PennEast Pipeline Company, LLC

PENNEAST PIPELINE PROJECT

L1 - ENVIRONMENTAL ASSESSMENT MODULE 1
PROJECT SUMMARY
CARBON COUNTY

REVISED MARCH 2020

Submitted by:

PennEast Pipeline Company, LLC

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Acronym List

ABACT	Antidegradation Best Available Combination of Technologies
Adelphia	Adelphia Gateway, LLC
Algonquin	Algonquin Gas Transmission, LLC
Bcf/d	billion cubic feet per day
BMPs	Best Management Practices
CIA	Cumulative Impacts Assessment
CIAA	cumulative impact assessment area
coco mats	coconut coir fiber mats
Concentric	Concentric Energy Advisors
CWA	Clean Water Act
dbh	diameter at breast height
EA	Environmental Assessment
EA Form	Environmental Assessment Form
eFACTs	Pennsylvania's Environment Facility Application Compliance Tracking System
EIS	Environmental Impact Statement
ETG	Elizabethtown Gas
EV	exceptional value
E&SCP	Erosion and Sediment Control Plan
FERC	Federal Energy Regulatory Commission
Gilbert	NRG REMA, LLC
HDD	Horizontal Directional Drill
HQ	high-quality
JPA	Joint Permit Application
LDC	local gas distribution companies
MLV	mainline block valve
MP	milepost
NEPA	National Environmental Policy Act
PADEP	Pennsylvania Department of Environmental Protection
New Jersey Authorizations	Certain governmental authorizations and certain real property rights for the Project facilities proposed to be constructed in New Jersey
PEM	Palustrine Emergent
PennEast	PennEast Pipeline Company, LLC
PFO	Palustrine Forested
Plan	Upland Erosion Control, Revegetation and Maintenance Plan (FERC)
PPC	Preparedness, Prevention and Contingency
Procedures	Wetland and Waterbody Construction and Mitigation Procedures
Project	PennEast Pipeline Project
PSEG	Public Service Enterprise Group
PSS	Palustrine Scrub-Shrub
ROW	Right-of-Way
South Jersey	South Jersey Gas Company
Tcf	trillion cubic feet
TCO	Columbia Gas Transmission

TGD	Technical Guidance Document (PADEP)
Texas Eastern	Texas Eastern Transmission, LP
UGI-LEH	UGI Utilities, Inc.
USACE	U.S. Army Corps of Engineers
WQS	water quality standards

Module S1: Project Summary

In accordance with the requirements contained within the Pennsylvania Department of Environmental Protection's (PADEP) Technical Guidance Document (TGD) titled, "Comprehensive Environmental Assessment of Proposed Project Impacts for Chapter 105 Water Obstruction and Encroachment Permit Applications" (Document No. 310-2137-006) and the assessment criteria detailed in Module 1 of the Environmental Assessment (EA) Form (EA Form) Instructions (Document No. 3150-PM-BWEW0017, Revised 6/2017), PennEast Pipeline Company, LLC (PennEast) has developed a Comprehensive Project Summary of the PennEast Pipeline Project (Project), as provided herein. This document follows the sequence of the requirements presented in the EA Form Instructions Module S1 Section.

S1.A Project Description

PennEast proposes to construct approximately 115 miles of 36-inch diameter pipeline from Luzerne County, Pennsylvania to Mercer County, New Jersey. The Blue Mountain Lateral, an approximately 0.5-mile lateral of 4-inch diameter pipe, will be constructed in Carbon County, Pennsylvania. This lateral will serve as an interconnect with UGI Central Penn Gas, Inc. (Blue Mountain Interconnect). The Hellertown Lateral, an approximately 2.1-mile lateral of 24-inch diameter pipe, will be constructed in Northampton County, Pennsylvania. This lateral will serve as an Interconnect with UGI Utilities, Inc. (UGI-LEH). The Gilbert Lateral, an approximately 0.6-mile lateral of 20-inch diameter pipe, will be constructed in Hunterdon County, New Jersey. This lateral will serve as an Interconnect with Elizabethtown Gas (ETG) and Gilbert (NRG REMA, LLC). The Lambertville Lateral, an approximately 1.4-mile lateral of 36-inch diameter pipe, will be constructed in Hunterdon County, New Jersey. This lateral will serve as an Interconnect with Algonquin Gas Transmission, LLC (Algonquin) and Texas Eastern Transmission, LP (Texas Eastern). Additionally, the Church Road Interconnects will be installed on the PennEast Mainline Pipeline in Northampton County, Pennsylvania, to provide service to Columbia Gas Transmission (TCO) and Adelphia Gateway, LLC (Adelphia). The associated aboveground infrastructure for the Project will consist of interconnect meter stations, mainline block valves (MLV), and a single compressor station and their appurtenant facilities and equipment (e.g., pig launchers/receivers, milepost markers, cathodic protection test posts, etc.).

An October 2019 revision to the Project Description included details regarding the components of the Project located within the state of Pennsylvania. This Project Description, revised March 2020, provides details on the proposed staging of Project construction and addition of the Church Road Interconnects. Impacts associated with the New Jersey portion of the Project will be reviewed by the New Jersey Department of Environmental Protection (NJDEP) as part of separate permit applications.

S1.A.1 Project Occurrence

The Project occurs in Luzerne, Carbon, Monroe, Northampton, and Bucks counties, Pennsylvania, and Hunterdon and Mercer counties, New Jersey. Within Pennsylvania, wetland and watercourse impacts are proposed in Luzerne, Carbon, Northampton, and Bucks counties. The Project will not impact waters of the Commonwealth in Monroe County; therefore, this EA does not include impacts in Monroe County.

S1.A.1(i) Comprehensive Environmental Assessment

Per the PADEP's TGD, a Comprehensive EA of proposed project impacts for Chapter 105 water obstructions and encroachments is required for this Project because it occurs in more than one county in the Commonwealth. This Comprehensive EA includes an summary of alternatives that PennEast evaluated during the Project design, a summary of the proposed impacts, a description of the proposed mitigation, a summary of compliance with antidegradation requirements in accordance with 25 PA Code Chapters 93, 95, 102, and 105, and a discussion of the cumulative impacts of the Project and other existing and potential impacts.

Alternatives

PennEast included a comprehensive assessment of alternatives for the Project within its Certificate Application to the Federal Energy Regulatory Commission (FERC). As lead agency under National Environmental Policy Act (NEPA) for the entire Project, FERC issued an environmental impact statement (EIS) to assess the environmental impacts associated with construction and operation of the Project. The EIS for the Project was issued in April 2017 and contained a robust assessment of alternatives for the Project including a "no action" alternative, system alternatives, route alternatives and variations, and aboveground facility alternatives. This Alternatives Analysis, as it pertains to the Pennsylvania portion of the Project, has been adapted to include the measures undertaken to avoid and minimize the Project's impact on the Waters of the Commonwealth to the maximum extent practicable in accordance with Chapter 105. This detailed analysis is provided in Joint Permit Application (JPA) Section S.

The Alternatives Analysis provided in JPA Section S explains that the no-action alternative would not meet the Project's purpose and need (described in Section S1.B.1 below), energy conservation and alternatives do not represent viable options for replacing natural gas, system alternatives could not meet the purpose and need while offering an environmental advantage, and there is no available capacity for existing pipeline systems to transport the required volumes of natural gas to PennEast's delivery points.

