ATTACHMENT P -1

ALTERNATIVES ANALYSIS

Revised November 18, 2016

1.0 INTRODUCTION

This Alternatives Analysis report describes the alternatives considered or currently under consideration for the proposed Atlantic Sunrise Project. This report discusses the following categories of alternatives: the no-action alternative, system alternatives, route alternatives, and construction alternatives. Additionally, ~~there s~~**S**ections 7 and 8 herein consider ~~Lancaster~~ **Columbia** County minor route alternatives and deviations.

The objective of Transcontinental Gas Pipe Line Company's (Transco's) alternatives analysis is to develop proposed pipeline routes that will be constructible, accomplish the Project's purpose, and will avoid or minimize potential adverse environmental impacts. This alternatives analysis was also developed to be consistent with the Federal Energy Regulatory Commission's regulatory requirements as set forth in 18 Code of Federal Regulations 380.15 and 25 PA. Code § 105.13(e)(viii). Thus, it contains a detailed analysis of alternatives to the proposed action, including alternative locations, r~~a~~outings or designs to avoid or minimize environmental impacts.

The information contained in this report is based upon field surveys, desktop review of available literature, stakeholder input, and publicly available information regarding existing pipeline infrastructure. Comparison analysis of the alternatives discussed in this report is based on rights-of-way (ROW) width assumptions and available data sets for desktop analysis. ~~Because this is a linear pipeline project access to private property will need to be obtained by negotiation in condemnation following the issuance of a Certificate of Public Necessity from FERC. Therefore, this report does not rely upon actual field survey data.~~

2.0 NO-ACTION ALTERNATIVE

This section describes the benefits and consequences of not constructing the Project. For example, if Transco does not construct the Project, temporary and permanent environmental impacts associated with construction and operation would be avoided. However, by not constructing the Project, Transco would not be able to provide the natural gas transportation service requested by the customers that have executed binding agreements for Transco to provide 1.7 million dekatherms per day (MMDth/d) of incremental firm transportation of natural gas from the Marcellus Shale production areas in northern Pennsylvania to its existing market areas, extending to as far south as the Station 85 Pooling Point1 in Choctaw County, Alabama. The no-action alternative would not result in increased access to reliable, domestic natural gas supplies from the Marcellus Shale production areas. Transco's review of existing and available energy sources indicates that natural gas is the best fuel source to provide clean, reliable energy necessary to meet existing and future demand while minimizing environmental impacts.

The existing Transco facilities in or near the Project area are not currently designed to transport natural gas from north to south and do not provide adequate pipeline takeaway capacity for transportation of natural gas to meet current transportation demand. If the no-action alternative is selected, Transco's customers will need to:

- Seek other transportation services;
- Forgo meeting their natural gas demand until energy conservation measures stabilize or decrease demand, possibly limiting their growth and the growth of the local economies they serve; and
- Depend on other future development projects with unpredictable schedules and undetermined environmental impacts.

For the reasons described above, the no-action alternative does not meet the Project objectives of providing the additional transportation capacity of natural gas requested by its customers within the time frame required.

3.0 TRANSCO EXISTING SYSTEM ALTERNATIVE

The Transco Existing System Alternative (Figure P-1) would utilize the existing ROWs of Transco's Leidy Line and Mainline systems to the extent practicable by installing noncontiguous pipeline looping and other facilities along these systems. This alternative incorporates a segment of the current proposed CPL North route, from the Zick Meter Station at about milepost (MP) 57.33, to the proposed North Diamond Regulator Station near MP L92.7 in Luzerne County, Pennsylvania. From this point, the alternative route runs east along the Leidy Line system to existing Compressor Station 515 in Luzerne County, Pennsylvania. An additional Leidy Line loop would be required between existing Compressor Stations 517 and 515 to accommodate volumes moving eastward. East of Compressor Station 515, several sections of looping would be required to transport the incremental volumes along the Leidy Line and Transco Mainline systems.

The proposed Unity Loop, Chapman Loop, and horsepower additions at Compressor Stations 517, 520 and 190 would still be required. Similarly, facilities located south of Compressor Station 195 (i.e., pipeline replacements in Virginia and aboveground facility modifications in Maryland, Virginia, North Carolina, and South Carolina) would also be required for the Transco Existing System Alternative to meet the purpose and need for the Project. Facilities that are common between the Project and the Transco Existing System Alternative are presented below in underlined text to distinguish them from the facilities unique to the Transco Existing System Alternative. This alternative is depicted as Figure P-1.

