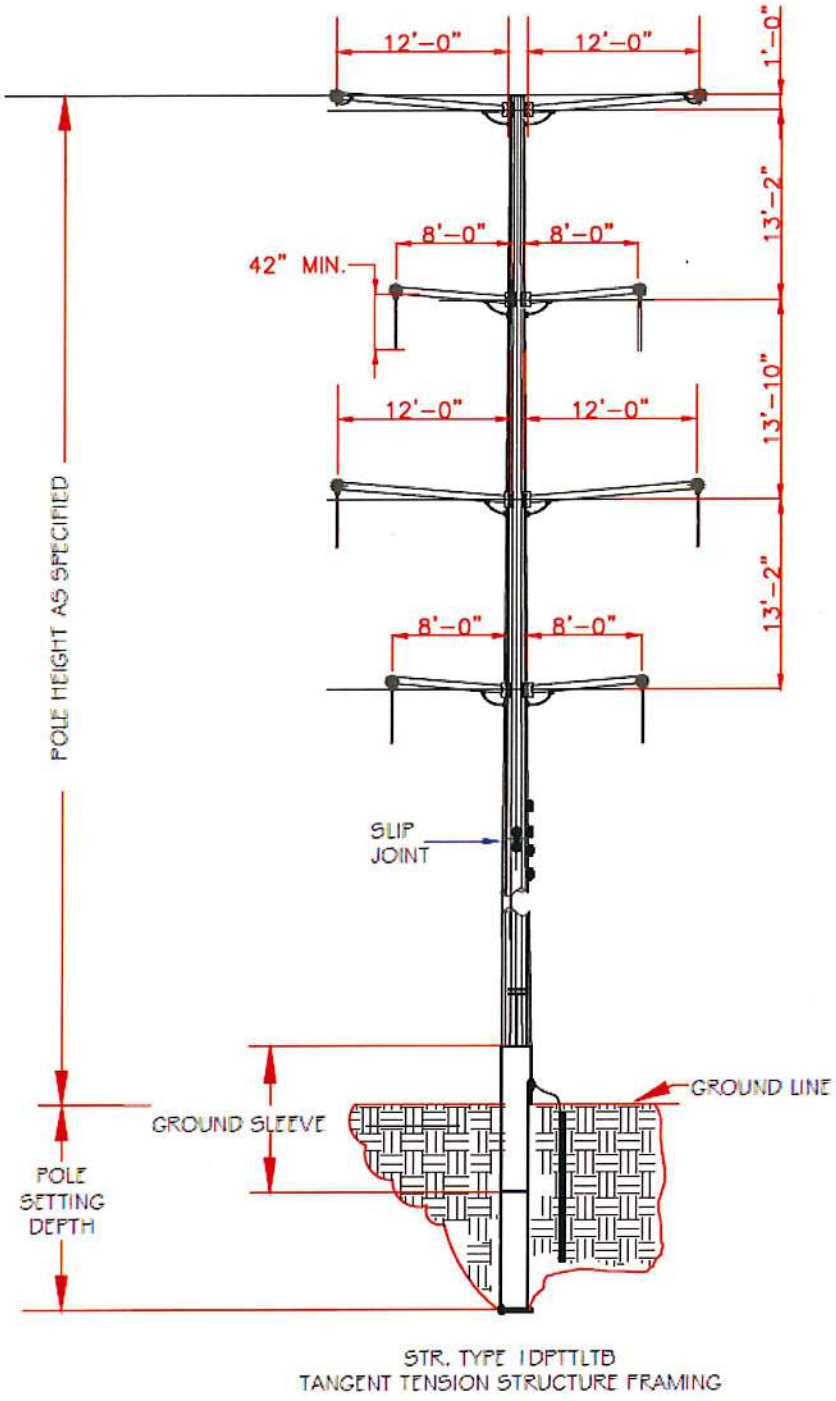


Figure 2-2. Typical Double-Circuit 138 kV Angle Suspension Structure

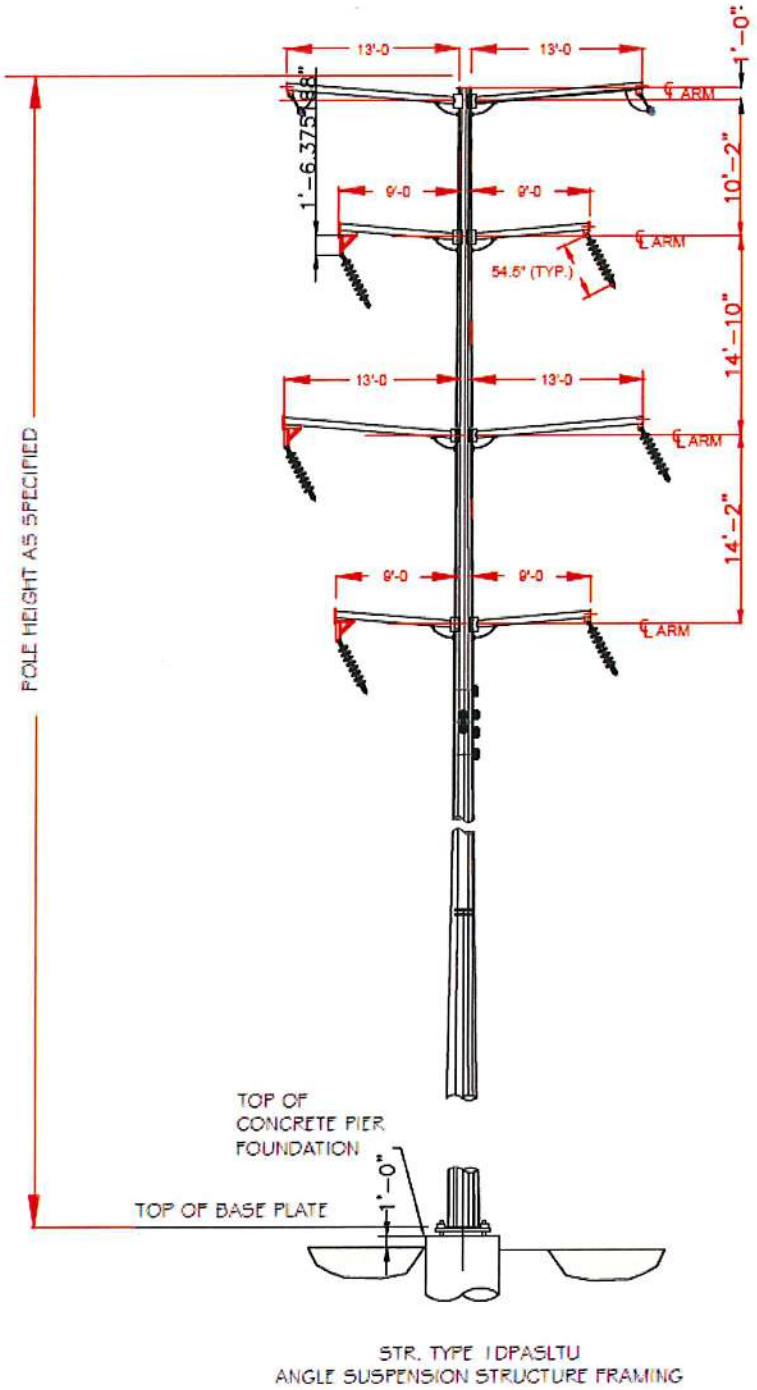


Figure 2-3. Typical Double-Circuit 138 kV Tangent Suspension Structure

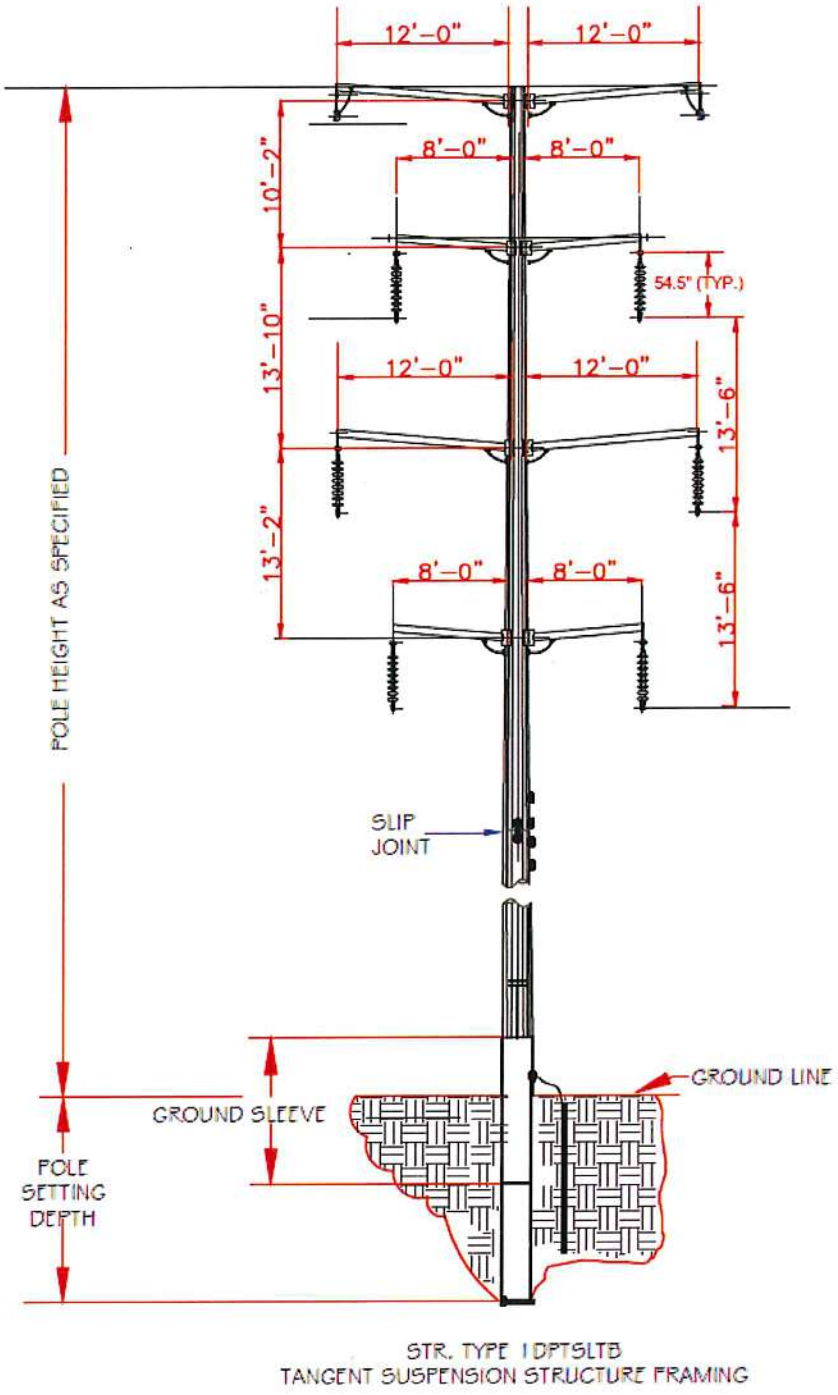


Figure 2-4. Typical Double-Circuit 138 kV 2-Pole Angle Tension Structure

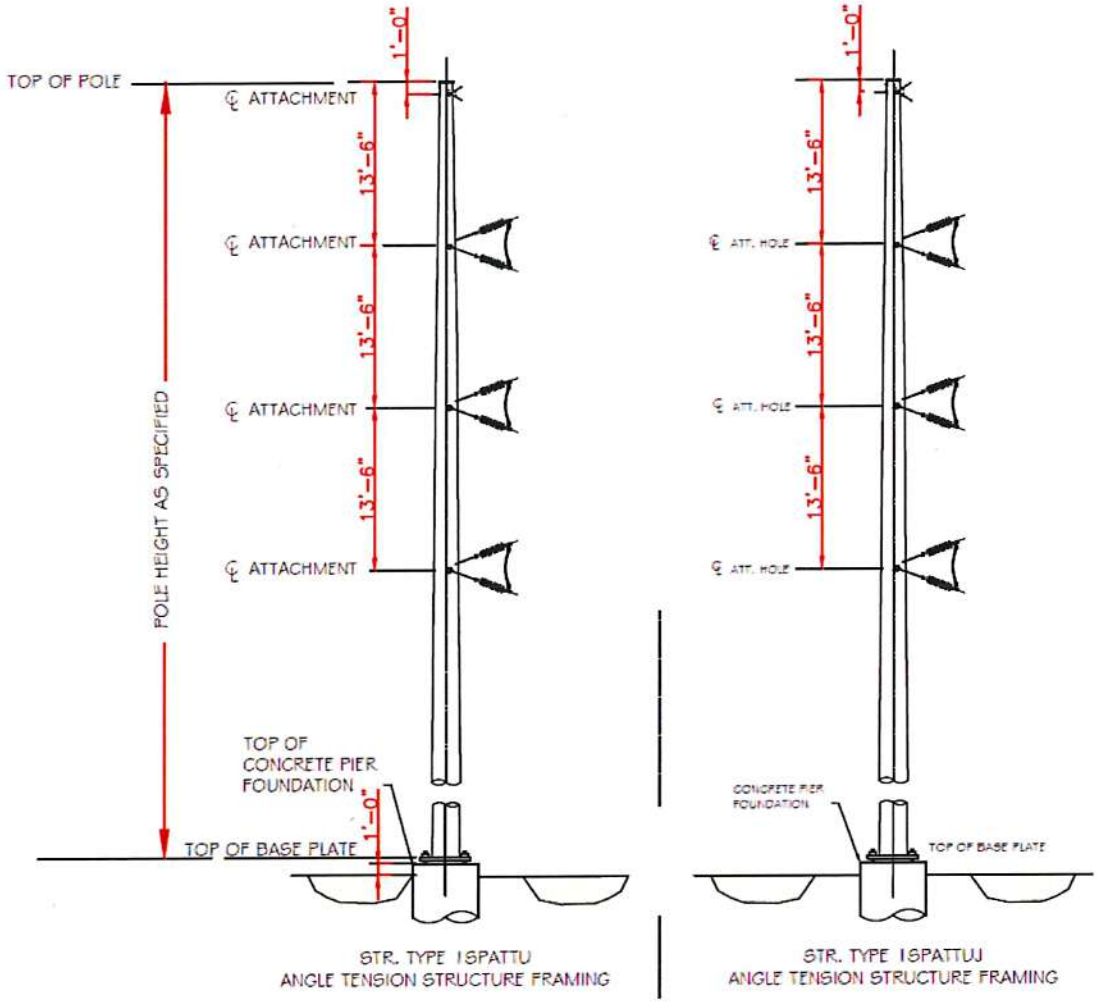
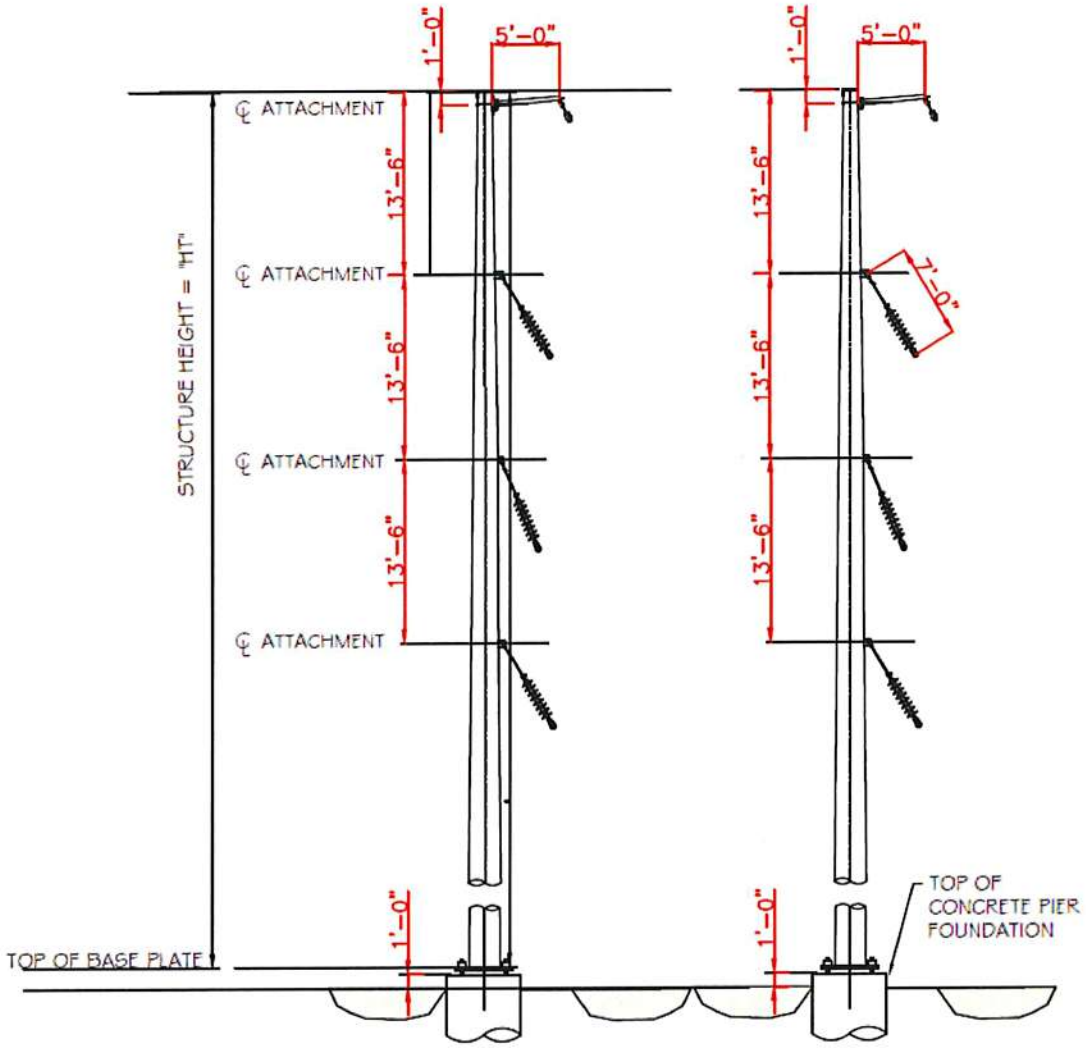


Figure 2-5. Typical Single-Circuit 138 kV 2-Pole Side Tension Structure



FRAMING 7-008-003 (1SPASTU)
ANGLE SUSPENSION STRUCTURE FRAMING

ATTACHMENT 3

SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT

DESCRIPTION OF THE RIGHT OF WAY

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ATTACHMENT 3

SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT

DESCRIPTION OF THE RIGHT OF WAY

A. INTRODUCTION

As explained in Attachment 1, PPL Electric ("PPL Electric") seeks Pennsylvania Public Utility Commission ("PUC" or the "Commission") approval to rebuild approximately 6.8 miles of existing Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines for double-circuit 138/69 kV operation in order to improve electric reliability in the region (the "Project"). The Project also includes rebuilding approximately 0.1 mile of the existing Palmerton 138/69 kV Transmission Tap Line and approximately 300 feet of the existing Palmerton Zinc 138/69 kV Transmission Tap for 138 kV operation. This attachment provides a description of the right of way ("ROW").

B. DESCRIPTION OF THE RIGHT OF WAY

The proposed Project is explained in detail in Attachment 1 and an engineering description of the rebuilt lines is provided in Attachment 2. The Project is located within Washington Township in Lehigh County, and the Borough of Palmerton and Lower Towamensing and East Penn townships, Carbon County, Pennsylvania. PPL Electric has discussed the proposed Project with representatives from Lehigh and Carbon counties and Washington, Lower Towamensing and East Penn Townships, none of which had any objection to the Project. **Figure 3-1** is an aerial exhibit of the Project that identifies the property owners crossed by the Project.