PennEast evaluated nine key, major route alternatives that would meet the Project's purpose and need. Existing utility corridors (natural gas pipelines, liquid pipelines, electric transmission, water, and sewer) were examined to identify potential areas where the Project's pipeline could parallel or be co-located within existing maintained rights-of-way (ROW). This assessment found that some of these ROWs had been encroached upon by residential and commercial development, resulting in inadequate space for the staging and construction of an additional pipeline between the existing facilities and the neighboring developments. Where environmental impacts were not greater, the Project was aligned with as many existing utility corridors as possible to ensure the Project can be safely constructed and operated and satisfy the Project customers' demands.

Necessary adjustments to the Project route were also made to account for engineering, environmental, safety, and land use constraints that were identified during the environmental survey process. Landowner and stakeholder input also resulted in minor route adjustments. After determining that the proposed route was the most constructible corridor, PennEast further assessed potential impacts to wetlands and watercourses within the 400-foot Study Area. Within the designated corridor, the centerline alignment and workspace limits were altered to avoid wetlands and watercourses to the extent practicable. Where impacts to wetland and watercourses could not be avoided, PennEast designed the Project to minimize the impacts through changes to the route, workspace, and construction techniques.

PennEast evaluated both conventional open-cut and trenchless construction techniques to construct the pipeline across wetlands and watercourses. PennEast analyzed each wetland and watercourse crossing location to determine whether conventional open-cut or trenchless construction techniques would be the most suitable crossing method. Several criteria were considered in determining the most appropriate crossing method:

- Geologic conditions,
- Topographic conditions,
- Available workspace, and
- Practicality.

In areas where trenchless construction methods are not feasible or practicable, a variety of best management practices (BMPs) will be implemented to minimize impacts. These BMPs include reducing the construction ROW width from 100 feet to 75 feet, minimizing construction durations, adhering to construction timing windows, implementing erosion and sediment controls, maintaining 30 feet of the 50-foot permanent ROW easement during operation, and mitigating impacts.

Impacts

According to the assessment criteria detailed in Module 3 of the EA Form Instructions, the PADEP defines permanent impacts as those areas that are affected by a water obstruction or encroachment that consist of both direct and indirect impacts resulting from the placement or construction of the obstruction or encroachment as well as the area necessary for the operation and maintenance of the obstruction or encroachment. For the Project, permanent impacts would include the proposed pipeline and its 30-foot maintained ROW, a new permanent access road that will result in permanent fill within a floodway and a new culvert installed within a watercourse, two permanent culvert replacements, and permanent fill in approximately 0.036 acres of PEM wetlands and 0.024 acres of PFO wetland mosaic to construct and operate the Kidder Compressor Station in Carbon County

Temporary impacts are defined as those areas affected during the construction of a water obstruction or encroachment that consist of both direct and indirect impacts that are restored upon completion of construction, but do not include areas that are required to operate and maintain the water obstruction or encroachment. For the Project, temporary impacts would include any workspace within a wetland, watercourse, or floodway that will be impacted during construction but is outside of the 30-foot maintained ROW, including temporary access roads, wareyards, and staging areas. Temporary impacts include workspace for spoil storage, equipment bridges, wetland matting, and other pipeline construction staging activities.

Direct impacts include the temporary or permanent loss of a resource through filling, draining, or converting a resource to another type, such as changing a palustrine wetland to a lacustrine wetland. For the Project, direct impacts include the installation of temporary equipment bridges and wetland mats, replacement of two existing culverts, the installation of a new permanent culvert, fill within one floodway, and fill within approximately 0.036 acres of PEM wetlands and 0.024 acres of PFO wetland mosaic to construct and operate the Kidder Compressor Station in Carbon County.

Indirect impacts consist of altering the chemical, physical, or biological components of an aquatic resource that result in a functional change of the resource, with no net loss of resource acreage. The construction

workspace within wetlands, watercourses, and floodways that is needed to construction the Project is considered an indirect impact. The area within the permanent ROW necessary to operate and maintain the Project is also an indirect impact.

A summary of the Project's permanent and temporary, and direct and indirect impacts is provided in Section S1.A.1(iv) below. Detailed accounting and quantification of the aquatic impacts is included in JPA Section L-3. There are no additional impacts anticipated to occur in the future beyond those contained within this permit application.

Mitigation

PennEast has selected the proposed pipeline route to avoid and minimize impacts to wetlands and watercourses to the greatest extent practicable while maintaining the economic and safety standards of the Project. As described in the Alternatives Analysis (JPA Section S), the centerline alignment and workspace limits were designed to avoid wetlands and watercourses to the extent practicable. Multiple route alternatives and route modifications were assessed and/or implemented to avoid unnecessary impacts to various resources, including aquatic habitats. Given the linear nature of the Project, total avoidance of aquatic habitats is not feasible and therefore, installation of the proposed Project facilities will result in temporary impacts to wetlands and watercourses, along with permanent impacts to select areas of palustrine forested (PFO) wetland via a cover type conversion to palustrine emergent (PEM) or palustrine scrub-shrub (PSS) cover. To mitigate unavoidable impacts, the workspace was reduced to minimize impacts. BMPs contained within the Erosion and Sediment Control Plan (E&SCP, JPA Section M) and listed in the Mitigation Plan (JPA Section L-4) will minimize impacts during construction, restoration and operation of the Project.

PennEast has also developed a Wetland and Riparian Reforestation Plan (JPA Section L-4A), which outlines the onsite restoration that is proposed at each wetland and riparian crossing. After each crossing is constructed, PennEast will restore pre-construction contours before seeding the areas with a conservation wetland seed mix (Ernst FACW Meadow Mix, ERNMX-122) and a riparian seed mix (Ernst Riparian Buffer Mix, ERNMX-178), respectively. In riparian buffers where slope exceeds 10%, PennEast's Standard Upland ROW mix will be used. Overlapping the seeded areas, PennEast proposes to replant trees and shrubs within forested riparian buffers and PFO and PSS wetlands, with the exception of a 30-foot wide corridor that is centered on the pipeline. The trees and shrubs will be planted at approximate 10-foot centers. This 30-foot wide ROW will be maintained periodically during Project operation, and to maintain the integrity of the pipeline coating, trees greater than 20 feet tall or 3 inches diameter at breast height (dbh) will be removed. The proposed woody plantings and conservation seed mixes are outlined in Table 1 of the Wetland and Riparian Reforestation Plan (JPA Section L-4A). The trees will be protected from herbivory using spiral tree wraps, and 24-inch diameter coconut coir fiber mats (Coco mats) will be installed around each planted tree to protect plants from weeds and frost. PennEast will monitor survivorship for two years. If survivorship is below 75% within a restored wetland or riparian area, PennEast will discuss remediation measures with the PADEP and U.S. Army Corps of Engineers (USACE).

