



## **PPL Electric Utilities**

**2014 RTEP Project Proposal Window 1**

**Generation Deliverability Flow Gates #797 and #801**

***Solution #6: Montour-Harwood 230kV Transmission Line Addition***

**Submitted July 28, 2014**

REDACTED VERSION

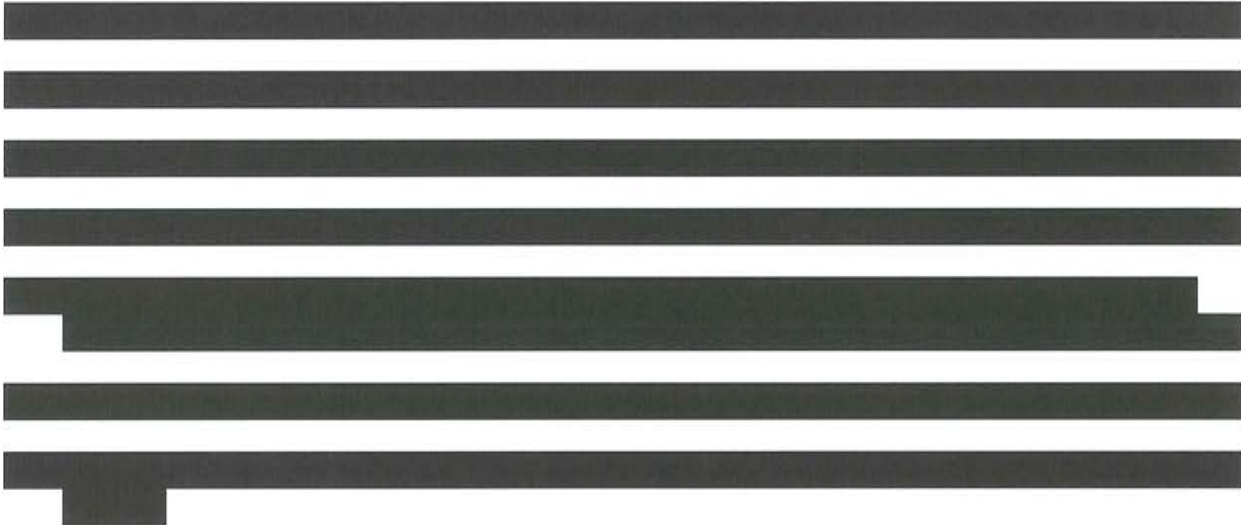


## **Montour-Harwood 230kV Transmission Line Addition**

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## **A Executive Summary - Option 6**

### **A.1 Name and Address of Proposing Entity**

Address:

PPL Electric Utilities Corporation  
Two North Ninth Street  
GENN5  
Allentown, PA 18101-1179  
(610) 774 – 5151

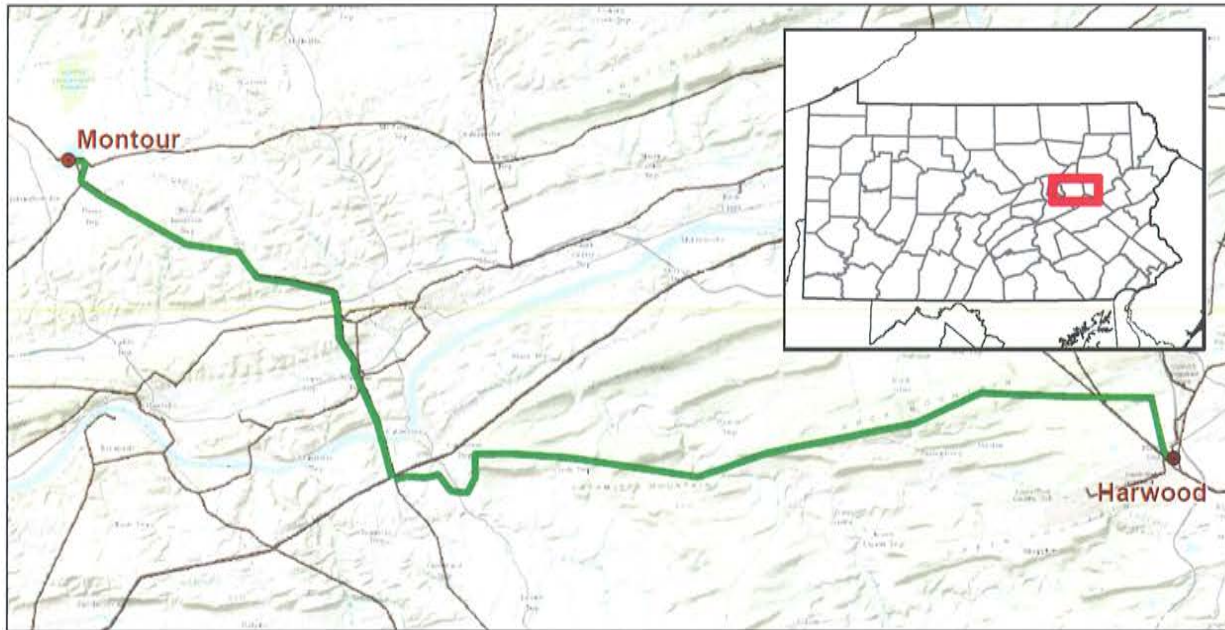
Point of Contact:

Vincent J. Cuce  
Manager, Asset Management Transmission & Substation  
Business: (610) 774 – 6580  
Cellular: (610) 737 – 2015

### **A.2 Description of Problem and Proposed Solution**

PPL Electric Utilities (PPL EU) proposes a new 43-mile 230kV transmission line from Montour Substation to Harwood Substation. This solution will relieve two Generation Deliverability violations (Flow Gates #797 and #801) on the existing Montour - Milton – Sunbury 230kV line for loss of the Montour – Susquehanna 230kV double-circuit (DCT) lines, as identified in PJM’s 2014 RTEP study results. The line will provide a single circuit to meet the current demand and be constructed to support future expansion to a DCT configuration in anticipation of future load growth. PPL will be responsible for planning, siting, design, right-of-way acquisition, permitting, construction, operation, and maintenance of the entire project. A map of the proposed development is included in Figure A.2.1.

**Figure A.2.1: Map of Proposed Solution Corridor**



### **Why This Solution?**

PJM identified that the Montour – Milton – Sunbury 230kV line can load to approximately 109% of its summer emergency MVA rating during this contingency under certain Generation Deliverability dispatches. Implementation of this solution reduces the thermal overload on the existing Montour – Milton – Sunbury 230kV line to approximately [REDACTED] of its summer emergency MVA rating.

### **Why PPL EU?**

PPL EU has successfully developed, operated, and maintained thousands of transmission infrastructure projects throughout its nearly 100 year history and is well positioned to implement the Montour-Harwood 230kV transmission line solution. PPL EU focuses on delivery excellence, blending capable people, mature processes, and rich vendor networks. PPL EU is backed by its parent company, PPL Corporation, one of the largest investor-owned utilities in the U.S. Both companies maintain “investment grade” credit ratings and conduct business according to a set of business standards codified in the PPL Standards of Conduct and Integrity.

As a developer, PPL EU:

- Obtains siting permit approval with state regulators successfully

- Seeks mutually beneficial arrangements with landowners using a formalized siting and right-of-way process that coordinates the planning-permitting-engineering-construction functions
- Employs best-in-class lifecycle approach to transmission asset management (see Section B1)
- Delivers projects on-time and on-budget, e.g., Susquehanna-Roseland and Northeast Pocono (see Appendix A)
- Anticipates circumstances specific to the region as the incumbent utility, e.g., topography, development types

As an operator, PPL EU:

- Conducts business safely with incidence rates lower than industry averages
- Maintains facilities beyond industry standards (top quartile System Average Interruption Frequency Index (SAIFI), multiple awards and recognition for Hurricane Sandy response) Builds relationships with local community (\$6M raised for charity in 2013)

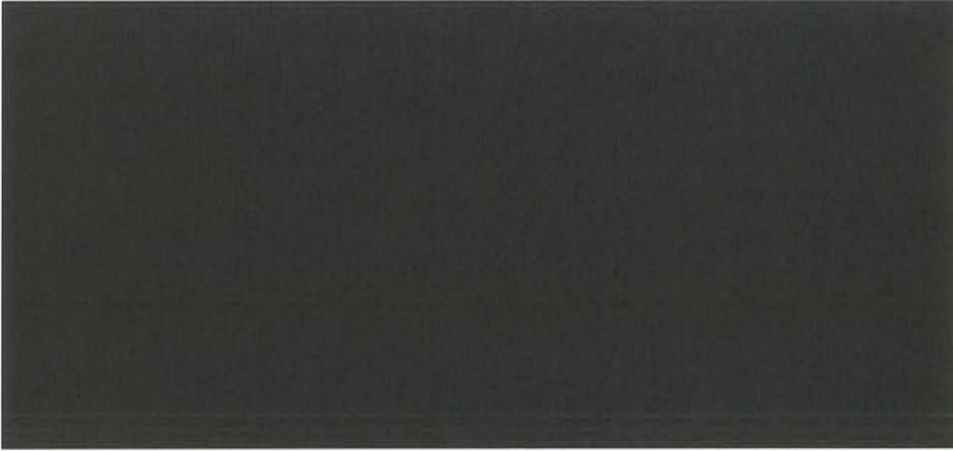
Further description of PPL EU's capabilities as a transmission developer and operator is presented in Section B.

### **A.3 Estimated Solution Cost**

Development of a new 43-mile 230kV transmission line from Montour to Harwood to resolve the Generation Deliverability violations described in Section A.2 is estimated at a total cost of \$164.2M (see Figure A.3.1 for more detail). This estimate is the result of a detailed design process that considered factors specific to this project (e.g., right-of-way, permits, terrain) and is informed by recent PPL EU transmission project experience.



**Figure A.3.1: Summary of Estimated Project Costs**



<b>Total (Including Contingency)</b>		<b>\$ 164.2</b>
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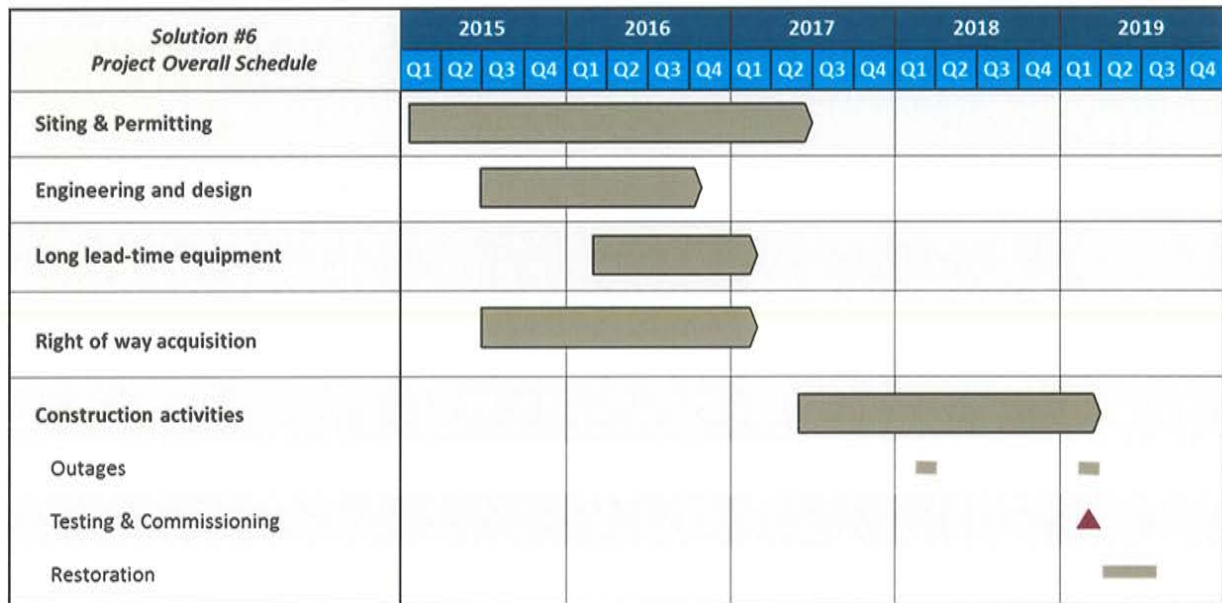
*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

#### **A.4 Solution Schedule and Milestones**

The solution described within this document will be commissioned and energized by the end of the second quarter of 2019 (see Figure A.4.1 for a summary), exceeding PJM’s target date for Generation Deliverability violation resolution. PPL EU is prepared to begin the planning and coordination required to execute against this timetable following the award of the project. PPL EU integrated planning, permitting, engineering, and constructability capabilities allow for efficient execution of the required activities recognizing that multiple stakeholders will be involved across the project lifecycle. The project will be led by the PPL EU Project Management Organization (PMP certified personnel) utilizing our repeatable design and construction processes along the schedule indicated in the figure below.

**Figure A.4.1: Overall Project Schedule and Milestones**



**A.5 Statement of Designated Entity Consideration**

PPL EU seeks, through the proposal herein, to be considered the Designated Entity to construct, own, operate, maintain, and finance the proposed solution.

**A.6 Affirmation of Pre-Qualification Information**

PPL EU’s pre-qualification information on record with PJM and as posted on PJM’s website, submitted on June 28, 2013 through the Office of the Interconnection prior to the opening of the Market Efficiency project proposal window, reflects the company’s current qualifications to be eligible for Designated Entity status as defined in the PJM Amended and Restated Operating Agreement (“PJM OA”) in Section 1.5.8(a) (PJM Designation 13-12).

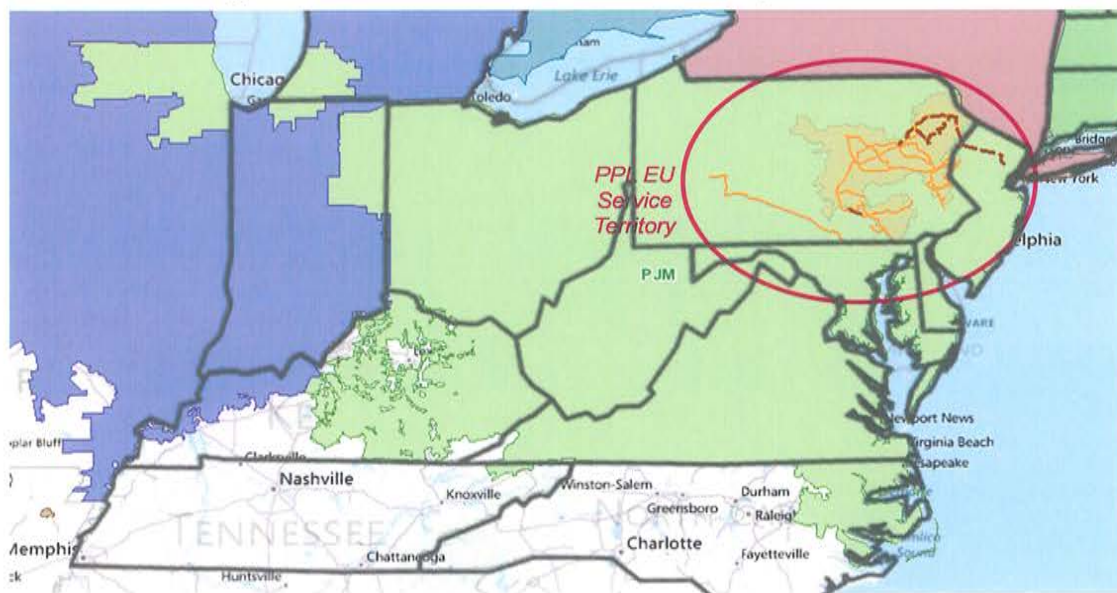
## B Company Evaluation Information

### B.1 Company Overview

PPL EU engages in the regulated transmission and distribution of electricity, providing high-quality, safe and reliable service to customers across central and eastern Pennsylvania. With the support of its parent company, PPL Corporation, PPL EU has access to the best practices and leading capabilities of one of the largest investor-owned companies in the U.S. utility sector.

PPL EU owns and operates a large transmission system within the PJM footprint, including 62 substations with a total capacity of 18.3 million kVA and approximately 4,000 transmission pole miles in service. Figure B.1.1 depicts PPL EU's existing transmission service territory within the broader PJM footprint.

**Figure B.1.1: PPL EU Transmission Footprint in PJM**

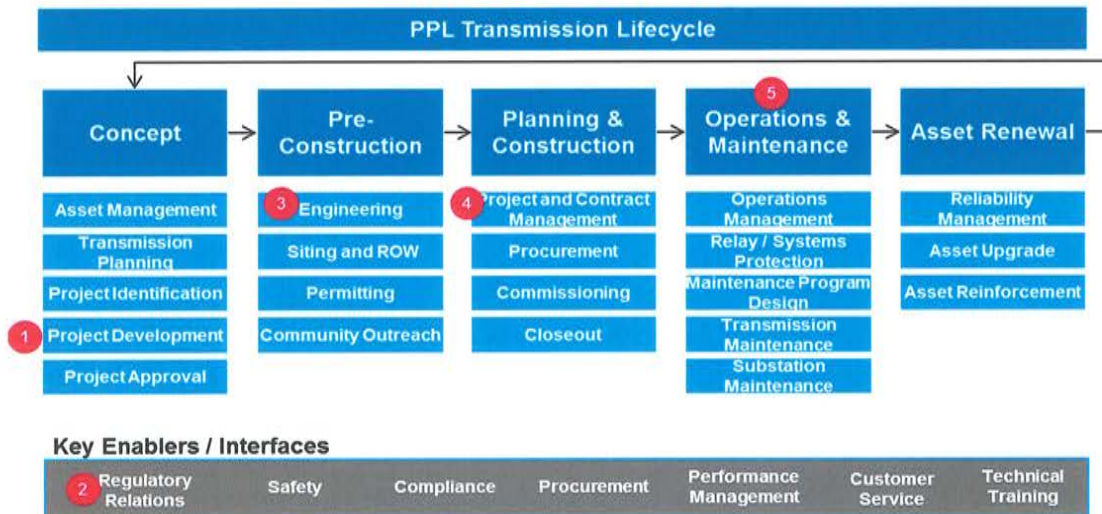


Management of this extensive transmission system and the project experience gained through constructing these assets, has enabled PPL EU to establish unique capabilities that are relevant to the proposed solution to the Montour–Milton-Sunbury 230kV line Generation Deliverability violations. PPL EU not only brings a well-established strong relationship with PJM, strong financial backing, and extensive project experience, but also a scalable contractor model, engineering expertise, and a culture of operational excellence that is required for successful project execution and asset operation.