As shown in **Figure 3-1a** through **Figure 3-1j**, the existing lines begin at a point where the existing Siegfried – East Palmerton #1 and #2 138/69 kV lines and the existing Siegfried – Hauto #1 and #4 138/69 kV lines diverge ("the Split"), located directly west of Brown Street in Washington Township, Lehigh County. The rebuilt double-circuit Siegfried – East Palmerton 138/69 kV Transmission Lines continue northeast for approximately 1 mile through a mix of forested and agricultural areas. At this point, the route turns east to cross Interstate 476 (I-476)

and continues east for 1.8 miles through forested land, including crossing 0.8 mile of State Game Land 217. From here, the route heads generally north/northeast for 1 mile through forested areas, crossing the Appalachian National Scenic Trail (AT) and paralleling the Delaware and Lehigh (D&L) Trail and the Lehigh River. After crossing the AT, the route continues north/northeast as a double-circuit transmission line. The route crosses the Lehigh River, continuing generally north/northeast for approximately 2.9 miles before terminating into the existing East Palmerton Substation, located south of Little Gap Road in Lower Towamensing Township, Carbon County.

The existing ROW varies between 100 and 150 feet but is generally 150 feet in width for the entire 6.8 miles of the Siegfried – East Palmerton #1 and #2 138/69 kV Transmission Lines. For a total of 4.2 miles, these two circuits are presently installed on two sets of parallel single-circuit transmission structures located within the same ROW. As shown in **Figures 3-1a through 3-1e**, as well as **Figure 3-1i**, one row of single-circuit structures is located within the approximate ROW center while the other row of single-circuit structures is located on the western edge of the ROW. When rebuilt, both circuits will be installed on a single set of double-circuit structures located in the center of the existing ROW for the entire 6.8 miles. PPL Electric has centerline rights for 0.2 mile where the existing line spans the Lehigh River, a railroad and a private property southwest of Route 145. When rebuilt, both circuits will be installed on a single set of double-circuit structures.

As shown on **Figure 3-1e**, the existing ROW traverses 1.0 mile of State Game Land 217. Although PPL Electric can rebuild the Project entirely within the existing ROW, PPL Electric acquired new ROW adjacent to the D&L Trail and the Lehigh River at the request of Lehigh Gap Nature Center to reduce impacts on their properties. By shifting the centerline in this area, ROW on two additional properties also had to be shifted. All three property owners[1] agreed to the shifts and granted PPL Electric the newly acquired ROW. No additional ROW is required for the construction, operation or maintenance of the Project.

[1] Properties are owned by Lehigh Gap Nature Center, Lehigh County and East Penn Township.

As shown on **Figure 3-1g**, the rebuilt 0.1-mile Palmerton 138/69 kV Transmission Tap traverses within the existing ROW, spanning the Aquashicola Creek through a forested area before terminating at the Palmerton Substation. The existing ROW through this segment varies between approximately 230 and 340 feet in width. No new ROW is required to rebuild this tap.

As shown on **Figure 3-1i**, the 300-foot rebuilt Palmerton Zinc 138/69 kV Transmission Tap traverses within the existing ROW through an industrialized area before terminating at the Palmerton Zinc Substation. The existing ROW through this segment is 175 feet in width. No new ROW is required to rebuild this tap. The industrial area is classified by the U.S. Environmental Protection Agency ("EPA") as a superfund site. PPL Electric is currently working with the property owner regarding this issue and any associated environmental and regulatory compliance concerns, and will comply with all environmental and health and safety requirements when working in this area.

As explained in Attachment 2, the average height of the new structures will be approximately 30 feet taller than the average height of the existing structures. Although the new structures will increase in height as compared to the existing outdated structures, the rebuilt transmission line will reduce overall impacts to land use within the ROW by consolidating the 4.2-mile-long section of parallel single-circuit lines into one double-circuit line. Rebuilding the entire line for double circuit reduces the total number of existing transmission structures in the ROW by 50. Further, the proposed structures will have a smaller overall footprint than the wooden H-frame structures and existing steel lattice structures.

There are 36 proposed structures which will be relocated more than 10 feet from the existing single-circuit structure locations in order to avoid wetlands and other areas of concern, as further explained in Attachment 2. In these areas, PPL Electric has discussed the proposed structure locations with the respective property owners, none of which had any objection to the new pole locations. Further, except for the PPL Electric property, the number of poles on any single property will not increase as a result of this Project.

The existing ROW is currently maintained in accordance with PPL Electric's Vegetation Management Program. All vegetation management will occur within PPL Electric's existing right of way. Only limited tree clearing within the ROW is anticipated as part of this Project. In areas where any vegetation management is required, 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 minimize any potential impacts.

In summary, PPL Electric does not believe the proposed Project will result in a substantial alteration of the ROW for the following reasons:

- The line will be constructed entirely within existing ROW and only a limited area of new ROW was acquired at the request of a property owner.
- Approximately 4.2 miles of the existing transmission line will be consolidated from two parallel single-circuit lines to one double-circuit line.
- The average structure height is only increasing by approximately 30 feet and the total number of structures is significantly decreasing within the existing ROW.
- New structures will be placed in close proximity to the existing structures.
- No structures will be placed on a property that does not already have an existing pole.

C. CULTURAL RESOURCES

PPL Electric conducted a review of the online Pennsylvania State Historic Preservation Office ("SHPO") Bureau for Historic Preservation ("BHP") Cultural Resources Geographic Information System ("CRGIS") database to determine if National Register of Historic Places ("NRHP")-listed or eligible historic properties are located in the Project vicinity. Based on this review, 17 historic architectural resources are located within 1 mile of the Project; six of these resources are NRHP-listed or eligible. Two listed resources are crossed by the Project. The listed Appalachian Trail (Key No. 144291) is located adjacent to Mountain Road in Washington Township, Lehigh County. The listed Carbon County Section of Lehigh Canal (Key No. 001313) is located adjacent to Route 248 in Lower Towamensing Township, Carbon County. No other listed resources are located within 1 mile of the Project. Three eligible architectural

resources are located within 1 mile and are not crossed by the Project. The eligible First National Bank of Palmerton; and the Palmerton Library (Key No. 106133) and the Neighborhood House; Palmerton Borough Hall (Key No. 097938) are both located within the eligible Palmerton Historic District (Key No. 142019) located in the borough of Palmerton. Three resources are identified as an "aggregate file" and their NHRP-eligibility are undetermined. One eligible archaeological site, the Lehigh Gap Dam (Key No. 36LH0105), is located within 0.5 mile of the Project. The archeological resources crossed by the ROW are two open habitation and prehistoric sites (Key No. 36CR0019 and 36CR0014) located south and east of Gap Road, in Lower Towamensing Township. Both of these archeological sites contain insufficient data available to make a decision as determined by the submitter. No previously identified archaeological sites are located within 0.5 mile of the Project.

PPL Electric submitted a letter to the SHPO on December 11, 2017. The SHPO responded in a letter dated January 10, 2018 that archaeological and above ground resources could potentially be affected. PPL Electric is currently working with the SHPO to determine what appropriate additional studies should be conducted to avoid potential impacts to cultural resources. Similarly, PPL Electric will continue to coordinate with the National Park Service regarding any cultural resource concerns related to crossing of the Appalachian Trail and work on federal lands.

D. LAND USE AND NATURAL FEATURES

Impacts to land use are anticipated to be minimal because the Project will be constructed within the existing ROW. PPL Electric will use and update previously established access roads for construction to the extent practical to further reduce interference with existing uses and minimize land use impacts.

No communication towers, pipelines, or other utilities will be affected by the proposed Project. The closest airport is a privately owned airport located approximately 1 mile south of the Project. No additional airports are located within 2 miles of the Project. PPL Electric does not anticipate any interference with airport operations because the Project is located a substantial distance from

the airport and new facilities will be generally similar in height to the existing facilities that PPL Electric is replacing. However, PPL Electric will file any required documentation with both the Federal Aviation Administration and the Pennsylvania Department of Transportation, Bureau of Aviation.

Two federal recreation areas are crossed by the Project. The Project crosses approximately 230 feet of the Appalachian Trail just west of the intersection of Route 873 and Mountain Road in Washington Township, Lehigh County. The Project reduces the total number of structures from two to one through the federal property. The existing structures on federal lands consist of two 55-foot-tall wooden H-frame structures that will be replaced with one 105-foot-tall steel monopole. The existing transmission line ROW crossing the Appalachian Trail predates the acquisition of the land by the National Park Service. The proposed structure will be placed in close proximity to the existing eastern H-frame structure. Existing access roads are located through the federal property. Because the number of structures will be reduced and construction work will be temporary in nature, PPL Electric believes the Project will not significantly impact the Appalachian Trail or associated federal lands by rebuilding the proposed structure in-place. PPL Electric is currently consulting with, and will obtain all necessary permits from, the National Park Service and will comply with all of the terms and conditions placed on those permits.

The Project also crosses D&L National Heritage Corridor in Washington Township, Lehigh County. The existing line parallels the D&L Trail for approximately 0.2 mile before crossing the trail once within existing ROW. As explained above, in this area, a property owner requested PPL Electric move the alignment of the line to the east. The existing line crosses the D&L Trail twice, while the proposed rebuilt line will only cross the D&L Trail once.

As previously mentioned, the Project crosses approximately 1 mile of Pennsylvania State Game Land 217 in Washington Township, Lehigh County. The existing transmission line traverses along the southern boundary of the Game Land. State Game Land 168 is located approximately 0.4 mile southeast of the Project. Based on this distance, the change in elevation, and heavy tree cover, the existing transmission line is not visually noticeable from State Game Land 168 and no

significant impacts to these areas are anticipated. No other recreational areas or natural landmarks are located within 1 mile of the Project.

The Project will traverse approximately 6.7 miles of one Important Bird Area (IBA)[2]. The Hawk Mountain and Kittatinny Ridge IBA is located within Washington Township, Lehigh County and Palmerton Borough and East Penn and Lower Towamensing townships in Carbon County. The IBA encompasses the National Park Service property, the Appalachian Trail, the D&L Trail and State Game Land 217 crossed by the Project. Impacts to birds within this IBA would be minimized by constructing the Project within an existing ROW. Although the Project would not introduce a new collision risk, it could potentially increase the existing collision risk because the proposed structures would be taller than existing structures. Further, the Project will reduce the path of exposure to the IBA by consolidating two parallel single-circuits into one double-circuit alignment.