No net loss to wetlands or watercourses will occur within the pipeline ROW as PennEast will restore all impacted wetlands within the pipeline ROW to pre-construction contours and will restore natural flow conditions to all affected watercourses. Approximately 0.036 acres of PEM wetlands and 0.024 acres of PFO wetland mosaic will be filled to construct and operate the Kidder Compressor Station in Carbon County. Permanent wetland impacts within the pipeline corridor will be associated with the conversion of

PFO and PSS wetlands to PSS and PEM wetlands and will be limited to a 30-foot wide maintenance corridor within the permanent ROW. Approximately 7.097 acre of PFO and PSS wetlands will be converted to PEM and PSS wetlands within the 30-foot wide maintained ROW. PennEast is proposing offsite compensatory mitigation in the form of wetland enhancement to compensate for the permanent impacts to wetland cover types. The proposed mitigation ratios are based on the type of conversion that is proposed (i.e. the frequency of ROW maintenance that will result in either PEM or PSS wetlands) and the wetland classification. These proposed ratios are presented in Module 4 (JPA Section L-4). The Project will also result in approximately 0.036 acres of fill within PEM wetlands and 0.024 acres of fill within a PFO wetland mosaic to construct and operate the Kidder Compressor Station. PennEast proposes offsite wetland creation at a 1:1 ratio and 2:1 ratio, respectively, to compensate for the PEM and PFO mosaic fill. A total of 14.393 acres of compensatory mitigation is proposed at three mitigation sites in the geographic service areas where the impacts will occur. One site has been selected in the Upper Central Susquehanna River Subbasin (Subbasin 2), and two sites have been selected in the Central Delaware River Subbasin (Subbasin 5). Each mitigation site consists of marginal agricultural land that has been historically or is currently used for pasture, hay harvesting, and/or growing corn or other small grain crops. Each site is bisected by or abutting one or more watercourses. Wetlands at each site would be enhanced by tree and shrub plantings and retiring current pasturing and agricultural operations. The enhancements will increase functions and values of the degraded wetlands as they develop into mixed wetland / riparian buffer complexes. Functional improvements include water quality benefits through increased sediment and nutrient sequestration, floral and vegetation diversity, and enhanced wildlife habitat. The PennEast has contracted WHM Solutions, Inc. to prepare a Compensatory Wetland Mitigation plan that is included in JPA Section L-4B.

Antidegradation

PennEast conducted an Antidegradation Analysis for the Project, which is provided in JPA Section L-3E. Impacts were assessed for consistency with state antidegradation requirements contained in Chapter 93, 95, and 102 (relating to water quality standards (WQS); wastewater treatment requirements; and erosion and sediment control) and the Clean Water Act (CWA) (33 U.S.C.A § §1251—1376). A summary of how the Project meets antidegradation requirements in presented below. The more detailed analysis that discusses the Project's compliance with specific antidegradation regulation is presented in JPA Section L-3E.

The Study Area associated with the Project site is tributary to numerous receiving waters. The Aquatic Resources Impact Table in JPA Section A-1 lists the watercourses and their tributaries by mile post (MP) within the Study Area that have Pennsylvania Code, Title 25, Chapter 93 designated protected aquatic life.

The number of high-quality (HQ) watercourses and exceptional value (EV) wetlands and watercourses crossed by the Project in Pennsylvania is summarized in Table CA-L1-1 below.

Table CA-L1-1
Number of Designated HQ Watercourses and EV Wetlands and Watercourses Impacted by the Project[1]

Facility	County	PA Code Designated or Existing Use – HQ[2]	PA Code Designated or Existing Use – EV[2]	Special Protection Wetlands – EV[3]
PennEast Mainline Route Pipeline	Luzerne	22	-	16
PennEast Mainline Route Pipeline	Carbon	35	16	40
PennEast Mainline Route Pipeline	Northampton	27	3	54
PennEast Mainline Route Pipeline	Monroe	-	-	-
PennEast Mainline Route Pipeline	Bucks	-	-	-
Kidder Compressor Station	Carbon	1	-	3
Blue Mountain 4-inch diameter Lateral	Carbon	3	-	-
Hellertown 24-inch diameter Lateral	Northampton	-	-	-
Temporary Access Roads	Luzerne	7	-	10
Temporary Access Roads	Carbon	2	-	-
Temporary Access Roads	Northampton	-	-	1
Temporary Access Roads	Monroe	-	-	-
Temporary Access Roads	Bucks	-	-	-
Total		**97**	**19**	**124**

Notes:

1. An individual watercourse crossing could have more than one designation.
2. Sources: PADEP Streams Chapter 93 Existing Use, dated 3/2019 and PADEP Streams Chapter 93 Designated Use, dated 3/2019. If a stream has an existing use, the designated use has been replaced with that value. Available at www.pasda.psu.edu.
3. Resource Value Definitions: Pennsylvania Exceptional Value Wetland as defined by PA Code §105.17 (relating to special criteria for projects affecting important wetlands). Criteria are:

(i) Serves as habitat for fauna or flora listed as ‘‘threatened’’ or ‘‘endangered”
(ii) Is hydrologically connected to or located within a 1/2-mile from habitat for fauna or flora listed as ‘‘threatened’’ or ‘‘endangered’’ and wetland dependent;
(iii) Located in or along the floodplain of the reach or tributaries of a wild trout watercourse or waters listed as exceptional value;
(iv) Located along an existing public or private drinking water supply.

Through the development and implementation of the selected alternatives presented in the Alternative Analysis (JPA Section S), the erosion and sediment control measures provided in the E&SCP (JPA Section M), and the Project’s Mitigation Plan (JPA Section L-4), PennEast will protect water quality and quantities

through Project construction and operation. This will primarily be accomplished by minimizing the amount of workspace that is needed to safely construct the Project, minimizing the duration of earth disturbance, executing dry or trenchless crossing techniques for all watercourse crossings, and following the requirements of the E&SCP and Site Restoration Plan.

There are no proposed increases in stormwater runoff associated with the pipeline ROW. The approximate original contours of the workspace will be maintained and/or restored to their original condition following construction, and disturbed areas will be re-vegetated or restored with pervious material. Existing drainage patterns will be maintained, and the volume and rate of stormwater runoff from the Project area in the post-construction condition is not expected to exceed that of the existing condition. Earth disturbances associated with the pipeline ROW will be stabilized with native meadow vegetation to promote infiltration to assist in mitigating temperature rises. At above-ground facilities where new impervious surface is proposed, infiltration of runoff collected in basins or berms will mitigate thermal impacts from post-construction stormwater. Therefore, the Project post-construction impact on thermal components will not alter aquatic resources. There are no long-term point source discharges associated with the Project, hence eliminating any possible discharge that would impact thermal components of waterbodies.

Antidegradation Best Available Combination of Technologies (ABACT) will be utilized in HQ and EV watersheds to provide environmentally sound and cost-effective BMPs to demonstrate that any change in stormwater runoff rate, volume or quality will maintain and protect the existing quality and water uses of receiving surface waters and preserve existing baseflow. The E&SCP (JPA Section M) shows the locations of all planned ABACT BMPs and details for construction of these facilities.

Non-discharge alternative BMPs were evaluated and implemented wherever possible. Table CA-L1-2 summarizes the justifications for implementing or not implementing non-discharge alternatives. Some of the non-discharge alternative BMPs considered on this Project where alternative routes, limiting the area of disturbance, and limiting the duration of the disturbance.

PennEast has prepared a Preparedness, Prevention and Contingency (PPC) Plan (JPA Section L-3B) for the Project. The purpose of this Plan is to reduce the probability and risk of an accidental discharge of polluting materials, including oils and hazardous substances, to surface waters or groundwater by PennEast and/or Contractor(s) during construction-related activities by providing instruction and expediting spill response and clean-up. An Unanticipated Discovery of Contamination Plan that provides work, investigation and reporting procedures for responding to the unanticipated discovery of contamination in soil, groundwater or sediment during excavation, construction or maintenance activity associated with construction has also been prepared for the Project and is included as an Appendix to the PPC Plan. PennEast has developed a Horizontal Directional Drill (HDD) Inadvertent Returns and Contingency Plan (JPA Section L3-C) for the Project to address pre-construction preparation and establish operational procedures and responsibilities for the prevention, containment and clean-up of inadvertent returns associated with HDDs. The development and integration of these plans further protect and maintain water quality through preventative protection and proactive containment and control of any potential releases.