PPL EU has established an operating model designed to efficiently and effectively invest in, operate and maintain its transmission system. This model establishes clear roles, responsibilities, processes and procedures to ensure accountability, facilitate timely decision-making, and optimize overall execution. A senior management team with almost 200 years of collective experience is responsible for overseeing an integrated transmission and distribution system. A set of PPL EU-designed operating principles ensure safe and reliable execution of its transmission strategy by aligning and focusing the organization on critical areas for success. Both the management team and the supporting organization have the requisite capabilities to advance transmission as a strategic priority for PPL EU.

Figure B.1.2 highlights capabilities particularly relevant for consideration of this proposed solution.

**Figure B.1.2: PPL EU Differentiating Capabilities**



### B.1.1 Project Development

PPL EU has extensive experience identifying and executing transmission projects, ranging from simple upgrades to large scale greenfield development. More than \$600 million in transmission grid investment is planned in 2014 alone and \$4.7 billion in the transmission and distribution grids over the next five years. Completing these projects requires extensive technical expertise, effective project management capabilities, the ability to work with numerous stakeholders, and effective cost controls over the capital being deployed. The in-flight 500kV new transmission line build Susquehanna-Roseland and 230kV new transmission line build at Northeast Pocono, described in detail in Appendix A, demonstrate PPL EU’s ability to successfully execute the complexities of large projects concurrently.

### ***B.1.2 Regulatory Relations***


Strong relationships with federal, state and local government and regulatory agencies have facilitated successful development and operation of transmission projects. Throughout PPL EU's nearly 100-year history, PPL has worked with agencies, communities and customers to site, permit, and license transmission projects within our transmission service territory. For example, National Park Service was a key stakeholder relationship developed to address the requirement for the Susquehanna-Roseland project to cross three national parks. Additionally, PPL EU has an outstanding success rate with obtaining siting application approvals through Pennsylvania's Public Utility Commission (PUC).

### ***B.1.3 Engineering***

With the increase in infrastructure investments, the Engineering department has gained a broad mix of recent design experience including both new capacity additions and upgrades, as well as varied electrical system specifications, weather and geographic topography conditions. PPL EU has designed over 1,000 miles in support of new line builds, existing transmission rebuilds, reconductoring and fiber optic cable additions.

Transmission Engineering utilizes current industry standards and adopts new technologies to improve process efficiency and effectiveness. Updated standards incorporate specifications such as 2-shield wires and high reliability performance lines. New state-of-the-art technology such as a Power Line Computer Aided tool called PLS – CADD acts as a centralized tool for designing and drafting. PPL EU is also a member of key industry forums such as the Electrical Power Research Institute (EPRI) and the EHV Engineering Committee, which build capabilities through collaboration with other members.

PPL's Engineering group not only leverages extensive experience in-house, but also has vast experience in managing contracted engineered services with 12+ engineering firms:

 , among others. These contractors have extensive knowledge and experience designing all transmission line voltage classes both within PJM as well as outside the PJM territory.

### ***B.1.4 Project and Contract Management***

The PPL EU Project Management team ensures that project activities are completed to scope, schedule and budget in order to achieve the business objectives and requirements of the company. The team is part of a dedicated organization using best-in-class process and with employees who maintain the Project Management Professional (PMP) certification. The Project Management team remains connected to projects throughout the

entire development lifecycle, beginning with a specific Project Manager assigned to a project in the early stages of Project Planning and Design. The Project Management team has experience managing projects across all service territories and across all types and sizes of projects. Depending on the size and scope of a particular project, Project Managers are responsible for managing and overseeing anywhere from one to fifteen projects at the same time. For the largest and most complex projects PPL EU will assign the most experienced Project Managers to ensure that the project is handled in the most efficient and effective method possible.

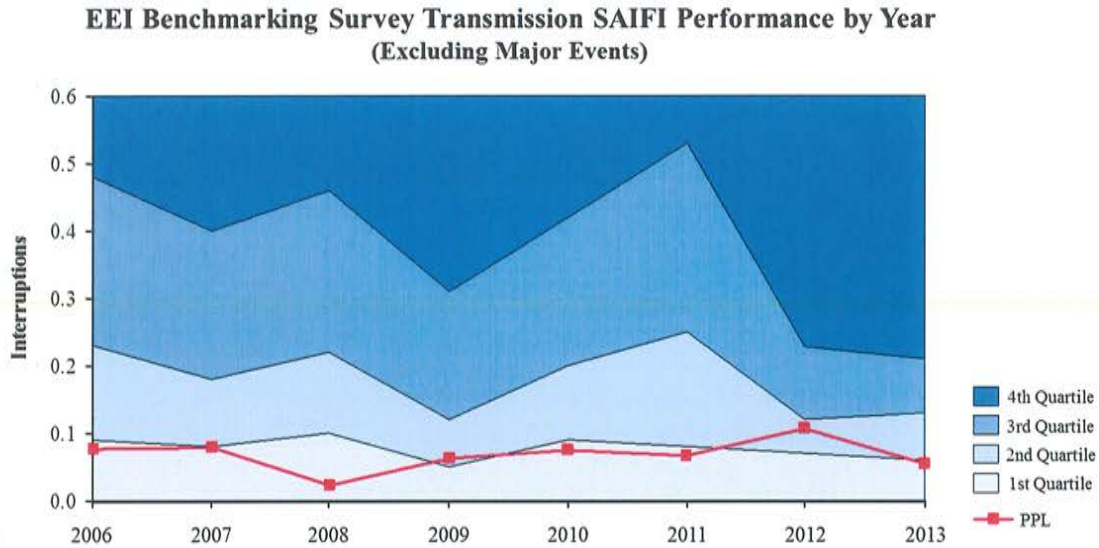
The ability to execute projects both large and small is built on a scalable contractor model across the transmission asset lifecycle, while maintaining stringent standards relating to safety, quality, and delivery. PPL EU has established a preferred set of contractors, Contractors of Choice (COC), through an extensive, formal request-for-proposal (RFP) process. The Contract Management team has established relationships with contractors nationwide, which creates a strong ability to effectively source the best contractor(s) for each piece of work required by PPL EU. This contracting process delivers a best practice contracting approach that complies with the National Contract Management Association standards and processes.

### ***B.1.5 Operations & Maintenance***

PPL EU has a strong history of execution excellence, as demonstrated by our exemplary track record of compliance, safety, reliability, and cost containment. Compliance with North American Electric Reliability Corporation (NERC) standards has always been, and continues to be, a high priority and PPL EU has routinely been recognized by ReliabilityFirst (RF) as a benchmark for compliance. In 2012, RF audited PPL EU on behalf of NERC for both Reliability Standards associated with Operations and Critical Infrastructure Protection (CIP) Reliability Standards, the company received high marks for both. PPL EU adopts standards and processes in advance of compliance requirements and offers regular training programs. Safety is a PPL EU core value embedded throughout PPL EU. The Safety program strives to minimize Occupational Safety and Health Administration (OSHA) designated Recordable Events and results are consistently better than industry peers.

Commitment to system performance through effective, preventive and real-time operations and maintenance programs is evidenced in the reliability performance metrics for PPL EU's system. As shown in Figure B.1.3, Transmission System Average Interruption Frequency Index ("T-SAIFI") performance has been at or near top-quartile performance for the past six years, averaging less than 0.1 interruptions over the period from 2006 through 2013 (excluding major events).

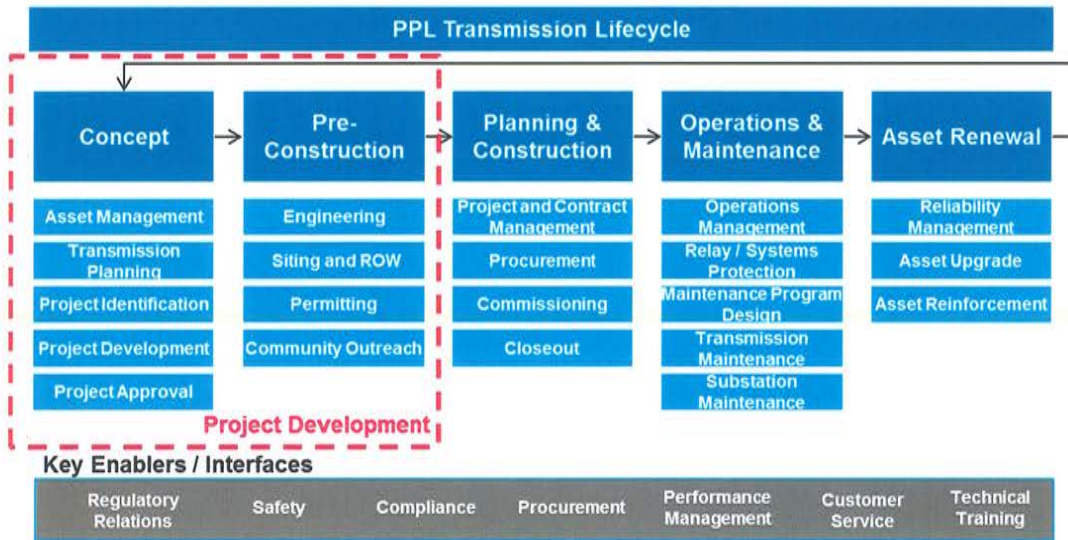
**Figure B.1.3: PPL EU T-SAIFI Historical Trend (In Interruptions)**



## B.2 Technical and Engineering Qualifications and Experience

PPL EU has nearly 100 years of experience in transmission development and construction, building everything from core 69kV connection projects to 500kV lines. With refined processes to manage the complexities inherent in all types of transmission projects, PPL EU organizes and operates with project execution in mind. Project control is maintained through strong governance, clear project review processes, and tools for stringent project estimating and control. The early phases are grounded in the principles of constructability, cross-functional collaboration and front-loaded engineering and design to avoid or minimize future scope, schedule or cost changes. For example, during the Concept phase the operations and maintenance teams provide input into new project development on optimal design and construction in terms of ease and cost to maintain the assets. PPL EU uses a blended approach of in-house teams and approved contractor resources to allow for high quality project execution at the lowest overall cost. Regardless of internal or external resources, all projects are delivered through the structured project development model shown in Figure B.2.1.

**Figure B.2.1: PPL EU Transmission Lifecycle**



Proven success in large capital projects such as the recent Susquehanna–Roseland project illustrates PPL EU’s effectiveness in executing its end-to-end transmission operating model. Certain elements of this operating model are highlighted below.

**Widespread Contractor Support**

With recent project experience at Susquehanna–Roseland and Northeast Pocono projects, PPL EU has built strong relationships with many large firms that have nation-wide capabilities. These relationships will allow access to talent with familiarity with the rules and regulations in Pennsylvania through the development and construction phase. In the event that the current vendor base cannot adequately support the project needs, the Sourcing organization has developed an extensive RFP process that comprehensively vets potential contractors for safety, performance, quality, Days Away, Restricted, or Transfer (DART) rates, and safety incidents.

**Secure and Cost Effective Supply**

Due to the significant volume of projects executed over the last several years, PPL EU receives preferred customer prices that are equal to or better than its peers, and has secured supply when others in the industry are unable to find needed resources and / or materials. For example, materials management for Susquehanna–Roseland was outsourced to HD Supply, a model that would likely be replicated for the proposed project. HD Supply’s widespread footprint positions this partner to effectively manage equipment purchasing, product tracking, and securing lay-down yard, in the territory.



**Siting, Permitting and Right-of-Way**

The Siting, Permitting and Right-of-Way departments have built a strong set of capabilities to support the proposed solution. The siting process includes the determination of a Project Study Area, identification of Alternative Corridors, identification of Alternative Routes within these Corridors, and Selection of the Preferred Route. Through early stakeholder engagement and public outreach, PPL EU has been successful at avoiding constraints and leveraging opportunities to minimize impact to the public and environment, while maintaining reasonable costs and preserving engineering and construction feasibility. PPL EU has an excellent success rate for securing approval for siting applications from PA PUC.

The Right-of-Way team is heavily integrated with the Siting team, which facilitates more effective community outreach and greater consensus on route development. In the past six years, PPL EU has successfully acquired over 140 right-of-way miles. PPL EU prides itself on taking a “property owner perspective” when acquiring right-of-way and accommodates landowner requests when practical. Acquiring right-of-way is a complex process necessitating the coordination of many stakeholders. PPL EU Permitting has a track record of successfully obtaining the necessary local, state and federal government permits and licenses for proposed transmission projects. Figure B.2.2 is a sample listing of projects and the corresponding permits and/or licenses that have recently been acquired to construct transmission projects:

**Figure B.2.2: Example of Recent Permits / Licenses Acquired**

Project Name	Permit / License Acquired
Susquehanna – Roseland	License for Right-of-Way – Delaware Forest
Susquehanna – Roseland	Letter of Authorization – Lackawanna Forest
Susquehanna – Roseland	License for Right-of-Way – Game Lands 183 & 300
Susquehanna – Roseland	Special Use Permit – PA Game Commission
Susquehanna – Roseland	PennDOT Permits (Min. Use, HOP, LAP)
Susquehanna – Roseland	DEP – Submerged Land License Agreement
Susquehanna – Roseland	PA Turnpike Commission Access & Restoration
NE Pocono Reliability	Special Use Permits – PA Game Commission
NE Pocono Reliability	NPDES Permit – Peckville-Varden Transmission Line
NE Pocono Reliability	NPDES Permit – Paupack Substation
NE Pocono Reliability	NPDES Permit – Paupack Taps, Transmission Line

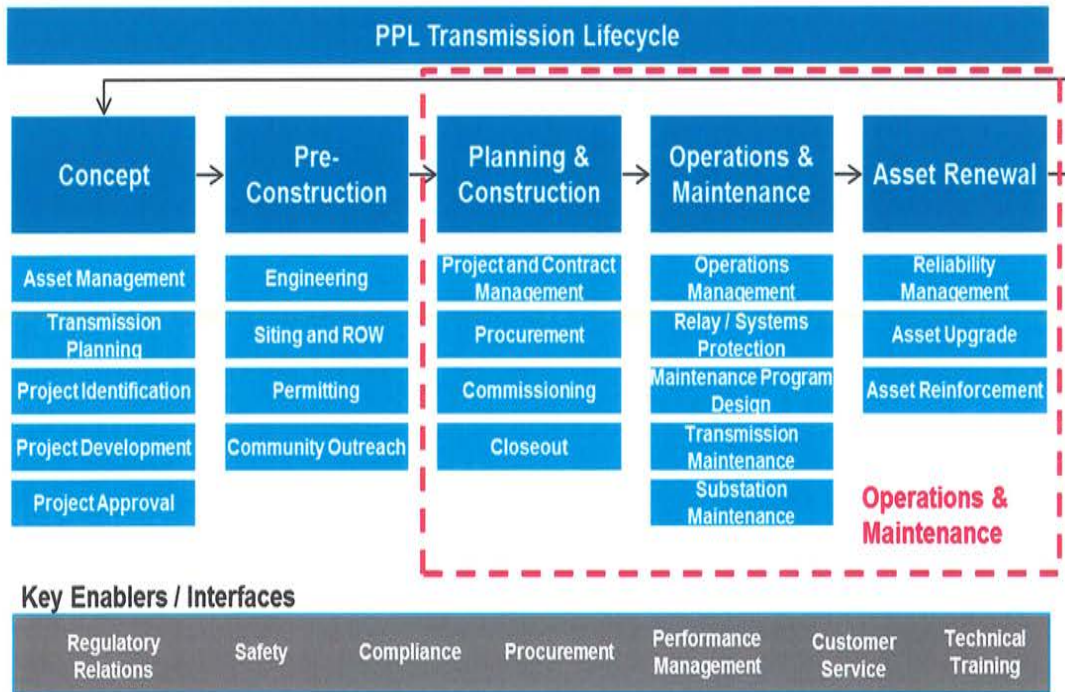
Project Name	Permit / License Acquired
NE Pocono Reliability	NPDES Permit – Paupack-Honesdale Transmission Line
NE Pocono Reliability	NPDES Permit – Pocono Substation
NE Pocono Reliability	NPDES Permit – Pocono to Paupack Transmission Line
NE Pocono Reliability	Two (2) Joint Permits (one per county) - Pocono to Paupack Transmission Line
NE Pocono Reliability	Joint Permits – Peckville-Varden Transmission Line
NE Pocono Reliability	Joint Permits – Paupack-Honesdale Transmission Line
NE Pocono Reliability	I-84 Clearing Permits
NE Pocono Reliability	PennDOT Permits
Blooming Grove – Hemlock	Road Use Agreement – Delaware Forest
Blooming Grove – Hemlock	License for Right-of-Way – Delaware Forest
Blooming Grove – Hemlock	DEP – GP8 Permit
Susquehanna – Harwood Reconductor	DEP – GP8 and GP11 Permit
Blooming Grove – Jackson	DEP – GP8 and GP11 Permit
Sunbury – Dauphin	NPS – Special Use Permit Appalachian Trail

During the development of the Susquehanna-Roseland project, PPL EU developed a strong capability across its Governmental and External Affairs group. In a challenging environment, PPL EU successfully established a process to allow groups to conduct reviews and on-site examinations to promote transparency and cooperation. With the potential for the proposed project to impact environmentally sensitive areas as further detailed in Section C, PPL EU will leverage this capability to coordinate with the Pennsylvania Department of Natural Resources. PPL EU understands the importance of engaging stakeholders and developing relationships and would engage local consultants as needed to augment PPL EU's existing network of relationships with federal, state, and local stakeholders.