A Natural Area Inventory ("NAI") has been prepared by The Nature Conservancy in association with the Pennsylvania Natural Heritage Program ("PNHP") for Lehigh and Carbon counties (2005). The Project crosses one NAI area. The West Lehigh River Kittatinny Slope is located in the southwestern portion of the Project area in Washington Township, Lehigh County and in East Penn Township, Carbon County. This NAI consists of the south-facing forested slopes and the ridgeline of Blue Mountain, which provide habitat for several species of concern. The Project is not expected to impact the West Lehigh River Kittatinny Slope because the Project will be rebuilt within the existing, cleared ROW. The Project will not traverse or affect any other unique geological, scenic or natural areas.

PPL Electric retained an environmental consultant to identify and delineate all wetlands and watercourses within the Project Area. The Project will span 46 wetlands and 25 streams. However, it is anticipated the Project will have no additional impacts on streams or wetlands because the entire Project will be built within the existing, cleared right of way, and because the new monopole structures will be located to avoid impacts to wetland and streams. PPL Electric

[2] IBAs are sites that provide essential habitat for one or more species of bird. IBAs include sites for breeding, wintering, and/or migrating birds.

will obtain all necessary permits from the Pennsylvania Department of Environmental Protection and the United States Army Corps of Engineers and will comply with all of the terms and conditions placed on those permits. PPL Electric will also prepare any required soil erosion and sedimentation control plans and obtain National Pollutant Discharge Elimination System (NPDES) permits and will comply with any conditions placed on those permits.

E. THREATENED AND ENDANGERED SPECIES

PPL Electric conducted an online PNDI database review on October 19, 2017[3]. Based on this review, the Pennsylvania Fish and Boat Commission ("PFBC") reported that the Project will not impact any threatened and endangered species, or special concern species and resources located within the Project area. Although the PFBC results indicated no further review is required, they indicated that the Project is located within the range of the timber rattlesnake (*Crotalus horridus*), and identified several recommended conservation measures. PPL Electric will comply with all conservation measures required by PFBC.

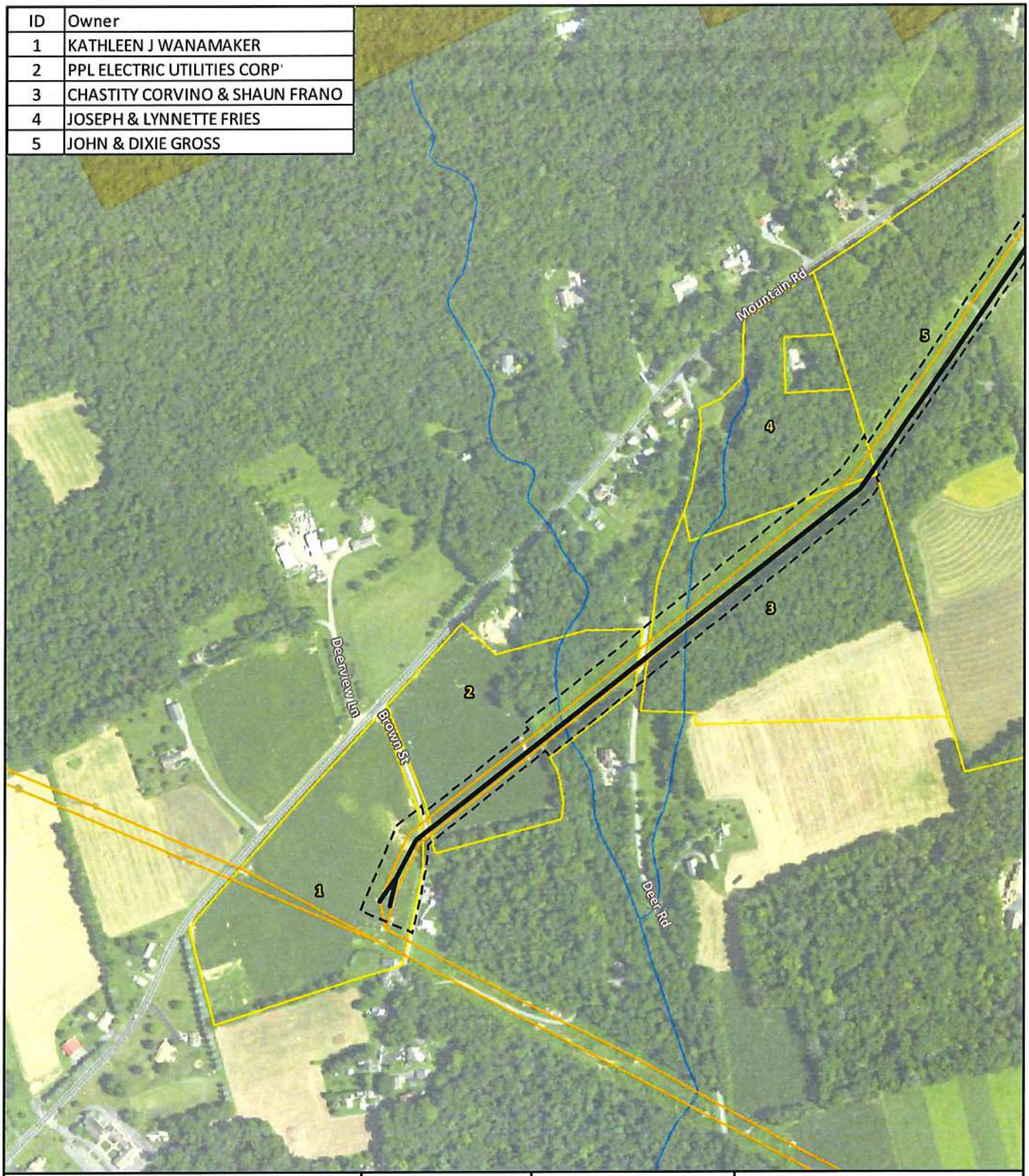
The Pennsylvania Game Commission ("PGC") indicated that the Project is located within range of the threatened Allegheny woodrat (*neotoma magister*). PPL Electric submitted a letter to PGC on January 31, 2018. The PGC responded on March 16, 2018 and determined that no impact is likely and that no further PNDI coordination with the PGC is necessary. PPL Electric will continue to consult with PGC to avoid potential impacts to the Allegheny woodrat.

The Pennsylvania Department of Conservation and Natural Resources ("DCNR") indicated that the Project is located within the vicinity of Long's sedge (*carex longii*), a special concern species. A botanical survey was conducted by Mellon Biological Services, LLC in July 2012. During surveys, Long's sedge was found within some delineated wetlands. However, no impacts to Long's sedge are anticipated within specific wetlands because these wetlands will be avoided during construction. PPL Electric submitted a follow-up letter with DCNR on January 31, 2018. The DCNR response letter on February 9, 2018 indicated no impacts are anticipated.

[3] Project Search ID: PNDI-642457

The U.S. Fish and Wildlife Service ("USFWS") indicated that the Project is located in the vicinity of an unidentified special concern species or resource and an unidentified sensitive species. Because the federally threatened bog turtle (*Glyptemys muhlenbergii*) is known to exist within Lehigh County, a Phase I bog turtle survey was conducted to determine if any known species habitat was located within the vicinity of the Project. PPL Electric retained a qualified bog turtle surveyor to conduct Phase I bog turtle surveys along the ROW in March and November 2012 and again between November and December 2017. Potential bog turtle habitat was identified within three delineated wetlands during the 2017 Phase I surveys. PPL Electric submitted a follow-up letter with USFWS on January 31, 2017 regarding the unidentified sensitive species and bog turtles. A qualified bog turtle surveyor will conduct Phase II presence/absence surveys in Spring 2018 and results will be forwarded to the USFWS.

PPL Electric will continue consultation with USFWS as needed to avoid impacts to species of concern and will obtain all required approvals, clearances, and permits prior to construction.


ID | Owner
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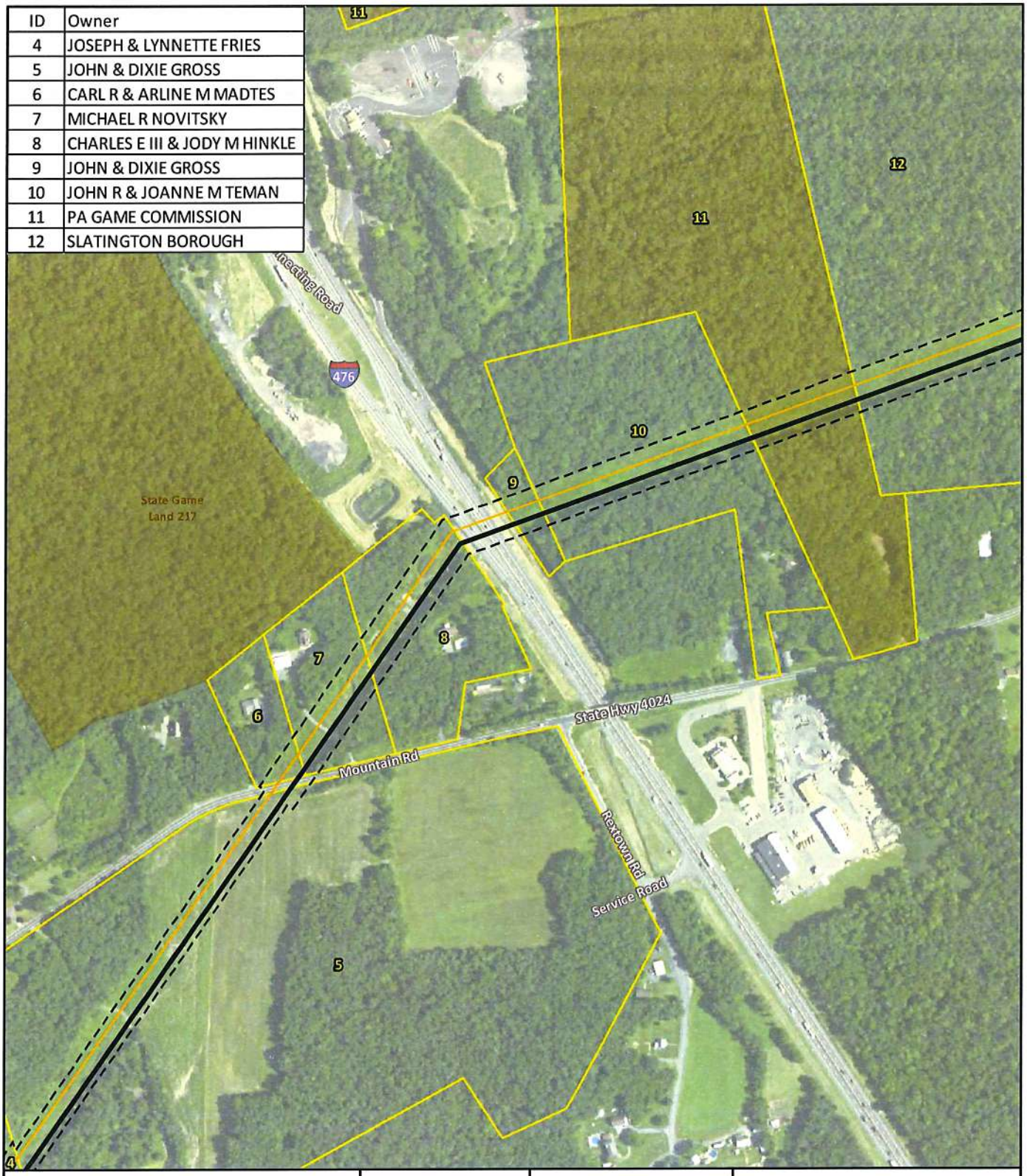
2 | PPL ELECTRIC UTILITIES CORP'
3 | CHASTITY CORVINO & SHAUN FRANO
4 | JOSEPH & LYNNETTE FRIES
5 | JOHN & DIXIE GROSS
Mountain Rd
Deerview Ln
Brown St
Deer Rd
1
2
3
4
5
Rebuild Centerline
Existing ROW
ROW Parcel
Existing Transmission
69 kV
River or Stream
Municipality Boundary
State Gameland
Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)
Coordinate System:
State Plane PA South
NAD 1983
April 17, 2018
CARBON COUNTY
NORTHAMPTON COUNTY
LEHIGH COUNTY
Figure 3-1a: Aerial Exhibit
Split - East Palmerton 138/69 kV
Transmission Line Rebuild
ppl
PPL Electric Utilities
Louis Berger
N
0 100 200 400 600
Feet