Table CA-L1-2
Summary of Non-Discharge Alternative BMPs Evaluated and Implemented

Non-discharge alternative BMP	Implemented in Project Design	Explanation
Alternative Routes	No	Alternative routes were evaluated and implemented, but none that would avoid special protection watersheds. Based on the linear nature of the Project and various natural gas delivery points, special protection watersheds cannot be avoided.
Limited Disturbed Area	Yes	The proposed Limits of Disturbance restrict construction activities to the minimum area needed to effectively and efficiently construct the Project.
Limiting Extent and Duration of the Disturbance	Yes	Earth disturbance will be limited to the respective stage of work in the construction sequence. Temporary or permanent stabilization will occur as soon as possible upon the completion of each stage.
Riparian Buffers and Riparian Forest Buffers	Yes and No	Yes: Forested riparian buffers were avoided to the extent practicable for above-ground facilities. Within Carbon County, the Kidder Compressor Station and the Blue Mountain Interconnect would impact riparian buffers. PennEast has requested a riparian buffer waiver for these impacts. No: Based on the linear nature of the pipeline, forested riparian buffers cannot be avoided during construction. Forested riparian buffers along the pipeline ROW will be seeded with a riparian buffer conservation mix and replanted with trees and shrubs, with the exception of a 30-foot wide tree-free ROW that will be maintained to protect the integrity of the pipeline coating.
Treatment Train Combination of BMPs	No	There is no combination of non-discharge alternative BMPs that would result in no net change from pre-development to post-development volume, rate and concentration of pollutants in stormwater runoff; therefore, PennEast proposes to use ABACT BMPs for the Pennsylvania portion of the Project.

Cumulative Impacts

PennEast prepared a Cumulative Impacts Assessment (CIA) to comply with the requirements of 25 Pa. Code § 105.14(b)(14) and 105.15, PADEP's Comprehensive Environmental Assessment TGD entitled *Comprehensive Environmental Assessment of Proposed Project Impacts for Chapter 105 Water Obstruction and Encroachment Permit Applications Technical Guidance Number 310-2137-006,* and the assessment criteria detailed in Module 3 of the EA Form Instructions (Document No. 3150-PM-BWEW0017, Revised 6/2017).

The CIA presented in JPA Section L-3F evaluates the cumulative impact of the Project and other potential or existing projects, and if impacts may result in a major impairment of the wetland resources, in consideration of interrelated wetland areas (inclusive of adjacent watercourses), affected by the Project. The CIA also has been prepared to comply with the requirements of § 105.18a(a)(6) and 105.18a(b)(6) to evaluate if the effect of the Project when considered in combination with the impacts of other potential or existing projects, including consideration of interrelated wetland areas (inclusive of adjacent watercourses), may result in the impairment of the Commonwealth's EV wetland resources or a major impairment of the Commonwealth's other wetland resources, respectively. The methodology for identifying other projects is detailed in the CIA presented in JPA Section L-3F. PennEast identified seventeen other projects that could potentially contribute to cumulative impacts when considered with the proposed Project. These include natural gas development projects (natural gas wells, pipeline gathering systems and interstate pipelines); electric generation and transmission projects; transportation projects; and residential, commercial and industrial development projects.

As indicated in PADEP's technical guidance, where a temporary wetland impact is proposed to be properly restored, the applicant does not need to identify the temporary impact as an adverse cumulative impact on the wetland resource. Therefore, temporary impacts and their restoration measures have been discussed as provided in EA Modules 3 and 4 (JPA Sections L-3 and L-4, respectively), but those temporary impacts are not considered an adverse cumulative impact and have not been discussed within this CIA.

Although the majority of wetland and watercourse impacts associated with the Project are temporary, there will be some permanent impacts. The Project will permanently impact approximately 8.29 acres of wetland associated with the permanent conversion of palustrine forested (PFO) and palustrine scrub-shrub (PSS) cover types to palustrine emergent (PEM) wetlands. The PFO and PSS wetland cover type conversion will result in some functional loss, but impacts will be offset through the enhancement of three offsite compensatory mitigation sites, described in the Compensatory Mitigation Plan in JPA Section L-4B. As presented in JPA Section L (EA) and JPA Section S (Alternatives Analysis), with implementation and proper installation and maintenance of the Project's BMPs, pre-construction wetland function and values within temporarily impacted wetlands will be restored, and impacts to wetlands and watercourses will be minor and mostly temporary, and result in no more than minimal individual and cumulative adverse environmental effects. In addition to the permanent conversion of PFO and PSS to PEM wetlands within the 30-foot wide maintained ROW, the Project will also result in permanent impacts to PEM wetlands, a PFO wetland mosaic, and three watercourses. Approximately 0.036 acres of PEM wetlands and 0.024 acres of PFO wetland mosaic will be filled to construct and operate the Kidder Compressor Station in Carbon County. The Project would also result in permanent watercourse impacts associated with the installation of three culverts. Two culverts along existing access roads will be replaced in-kind, one of which is in Luzerne County and the other is in Carbon County. Additionally, one new culvert will be installed for access to the proposed Kidder Compressor Station in Carbon County.

Of the seventeen other past, present, or future projects that were identified in the CIA, only two resulted in permanent wetland or watercourse impacts that may contribute to cumulative impacts of the resources that will be impacted by the Project. The other projects' cumulative impacts included approximately 0.05 acre of wetland fill and 162 linear feet of permanent culverts within two watercourses.

Based on the results of the CIA, construction of the Project combined with other potential or existing projects that were evaluated within the cumulative impact assessment area (CIAA) will result in an aggregate cumulative 7.184 acres of permanent wetland impacts and 193 linear feet of permanent watercourse impacts. With the implementation of each potential or existing project in compliance with BMPs and permit conditions, the remaining disturbances to wetlands and watercourses are or are anticipated to be minor and temporary, and result in no more than minimal individual and cumulative adverse environmental effects. The cumulative impacts will not result in the impairment of the Commonwealth's EV wetland resources or a major impairment of the Commonwealth's other wetland resources.

S1.A.1(ii) Nature and Extent of Overall Project and Anticipated Construction Timeline

Proposed Construction Activities

The proposed Project will be constructed in compliance with applicable specifications, Federal regulations and guidelines, and the Project-specific permit conditions. Construction of the Project will commence after ROW and applicable regulatory permits and clearances have been acquired for the Project.

The Project will be constructed in two stages. The first stage will be located entirely within Pennsylvania and will include all project components north of MP 68.2R3 and north of State Route (SR) 33. The second stage will be located in both Pennsylvania and New Jersey and will include the proposed bore under SR 33, the activities at the Delaware River, and all other project components south of MP 68.2R3. Construction of each Project stage is anticipated to require approximately 12 months to complete.

Construction of the Project will involve primarily temporary impacts to regulated wetlands and watercourses within the pipeline ROW. As described in Section S.1.A.1(i) above, there will be limited permanent impacts associated with the permanent conversion of wetland cover types. Inherently, pipeline projects must traverse the landscape to connect two locations, and thus avoidance of all resource crossings is rarely possible. In selecting the route for this pipeline PennEast attempted to minimize wetland, watercourse and other environmental impacts to the greatest extent practicable.