### B.3 Operations & Maintenance Qualifications and Experience

PPL EU is committed to achieving leading operations reliability and system performance for its transmission system. Figure B.3.1 depicts the functions that support the operations and maintenance portion of the transmission asset lifecycle.

**Figure B.3.1: PPL EU Transmission Lifecycle**



PPL EU, as the owner of the conductor assets will provide all required maintenance at PPL’s standards. PPL EU’s stringent prioritized maintenance programs are developed based on established reliability standards, asset management driven-programs, and overall equipment criticality. While all transmission operators face tradeoffs related to optimizing capital, O&M, reliability and overall value, PPL EU has developed a proactive asset renewal program that carefully weighs the most prudent and cost-effective methods to ensure system performance at a sustainable cost. This focus on reducing the number of degraded elements, as well as reducing system vulnerabilities, identifies the most critical infrastructure and prioritizes the most important renewal work. A programmatic approach to preventive maintenance facilitates improvements to field productivity by reducing emergent work initiated by equipment failures, allowing workers to focus on scheduled work. PPL EU’s maintenance model and vegetation management program are well suited to efficiently and effectively maintain the proposed solution.

**Maintenance Model**

A flexible maintenance model allows PPL EU to provide maintenance support free of geographic constraints. Currently, PPL EU retains asset management responsibilities centrally while using a mix of in-sourcing and outsourcing for in-field maintenance work [REDACTED]. The team relies on electronic communications from inspectors, including detailed inventory and images of each structure, which allows PPL

EU to easily scale the operation to any geographic area. This model is utilized across the PPL service territory where pictures are taken to manage the maintenance requirements remotely. Trips to the field are the exception and usually do not extend beyond a detailed walk down of the line at the end of construction. PPL EU is confident that its successful experience managing maintenance contractors will allow it to capably manage the maintenance requirements of the proposed project.

### **Operations Model**

PPL EU facilities will be operated at the direction of PJM and controlled and maintained consistent with the current PPL EU operations and maintenance practices.

To operate and maintain the transmission grid reliably, PPL EU manages a Transmission Control Center (TCC) that adheres to the guiding principles of safety, reliability and production in that order.

In addition to real time operations, PPL EU develops a construction and maintenance outage plan. TCC Planning processes requests to upgrade transmission facilities and translates those to equipment outages using the PJM outage criteria time lines. The TCC plans all outage requests, limits risks to the electric system and PPL EU customer base, and responds to any unplanned events. Transmission outage planning, including risk and conflict analysis, is crucial to promoting safety, preserving the reliability of the bulk and non-bulk transmission system, and eliminating volatility in the work portfolio.

### **Vegetation Management**

PPL EU Vegetation Management leverages “open book,” long-term, managed business relationships with two of the largest vegetation management contractors in North America [REDACTED]. Over the last three years, 100% of the vegetation management plan has successfully been completed for 138kV, 230kV and 500kV lines. PPL EU has had zero tree-related events on 230kV or 500kV transmissions facilities during that timeframe. PPL EU will be able to utilize its contractor base to maintain the same high standards for the proposed solution.

## **B.4 Emergency Response and Restoration**

PPL EU has an industry leading emergency preparedness and response program, led by a dedicated Emergency Preparedness group which develops and maintains comprehensive emergency response plans and supports the effective execution of these plans. PPL EU’s recent experience in major storms, particularly Hurricane Sandy, Hurricane Isaac, a major snow in October of 2012, and extremely high winds in May 2012 have improved our emergency response processes. We have demonstrated the ability to quickly restore our

own assets under various scenarios. PPL EU’s award recognition in emergency response can be found in Figure B.4.1.

**Figure B.4.1: Summary of Major Award Recognition**

PPL’s Award Recognition
2013 Electric Light and Power Magazine’s Utility of the Year Award. Also, won in 2008.
2013 North East PA Manufactures and Employers Association Process Improvement Award for improvements related to storm response processes
J.D. Powers and Associates conducted a national survey of consumers to rate performance of utilities and local, state and federal government actions prior to and following Hurricane Sandy. In February, 2013 J.D. Power recognized PPL as one of only three utilities that performed “Particularly well”
2012 EEI Emergency Recovery Award for Hurricane Sandy
2012 EEI Emergency Assistance Award, for tremendous support in the recovery from Hurricanes Isaac and Sandy

As owners of the proposed Montour-Harwood 230kV line, PPL EU will maintain responsibility for executing the emergency response plan. PPL EU is confident that it can successfully execute the response plan as the line is entirely within its traditional operating area and proximate to its wide resource network of local contractors, crews, and additional resources gained through participation in mutual assistance groups.

PPL EU is a member of two regional mutual assistance groups, the North Atlantic Mutual Assistance Group (NAMAG) and the Southeastern Electric Exchange (S.E.E.). PPL EU also has access to additional resources through the Contractors of Choice working on PPL EU’s transmission and distribution systems and Louisville Gas & Electric and Kentucky Utilities.

Overall, PPL EU has developed a unique network of third party support that will allow it to successfully execute against the emergency response plan. Further detail into PPL’s emergency preparedness organization and processes can be found in the pre-qualification document for Designated Entity status.

**B.5 Cost / Schedule Adherence**

PPL EU has implemented processes, governance, and project management tools to ensure projects are delivered on-time and on-budget.

The Project Controls Department is responsible for monitoring project progress to compare actual versus baseline resource usage and analyze project variances utilizing statistical techniques such as Earned Value Metrics and Reporting to identify trends, develop forecasts, and expose potential problems. The Project Controls Department also implements process controls, monitors and audits projects to control project risks, ensures adherence to Generally Accepted Accounting Principles (GAAP), and compliance to Federal Energy Regulatory Commission (FERC) and Sarbanes Oxley Act (SOX) regulations.

## **B.6 Proposed Project Financing**

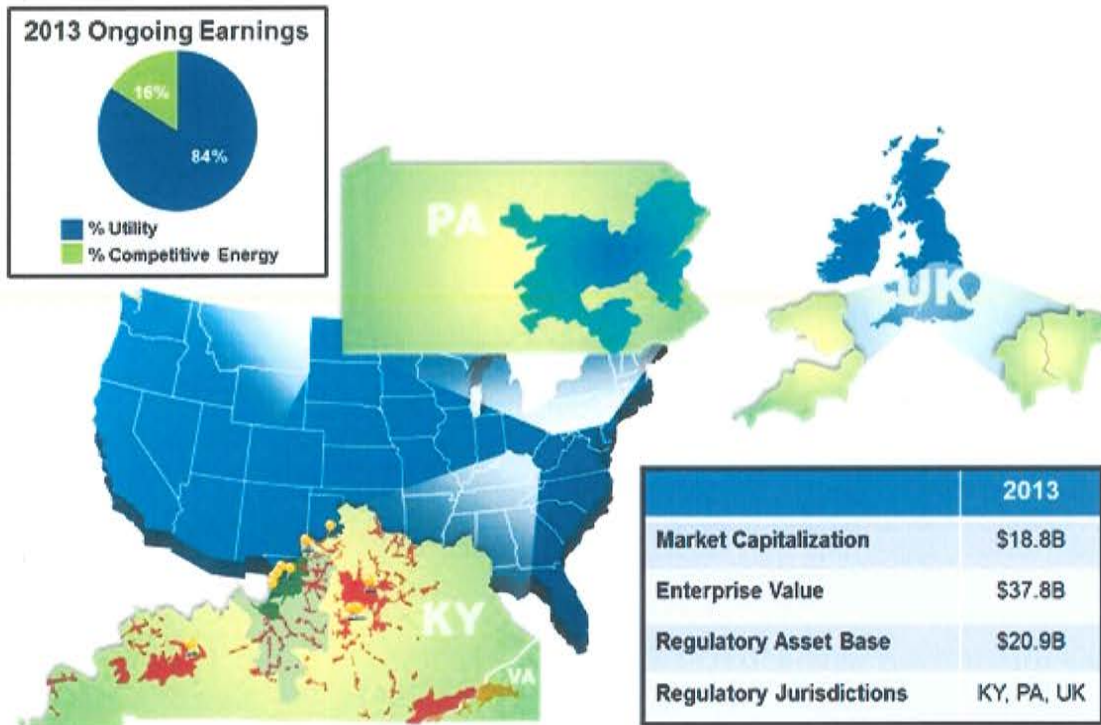
PPL and PPL EU propose to finance the project across its capital structure using approximately 50% debt and equity, including cash from operations. We expect to utilize the commercial bank lending and debt capital markets, using a variety of short-term and long-term securities.

### **Financial Strength**

PPL is one of the largest public utility owners in the US with over \$1.5 billion in ongoing earnings and \$2.9 billion of cash from operations in 2013. The majority of PPL's ongoing earnings and cash flows stemmed from stable, regulated utility operations in the US and UK with over \$20 billion in regulated asset base. This diverse base of regulated cash flows supports PPL's strong balance sheet and enables it to maintain a credit profile that supports consistent access to the equity and debt capital markets and bank markets for additional financing needs at cost effective rates.

PPL EU had over \$500 million of cash flow generated from operations during 2013, and \$300 million of available liquidity, primarily through its commercial paper program and/or bank syndicated credit facilities. PPL EU also has consistent access to the commercial bank lending markets and debt capital markets. Through its parent, PPL, PPL EU has access to appropriate amounts of equity to provide efficient financing resulting in the lowest cost of capital for the ratepayers.

Figure B.6.1: PPL Financial Summary



**Credit Metrics:**

PPL Corporation and PPL EU have a strong financial foundation that enables the development, operation and maintenance of transmission facilities. To manage financing costs and access to credit markets, a key objective of PPL’s strategy is to maintain a strong investment grade credit profile and strong liquidity position. Additionally, PPL has put in place financial and operational risk management programs that, among other things, are designed to monitor and manage its exposure to earnings and cash flow volatility related to changes in energy and fuel prices, interest rates, counterparty credit quality and the operating performance of its generating units.

PPL EU is focused on timely recovery of costs, efficient operations, strong customer service and constructive regulatory relationships. PPL EU has a low-risk, fully regulated business profile with significant borrowing capacity and stable cash flows. Both PPL and PPL EU maintain investment grade credit ratings from the major credit rating agencies. PPL EU’s financing plan would be executed in a manner that does not negatively impact its current credit ratings.

**Figure B.6.2: Credit Ratings**

Issuer	Rating	Moody's	S&P
<b>PPL Corporation</b>	LT Issuer Rating	Baa3	BBB
<b>PPL Electric Utilities Corporation</b>	Senior Secured Debt	A2	A-
<b>PPL Electric Utilities Corporation</b>	Commercial Paper	P-2	A-2

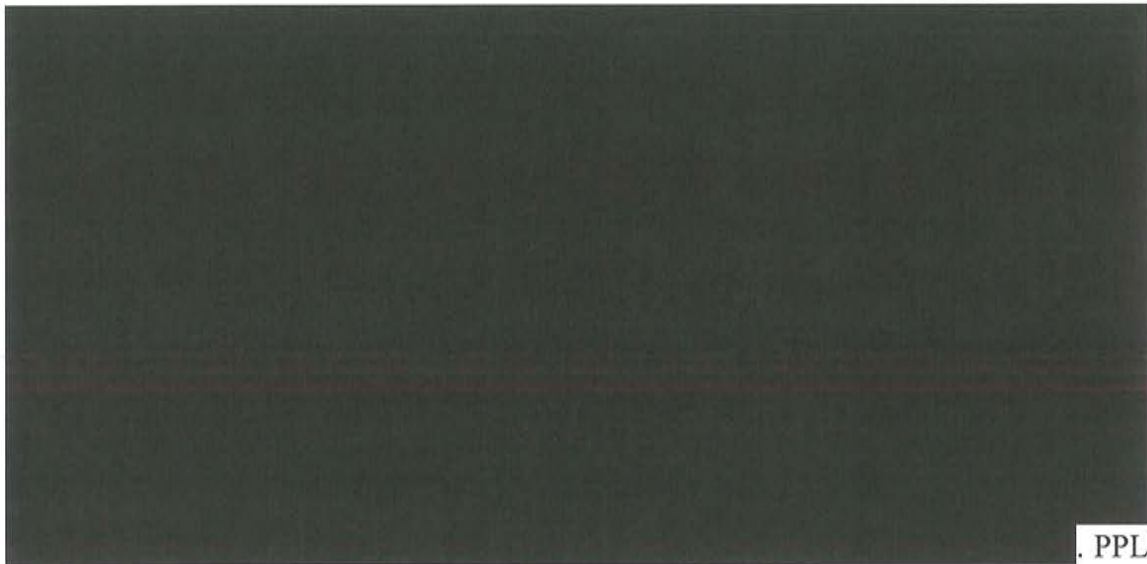
Because of our strong investment-grade credit ratings and ability to finance a wide variety of funding sources, PPL Corporation and PPL EU expect the cost of financing to be extremely competitive.

## **C Proposed Project Constructability Information**

### **C.1 Proposed Solution Scope**

#### ***C.1.1 Project Summary: New Montour – Harwood 230kV transmission line***

PPL EU proposes a new 43-mile 230kV transmission line from the Montour Switchyard to Harwood Substation. The line will be built with design provisions so that it may become a double-circuit (DCT) line in the future, though only one circuit will be added at this time.



PPL EU will be responsible for planning, siting, design, right-of-way acquisition, siting and permitting, construction, operation, and maintenance of the entire project.



Figure C.1.1: Proposed 230kV Transmission Line

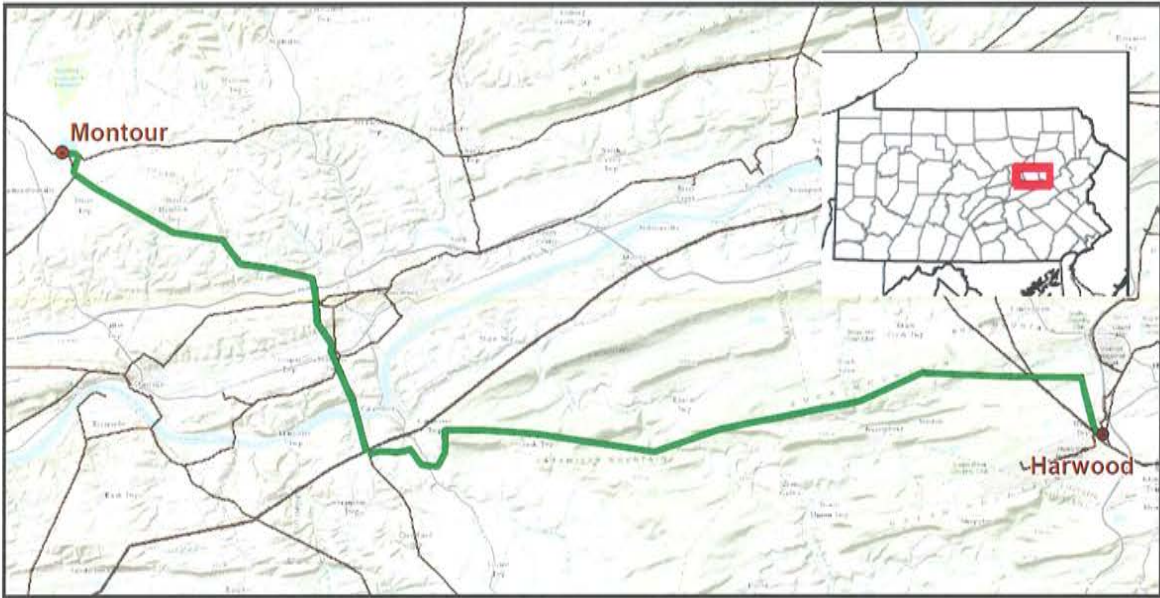
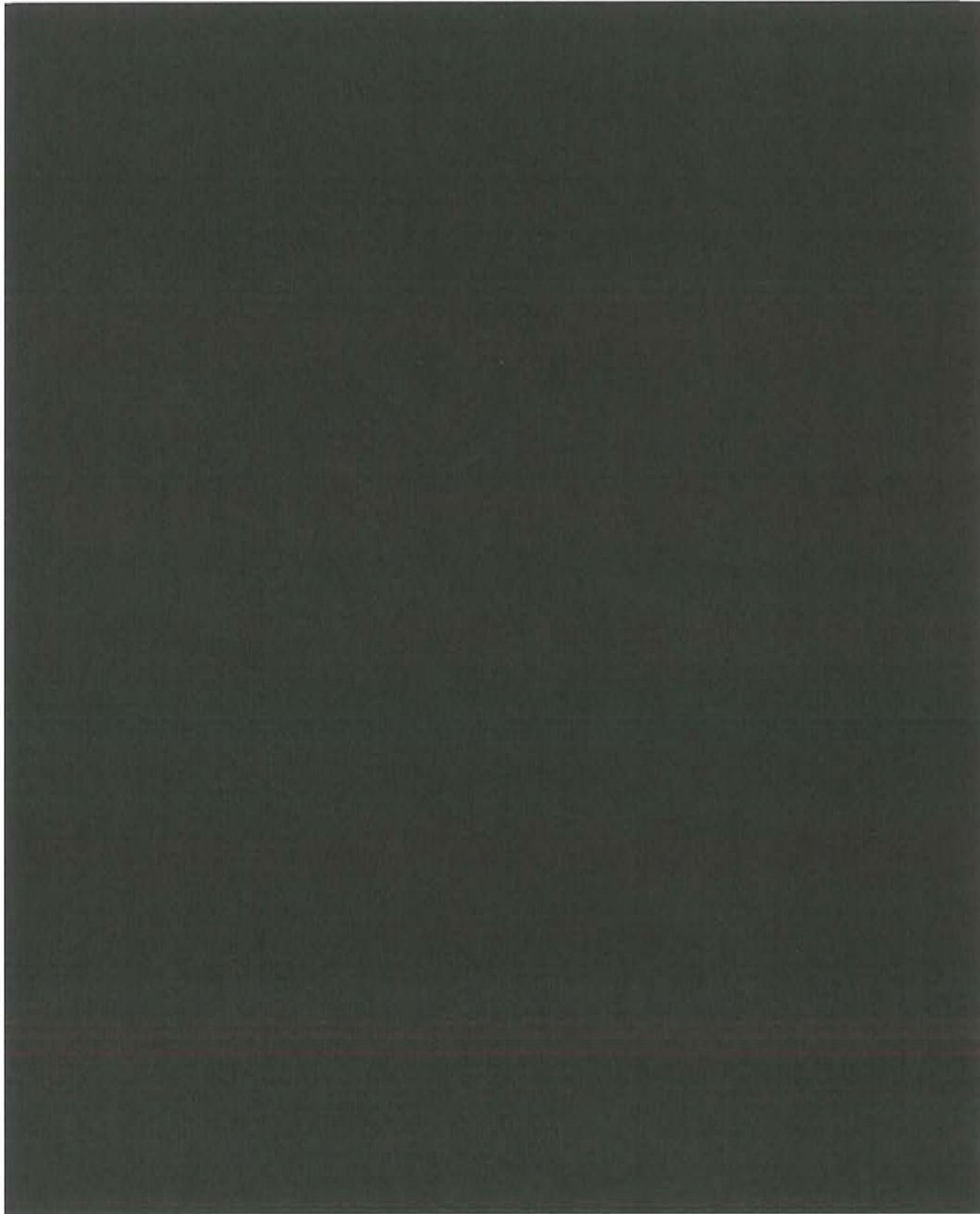