The following facilities would be necessary for the Transco Existing System Alternative:

- Greenfield Pipeline
    - 36.2 miles of new 30-inch-diameter greenfield pipeline in Pennsylvania from the Zick Meter Station to the North Diamond Regulator Station.
- Looping Pipeline
    - 8.6 miles of new 42-inch-diameter looping in Lycoming County, Pennsylvania (Unity Loop).
    - 2.9 miles of new 36-inch-diameter looping in Clinton County, Pennsylvania (Chapman Loop).
    - 23.7 miles of new 42-inch-diameter loop from MP L92.7 to Station 515 in Luzerne County, Pennsylvania.
    - 8.6 miles of new 42-inch-diameter loop from MP LL7.7 4 to MP LL9.0 in Luzerne County, Pennsylvania.
    - 8.3 miles of new 42-inch-diameter loop from Station 515 to L60.7 in Luzerne County and Monroe County, Pennsylvania.
    - 14.8 miles of new 42-inch-diameter loop from L57.5 to L42.7 in Monroe County, Pennsylvania.
    - 30.3 miles of new 42-inch-diameter loop from Transco Delaware Regulator Station to Centerville Regulator Station (includes Delaware River Crossing) in

Northampton County, Somerset County, and Warren County, New Jersey, and Northampton County, Pennsylvania.

- 16.6 miles of new 42-inch-diameter loop from Transco Centerville Regulator Station to Transco Station 205 in Somerset County and Mercer County, New Jersey.
- 7.7 miles of new 42-inch-diameter loop from MP 1765.7 to Station 205 in Mercer County, New Jersey.
- 43.0 miles of new 42-inch-diameter loop from Station 200 to MP 1765.3 in Mercer County, New Jersey, and Bucks County, Pennsylvania.
- 39.6 miles of new 42-inch diameter loop from MP 1682.7 to Station 200 in Chester County and Lancaster County, Pennsylvania.
- 4.8 miles of new 42-inch-diameter loop from Station 195 to MP 1679.3 in York County, Pennsylvania.

- Pipeline Replacement
    - 2.5 miles of 30-inch-diameter pipeline replacements between Transco Mainline MP 1578.7 and 1581.0 in Prince William County, Virginia.
- Greenfield Compressor Station
    - One new 30,000-horsepower (hp) compressor station in Wyoming County, Pennsylvania (Station 605).
- Horsepower Additions at Existing Transco Compressor Stations
    - One new 16,000-hp compressor unit at Station 520 in Lycoming County, Pennsylvania.
    - One new 16,000-hp compressor unit at Station 517 in Columbia County, Pennsylvania.
    - One new 16,000-hp compressor unit and one new 30,000-hp compressor unit at Station 515 in Luzerne County, Pennsylvania.
    - One new 30,000-hp compressor unit at Station 200 in Chester County, Pennsylvania.
    - One new 15,000-hp compressor unit at Station 195 in York County, Pennsylvania.
    - One new 30,000-hp compressor unit at Station 190 in Howard County,

Maryland.

- Additional ancillary facilities, such as MLVs, cathodic protection, communication facilities, and internal inspection device (i.e., pig) launchers and receivers in Pennsylvania.
- Two new meter stations and three new regulator stations with interconnecting piping in Pennsylvania.
- Modifications to six existing compressor stations that enable compression for bidirectional flow in Maryland, Virginia, and North Carolina;
- Installation of deodorization/odor masking equipment at four existing compressor stations in North Carolina
- Supplemental odorization, odor detection, and/or odor masking/deodorization equipment at 42 meter/regulator stations in North Carolina and South Carolina; and
- Odor masking/deodorization equipment at 14 MLV locations in North Carolina and South Carolina.

Transco did not select this system alternative due to the following constraints:

- The alternative would require construction of about 51.1 miles of additional pipeline along the Transco Mainline and Leidy Line systems. The longer distance of this route would require more total land than the Project for construction and would increase impacts on land uses, especially on forest lands, wetlands, waterbodies, and major waterbodies. As indicated above, the Chapman Loop would still be needed for this alternative.
- Pipeline looping along Transco's existing Mainline System would locate pipeline in proximity to areas of high population density, including: Wilkes-Barre, Pennsylvania; Trenton, New Jersey; and Princeton, New Jersey. Therefore, colocation with the existing Mainline System would not be possible for all pipeline looping.
- Looping along these areas would result in greater impacts on residential and other developed areas with a 15 times greater occurrence of residential structures located within 50 feet of construction workspace.
- High densities of residential developments in proximity to the existing pipeline facilities would likely require acquisition of residential properties to allow the addition of a pipeline loop within Transco's existing Mainline System ROWs.