Some wetlands within the Project area are classified as EV according to PA Code, Title 25: Chapter 105 [105.17(iii)], as they are located in or along the floodplains of an Exceptional Value watercourses or Wild Trout Waters (Commonwealth of PA, 2018). There is no anticipated net loss of these wetlands as all temporarily impacted EV resources will be restored to pre-construction conditions. The construction of this Project will not cause or contribute to pollution of groundwater or surface waters or diminution of resources sufficient to interfere with their uses. The cumulative effects of this Project and other projects will not result in the impairment of the Commonwealth's EV wetland resources.

Construction and restoration techniques used will be typical for cross-country and residential construction. The E&SCP (JPA Section M) provides detail of these techniques and the mitigation measures that will be used for the Project. Additional construction techniques and measures that will be employed are described in the Project's PPC Plan (JPA Section L-3B). The Project E&SCP will be consistent with the FERC's

Upland Erosion Control, Revegetation, and Maintenance Plan (May 2013 version) and Wetland and Waterbody Construction and Mitigation Procedures (May 2013 version), collectively described as the FERC *Plan and Procedures*.

Standard Construction Procedures

Construction of the Project will follow standard construction practices and will typically involve numerous divisions of the pipeline (spreads) with crews progressing work along the ROW within each spread in an ordered, choreographed fashion. The Project anticipates division of the pipeline portion of the Project into five construction spreads, four of which will be in Pennsylvania. Table CA-L1-3 identifies the anticipated construction spreads in Pennsylvania and New Jersey.

Table CA-L1-3
Anticipated Construction Spreads

Spread	From MP	To MP	State	From	To
1	0.0	17.8	PA	Origination	Meadow Run Road Crossing
2	17.8	49.0R3	PA	Meadow Run Road Crossing	Lower Smith Gap Road
3.1	49.0R3	68.2R3	PA	Lower Smith Gap Road	Church Road Interconnects
3.2	68.2R3	77.4	PA	Church Road Interconnects	Delaware River (west side)
4	77.4	115.0	PA/NJ	Delaware River (west side)	End

Typically, survey crews will begin the operations by demarcating the pipeline centerline and construction workspace along the ROW. Winter tree clearing may be employed in areas with sensitive habitat. Clearing, grading, trenching, and other crews would follow until a final cleanup crew initiates the restoration process. Crews most frequently progress in close sequence to facilitate orderly progress, minimize the active construction spread size, and expedite restoration efforts.

Pipeline construction generally involves the following sequential operations, which are discussed in more detail in the E&SCP (JPA Section M). These steps are summarized in the bullets below, and additional details are provided in the following sections.

Pipeline Construction – Typical Sequential Operation Steps:

- Survey/staking the route, approved workspace, and foreign line crossings.
- Clearing – remove vegetation from construction workspace.
- Installation of erosion and sediment controls.
- Grading to establish safe workspace; installation of erosion and sediment controls.
- Trenching – pipeline trench excavation.
- Stringing – placement of pipe joints along the trench line.
- Bending – bending pipe joints, as needed, for route and terrain.
- Welding.
- Pipe integrity – visual inspection, non-destructive examination of welds.
- Weld coating – corrosion protection and waterproofing.
- Lowering in – pipe placed in trench, tie-ins with previously laid sections, backfill.
- Hydrostatic testing – confirmation of pipeline integrity.

- In-line tool inspection of new pipeline segments.
- Tie-in to existing pipeline, purge, pack new section with gas.
- Regrade construction workspace to previous contours; clean-up, restoration, and seeding.

During construction, PennEast will apply dust mitigation measures, as necessary. Such applications will be at the direction of the Contractor Supervisor, Environmental Inspector, and/or the onsite Chief Construction Inspector. Typical measures that may be employed to minimize dust will be the use of water trucks to dampen workspace, if necessary, and use of paved roadways.

Specialized Construction Methods

A detailed description of the Project's proposed Specialized Construction Methods is provided in Sections 1.3.2-1.3.4 of the Project Description (JPA Section J).

S1.A.1(iii) Associated PADEP Chapter 105 Permit Applications

PennEast has submitted four Joint Permit Applications for the Project, application numbers for which are provided in Table CA-L1-4.

Table CA-L1-4
Application Numbers for the Project Joint Permit Applications

County	PADEP Application Number
Luzerne	E40-780
Carbon	E13-185
Northampton	E48-435
Bucks	E09-998

S1.A.1(iv) Summary of Proposed Project Impacts

Table CA-L1-5 provides a summary of the proposed impacts for the overall Project. The overall Project includes impacts within Luzerne, Carbon, Northampton and Bucks counties, Pennsylvania. There are no proposed aquatic resource impacts in Monroe County.

Table CA-L1-5
Summary of Overall Project Impacts

Resource Type	Direct (acres)	Indirect (acres)
Permanent		
Riverine[1]	0.362	14.464
Lacustrine	-	0.448
Wetland	0.060	8.808
Temporary		
Riverine[1]	3.076	47.222
Lacustrine	-	0.895
Wetland	9.316	14.637

Resource Type	Direct (acres)	Indirect (acres)

Notes:

1. Includes watercourse floodway and channel.

S1.B Additional Information

S1.B.1 Purpose and Need

PennEast proposes to construct, install and operate the Project facilities to provide approximately 1.1 million dekatherms per day of year-round transportation service from northern Pennsylvania to markets in New Jersey, eastern and southeastern Pennsylvania, and surrounding states. The Project was developed in response to market demands in New Jersey and Pennsylvania, and interest from shippers that require transportation capacity to accommodate increased demand and greater reliability of on natural gas in the region. The Project will include a new pipeline and aboveground facilities that will provide a new source of natural gas supply from the Marcellus Shale producing region to New Jersey, Pennsylvania and surrounding states, enhancing the region's supply diversity. The Project is designed to provide a new pipeline to serve markets in the region with firm, reliable access to the Marcellus supplies versus the traditional, more costly Gulf Coast regional supplies and pipeline pathways. An additional supply of natural gas to the region will provide a benefit to consumers, utilities, and electric generators by providing enhanced competition among suppliers and pipeline transportation providers. The Project will satisfy the needs of shippers seeking (i) additional supply flexibility, diversity and reliability; (ii) liquid points for trading in locally produced gas from the Marcellus Shale and the Utica Shale; (iii) direct access to premium markets in the northeast and mid-Atlantic regions; (iv) the ability to capture pricing differentials between the various interconnected market pipelines; (iv) enhanced natural gas transportation system reliability to the region with modern, state-of-the art facilities and (v) firm access to currently the most affordable long-lived dry gas reserves. The Project will provide shippers additional opportunities to buy and sell supplies and to transport natural gas to where it is needed and valued most. The Project also offers shippers a reliable, short-haul transportation option for direct access to Marcellus Shale natural gas supplies absent several risks associated with long-haul pipelines originating and traversing other regions of the country.

PennEast has encountered regulatory and property rights acquisition delays in New Jersey (the New Jersey Authorizations), which has the potential to delay completion of the Project and prevent natural gas providers from meeting market demands. To mitigate these delays, PennEast will construct the Project in two stages to allow PennEast to provide up to 650,000 Dth/Day of firm transportation service through approximately MP 68.2R3 in Northampton County, Pennsylvania. By staging the construction, PennEast will be able to construct and operate the portion of the pipeline and associated facilities and appurtenances north of MP 68.2R3, independent of those proposed as part of the construction of the second stage of construction south of MP 68.2R3, and meet its long-term firm service commitments. As such, the proposed construction activities for the first construction phase are a stand-alone project and are not dependent on construction of the second stage. Upon receipt of the New Jersey Authorizations, PennEast will construct and operate the pipeline and associated facilities and appurtenances south of MP 68.2R3.