Figure C.1.2 below provides an overall one-line diagram that illustrates the system topology for the proposed solution.

**Figure C.1.2: Solution One-Line Diagram**



**Area Description and Reliability Concerns Being Addressed:**

The PPL EU transmission system in the area of concern consists of 230kV and 500kV networked lines that transmit power across the PPL EU system from generation resources in the west to load pockets in the east. The Montour – Milton – Sunbury 230kV transmission line is one of several 230kV transmission lines that transmit power from Sunbury to Susquehanna. In RTEP study results, PJM has identified that the Montour – Milton – Sunbury 230kV transmission line could load up to as high as 109% of its summer emergency rating for loss of the Montour – Susquehanna 230kV DCT line under certain Generation Deliverability dispatches.

A new Montour to Harwood 230kV line will mitigate this thermal load concern by providing a new parallel transmission path to the DCT line that is the critical contingency. Addition of this project reduces the thermal overload on the existing Montour – Milton – Sunbury 230kV transmission line to approximately [REDACTED] of its summer emergency rating.

**C.1.2 Transmission Line Component(s)**

**Detailed description:**

The new Montour – Harwood 230kV transmission line will consist of overhead double circuit self-supporting steel monopoles utilizing 1590 ACSR conductor stacked in a vertical configuration. [REDACTED]

[REDACTED] This new line will have a 648 MVA normal rating and an 802 MVA emergency rating.

The proposed new transmission line route will maximize use of existing right-of-way [REDACTED]

[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

[Redacted]

[Redacted]

[Redacted]

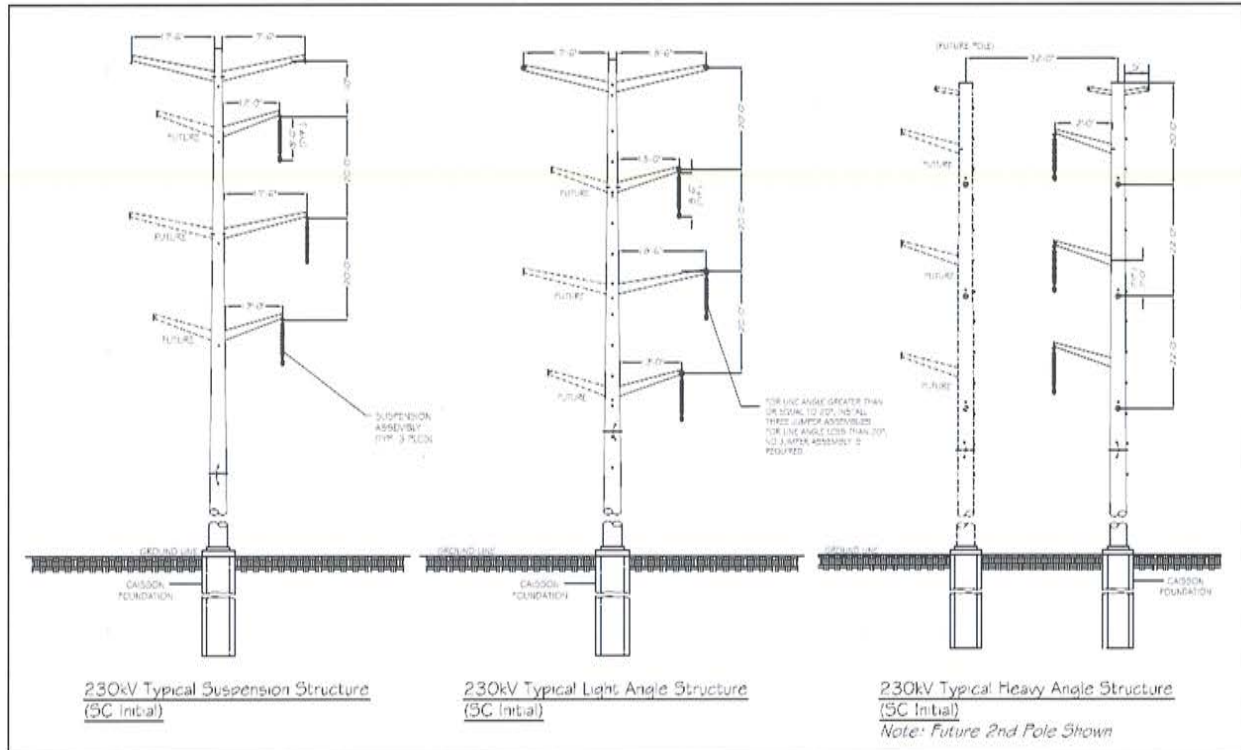
**Preliminary list of materials and Structure Type Drawings**

The transmission line major materials will include the following:

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

The proposed 230kV transmission line will use the following typical structure design:

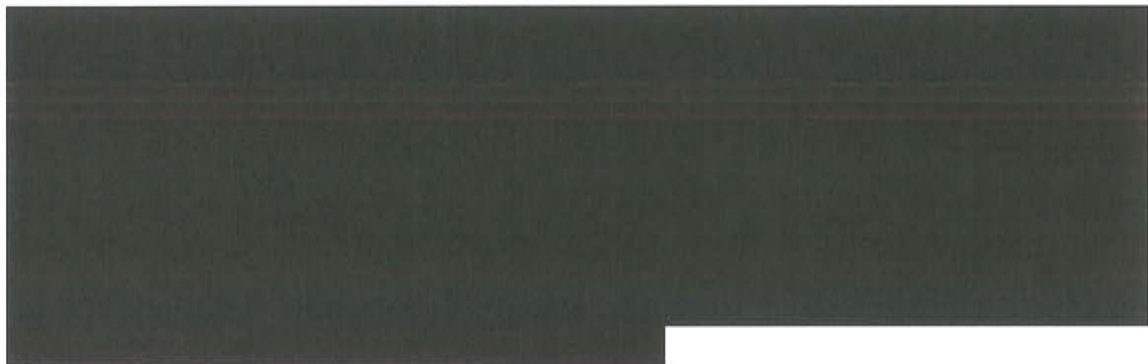
**Figure C.1.3: Typical 230kV Structure Types**



### C.1.3 Substation Component(s)

#### Montour Switchyard Upgrade

##### Detailed description



*Relay and Controls Equipment*

[REDACTED]

*Relay Protection Communication Plan*

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



*Switchyard General Arrangement*

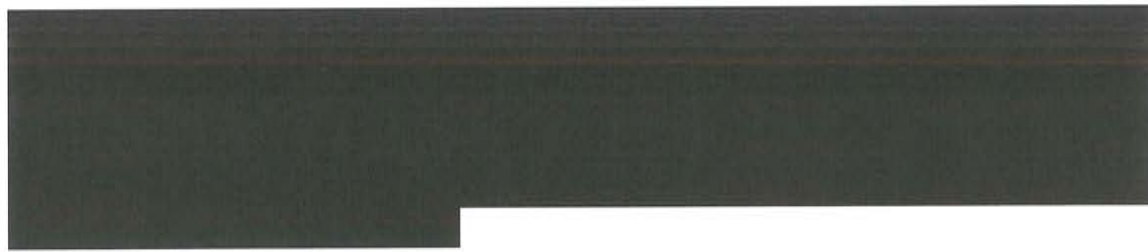


*Preliminary list of materials*

- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]
- [Redacted]

**Harwood Substation Upgrade**

*Detailed Description*



*Relay and Controls Equipment*



[REDACTED]

*Substation General Arrangement*

[REDACTED]

*Preliminary list of materials*

[REDACTED]

***C.1.4 Transmission Facilities to be Constructed by Others***

**Transmission line relocation**

No transmission line relocations will be constructed by others.

**Substation Expansion or Modification**

No substation expansions or modifications will be constructed by others.



## **C.2 Environmental, Permitting and Land Acquisition**

### ***C.2.1 Siting, Permitting and Land Acquisition Overview***

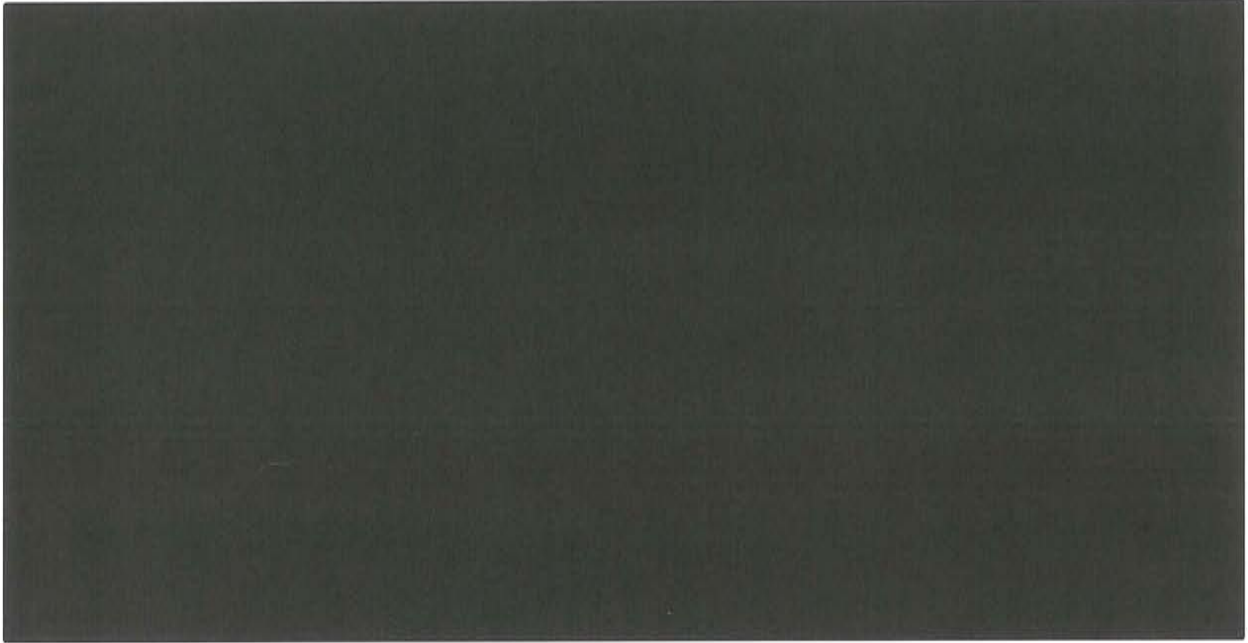
As described in Section B, the Siting, Right-of-Way, and Permitting group has built a strong set of capabilities to support the proposed project. The Siting and Right-of-Way department has established relationships with five external right-of-way contractors and four siting contractors to support the full right-of-way and siting processes. The PPL EU Permitting department has a track record of successfully obtaining the necessary local, state and federal government permits and licenses for proposed transmission projects. PPL EU understands the importance of engaging stakeholders and developing relationships and will engage local consultants as needed to augment the company's existing network of relationships with federal, state, and local stakeholders.

### ***C.2.2 Route Alternative Assessment***

When siting high-voltage transmission lines, a balance is struck between multiple objectives, e.g., low environmental impact, high constructability, low cost. The preliminary review conducted evaluated major opportunities and constraints within the region between and surrounding the Montour and Harwood Substations. This review allows development of general assumptions concerning the costs and methodology required to complete a full alternatives report for a new 230kV transmission line connecting these two substations, [REDACTED]

[REDACTED]

**Figure C.2.1: Alternative Routes considered between Montour and Harwood**

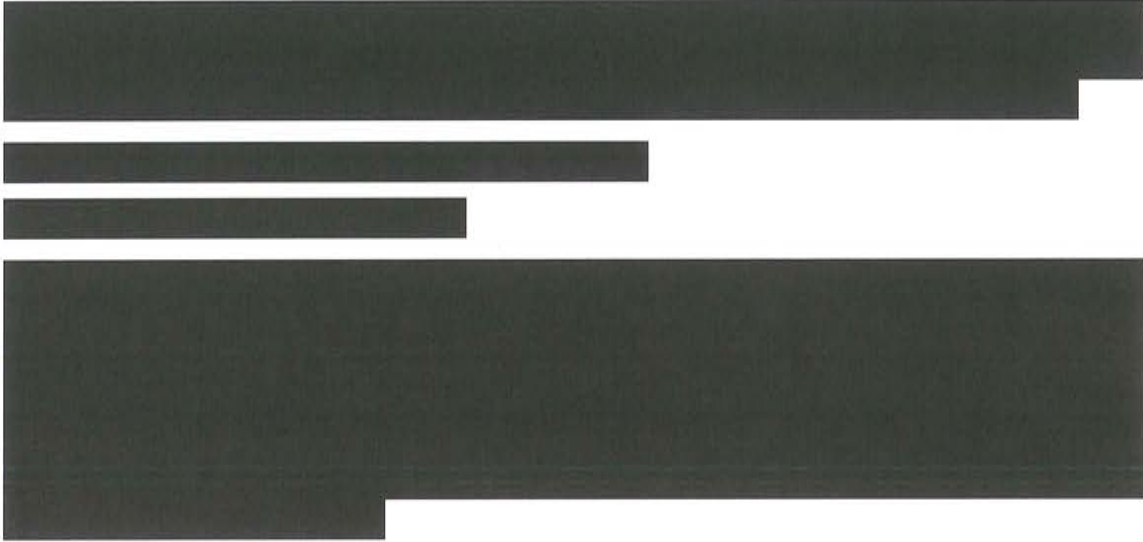


***C.2.3 Environmental Impact Review Methodology and Preliminary Results***

[Redacted text block]

[Redacted text block]

[Redacted text block]



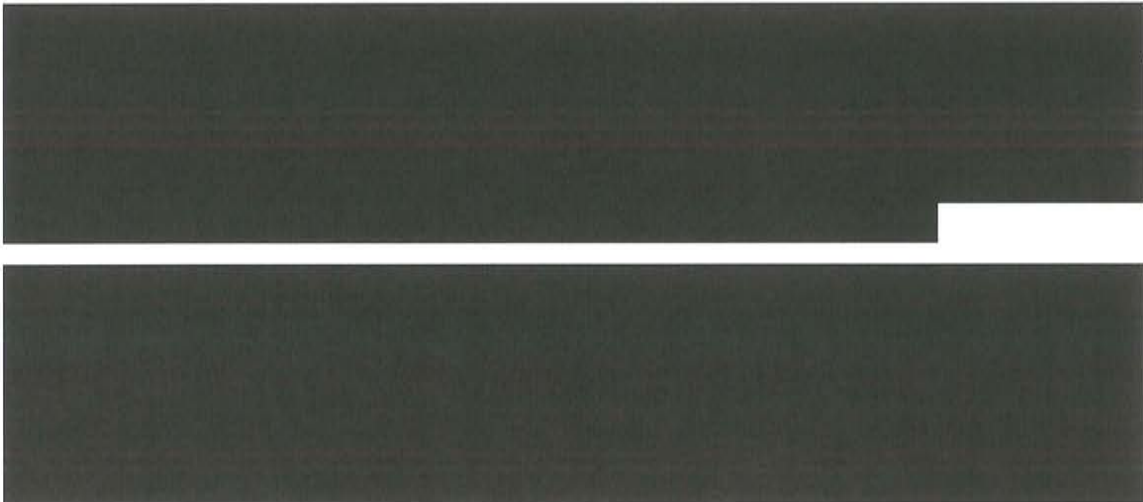
***C.2.4 Right-of-Way & Land Acquisition Plan & Approach (public & private)***

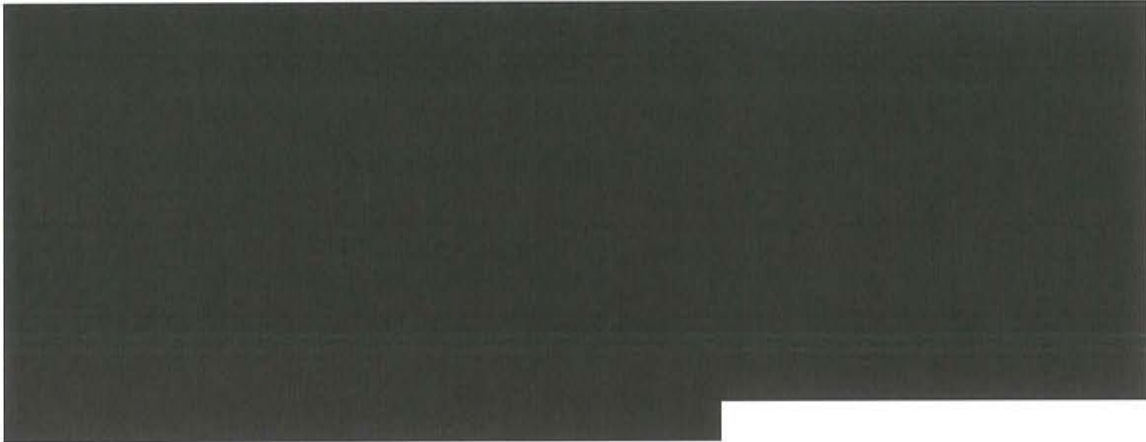
As part of securing the required right of way to accommodate the new transmission line, PPL EU will work with the affected private landowners to acquire permanent irrevocable easements. As indicated in section C2 (Permitting), the project will also be crossing some state land. In this case, PPL EU will work with the affected state agency to obtain licenses to locate required facilities within its land.