ID | Owner
4 | JOSEPH & LYNNETTE FRIES
5 | JOHN & DIXIE GROSS
6 | CARL R & ARLINE M MADTES
7 | MICHAEL R NOVITSKY
8 | CHARLES E III & JODY M HINKLE
9 | JOHN & DIXIE GROSS
10 | JOHN R & JOANNE M TEMAN
11 | PA GAME COMMISSION
12 | SLATINGTON BOROUGH
Meeting Road
476
State Game Land 217
State Hwy 4024
Mountain Rd
Rextown Rd
Service Road
Rebuild Centerline
Existing ROW
ROW Parcel
Existing Transmission
69 kV
River or Stream
Municipality Boundary
State Gameland
Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)
Coordinate System:
State Plane PA South
NAD 1983
April 17, 2018
CARBON COUNTY
NORTHAMPTON COUNTY
LEHIGH COUNTY
Figure 3-1b: Aerial Exhibit
Split - East Palmerton 138/69 kV
Transmission Line Rebuild
ppl
PPL Electric Utilities
Louis Berger
N
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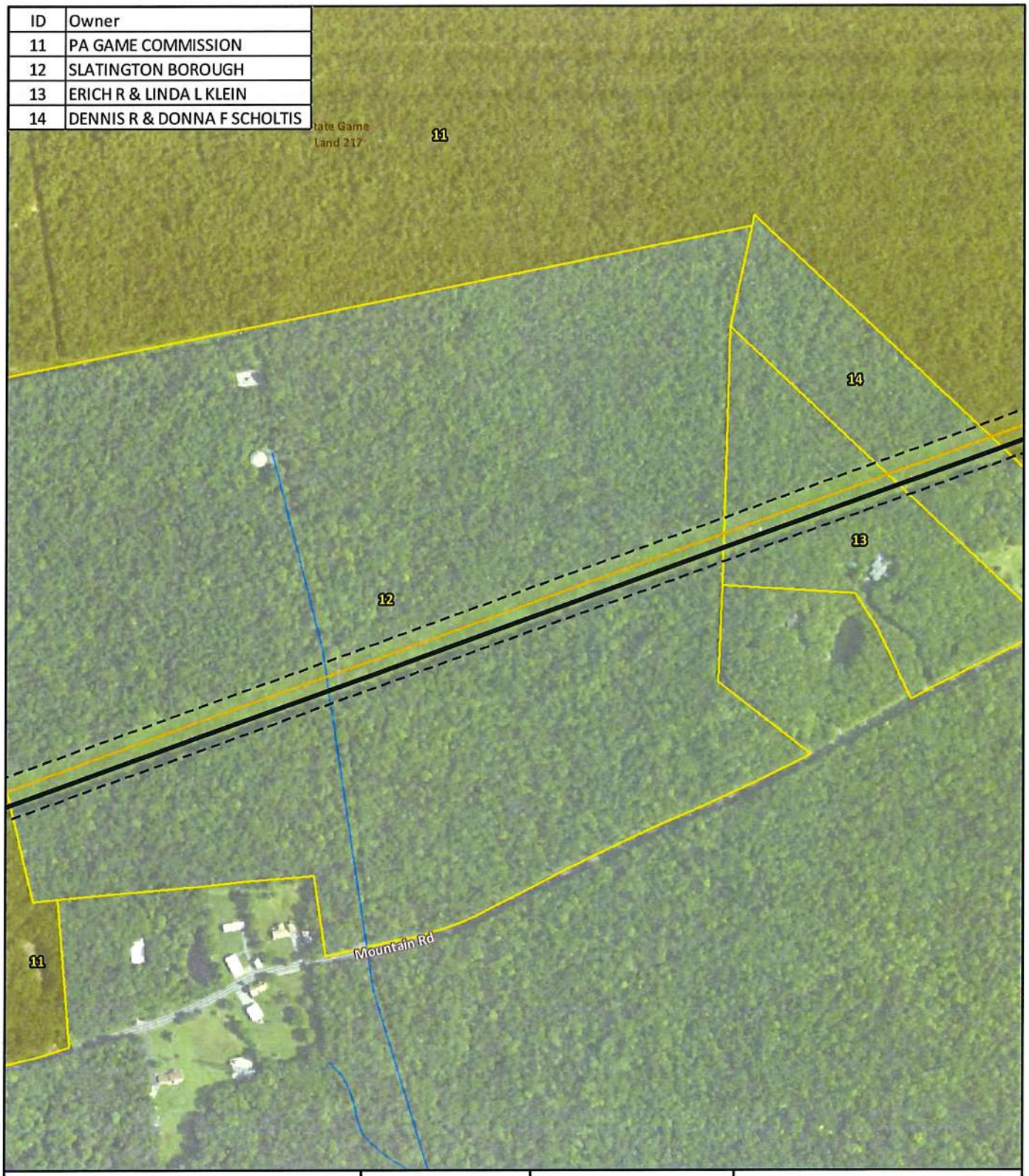
Feet


ID
Owner
11
PA GAME COMMISSION
12
SLATINGTON BOROUGH
13
ERICH R & LINDA L KLEIN
14
DENNIS R & DONNA F SCHOLTIS
State Game Land 217
11
14
13
12
11
Mountain Rd
Rebuild Centerline
Existing ROW
ROW Parcel
Existing Transmission
69 kV
River or Stream
Municipality Boundary
State Gameland
Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)
Coordinate System:
State Plane PA South
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NORTHAMPTON COUNTY
LEHIGH COUNTY
Figure 3-1c: Aerial Exhibit
Split - East Palmerton 138/69 kV
Transmission Line Rebuild
ppl
PPL Electric Utilities
Louis Berger
N
0 100 200 400 600
Feet

Rebuild Centerline
Existing ROW
ROW Parcel
Existing Transmission
69 kV
River or Stream
Municipality Boundary
Appalachian Trail
State Gameland
Federal Land

Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)

Coordinate System:
State Plane PA South
NAD 1983

April 17, 2018

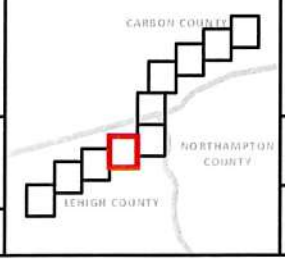
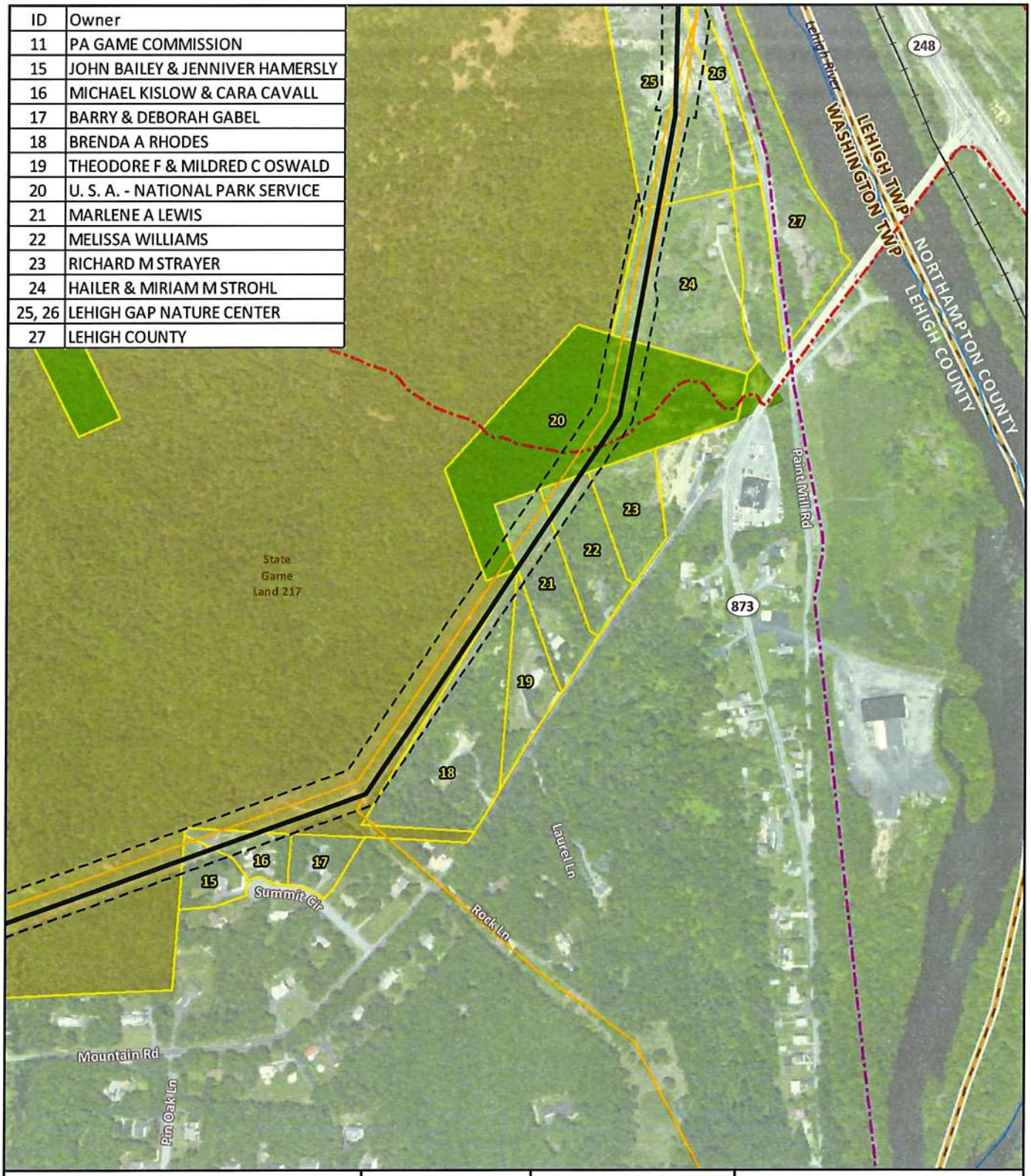