Energy Market Outlook

A review of the Annual Energy Outlook 2018 (Energy Information Administration 2018) reference case indicates that natural gas consumption will rise from 27.50 trillion cubic feet (Tcf) in 2016 to 34.48 Tcf in 2050.

The pipeline capacity that PennEast will create will not simply provide additional supply to the nearby markets; it will provide new supply sources as well. The winters of 2013/2014 and 2017/2018 demonstrated that there were significant constraints in the natural gas supply system created by a combination of increased demand from residential, commercial and industrial conversions; cold weather affecting traditional demand; lower than average storage inventories; and new natural-gas fired power generation. While natural gas prices have steeply declined over the last several years, constraints between supply and demand areas due to lack of sufficient pipeline capacity, particularly on days where demand is highest, led to unprecedented spikes in the cost of natural gas and electricity for the market region as illustrated in Figures 1.1-1 and 1.1-2. Concentric Energy Advisors (Concentric) performed a study titled "Estimated Energy Market Savings from Additional Pipeline Infrastructure Serving Eastern Pennsylvania and New Jersey[1]" that conservatively estimates the energy consumers in New Jersey and Pennsylvania could have saved approximately $890 million annually if 1 billion cubic feet per day (1 Bcf/d) of additional capacity, such as that offered by PennEast, had been available to deliver additional natural gas supplies to the region in the 2013/2014 winter. Concentric updated the analysis after the 2017/2018 winter and estimated that Pennsylvania and New Jersey energy consumers could have saved an additional $435 million in the winter of 2017/2018, had an additional 1 Bcf/d of pipeline capacity been available[2]. These savings would take form by way of increased disposable income to families and businesses.

[1] Concentric, March 2015, Estimated Energy Market Savings from Additional Pipeline Infrastructure Serving Eastern Pennsylvania and New Jersey.

[2] Concentric, April 2018, Estimated Energy Market Savings from Additional Pipeline Infrastructure Serving Eastern Pennsylvania and New Jersey

Figure 1.1-1
Regional Power and Natural Gas Price Spike in Winter 2013/2014[3]

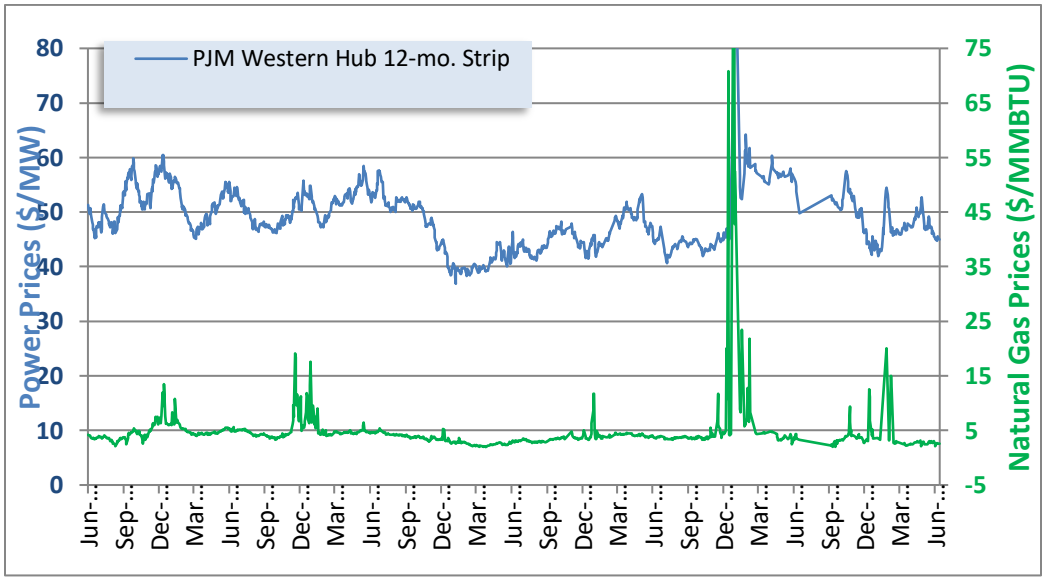
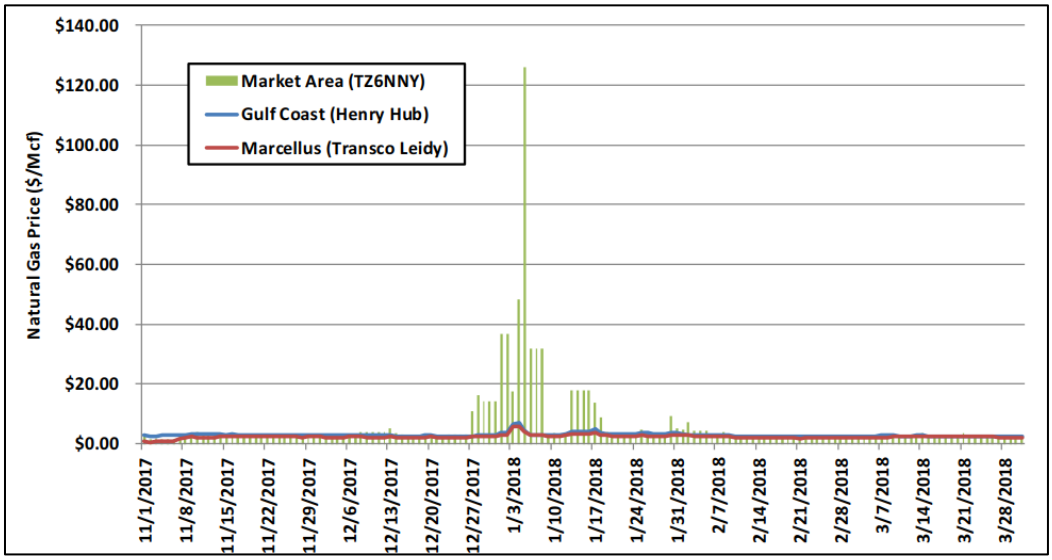


Figure 1.1-2
Daily Spot Natural Gas Prices – Winter 2017/2018[4]



[3] Concentric, March 2015, Estimated Energy Market Savings from Additional Pipeline Infrastructure Serving Eastern Pennsylvania and New Jersey.

[4] Concentric, April 2018, Estimated Energy Market Savings from Additional Pipeline Infrastructure Serving Eastern Pennsylvania and New Jersey.

Concentric evaluated four primary areas where energy cost savings could have been achieved due to the availability of an additional 1 Bcf/d of pipeline capacity during the 2013/2014 and 2017/2018 winters. These areas of saving included gas-fired power generation, oil-fired power generation displacement, industrial gas transportation, and local gas distribution companies (LDC). As shown in Figure 1.1-3, electric consumers in Pennsylvania and New Jersey could have saved approximately $246 million during the 2017/2018 winter, and natural gas consumers could have saved approximately $189 million.