- The alternative would require 183,000 hp of compression, which is 51,000 hp more than the Project.

Due to the increased horsepower and looping required and the associated increase in residential impacts, this alternative was removed from further consideration.

4.0 DEVELOPMENT OF THE PROPOSED ROUTE

Based on the commercial aspects of the Project, Transco evaluated start and endpoints for the Project and identified potential route alternatives between the start and endpoints of the Central Penn Line. This section provides the framework used to define the route start and endpoints of the Central Penn Line, as well as selection of the proposed route.

4.1 Route Start and Endpoints

The locations that Transco evaluated for start and endpoints were based on the need to meet the stated purpose of the Project while maximizing the use of existing Transco infrastructure for efficiency and reliability and to minimize the amount of incremental facilities required. Using these parameters, Transco designed the Project to have the capacity to receive up to 1.7 MMDth/d of natural gas from both new receipt points on CPL North and from existing receipt points along the Leidy Line system.

4.2 Selecting the North Endpoint of CPL North

New receipt points on CPL North include the Zick and Springville Meter Station in Susquehanna County, Pennsylvania, which can provide approximately 850,000 dekatherms per day (Dth/d) from interconnecting midstream pipelines. As it is the northernmost receipt point, Transco determined that the Zick Meter Station will serve as the northern endpoint of the pipeline route.

4.3 Selecting the Tie-In Location between CPL North, CPL South, and Existing Leidy Line System

In addition to the 850,000 Dth/d received on CPL North, the remaining 850,000 Dth/d will be received through various receipt points along Transco's existing Leidy Line system, and the full 1.7 MMDth/d will be aggregated into CPL South. CPL North and existing Leidy Line A share a corridor that rejoins Leidy Line system pipelines B, C, and D at MP L113.7. This is the easternmost location of the preferred aggregation point. Compressor Station 517 is located at MP L115.2 and defines the westernmost location of the aggregation point. Aggregating volumes on the discharge (east) side of Compressor Station 517 optimizes the horsepower at the station, providing higher pressure into CPL South. Therefore, an aggregation point between MP L113.7 and L115.2 is preferred. Transco determined MP L114.0 to be the ideal point within this range, as it would shorten the length of the CPL North pipeline. Furthermore, if the aggregation point were located west of Compressor Station 517 at approximately MP L123.0, an additional 25,000 hp would be required at proposed Compressor Station 610 as lower suction pressure gas would be entering the station piping. Consequently, this reinforces Transco's proposed tie-in location between MP L113.7 and MP L115.2.

<u>4.4 Selecting the Tie-In Location between CPL South and the Existing Transco Mainline</u>

The southern endpoint of CPL South must tie into Transco's existing Mainline system in order to serve its existing market areas. To minimize the amount of additional facilities needed to meet the Project's purpose, Transco determined that the optimal hydraulic endpoint of the pipeline route is between MP 1674.6 (existing Compressor Station 195) and MP 1683.7 of the Transco Mainline system. However, extending south of MP 1679.8 would necessitate an additional crossing of the Susquehanna River, for which Transco was not able to find a suitable crossing location. Therefore, Transco determined the optimal range to be between MP 1679.8 and 1683.7. The proposed route for CPL South ties into the existing Transco Mainline system at MP 1683.3.

Any system tie-ins north of MP 1683.7 would require additional mainline facilities (mainline looping and/or compression) between existing Compressor Station 195 and the tie-in location. For example, Transco evaluated a tie-in point near MP 1686.4, located 3.10 miles northeast of the current proposed tie-in. Transco's hydraulic study determined that a tie-in at this location would require an additional 4,000 hp at existing Compressor Station 195, as well as compressor re-wheeling and modifications to two existing reciprocating compressors to operate the higher differential pressure. Alternatively, an approximately 4-mile-long loop would be required between MP 1682.4 and MP 1686.4. Any tie-in point further northeast than MP 1686.4 would necessitate additional incremental facilities, such as additional compression, looping, or some combination of the two.

<u>4.5 Routing Alternatives & Proposed Route Selection</u>

Transco identified certain routing constraints and sensitive areas requiring detailed analysis to ensure avoidance or minimization of impacts when evaluating alternatives and selecting the proposed pipeline routes.

When identifying routing options, Transco attempted to co-locate the pipeline with existing utility corridors and ROWs while considering impacts on other environmental factors. The use of co-location as a principal design element is consistent with the FERC guidelines, which stress the corridor concept, and complements the existing land use characteristics in the Project area. Siting pipeline facilities along existing corridors reduces the need to establish new corridors in previously undisturbed areas, which reduces the amount of fragmentation of interior forest and minimizes the number of affected landowners. Transco defines co-location as siting a pipeline right-of-way (ROW) that:

- Lies within an existing ROW or easement; or
- Abuts an existing ROW or easement.