Figure 3-1d: Aerial Exhibit
Split - East Palmerton 138/69 kV Transmission Line Rebuild

ppl
PPL Electric Utilities
Louis Berger

N
0 100 200 400 600
Feet


ID | Owner
11 | PA GAME COMMISSION
15 | JOHN BAILEY & JENNIVER HAMERSLY
16 | MICHAEL KISLOW & CARA CAVALL
17 | BARRY & DEBORAH GABEL
18 | BRENDA A RHODES
19 | THEODORE F & MILDRED C OSWALD
20 | U. S. A. - NATIONAL PARK SERVICE
21 | MARLENE A LEWIS
22 | MELISSA WILLIAMS
23 | RICHARD M STRAYER
24 | HAILER & MIRIAM M STROHL
25, 26 | LEHIGH GAP NATURE CENTER
27 | LEHIGH COUNTY
State Game Land 217
LEHIGH TWP
WASHINGTON TWP
NORTHAMPTON COUNTY
LEHIGH COUNTY
Lehigh River
Paint Mill Rd
Laurel Ln
Summit Cir
Rock Ln
Mountain Rd
Pin Oak Ln
248
873
Rebuild Centerline
Existing ROW
ROW Parcel
Existing Transmission
69 kV
Railroad
River or Stream
Municipality Boundary
County Boundary
Appalachian Trail
Delaware & Lehigh Trail
State Gameland
Federal Land
Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)
Coordinate System:
State Plane PA South
NAD 1983
April 17, 2018
CARBON COUNTY
NORTHAMPTON COUNTY
LEHIGH COUNTY
Figure 3-1e: Aerial Exhibit
Split - East Palmerton 138/69 kV
Transmission Line Rebuild
ppl
Louis Berger
N
0 100 200 400 600
Feet

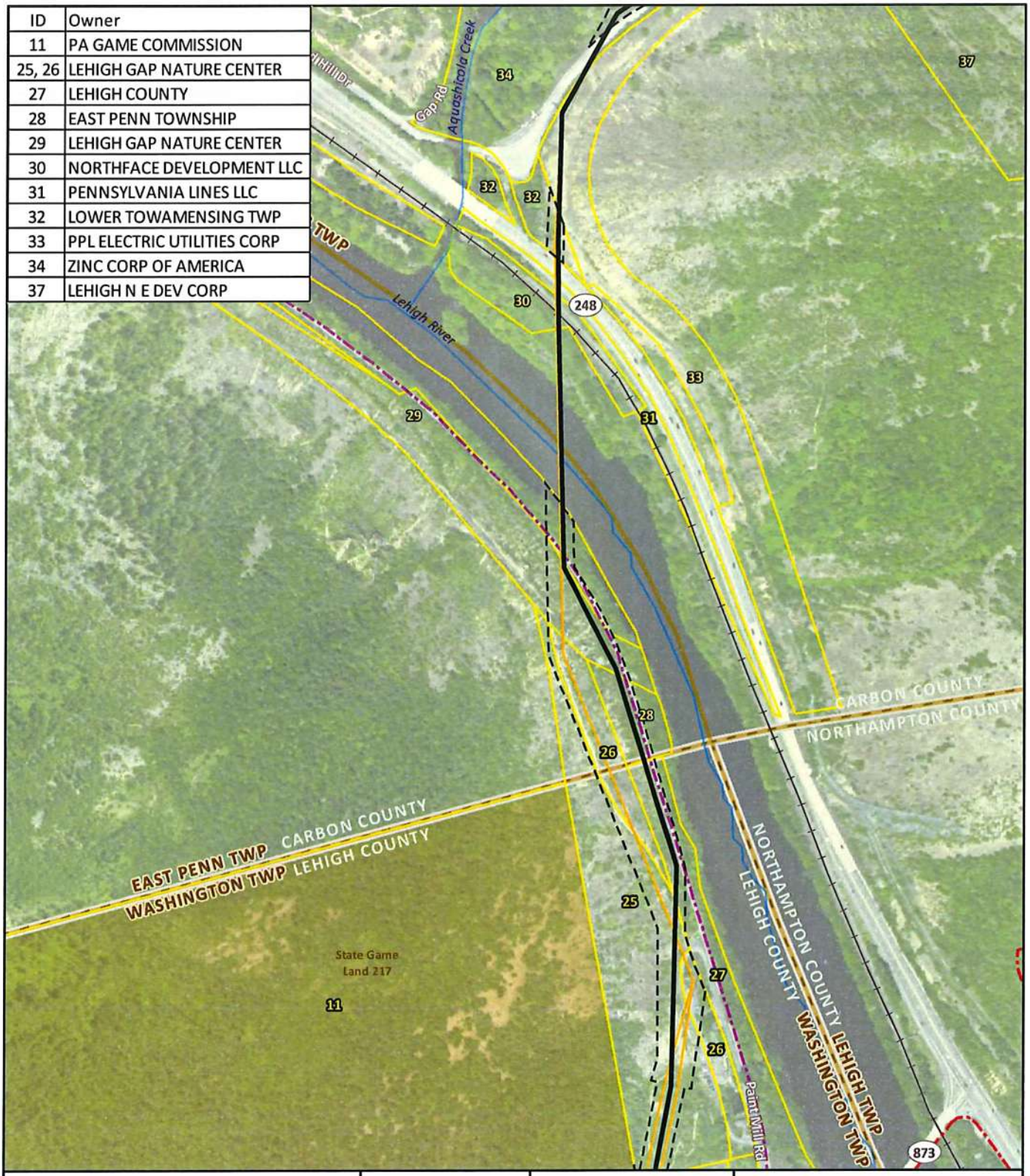
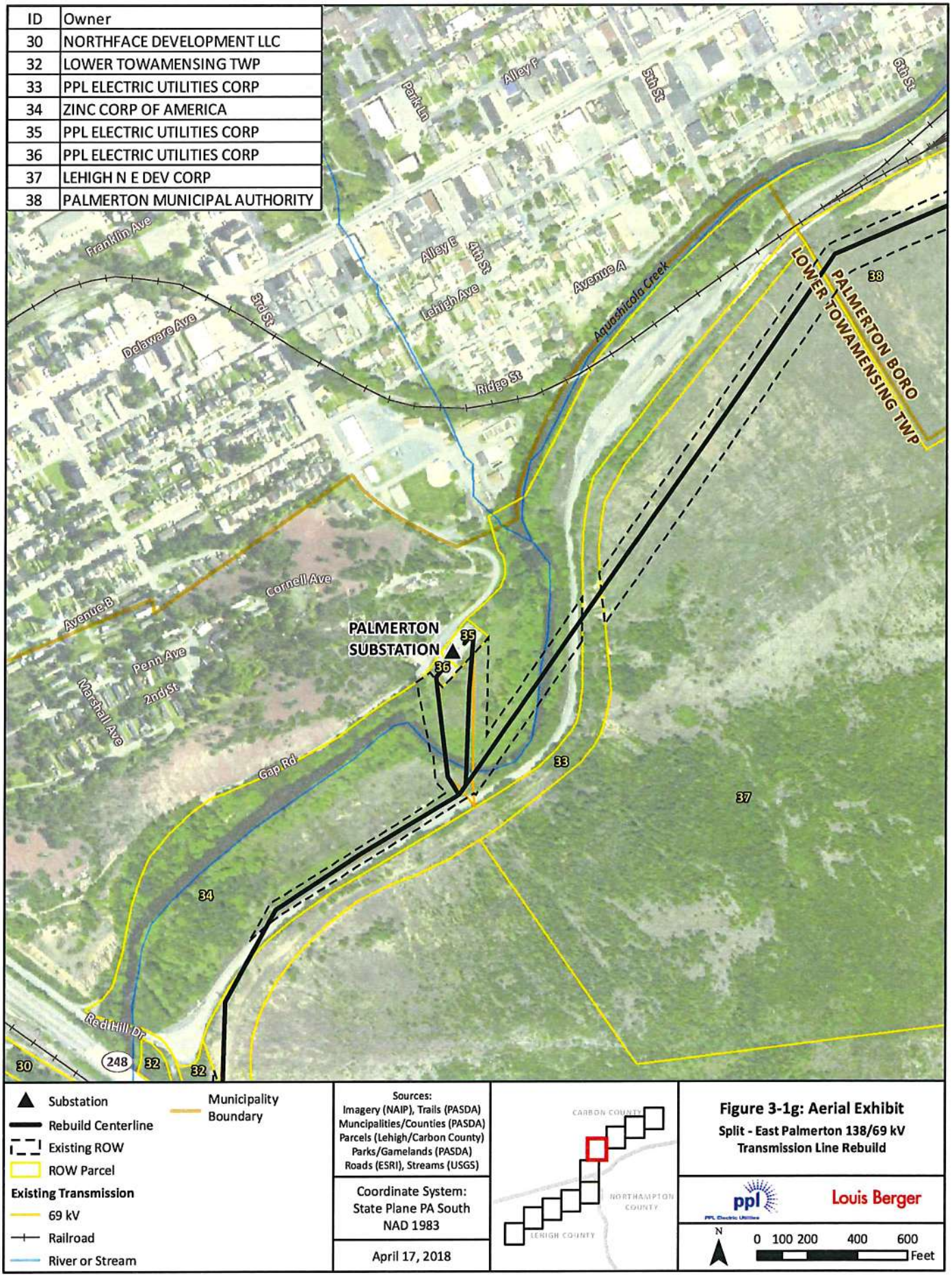