PPL EU plans to expand substations within the fence area of the existing substation and therefore the boundary of the current property line, and does not anticipate the need to acquire any additional land.

***C.2.5 Permitting plan and approach***

**Project Configuration Preliminary Review**





**Permitting Support Activities**

*Wetland and Waterway/Stream Delineation*

PPL EU is required to evaluate the project area for the presence of wetlands and streams utilizing the methodology identified in the U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual (1987 Manual) (Environmental Laboratory, 1987), and the newly adopted U.S. Army Corps of Engineers Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont (Version 2.0). The resulting Wetland and Stream Identification and Delineation Report will be submitted as part of the federal or state permitting process

*Threatened and Endangered Species*

The results of the PNDI review will assist in detailing the potential need for additional T&E surveys at the project site. Based on the February 2014 United States Fish and Wildlife Service (USFWS) list of federally listed species, the endangered Indiana bat (*Myotis sodalis*), the proposed-endangered northern long-eared bat (*Myotis septentrionalis*), and the endangered northeastern bulrush (*Scirpus ancistrochaetus*) may be located within the project area. As a new alignment, tree clearing will be necessary for the project and bat surveys will likely be required. If deemed required, PPL EU will coordinate with the USFWS to obtain survey plan approval. Surveys for these two bat species may be conducted simultaneously but will need to be conducted by USFWS approved surveyors. The surveys must also be conducted at a specific time of year (late-spring to early summer).

With the presence of several National Wetland Inventory emergent wetlands in the project area, botanical studies for the northeastern bulrush are also considered likely. The

permitting plan will include coordination with the USFWS to determine if impacts to this plant species can be avoided through modifications in the work procedures. There is also a timing consideration to this study as the plant can only be positively identified at specific times of the year (summer).

A review of Pennsylvania Natural Heritage Program's Species List (January 2014) indicates that there are over 400 T&E plant and animal species listed in the state. PPL EU will coordinate with the Pennsylvania Department of Conservation and Natural Resources (DCNR), the Pennsylvania Fish and Boat Commission (PFBC), and the Pennsylvania Game Commission (PGC) to determine the need to conduct species-specific surveys. Modifications in construction practices and seasonal restrictions could minimize the need for potential presence/absence surveys. Additional T&E studies for building the new 230kV transmission line between the Montour and Sunbury Substations are anticipated and include state-listed bat species (e.g., Northern Myotis (*Myotis septentrionalis*), timber rattlesnake (*Crotalus horridus*), and various plant surveys. The state-listed bat studies may be conducted simultaneously with the federal-listed species.

#### *Cultural Resources Phase I*

Building a new 230kV transmission line will involve extensive earth disturbance to create new access roads and install the new poles. Due to these impacts, PPL EU will likely be required by the Pennsylvania Historic and Museum Commission (PHMC) to conduct a Phase I Archaeological Survey of these areas. The Phase I archaeological field reconnaissance will involve both visual pedestrian inspection of the ground surface and set-interval (15-meter, or 50-foot) shovel-testing within the limits of ground disturbance, in accordance with PHMC guidelines. Any archaeological resources identified by the archaeological field reconnaissance will be submitted to the PHMC for inventory, and preliminarily assessed for National Registry of Historic Places (NRHP) eligibility. This evaluation may also include geomorphological investigations as the project will involve new crossings of the West Branch and North Branch Susquehanna River. PHMC may also require that architectural history evaluations be conducted as the project involves a new alignment through areas that may contain existing historic structures.

#### *Migratory Birds*

Based on review of the project, significant forested areas are present that will be impacted by the proposed project. The potential for bird species protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act appears relevant especially given that the alignment will need to span the North Branch Susquehanna River, which is known migratory corridors and home to raptors including the bald eagle (*Haliaeetus leucocephalus*). PPL EU will need to coordinate with the USFWS regarding birds protected under MBTA and may need to submit a project-specific Avian Protection Plan.

### *Public Lands*

The project will result in moderate impacts to State Game Lands (SGL 58) but will avoid impacts to other public lands (e.g., State Parks and State Forests). PPL EU will need to coordinate with PGC for a license to traverse these lands. PPL EU can review the Public Areas Database of the United States (PADUS) to identify areas of concern as they pertain to other public lands, such as open space or private conserved lands. Additional information on potential public lands in the area will be identified during the permitting process.

### **State Permitting**

**Pennsylvania Department of Environmental Protection (PADEP) Chapter 105 Water Obstructions and Encroachments Permits:** PPL EU will coordinate with PADEP to determine the level of state permitting required for the project. According to Chapter 105 (Dam Safety and Waterway Management), Title 25 (Environmental Protection) of the Pennsylvania Code (25 Pa. Code §105), a permit is needed for all activities along or across, or projecting into a watercourse, floodway or body of water (including wetlands), whether temporary or permanent, including aerial crossings. As defined in Chapter 105, PADEP provides for a series of Waivers and General Permits (GP) that address projects that involve no (waivers) or minimal (general permits) impacts to regulated streams and wetlands. Due to the anticipated level of stream or wetland impacts associated with the construction of new 43-mile long right-of-way, use of the PADEP GPs is unlikely. For this project, PPL EU will need to submit a Joint Permit Application (JPA) to PADEP that may involve USACE review. The JPA is discussed below under the Federal Permits and Coordination section.

For this project, earth disturbance activities will occur where new access roads and poles will be installed. As total earth disturbance is anticipated to be greater than one acre, an approved E&S Control Plan and a National Pollutant Discharge Elimination System (NPDES) permit are anticipated to be required. The process involves review of the E&S Control Plans by the local CCDs and PADEP with the NPDES permit being issued by PADEP after approval of the plans. Note that one CCD may assume the role of lead reviewer but the other CCDs will review the alignments within their county boundaries. As the project is not located in any High Quality (HQ) or Exceptional Value (EV) watersheds, it is anticipated that an Application for General NPDES Permit for Stormwater Discharges Associated with Construction Activities would need to be prepared for the project. It is also anticipated that the limits of disturbance (LOD) will be greater than ten acres, which will require consultation with the PHMC to address the potential for cultural resources within the anticipated LOD.

**Pennsylvania Department of Transportation (PennDOT) Permits:** As portions of the project parallel existing transmission line right-of-way, PPL EU will coordinate with

PennDOT to determine the existence and status of permits for temporary and permanent construction entrances at these locations. For other portions of the proposed transmission line, PPL EU will identify potential access road or utility line crossing locations and collect the appropriate information required by PennDOT to permit the new location. These permits may include:

- Highway Occupancy Permit (HOP) - Utility Crossing: There are several locations where the utility line will span over a state highway, which will require acquisition of a PennDOT Highway Occupancy Permit (HOP).
- HOP - Minimum Use Driveway (MUD) Permits: PennDOT Minimum Use Driveway (MUD) Permits will be required for any construction access roads that connect onto a state road.

### **Federal Permitting**

**United States Army Corps of Engineers (USACE) – Section 404 Clean Water Act/Section 10 Rivers and Harbors Act:** PPL EU will coordinate with the USACE to determine the level of federal permitting required for the project. The USACE has jurisdiction over temporary or permanent project activities that place fill materials into waters of the United States, including wetlands. These impacts to wetlands and streams trigger permitting requirements under Section 404 of the Clean Water Act. Similarly, construction within or crossing a navigable waterway requires a Section 10 permit, as defined by the Rivers and Harbors Act.

In Pennsylvania, the federal permit process is typically covered under the Pennsylvania State Programmatic General Permit (PASPGP-4) process. Due to the anticipated permanent and temporary resource impacts associated with the proposed project, PPL EU will likely need to submit a JPA to PADEP, who will then coordinate with the USACE to determine how the project should be classified based on the following three categories:

- Category I - these activities have minimal impacts to natural resources and are associated with the Waivers and General Permits offered by PADEP. Category I projects involve submission of a GP registration package to PADEP and do not involve a JPA. These activities also do not require USACE notification and PADEP can issue the federal permit (PASPGP-4) on behalf of the USACE.
- Category II - these activities result in direct or indirect impacts to 1.0 acre (cumulation of temporary and permanent impacts) or less of waters of the United States, including wetlands or 250 linear feet or less of streams, watercourses, or open waters. For linear projects, the sum of all impacts for all crossings of waters and/or wetlands associated with the overall linear project is used for these calculations. Category II projects involve the submission of a JPA. A PASPGP-4 may be issued by

PADEP after an opportunity for review by the USACE and the general public through the publication of the project activities in the Pennsylvania Bulletin.

- Category III – these activities exceed the limitations of the Category II impact thresholds to wetlands (over 1.0 acre) or streams (over 250 linear feet). Other factors that may elevate the project to Category III include potential conflicts with federally listed species as identified during the Pennsylvania Natural Diversity Inventory (PNDI) review process or that may adversely affect cultural resources that are listed or are eligible for listing in the National Register of Historic Places pursuant to the requirements of Section 106 of the National Historic Preservation Act. This includes projects where the Pennsylvania Historical and Museum Commission (PHMC) have determined that archaeological or other cultural resources are believed to exist within the permit area. Category III projects involve the submission of a JPA. Depending on the review by USACE, PADEP may issue the PASPGP-4 or the project may require another type of federal authorization.

The project will be located predominantly within the boundaries of the Baltimore District of the USACE. This distinction is made because there are differences between the districts as to how they view the use of timber matting for wetland crossings. The Philadelphia District does not view this activity as a disturbance, whereas the Baltimore District views it as a temporary impact. Temporary wetland impacts are used to assess the cumulative impact of the project and may elevate the area of wetland impacts to be reviewed.

Note also that the development of a JPA package is a major project schedule concern. The JPA process has a significantly longer planning and preparation time, requires development of more detailed design information, and typically involves additional evaluations, such as Hydraulics and Hydrology (H&H) Assessments and Environmental Assessments (EA). Development of the JPA document typically takes 6 months and review by PADEP and the USACE may take an additional 9-12 months.

Based on the anticipated level of impacts, it is presumed that the JPA package will be classified as a Category II project. In this case, the PASPGP-4 could be issued under the delegated authority of PADEP. The PASPGP-4 would also provide USACE authority to conduct permitted work in or over rivers regulated under Section 10, which would include both the West Branch and North Branch Susquehanna River. Furthermore, depending on the extent of resource impacts, mitigation may be expected as part of the project. Note also that a Section 401 Water Quality Certification will be issued in conjunction with the PADEP permits.

**Federal Aviation Administration (FAA) – Obstruction Determination:** As the project involves the installation of new poles, PPL EU will need to coordinate with the FAA regarding potential obstruction to air travel, which will involve completing online

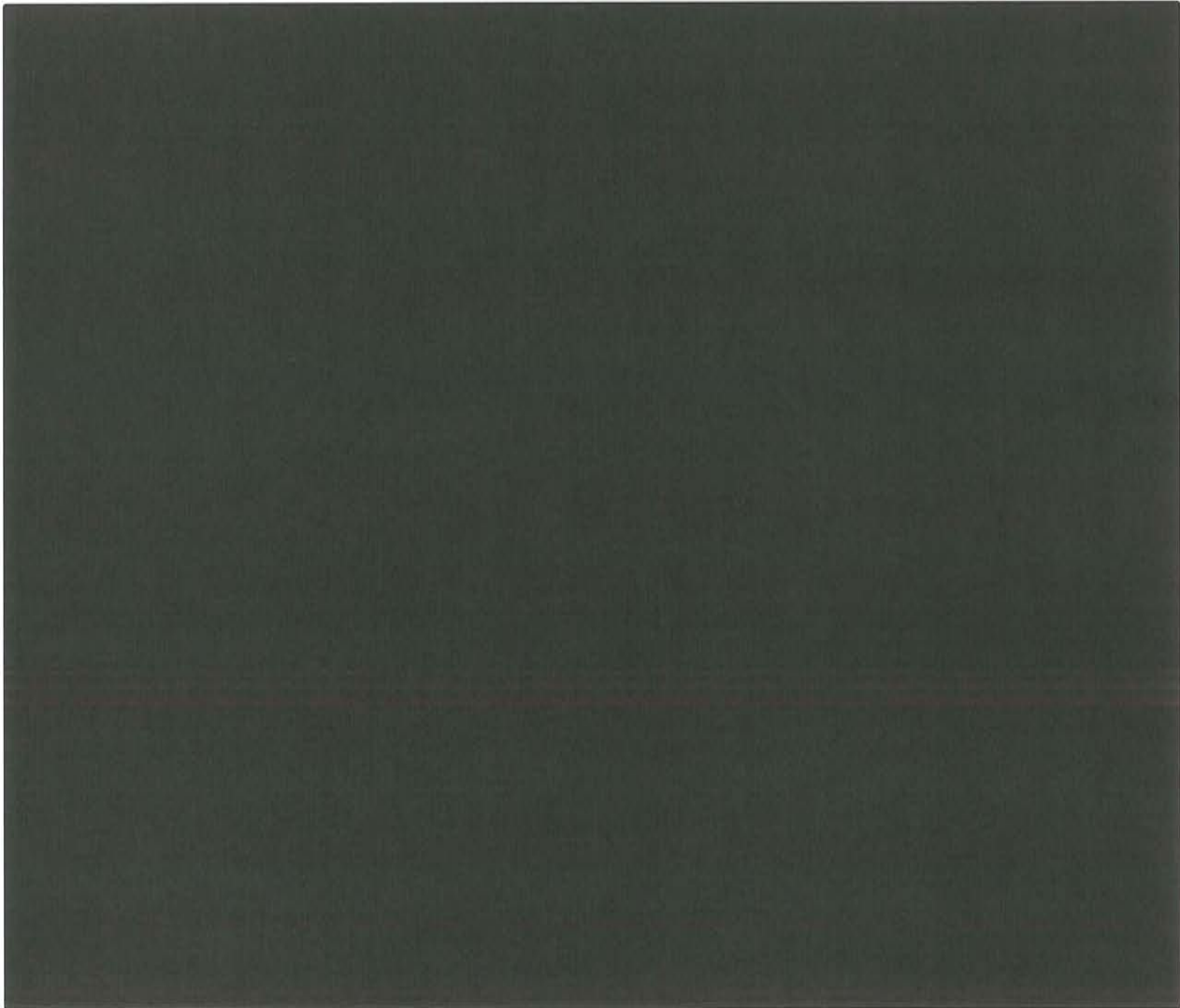


forms available on the FAA's Notice Criteria Tool website. This tool allows input of heights, elevations, and location of proposed structures to solicit the need to further coordinate with FAA.

**Project Permitting Summary**

The permits that may be required by environmental regulatory agencies on the federal, state, and county level for the proposed construction of the new Montour to Harwood 230kV transmission line is listed in Figure C.2.2 below. It should be noted that building permits for utility corridors are often exempted by local municipalities. Local building permits requirements from specific municipalities will be reviewed when the project moves to its development phase.