The following routing considerations also influenced the development of the proposed routes:

- Identifying crossing locations of the Susquehanna River where, based on terrain, horizontal directional drilling (HDD) appeared to be technically feasible;
- Minimizing visual impacts on the Appalachian Trail;
- Crossing areas of significant topographic relief where technically feasible;
- Avoiding state lands, including state parks, state forests, and state game lands to the maximum extent practicable; and
- Avoiding densely populated areas to the extent practicable.

Transco's pipeline route selection process considered three types of route alternatives:

- Major route alternative – a route that differs substantially in both length and distance from the proposed route, which are described in Section 6.0 and are presented on an entire Project basis for the overall Atlantic Sunrise Project;

- Minor route alternative – a route that deviates from short segments of the proposed route which are described in Section 7.0 and are presented on a County basis related to the specific permit application for which this Attachment P is prepared for; and
- Route deviation – minor adjustments to the proposed route, typically to avoid specific features (e.g., topography, sensitive habitat, structures), summarized in Table P-1 for CPL North and CPL South.

After taking the above into consideration, Transco narrowed its analysis to 600-foot-wide study corridors for the CPL North and CPL South pipeline routes, which were determined based on desktop data and aerial reconnaissance (helicopter overflights). Once this initial routing process was complete, Transco began field routing efforts within these study corridors. These field efforts began in May 2014 and continued up to the submittal of this ***revised*** application. A detailed discussion on the field routing process and impact avoidance and minimization measures undertaken as part of the Project are described in Section 5.0 of this Alternatives Analysis.

In addition to route adjustments based on field routing, biological and cultural resource surveys, Transco considered alternatives requested by landowners and other stakeholders through stakeholder outreach, commencing with Transco's open houses held in May and June of 2014. Transco reviewed each requested route adjustment for feasibility as a viable alternative based on the Project route, constructability, and the minimization of impacts on sensitive resources.

Transco used various data sources to identify and evaluate pipeline route alternatives, including: observations made during routing surveys and field reconnaissance; Google Earth™; geographic information system databases from county, state, and federal sources; recently produced aerial photography; U.S. Geological Survey (USGS) topographic maps; National Wetland Inventory maps; and remote-sensing data. The factors used to select the proposed routes over the alternative routes focused on FERC scoping information, landowner concerns, minimizing the number of affected landowners, minimizing adverse environmental impacts, ensuring constructability, and promoting safety.

FIGURE P-1

5.0 IMPACT AVOIDANCE AND MINIMIZATION MEASURES

Due to the linear nature of the Project, it is not possible to completely avoid impacts to wetlands, waterbodies, or other sensitive resources. Therefore, Transco used a comprehensive field routing process to identify a constructible alignment for CPL North and CPL South that would minimize impacts to wetlands, waterbodies, or other sensitive resources to the extent practicable. A similar approach was taken on the Chapman and Unity Loops; however, in these cases routing options were limited to the north or south side of the existing right-of-way to maximize opportunities for co-location. Impact minimization and avoidance has been accomplished with field routing teams comprised of engineering, construction, and environmental specialists. These teams are assessing the routes with regard to the following considerations:

Engineering

- Avoiding general engineering and constructability constraints;
- Minimizing route distance along steep slopes and side slopes;
- Reducing the number of severe pipeline bends and turning angles;
- Identifying and avoiding, where practicable, areas of karst topography;
- Identifying and evaluating opportunities for utilizing trenchless technology such as HDD and boring; and
- Identifying and avoiding, where practicable, locations with a potential need for blasting.

Environmental

- Minimizing impacts at any single wetland crossing to 1 acre or less wherever practicable;
- Avoiding or minimizing impacts on forested wetlands and other wetlands;
- Avoiding or minimizing impacts on known threatened and endangered species habitat, such as:
    - Rocky talus slopes potentially used as habitat by the timber rattlesnake (*Crotalus horridus*), Allegheny woodrat (*Neotoma magister*), and small-footed bat (*Myotis leibii*);
    - Wetland complexes with features suggesting potential suitability as bog turtle habitat; and

  - Palustrine emergent wetlands surrounded by woodlands, which may be suitable habitat for the northeastern bulrush (*Scirpus ancistrochaetus*)
  - Forest stands containing trees greater than 5 inches diameter at breast height with exfoliating bark, cracks, crevices, and/or hollows. Prime examples would include live shagbark hickory trees (*Carya ovata*) and shellbark hickory trees (*C. laciniosa*), dead elms (*Ulmus* spp.), dead poplars (*Populus spp*.), or any tree with a rotted-out cavity, which may be potential roosting trees or suitable habitat for the Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*).
- Crossing waterbodies at 90 degree angles to minimize in-stream disturbance wherever practicable;
- Avoiding or minimizing crossings of major waterbodies;
- Minimizing impacts on contiguous upland forest by routing the centerline along tree lines or through existing cleared areas to the greatest extent practicable; and
- Identifying and avoiding, where practicable, groundwater springs/seeps.