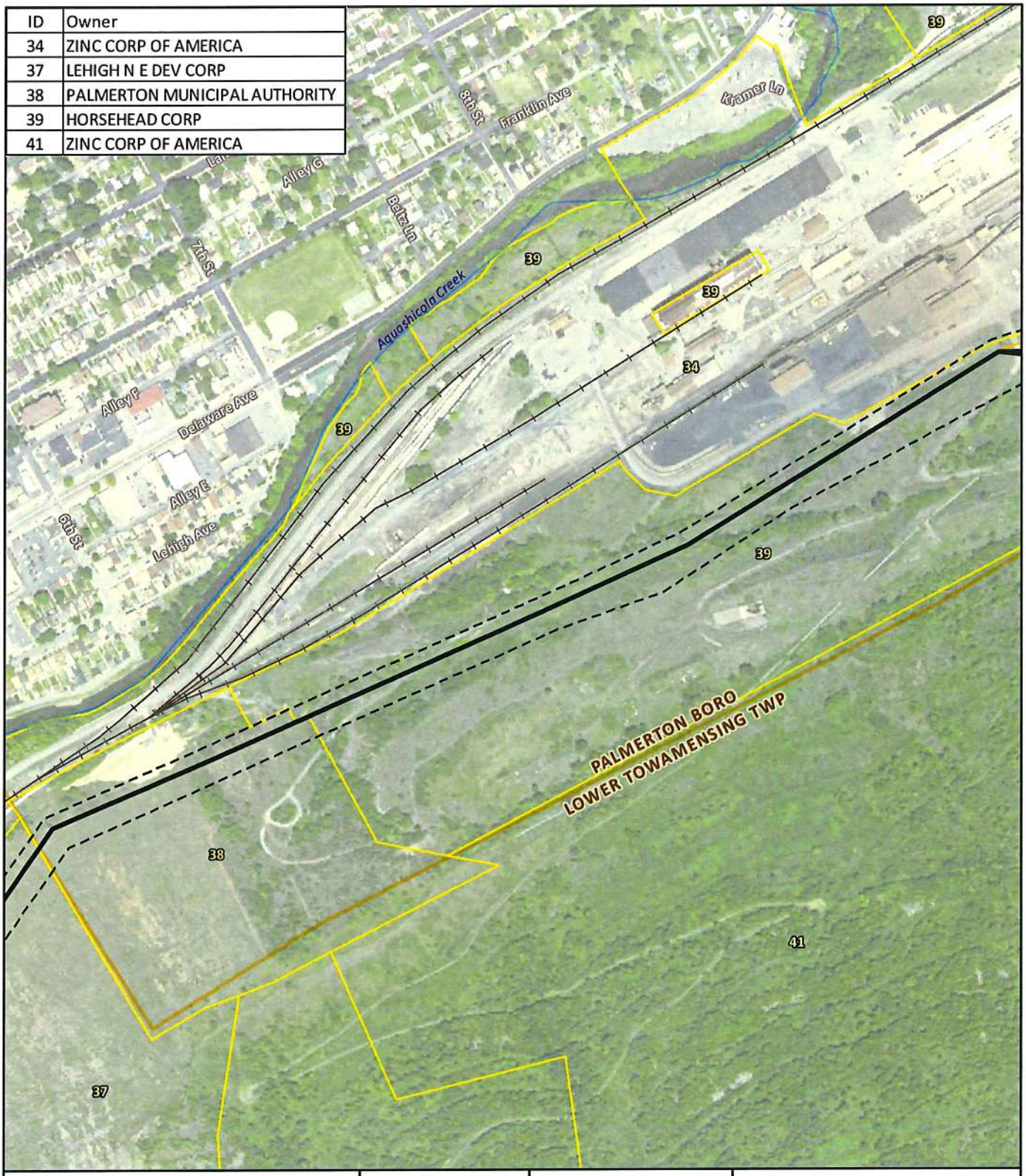
Figure 3-1f: Aerial Exhibit

Split - East Palmerton 138/69 kV Transmission Line Rebuild

ppl

Louis Berger


ID | Owner
30 | NORTHFACE DEVELOPMENT LLC
32 | LOWER TOWAMENSING TWP
33 | PPL ELECTRIC UTILITIES CORP
34 | ZINC CORP OF AMERICA
35 | PPL ELECTRIC UTILITIES CORP
36 | PPL ELECTRIC UTILITIES CORP
37 | LEHIGH N E DEV CORP
38 | PALMERTON MUNICIPAL AUTHORITY
PALMERTON SUBSTATION
LOWER TOWAMENSING TWP
PALMERTON BORO
Aquashicola Creek
Franklin Ave
Delaware Ave
Lehigh Ave
Ridge St
Alley E
Alley F
Park Ln
3rd St
4th St
5th St
6th St
Avenue A
Avenue B
Cornell Ave
Penn Ave
2nd St
Marshall Ave
Gap Rd
Red Hill Dr
248
Substation
Rebuild Centerline
Existing ROW
ROW Parcel
Existing Transmission
69 kV
Railroad
River or Stream
Municipality Boundary
Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)
Coordinate System:
State Plane PA South
NAD 1983
April 17, 2018
CARBON COUNTY
NORTHAMPTON COUNTY
LEHIGH COUNTY
Figure 3-1g: Aerial Exhibit
Split - East Palmerton 138/69 kV
Transmission Line Rebuild
ppl
Louis Berger
N
0 100 200 400 600
Feet



Rebuild Centerline
Existing ROW
ROW Parcel
River or Stream
Municipality Boundary

Existing Transmission
69 kV
Railroad

Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)

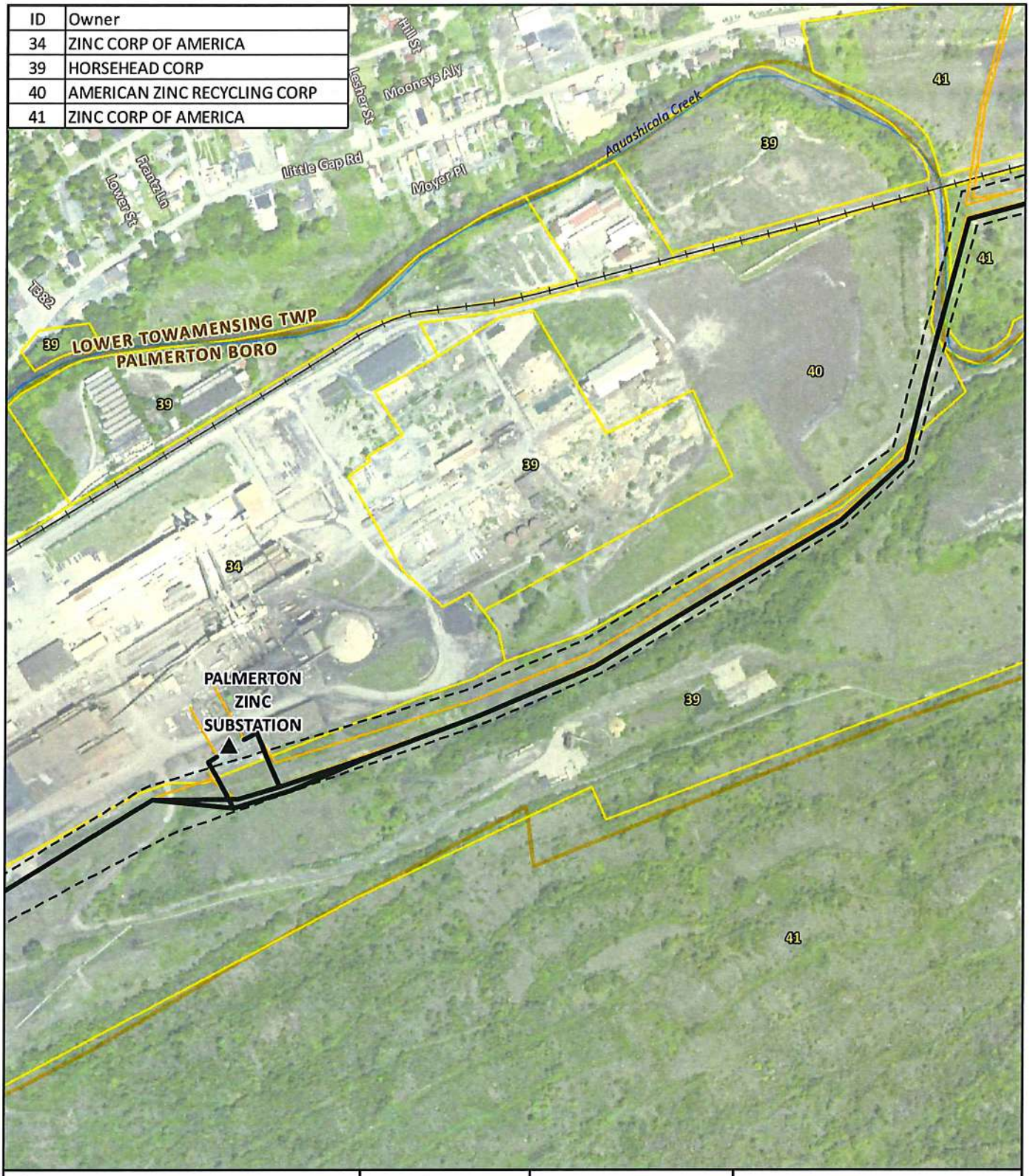
Coordinate System:
State Plane PA South
NAD 1983