**Figure C.2.2: Potential Environmental Permits**



Permitting of transmission line corridors is a complex process with many involved parties. Because of the potential complexity of the proposed project, it is difficult to quantify all the specific risks associated with the environmental permitting process. Some of the potential risks which will need to be addressed during the project development phase include:

[REDACTED]

**C.2.6 Public Opposition Review**

Public opposition to the initial 15-miles extending from the Montour Substation would be subject to moderate public opposition. PPL EU maintains future-use easements along this section, but several landowners have developed within these eased areas and conflicts in these areas are anticipated.

[REDACTED]

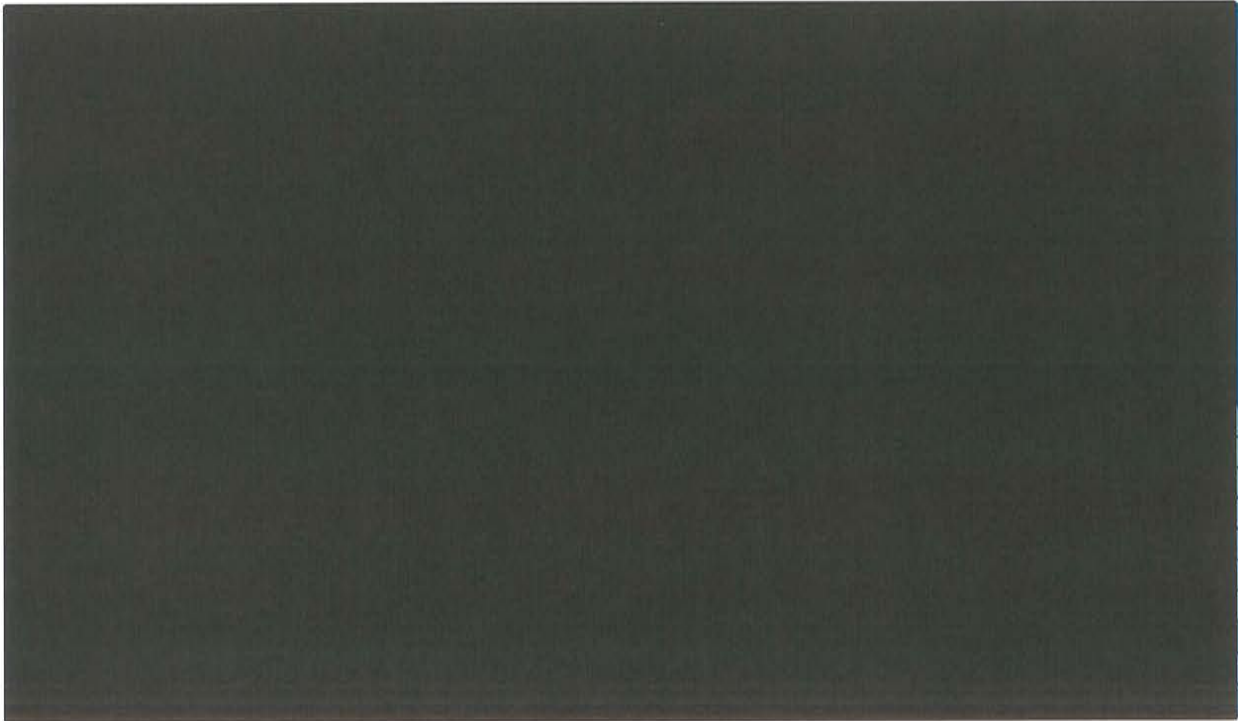
[REDACTED]



### C.3 Project Component Cost Estimates

The estimated total project cost is \$164.2M and should be interpreted as a budget estimate. The bottom up development and top down verification provides an [redacted] confidence level in the project estimate, based on the baseline scope of work and assumptions.

**Figure C.3.1: Summary of Estimated Project Costs**



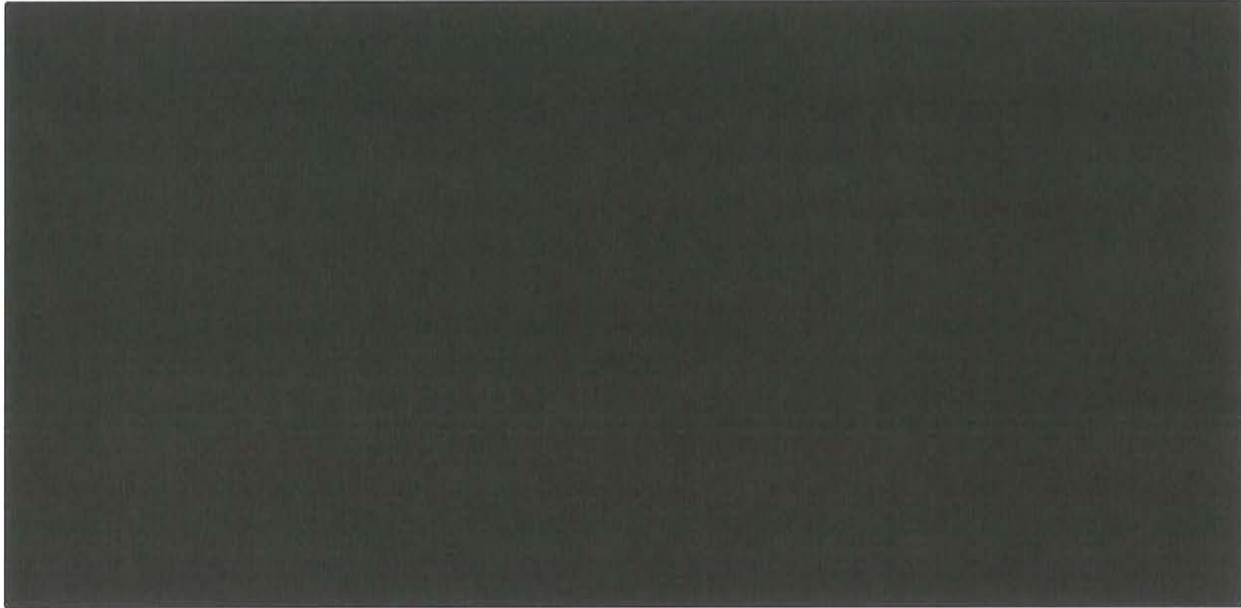
*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

#### **C.3.1 Engineering and Design Costs**

In order to support the proposed project, engineering will request survey and core borings. These two elements, in addition to the labor required to support the design, will represent the majority of project costs for the proposed project are presented in Figure C.3.2 below.

**Figure C.3.2: Summary of Estimated Engineering Costs**



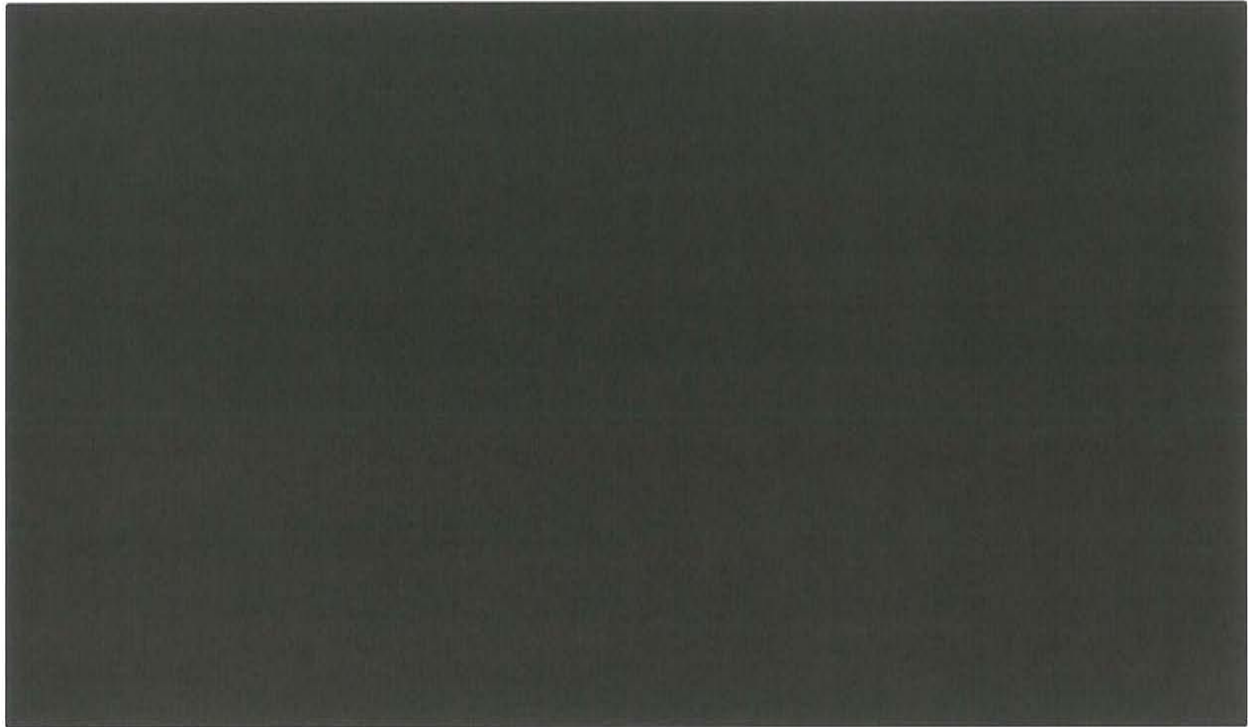
*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

### ***C.3.2 Material and Equipment Costs***

Material and equipment cost estimates are based on quantity take-offs for both the transmission and substation scope of work. The pricing for these materials are based on average cost from suppliers utilized in previous PPL EU projects. Material and equipment costs for the proposed project are presented in Figure C.3.3 below.

### Figure C.3.3: Summary of Material and Equipment Costs



*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

### ***C.3.3 Construction and Commissioning Costs***

Transmission line construction cost estimates are based on quantity take-offs developed from past experience benchmarking of number of structures per mile multipliers for initial estimation, assuming standard construction designs and construction methods. The transmission line elements include

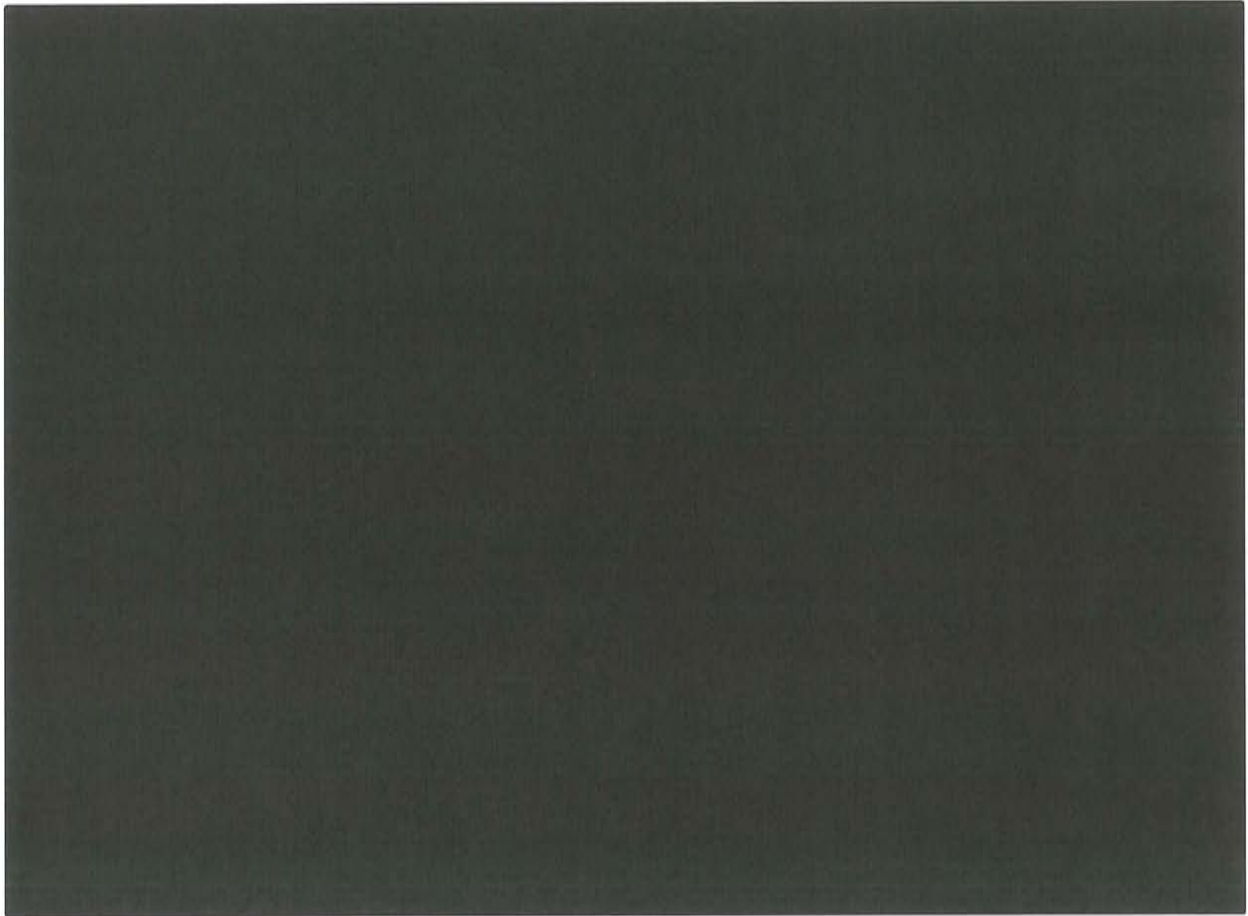
- Below Grade Line Construction: *Foundations for the steel structures including rebar and anchor bolts*
- Transmission Line Structures : *Erection of the steel structures with associated insulators and conductor attachments*
- Conductor Installation: *Stringing, Clipping and sagging the conductor*
- Fiber Optic Installation: *Stringing, sagging and installation of splice cans*
- Access and Crane Pads
- Mobilization, Demobilization and Contractor Setup

PPL EU estimates that the construction cost for the proposed [REDACTED] to Harwood - Single circuit 230kV transmission line would be [REDACTED]. Substation cost estimates are also based on past experience for similar type of equipment based on anticipated construction take-off commensurable of the current level of definition for the project. Substation construction costs include:

- Substation Steel Structure Construction: *Steel structures assemblies*
- High Voltage Equipment Construction: *Installation of the major substation elements including but not limited to power transformers, breakers, switches..*
- Bus Materials: *Installation of bus related materials including but not limited to bus, insulators, connectors, tap...*
- Conduit: *Installation of conduits in the substation yard*
- Control House: *Installation and dress up of the control house*
- Oil Containment Pit
- Testing and Commissioning
- Mobilization, Demobilization and Contractor Setup

PPL EU estimates that the construction cost for the substation portion of the project would be [REDACTED] for construction and commissioning costs. Construction and commissioning costs for the proposed project are presented in Figure C.3.4 below.

**Figure C.3.4: Summary of Construction and Commissioning Costs**



*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

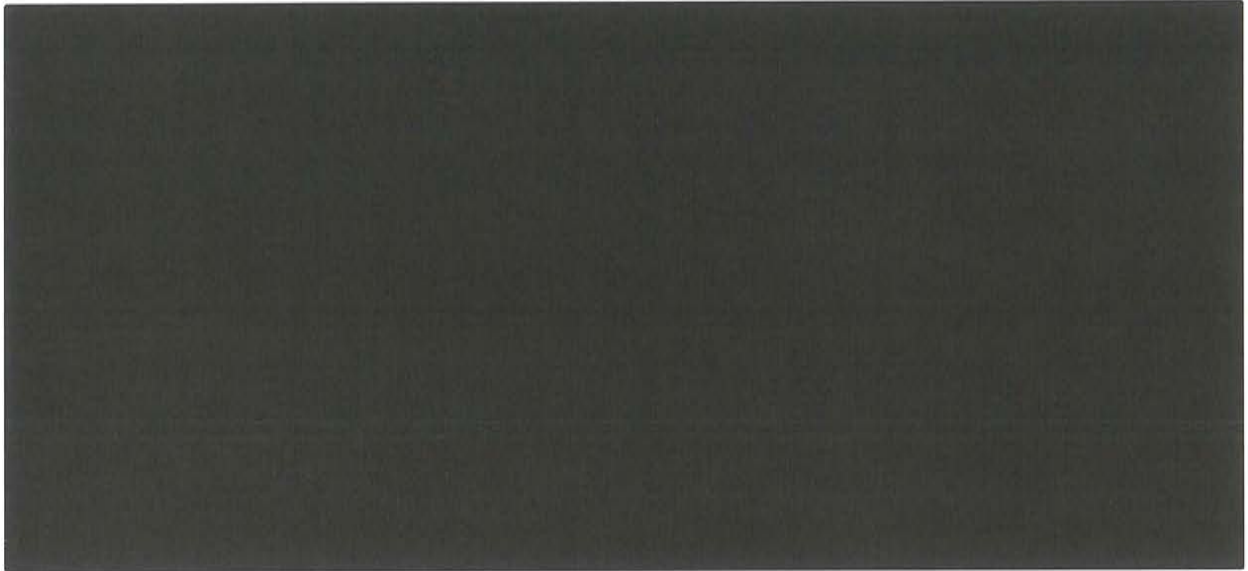
### ***C.3.4 Right-of-Way and Land Procurement Costs***

PPL EU conducted a desktop cost analysis for the proposed Montour to Hardwood 230kV transmission line regarding the right-of-way and land procurement costs:

- Labor to Secure the Land Rights: *Survey Permissions, Title, Acquisition, Non-Env. Permitting, Const. Monitoring & Restoration, Access Roads, Recording, Field Office*
- Land Costs to Secure Easements: *Easement Costs for Right-of-Way, Damages for Crops, Access Roads, Staging Yards and Misc. & Temporary Workspace Agreements*

Figure C.3.5 outlines the estimated right-of-way and land procurement costs for the proposed project.