Figure 1.1-3
Estimated Savings if an Additional 1 Bcf/d of Pipeline Capacity Had Been Available for the Winter of 2017/2018[5]

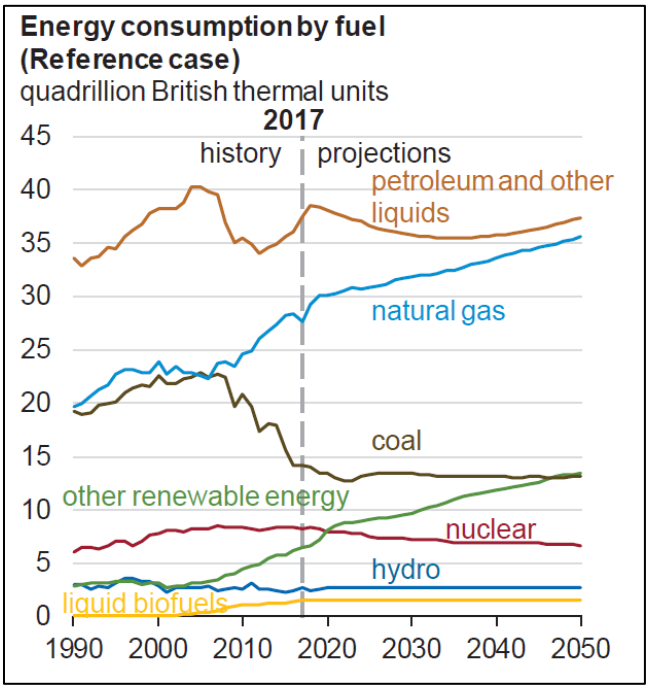
(All figures in $Millions)	Eastern Pennsylvania	New Jersey	Total
Electric Market Savings			
Gas-Fired Generation	$ 138	$ 100	$ 238
Oil-Fired Generation Displacement	$ 5	$ 3	$ 8
Subtotal	$ 143	$ 104	$ 246
Gas Market Savings			
LDC Gas Supply Procurement	$ 15	$ 30	$ 45
Industrial Transportation Customer	$ 106	$ 37	$ 144
Subtotal	$ 121	$ 67	$ 189
Total Estimated Savings:	**$ 264**	**$ 171**	**$ 435**

The lack of a new pipeline with access to supply sources in Pennsylvania combined with increasing demand throughout the region will continue to create dramatic seasonal price fluctuations in New Jersey, Pennsylvania, and surrounding states with higher gas and electric rates and an increased potential for energy shortages during peak demand, resulting in threats to business continuity, public safety and national security. Failure to add critical new infrastructure will also prevent these markets from fully realizing the economic benefit of lower-cost energy supply. Continued increases in demand for natural gas across all market sectors, particularly for natural gas-fired power generation, conversions from other fossil fuels and increased usage in the transportation markets will further exacerbate this problem or otherwise not be met if new infrastructure is not constructed. Higher energy prices reduce disposable income for residents, increase operating costs thereby decreasing competitiveness for businesses and upward pressure on personal income tax rates resulting from lower business income tax base. Accordingly, the Project is designed to bring the lowest cost natural gas available in the country to homes and businesses and to provide low-cost fuel to power generation that supplies New Jersey, Pennsylvania and surrounding states well beyond the Project footprint. Figures 1.1-4 and 1.1-5 illustrate the continued increasing importance of

[5] Concentric, April 2018, Estimated Energy Market Savings from Additional Pipeline Infrastructure Serving Eastern Pennsylvania and New Jersey.

natural gas as part of the country's overall fuel mix as well as the continued increase of natural gas fired generation expected between 2018 and 2050. Figure 1.1-6 shows the PJM generation fuel mix as of July 2018. As shown in the graphic, natural gas represents the largest fuel type utilized for electric generation in the PJM region.

Figure 1.1-4[6]
Energy Consumption by Fuel – Projected to 2050 (Reference Case)



[6] Energy Information Administration Annual Energy Outlook 2014

Figure 1.1-5[7]
Projected Energy Production Fuel Mix – By 2050 (Reference Case)

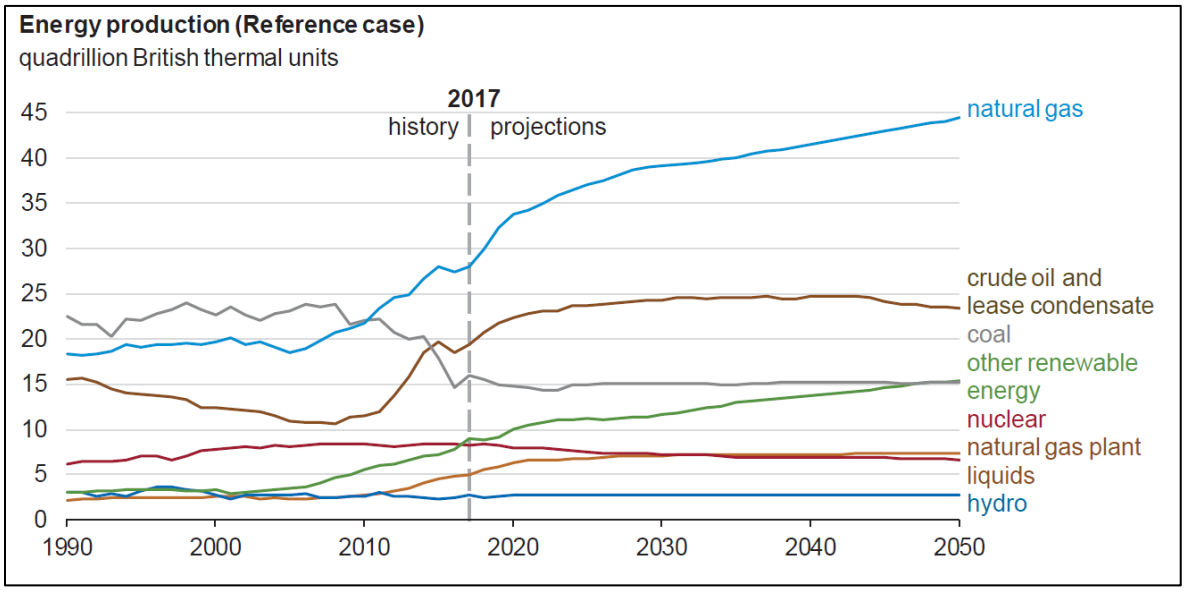
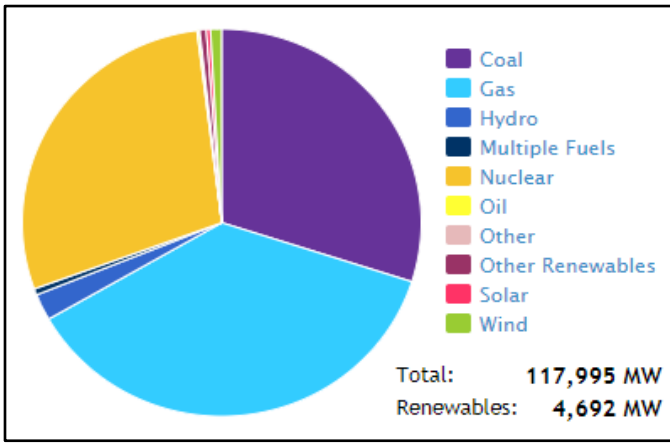


Figure 1.1-6
PJM Capacity Fuel Mix – July 2018



Fuel	MW	Percent of Total
Coal	35,320	30%
Gas	43,390	37%
Hydro	2,627	2%
Multiple Fuels	619	1%
Nuclear	33,705	29%
Oil	221	0%
Other	48	0%
Other Renewables	611	1%
Solar	390	0%
Wind	1,064	1%
Total	**117,995**	**100%**