April 17, 2018

Figure 3-1h: Aerial Exhibit
Split - East Palmerton 138/69 kV Transmission Line Rebuild

ppl
PPL Electric Utilities
Louis Berger

N
0 100 200 400 600
Feet



Substation
Rebuild Centerline
Existing ROW
ROW Parcel
Existing Transmission
69 kV
Railroad
River or Stream
Municipality Boundary

Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)

Coordinate System:
State Plane PA South
NAD 1983

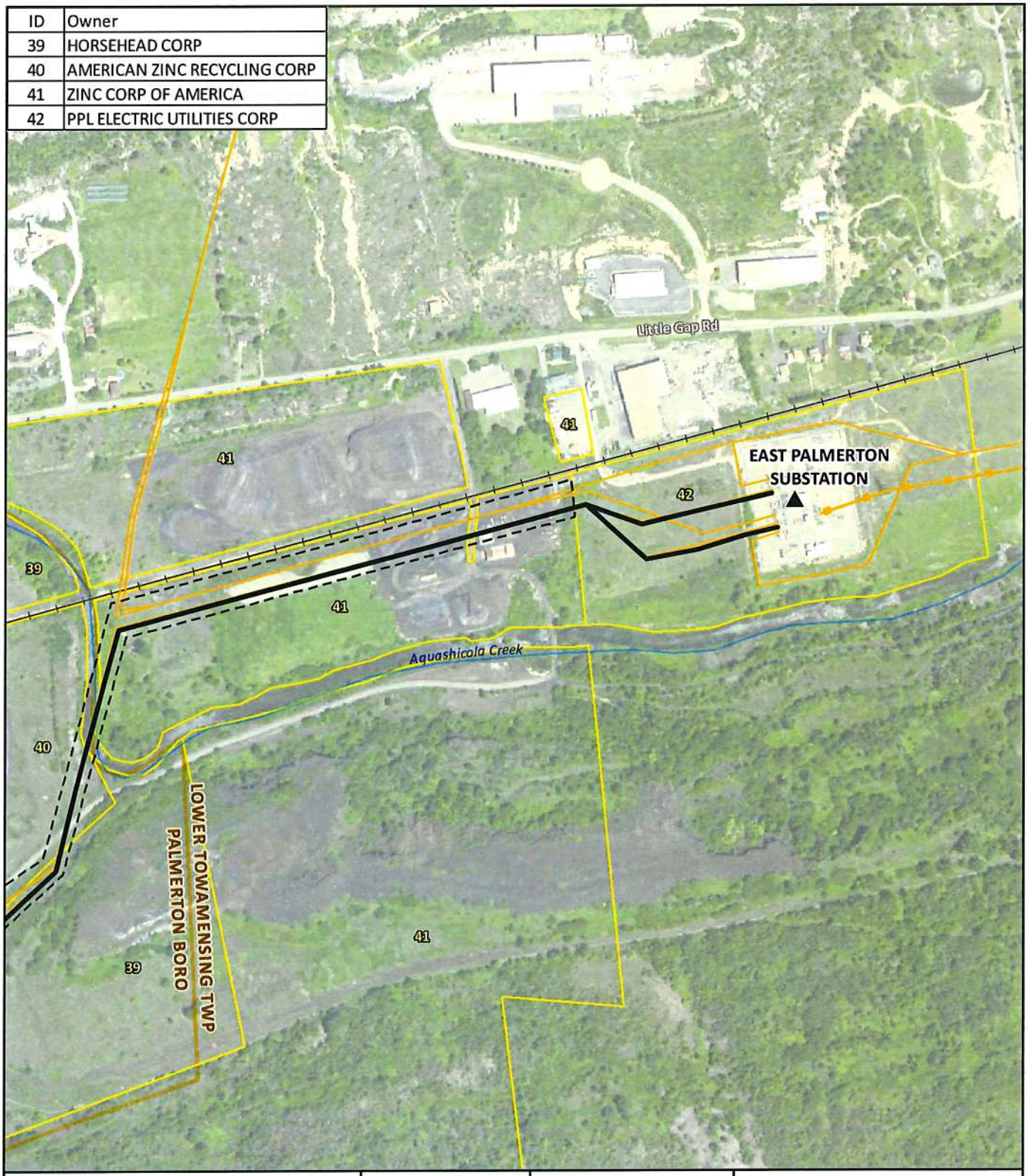
April 17, 2018

CARBON COUNTY
NORTHAMPTON COUNTY
LEHIGH COUNTY

Figure 3-1i: Aerial Exhibit
Split - East Palmerton 138/69 kV Transmission Line Rebuild

ppl
Louis Berger

N
0 100 200 400 600
Feet



Substation
Rebuild Centerline
Existing ROW
ROW Parcel

Existing Transmission
230 - 500 kV
69 kV
Railroad

River or Stream
Municipality Boundary

Sources:
Imagery (NAIP), Trails (PASDA)
Muncipalities/Counties (PASDA)
Parcels (Lehigh/Carbon County)
Parks/Gamelands (PASDA)
Roads (ESRI), Streams (USGS)

Coordinate System:
State Plane PA South
NAD 1983

April 17, 2018

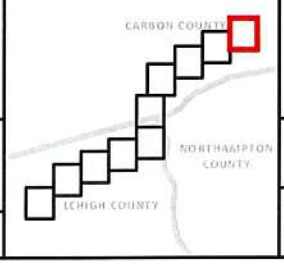


Figure 3-1j: Aerial Exhibit
Split - East Palmerton 138/69 kV Transmission Line Rebuild

ppl
PPL Electric Utilities
Louis Berger

N
0 100 200 400 600
Feet

ATTACHMENT 4

SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT

PPL ELECTRIC DESIGN CRITERIA AND SAFETY PRACTICES

TABLE OF CONTENTS

LIST OF TABLES

ATTACHMENT 4

SIEGFRIED – EAST PALMERTON #1 & #2 138/69 KV REBUILD PROJECT

PPL ELECTRIC DESIGN CRITERIA AND SAFETY PRACTICES

A. DESIGN CONSIDERATIONS

PPL Electric's new and rebuilt transmission lines 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 are designed to maintain public safety. PPL Electric transmission line design standards meet or surpass the NESC clearances and loading requirements.

For example, the NESC specifies strength and loading rules based on three different "grades of construction" for conductors and supporting structures:

- Grade B – This grade of construction provides the highest margin of safety and is required when the pole supports spans that cross limited access highways, railroads, and waterways.
- Grade C – This grade of construction is most common and provides a basic margin of safety. It is often utilized for the typical power and joint-use distribution pole.
- Grade N – This is the lowest grade of construction and is most often used for emergency and temporary construction.

PPL Electric designs all of its transmission lines for Grade B construction. The use of Grade B design and construction translates to higher levels of structural reliability and safety to withstand the environmental conditions of ice and/or wind loading, which provides a higher margin of safety.

Another example is the design parameters utilized to account for ice and wind loadings on the wires and structure. The conductor sags and tensions along with the structure loading used in line designs are the result of various ice and wind combinations. PPL Electric's transmission lines are designed to exceed NESC requirements by accounting for additional load cases with various ice and wind loading conditions not required by NESC. This means that PPL Electric lines are designed to operate safely and reliably during extreme inclement weather even more severe than assumed by the NESC. In addition, where practicable, PPL Electric transmission lines are designed with more clearance to the ground than required by the NESC. The tables below compare PPL Electric's general conductor to ground design and the NESC minimum ground clearances for lines of various voltages.

TABLE 4-1. 69 kV VERTICAL CLEARANCE TO GROUND		
Surface Underneath Conductors	**NESC Standard Clearance**	**PPL Conductor Clearances**
Roads, streets, alleys	19.2 Ft.	30 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	19.2 Ft.	30 Ft.
Spaces accessible to pedestrians only	15.2 Ft.	30 Ft.
Railroad tracks	27.2 Ft.	31.5 Ft.

TABLE 4-2. 138 kV VERTICAL CLEARANCE TO GROUND		
Surface Underneath Conductors	**NESC Standard Clearance**	**PPL Conductor Clearances**
Roads, streets, alleys	20.6 Ft.	31 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	20.6 Ft.	31 Ft.
Spaces accessible to pedestrians only	16.6 Ft.	31 Ft.
Railroad tracks	28.6 Ft.	35 Ft.

TABLE 4-3. 230 kV VERTICAL CLEARANCE TO GROUND		
Surface Underneath Conductors	**NESC Standard Clearance**	**PPL Conductor Clearances**
Roads, streets, alleys	22.4 Ft.	33 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	22.4 Ft.	33 Ft.
Spaces accessible to pedestrians only	18.4 Ft.	33 Ft.
Railroad tracks	30.4 Ft.	35 Ft.

TABLE 4-4. 500 kV VERTICAL CLEARANCE TO GROUND		
Surface Underneath Conductors	**NESC Standard Clearance**	**PPL Conductor Clearances**
Roads, streets, alleys	28.4 Ft.	40 Ft.
Other land traversed by vehicles (such as cultivated field, forest, etc.)	28.4 Ft.	40 Ft.
Spaces accessible to pedestrians only	24.4 Ft.	40 Ft.
Railroad tracks	36.4 Ft.	53 Ft.

A relay protection system is also used on PPL Electric's transmission lines to protect the public safety, as well as the equipment on 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.

B. 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 patrols as needed. Helicopter patrols are performed on all lines on a predetermined frequency, depending on voltage level. The two-man helicopter crew flies parallel 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.

C. PERSONNEL SAFETY RULES

Overall PPL Electric designs and constructs projects with high regards to both public and employee safety, and follows or exceeds all codes and requirements. The following are a few, but not all, of the PPL Electric safety rules that demonstrate the Company's dedication to employee and contractor 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 or contractors 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 lineman 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.
- 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.
- 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.

D. 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 higher than the minimum NESC ground clearance and reverse phasing of new double circuit lines where it is feasible to do so at low or no cost. The implementation of additional modifications to reduce magnetic field levels, are considered, provided those modifications can be made at low or no cost and will not interfere with the operation of the line.