**Figure C.3.5: Summary of Estimated Right-of-Way and Land Procurement Costs**



*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

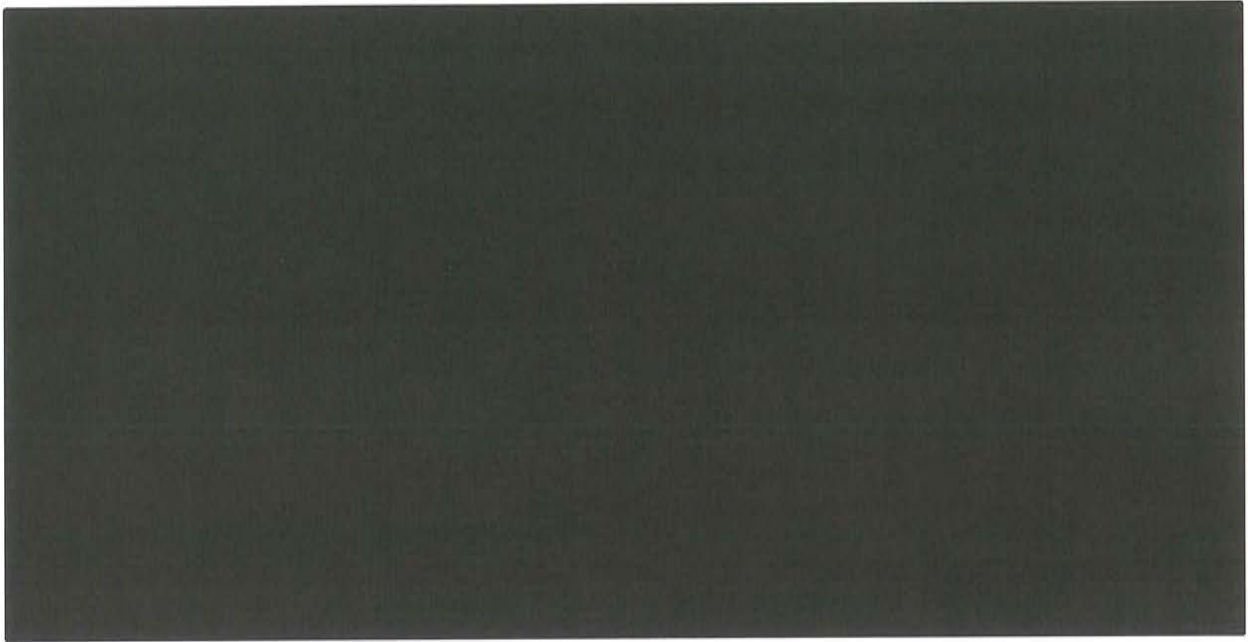
***C.3.5 Siting and Permitting Costs***

PPL EU conducted a desktop cost analysis for the proposed Montour to Harwood 230kV transmission line's siting and permitting costs including: Environmental Permitting, Non Environmental Permits, Siting (Public Outreach, Open House), Legal Costs and Lidar.

Figure C.3.6, outlines the permitting costs for the proposed project



**Figure C.3.6: Summary of Right-of-Way, Siting and Permitting Costs**



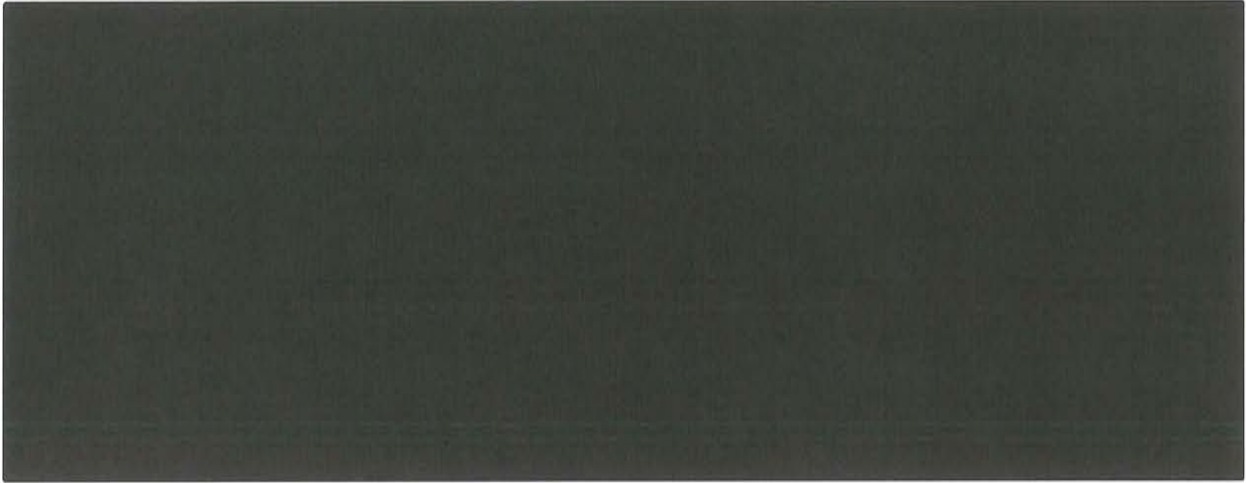
*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

### ***C.3.6 Construction Management Costs***

PPL EU conducted a desktop cost analysis for the proposed Montour to Harwood 230kV transmission line. Figure C.3.7 outlines the construction management estimated costs for the proposed project.

**Figure C.3.7: Summary of Construction Management Costs**



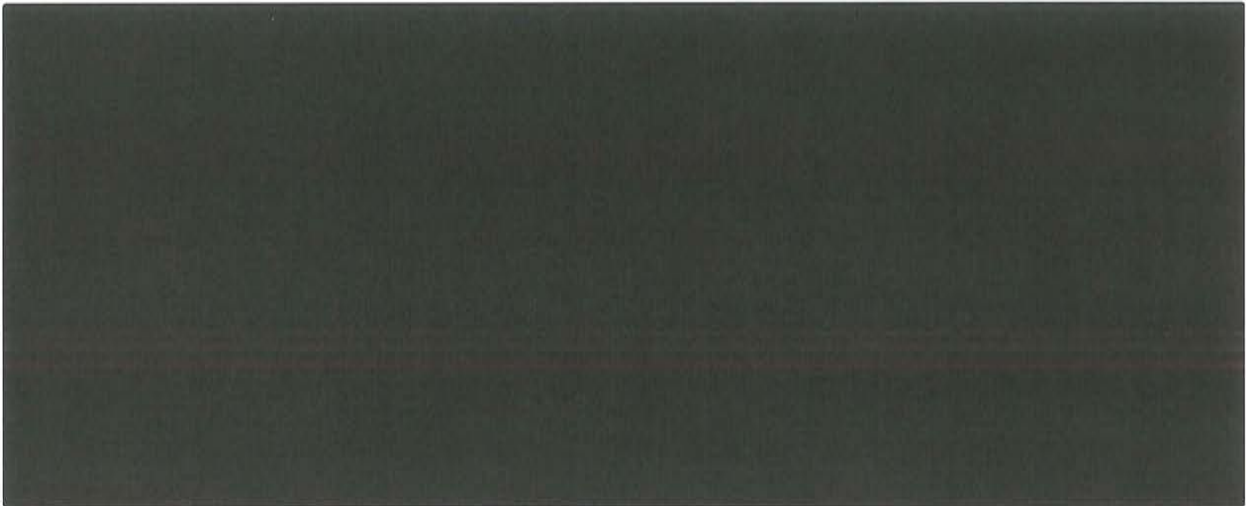
*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

### **C.3.7 Other Costs**

The project includes A&G and Allowable Funds Used During Construction (AFUDC) at a rate of ■ for each year to account for the cost to borrow capital. Figure C.3.8 outlines the additional costs adder for the proposed project for these categories.

**Figure C.3.8: Summary of Other Costs Adders**



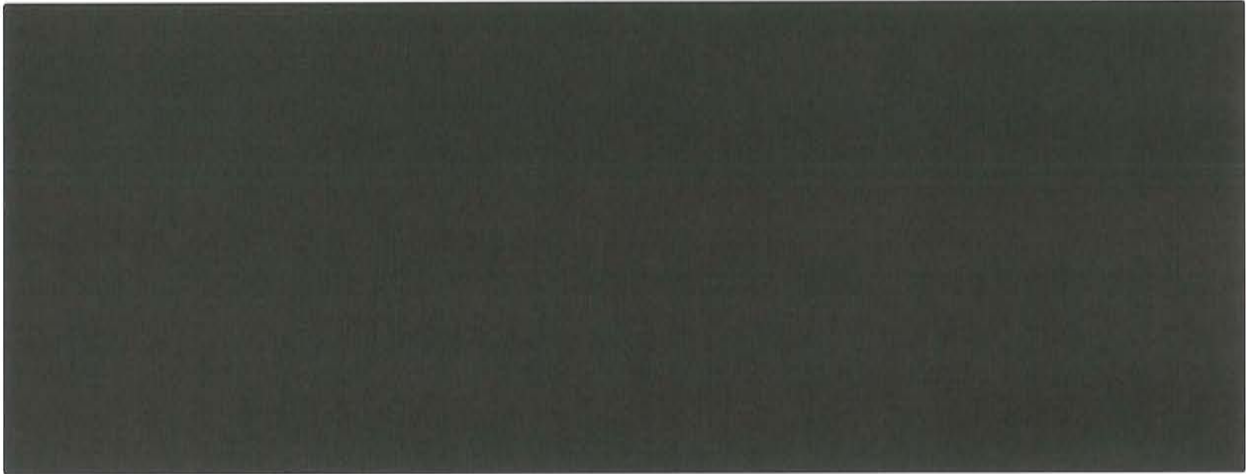
*Note 1: Cost in \$ Millions*

*Note 2: Numbers may not sum due to rounding*

### C.3.8 Contingency

As mentioned earlier in this section, PPL EU has developed a budget level estimate. As such, PPL EU recommends that a contingency be applied to cost estimates to account for the unforeseen costs required to support construction activities. Figure C.3.9 below presents the contingency costs for the proposed project.

**Figure C.3.9: Summary of Contingency**



*Note 1: Cost in \$ Millions*

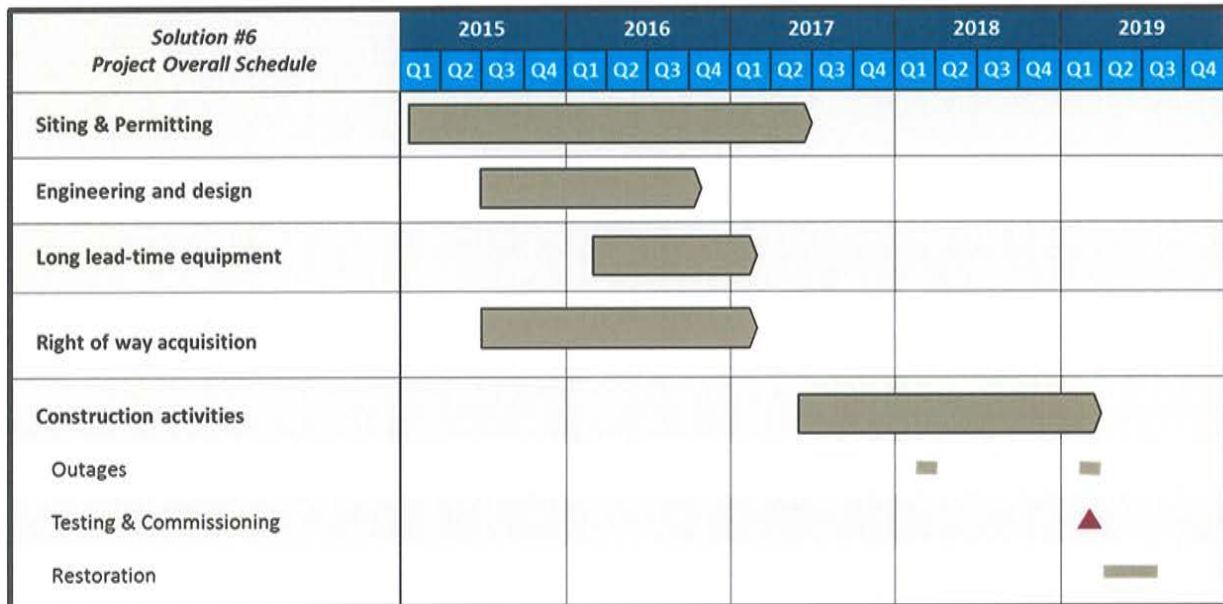
*Note 2: Numbers may not sum due to rounding*

## C.4 Schedule

### C.4.1 Overall Project Schedule

A 5-year project schedule is required for the proposed project: 29 months for planning & design, Right-of-Way, siting, & permitting activities and long lead time procurement, and another 21 months for construction and commissioning (with some overlap). An integrated project schedule is provided in Figure C.4.1.

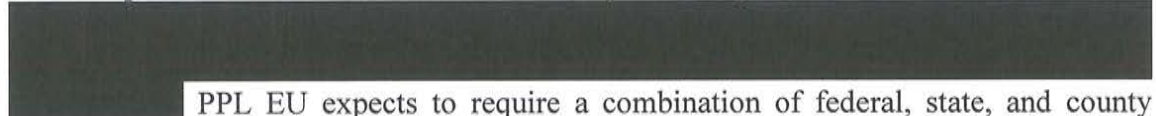
**Figure C.4.1: Montour to Harwood 230kV Single Circuit Integrated Schedule**



Successful completion of the Montour to Harwood Single Circuit 230kV transmission line addition will require coordination between engineering, Right-of-Way / land acquisition, long-lead time equipment procurement, CPCN / permitting, and construction activities.

### Permitting Requirements

This schedule is based on a preliminary understanding of the topographical and ownership variances in the area. Based on the preliminary assessment and route, the area



PPL EU expects to require a combination of federal, state, and county permits.

## Site Acquisition and/or Right-of-Way Acquisition

Based on an initial review of the proposed project routing, there will be a 13-months right-of-way schedule with an estimated 29 months schedule for Siting & Permitting. PPL EU conducted a preliminary review of the transmission line siting considerations in order to develop a high level schedule estimate.

## Engineering and Design

The proposed solution would require an estimated 17 months of Engineering. Key activities include identifying pole locations, conducting core borings, finalizing steel pole orders, designing the foundation, and finally, completing the engineering release.

Engineering activities will span a variety of disciplines:

- Surveying: *Site selection and physical arrangement utilizing aerial (LiDAR) surveys*
- Civil: *Foundation, ground grid design, water and water retention designs*
- Environmental: *Environmental effects, access road design, spill response, SPCC plans in close conjunction with the Right-of-Way/Siting/Permitting team*
- Geo-Technical: *Soil investigation and earth resistivity*
- Structural: *Structural loading, component and hardware analysis including equipment standards, procurement, factory acceptance testing, equipment ratings, insulation ratings*
- Mechanical: *Conductor Sag/Tension design*
- Electrical: *Grounding, clearances analysis, insulation design, lightning performance*
- Telecommunication: *Fiber optics design (OPGW)*

## Long Lead Time Equipment

PPL EU expects the construction phase to last 18 months with several key long lead items requiring upfront procurement activities. Site clearing, preparation and delivery as well as site restoration, crop damage, and landscape work are performed in coordination with the Right-of-Way team.

The proposed project design requires several long lead time materials to be delivered prior to the construction phase. Average lead times range from 12 – 30 weeks for transmission line materials and 12 weeks to a year for substation equipment. The typical long lead time materials include 1590 kcmil ACSR, 0.752 OPGW, steel structures for transmission line construction and Breakers, Switches, Transformers, Steel for substation work.