In addition to the long term benefits offered by the Project, such as enhanced system reliability, supply diversity, modernization of the natural gas infrastructure system, and significant consumer savings, there are also significant short term benefits provided by the Project. The design, construction, and engineering phases of the project are expected to produce a significant economic benefit/boom to the region. Drexel University's highly renowned School of Economics and Econsult Solutions constructed a standard input-output model of the Project's expenditures. The study titled "PennEast Pipeline Project Economic Impact

[7] Energy Information Administration Annual Energy Outlook 2014

Analysis" estimates over $1.6 billion in economic benefits, 12,160 jobs supported from the investment and $740 million in labor income generated from Project's design and construction. Importantly, Drexel and Econsult also estimated for every $10 million in increased disposable income resulting from reduced energy costs, this would generate a total economic impact of $13.5 million and support 90 jobs. Therefore, combined with the $893 million of potential annual energy savings estimated by Concentric as described earlier, PennEast represents a potential ongoing annual economic benefit of $1.21 billion and 8,041 jobs to the region. Therefore, the proposed Project will help to spur economic growth in New Jersey, Pennsylvania and surrounding states by providing an abundant supply of low-cost energy, making the region more competitive.

S1.B.2 Statement of Water Dependency

PennEast requires access and proximity to and siting in, on, over or under waters and wetlands in order to achieve its basic purpose to provide approximately 1.1 million MMDth/day of year-round transportation service from northern Pennsylvania to markets in eastern and southeastern Pennsylvania, New Jersey and surrounding states. Therefore, the linear nature and approximately 78 miles of the Project across four counties in Pennsylvania make the Project water-dependent, according to 25 Pa. Code 105.13(e)(1).

S1.B.3 Summary of Resources on Project Site

The area investigated for this Project was defined by an approximately 1,509.6-acre Study Area in Carbon County. Table CA-L1-6 below provides a summary of the amount and types of riverine and lacustrine, including floodways, and wetland resources that were identified within the Study Area in Carbon County.

Table CA-L1-6
Summary of Delineated Resources Present within the Project Study Area in Carbon County

Resource Type	Classification	Quantity within Project Study Area	Delineated Size within Project Study Area (acres)	Quantity Impacted by the Project	Delineated Size Impacted by the Project (acres)
Wetland[1]	PEM	37	11.463	23	1.638
	PSS	19	21.652	11	0.458
	PFO	36	53.247	22	9.478
	PUB	3	0.213	1	0.075
	Mosaic	1	0.138	1	0.024
	Vernal Pool	2	0.042	1	0.013
	Total	**98**	**86.755**	**59**	**11.686**
Riverine and Lacustrine (including floodways)[2]	EPH	12	8.220	9	1.618
	INT	36	23.557	25	3.101
	PER	32	48.004	27	3.788
	Total	**80**	**79.781**	**61**	**8.507**

Notes:

1. PEM: Palustrine Emergent, PSS: Palustrine Shrub-Scrub, PFO: Palustrine Forested, PUB: Palustrine Unconsolidated Bottom

Resource Type	Classification	Quantity within Project Study Area	Delineated Size within Project Study Area (acres)	Quantity Impacted by the Project	Delineated Size Impacted by the Project (acres)

2. PER: Perennial, INT: Intermittent, EPH: Ephemeral

S1.B.4 Summary of Permanent, Temporary, Direct, and Indirect Project Impacts

Permanent and temporary impacts are defined in defined in Section S.1.A(i) above. Temporary impacts include those areas affected during the construction of a water obstruction or encroachment that are restored upon completion of construction, but do not include areas that are required to operate and maintain the water obstruction or encroachment. For the Project, temporary impacts would include any workspace within a wetland, watercourse, or floodway that will be impacted during construction but is outside of the 30-foot maintained ROW, including temporary access roads, wareyards, and staging areas. Temporary impacts may result from workspace for spoil storage, equipment bridges, wetland matting, and other pipeline construction staging activities. For the Project, permanent impacts would include the proposed pipeline and its 30-foot maintained ROW, a new permanent access road that will result in permanent fill within a floodway and a new culvert installed within a watercourse, two permanent culvert replacements, and permanent fill in approximately 0.036 acres of PEM wetlands and 0.024 acres of PFO wetland mosaic to construct and operate the Kidder Compressor Station in Carbon County.

Permanent and temporary impacts can be also be categorized as direct or indirect impacts. Direct impacts include the temporary or permanent loss of a resource through filling, draining, or converting a resource to another type, such as changing a palustrine wetland to a lacustrine wetland. For the Project, direct impacts include the installation of temporary equipment bridges and wetland mats, replacement of two existing culverts, the installation of a new permanent culvert, fill within one floodway, and fill within approximately 0.036 acres of PEM wetlands and 0.024 acres of PFO wetland mosaic to construct and operate the Kidder Compressor Station in Carbon County. Indirect impacts consist of altering the chemical, physical, or biological components of an aquatic resource that result in a functional change of the resource, with no net loss of resource acreage. The construction workspace within wetlands, watercourses, and floodways that is needed to construction the Project is considered an indirect impact. The area within the permanent ROW necessary to operate and maintain the Project is also an indirect impact.

Specifically within Carbon County, the permanent, temporary, direct, and indirect impacts are described below:

- Temporary indirect impacts include the acreage of wetlands, watercourses, and floodways within the construction workspace that are outside of the 30-foot maintained ROW.

- Temporary direct impacts within Carbon County include the installation of temporary equipment bridges across watercourses and temporary mats within floodways and wetlands. PennEast anticipates using 16-foot wide timber mats of other comparable structures to construct temporary bridges and to mat wetlands.

- Permanent direct impacts are limited to the installation of a new culvert associated with the Kidder Compressor Station and the replacement of one existing culvert along access road AR-034. The existing

corrugated metal culvert on AR-034 is in disrepair, and would not support the construction equipment that is necessary for Project construction. Therefore, PennEast proposes to replace the culvert.

- Permanent indirect impacts are limited to the acreage of wetlands, watercourses, and floodways within the 30-foot maintained ROW.

Table CA-L1-7 below provides a summary of the proposed permanent and temporary direct and indirect impacts of the Project in Carbon County. Because these impact types overlap, the impacts are not additive.

Table CA-L1-7
Carbon County Impact Summary

Resource Type	Direct (acres)	Indirect (acres)
Permanent		
Riverine (including floodways)	0.322	3.923
Lacustrine (including floodways)	-	0.045
Wetland	0.060	4.699
Temporary		
Riverine (including floodways)	0.813	4.539
Lacustrine (including floodways)	-	-
Wetland	4.643	6.987

References

Commonwealth of Pennsylvania. 2018. The Pennsylvania Code, Title 25: Environmental Protection, Chapter 93: Water Quality Standards. Accessed at https://www.pacode.com/secure/data/025/chapter93/chap93toc.html on February 13, 2018.

PADEP 2003. Water Quality Antidegradation Implementation Guidance. Document Number 391-0300-002. PADEP, Bureau of Water Supply and Wastewater Management. Available online at: http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-47704/391-0300-002.pdf

PADEP 2012. Erosion and Sediment Pollution Control Program Manual. Technical Guidance Number 363-2134-008. PADEP, Bureau of Water Supply and Wastewater Management. Available online at: http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-88925/363-2134-008.pdf