**Construction activities, Outage plan to support construction and energization, Testing and commissioning**

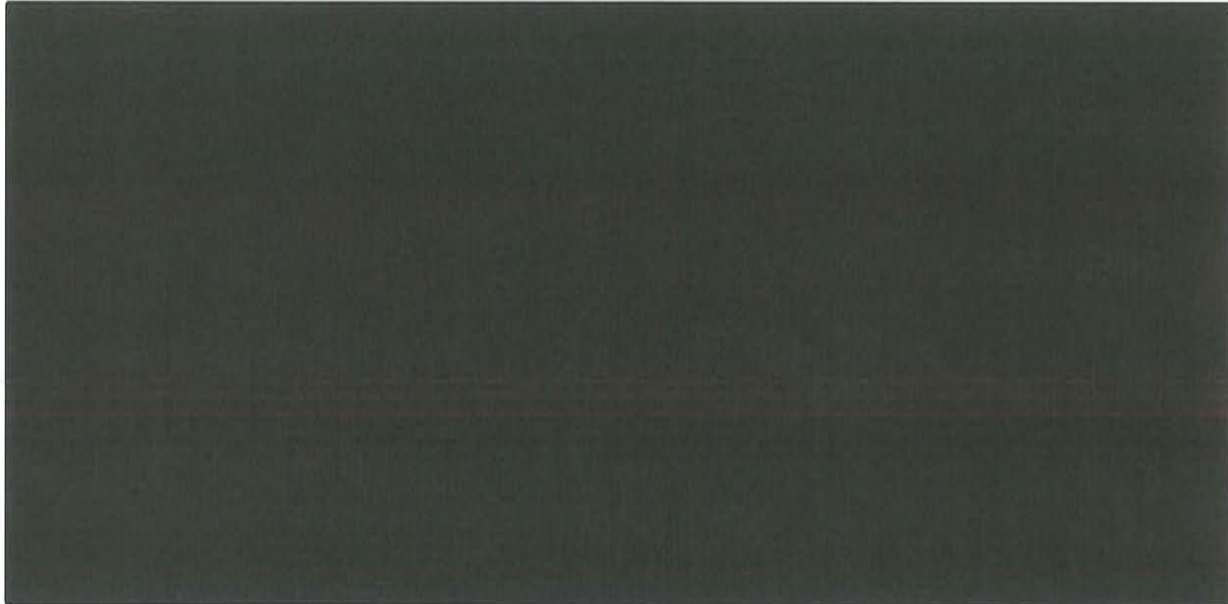
The substation and transmission line schedule includes standard construction activities:

- Site Clearing/Prep/Delivery: *Clearing / grubbing preparation, access road completion, site delivery*
- Mechanical: *Site pad construction, mechanical work foundation, below grade work, conduit, ground grid*
- Electrical: *Pole and conductor construction, conductor/device removal, pole testing for ground resistance, structure removal, communication, splicing & testing, substation equipment installation, testing and commissioning*
- Demobilization: *Site restoration, crop damage, landscaping*

**C.4.2 Montour Substation Schedule**

The Montour substation expansion will be developed constructed and commissioned as described in the schedule below:

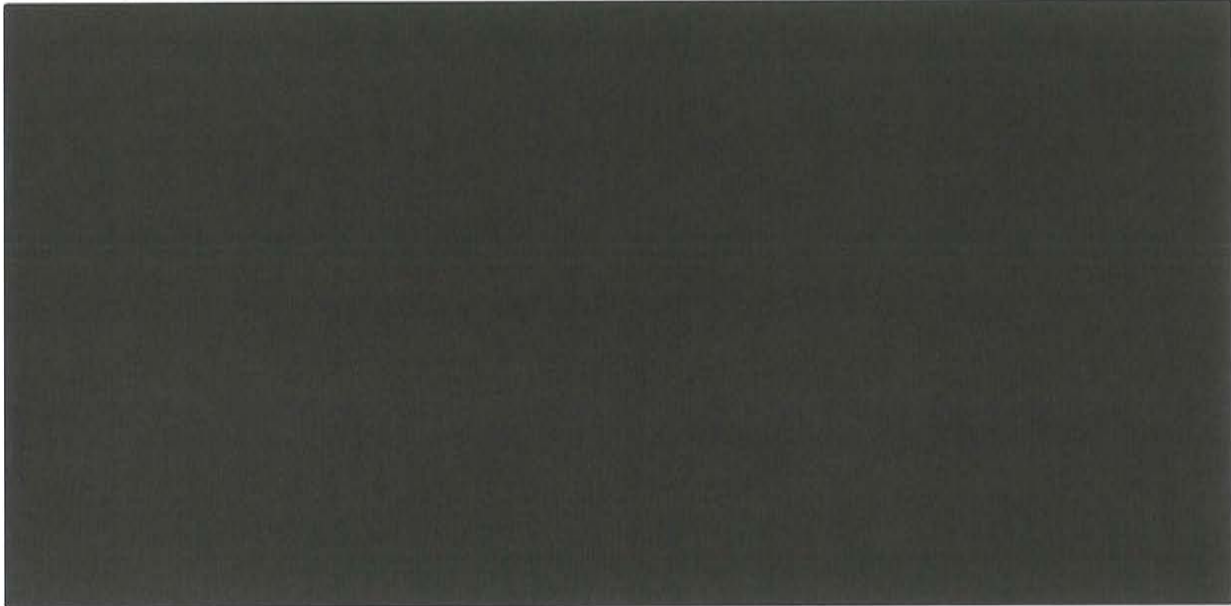
**Figure C.4.2: Montour Substation Schedule**



### ***C.4.3 Montour to Harwood 230kV Transmission Line Addition Schedule***

The 230kV transmission line addition will be developed constructed and commissioned as described in the schedule below:

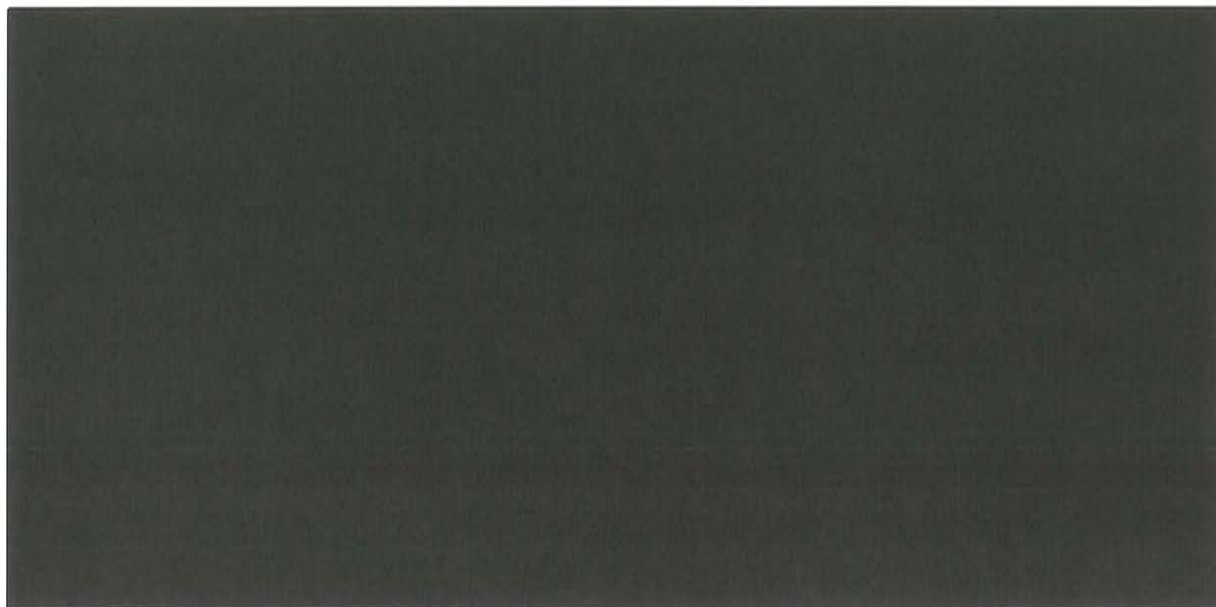
**Figure C.4.3: Montour to Harwood Transmission Line Development Schedule**



### ***C.4.4 Harwood Substation Schedule***

The Harwood substation expansion will be developed constructed and commissioned as described in the schedule below:

**Figure C.4.4: Harwood Substation Schedule**



## **C.5 On-going Transmission Facility Items**

### ***C.5.1 Operations Plan***

#### **Operations Plan Overview**

These facilities will be operated by PPL EU at the direction of PJM and controlled and maintained by PPL EU consistent with the current operations and maintenance practices used by PPL EU. PPL EU's Transmission Control Center (TCC) is tasked with the responsibility of monitoring and operating a reliable transmission grid as defined by PJM, RFC and NERC.

#### **Transmission Control Center**

In order to operate and maintain the transmission grid reliably, PPL EU manages a Transmission Control Center (TCC) 365 days, 24 hours a day located in the [REDACTED]. PPL EU has operated a Transmission Control Center since its inception in 1926 and was an original PJM member.

Our current NERC/RF certified control center is a secure, state-of-the-art facility with redundant data and communication. The Disaster Recovery Site is an independent facility with similar capability and both sites meet all RFC and NERC criteria. The control center adheres to the guiding principles of safety, reliability and production in that order.



## **Transmission Control Center Operations**

Core responsibilities of the TCC include monitoring and operating the Bulk Electric System and 69kV transmission systems in the PPL EU footprint, directing the application of the PPL EU Energy Control Process (Permit and Tag), and analyzing load flow studies.

The Operations engineering section resolves operational discrepancies with PJM when load flow models provide inconsistent results and stability studies are required. A key differentiating attribute of the TCC that sets PPL EU apart from other utilities is its experience with nuclear generation and managing complex interfaces safely and reliably. Its tight linkage and coordination with the Susquehanna nuclear plant include interface documents and maintenance and outage coordination meetings. This interface demonstrates PPL EU's ability to manage significant and complex interfaces safely and reliably.

## **Outage Requests**

In addition to real time operations, PPL EU develops a construction and maintenance outage plan. TCC Planning processes requests to upgrade transmission facilities and translates those to equipment outages using the PJM outage criteria timelines. The TCC effectively plans all outage requests, limits risks to the electric system and PPL EU customer base, and responds to any unplanned events. Transmission outage planning, including risk and conflict analysis, is crucial to promoting safety, preserving the reliability of the bulk and non-bulk transmission system, eliminating volatility in the work portfolio.

## **Employee Qualifications**

TCC employees seek continuous improvement in technologies and processes, are trained in all operator tasks, and embrace compliance as a measure of our effectiveness. PPL EU TCC follows best-in-class training practices, which increases the effectiveness of the organization, and creates a distinct advantage when dealing with adverse conditions. All Transmission Control Center employees are trained within the TCC by NERC certified trainers and they receive NERC, PJM Transmission Operator, PJM Generation, and PPL EU training certifications. In addition, PPL EU owns an internal simulator that is used for training.

TCC operators have broad experiences across multiple areas of the control center and are well versed on the uses of security-analysis tools. As a result of the training, the operators are all able to take action when necessary and can perform basic trouble shooting on advanced systems. All team members at the TCC participate in system restoration drills, and act as liaisons between PPL EU and PJM for information dissemination. All operators are coached and trained in system restoration drill requirements.

### **Significant Operating Response Team**

The Significant Operating Response Team (SORT) is a joint effort between the Transmission Operations, Transmission Planning and Engineering departments, which includes Substation and Relay engineering, Protection analysis, Transmission Engineering, T&S Maintenance Engineering, and Relay Test. This group of engineers is on-call to address any electric system event that may occur. The team is also responsible for conducting root cause investigations. The SORT and subsequent root-cause analysis allows for PPL EU to successfully translate lessons learned into success for future transmission projects.

### ***C.5.2 Maintenance Plan***

PPL EU Transmission Maintenance Group is responsible for the transmission line preventative maintenance program for the PPL EU Transmission System. This includes periodic review and comment on the content of the program with ultimate responsibility for the program residing within the Asset & Strategy Policy Group of T&S Asset Management. The T&S Maintenance Engineering – Transmission Maintenance Group reports to the Manager – T&S Maintenance which reports directly to the Director – Engineering. PPL EU currently groups equipment into functional groups allowing optimum scheduling of equipment maintenance under a single outage window. Inspection activities are timed to maintain the desired performance levels defined for each individual asset.

### **Transmission Line Maintenance**

- Comprehensive Helicopter Patrols: detect problems that can only be seen at the pole top, i.e. arm rot, loose or worn hardware, flashed insulators, overhead ground wire and ground lead connections and conductor damage. Detailed inspection reports are submitted by the inspection vendor, which include structure details, digital photos of the deficiency as well as repair accessibility recommendations. This information is entered via file transfer protocol directly into PPL EU's Transmission Maintenance Program (TMP).
- Routine Helicopter Patrols: detect imminent failures that are obvious that occur between comprehensive patrols. These imminent failures are typically caused by storms, through faults, and vandalism. These patrols are completed at a much faster pace allowing the entire PPL EU system to be patrolled annually. Inspection reports are submitted by the inspection vendor and are reviewed by Transmission Maintenance Staff.
- Ohmstick Inspections: PPL EU utilizes a process employing the Sensorlink Radio Ohmstick to determine health of compression connections. This live line micro-ohm measurement of connections and conductor is completed periodically via helicopter to

determine the health of this critical asset. Additional ohmstick measurements are conducted using hot line tool methods via ground crews as needed.

- Emergency Patrols: dictated by system conditions, the Transmission Control Center (TCC) can request an emergency patrol be completed. This is usually after an operation on the PPL EU Transmission System. These patrols are most often completed by helicopter, although they can also be conducted on foot. Information from Lightning Detection and Relay Data is used to determine areas for focused patrols. Inspection reports are submitted by the inspection vendor and are reviewed by Transmission Maintenance Staff.
- Special Patrols: also dictated by system conditions, but not typically initiated as a result of an operation. These patrols are typically completed by helicopter, but can also be foot patrols. The most typical special patrols completed are the result of Risk Mitigation Studies performed as part of abnormal sectionalizing due to new construction outages. Additional special patrols can be to inventory specific line hardware, assist line design, etc.
- Foot Patrols: detect failure modes that evolve over long periods of time at the base of the structure. At present, foot patrols are on an as needed basis, but in the past have been completed on regular intervals.
- Thermovision: annual inspection of the entire PPL EU transmission system with an infrared camera to detect poor or deteriorated electrical connections. Inspection includes, transmission lines, switches, and substations. Detailed inspection reports are provided by the inspection vendor to include Infrared image, digital image, and analysis of the infrared abnormality to include Deg C rise above reference and ambient temperature.
- Acceptance of Facilities: process for commissioning new facilities for service on the PPL EU system. Involves inspection of new construction to insure adherence to PPL EU design and specifications. Review includes receipt of acceptance testing (ductor, x-ray, ohm-stick, etc.), comprehensive inspection and receipt of necessary inventory information.
- Right-of-Way Encroachment Review: process for review PPL EU ability to operate and maintain transmission assets, as well as insure electrical clearances are maintained due to proposed projects within PPL EU right-of-ways.

### **Substation Maintenance**

Nearly all substation maintenance within PPL EU is performed by internal forces [REDACTED]. The field forces have been trained on the specific equipment and schemes and are capable of performing all levels of work from inspections to overhauls and rebuilds. The company also employs skilled workers in the forms of relay maintenance, insulation

testing and transformer maintenance. Contract forces may be used at times of heavy workload.

PPL EU's current maintenance program heavily employs time-based cycles. The equipment data is kept in a maintenance management system (MMS) that serves dual functions; inventory management and maintenance order generation. A piece of equipment can have one or more triggers assigned to it with the appropriate frequency for each. When the maintenance comes due, the MMS will generate a work order for a field crew to perform. When complete, the trigger automatically resets to reflect the next maintenance due date. Triggers can range from weeks to years. The substation maintenance department is responsible for the upkeep of both the maintenance program and the inventory data. Test data is reviewed by the maintenance department and corrective orders are issued as needed.

Most of the maintenance performed can be considered either visual or diagnostic. Invasive work, such as an overhaul is performed on an as-needed basis to correct issues found during diagnostic testing.

As technology improves, PPL EU is moving away from time-based maintenance to a condition-based program. Online monitoring of equipment results in less time required for a crew to perform diagnostic work and allows for some data to be telemetered back to the office for analysis.

### **Project Spare Equipment**

PPL EU owns and maintains a fleet of spare substation equipment to include at least one of each major piece of equipment, such as power transformers, CB's, CCVT's, etc... Items such as spare transformers are kept at strategically located substations based on the location of in-service units. If a piece of equipment were to fail, a cross-functional team evaluates the failure and determines if the system spare is needed. These spares are incorporated into our time-based maintenance program to assure that they are ready when called upon. The proposed project will have equipment specified to match the current standard equipment so that any existing spares would be compatible.

## C.6 Assumptions

The project execution model relies upon a set of assumptions described in Figure C.6.1.

**Figure C.6.1: Summary of Major Assumptions**

Key Assumptions	
<b>Transmission Design</b>	<ul style="list-style-type: none"> <li>• Steel structure count and line angles are based on preliminary line route</li> <li>• No Significant right-of-way or height restrictions which require alternate design</li> <li>• PPL EU designs transmission and substation facilities to meet or exceed PJM design standards. PPL EU designs transmission structures to have greater resistance to natural elements, e.g., wind loading, ground clearance, lightning protection</li> </ul>
<b>Substation Design</b>	<ul style="list-style-type: none"> <li>• Design based upon PPL EU’s bulk power Substation design standard</li> <li>• Yard and control room capacity sufficient to expand within existing footprint</li> </ul>
<b>Planning</b>	<ul style="list-style-type: none"> <li>• PJM 2019 RTEP base case is the basis for reliability results that determined drivers for potential upgrades</li> </ul>
<b>Schedule</b>	<ul style="list-style-type: none"> <li>• Outages based upon proposed construction sequence and system requirements</li> <li>• Long-lead time items: transformers 12-18 months, steel poles up to 30 weeks</li> <li>• PJM will award a proposal by January 1<sup>st</sup>, 2015</li> <li>• Proposed outages will be granted to support construction execution</li> </ul>
<b>Siting / Right-of-Way</b>	<ul style="list-style-type: none"> <li>• PUC will approve selected route and allow PPL EU to exercise eminent domain, if needed</li> <li>• Right of way / land costs based on the scheduled time frame for acquisition</li> </ul>
<b>Permitting / Environmental</b>	<ul style="list-style-type: none"> <li>• Detailed studies of the existing land to confirm transmission line routes</li> <li>• Phase II and III archaeological studies and threatened and endangered (T&amp;E) species studies may be required for the projects, time and costs to conduct studies not included</li> <li>• Impacts to environmentally sensitive lands such as state parks, state wildlife management areas may result from the projects</li> </ul>
<b>Financial</b>	
<b>Operation &amp; Maintenance</b>	<ul style="list-style-type: none"> <li>• Assets to be operated and maintained consistent with PPL EU practices, e.g., through TCC and with Lifecycle Asset Management approach</li> </ul>

ALL APPENDICES ARE REDACTED