Land

- Minimizing impacts on private property and structures;
- Minimizing conflicts with land use; and
- Minimizing impacts on residential water wells and septic systems.

Cultural

- Avoiding or minimizing impacts on sites listed on or potentially eligible for listing on the National Register of Historic Places; and
- Identifying and avoiding, where practicable, aboveground structures that appeared to be over 50 years old.

Transco initiated routing surveys within the 600-foot-wide study corridors in May ***2014*** and ~~will~~ ***has*** continue***d*** the routing process ***through 2016*** as survey permission ~~is~~ ***has been*** granted. **~~This process will continue until all parcels are surveyed~~.**

The routing survey crews started with a preliminary pipeline route centered within the 600-foot-wide study corridors. The preliminary pipeline route was either confirmed as adequate or adjusted to avoid and/or minimize, to the extent practicable, any issues encountered during the routing surveys according to the considerations noted above. The routing survey teams documented the reasons for the adjustments and classified them according to the engineering, environmental, land, and cultural considerations evaluated. ***Appendix P-1 provides the results of stream and wetland avoidance and minimization measures identified for the Project in Susquehanna County by the routing survey crews.***

~~**Since routing surveys began in May 2014, the survey teams have completed 352 adjustments to the CPL North and CPL South routes. These adjustments avoided, reduced, or minimized impacts on sensitive features identified during the routing surveys. Approximately 25 percent of the adjustments were along CPL North, with the remaining 75 percent located along CPL South. Most of the adjustments resulted in the avoidance or minimization of impacts on more than one feature. Table P-1 depicts the summary of route adjustments made during field survey for CPL North and CPL South by feature type.**~~

~~**Table P-1**~~
~~**Summary of Routing Adjustments**~~

County	Features Avoided or Minimized Based on Route Adjustments						
	Wetland	Waterbody	T&E Habitat	Engineering	Land	Cultural	Upland Forest
Columbia	1	0	0	0	1	0	1
Luzerne	6	3	1	2	7	0	6
Wyoming	9	8	0	9	16	1	9
Susquehanna	2	3	0	5	2	0	2
CPL North Total	18	14	1	16	26	1	18
Lancaster	6	19	1	21	33	0	6
Lebanon	17	21	3	18	25	2	17
Schuylkill	2	4	0	2	6	0	2
Northumberland	0	0	0	3	5	0	0
Columbia	6	11	1	8	12	1	6
CPL South Total	31	55	5	52	81	3	31

County	Features Avoided or Minimized Based on Route Adjustments						
	Wetland	Waterbody	T&E Habitat	Engineering	Land	Cultural	Upland Forest
Key: CPL = Central Penn Line T&E = Threatened and Endangered							

6.0 ATLANTIC SUNRISE MAJOR ROUTE ALTERNATIVES – CENTRAL PENN LINES

Major route alternatives differ substantially in both length and distance from the proposed route. During the Project development process, Transco considered three major route alternatives before selecting its 600-foot-wide study corridors and proposed routes: the Diamond CPL North Alternative, Williams Midstream CPL North Alternative, and Western CPL South Alternative.

Each of the major route alternatives is described below. Transco did not complete full hydraulic modeling, nor did it evaluate costs for any of the major alternatives, because those alternatives have significantly greater environmental impacts than proposed routes for CPL North and CPL South. Figure P-2 shows the major alternatives in relation to the proposed routes.

<u>6.1 Diamond CPL North Alternative</u>

The Diamond CPL North Alternative6 starts at the Zick Meter Station in Susquehanna County, Pennsylvania. The route continues south for approximately 80 miles, bisecting Transco's existing Leidy Line A to the north and Leidy Lines B and C to the south and terminates near MP 93.2 of the CPL South route in Columbia County, Pennsylvania.

Approximately 48 miles of the route is co-located with other ROW, with the remaining approximately 32 miles being primarily greenfield. The Diamond CPL North Alternative is an alternative route for CPL North, as the entire length of CPL South would still be required for this alternative, including the segment of the proposed route between MP 125.1 and MP 93.2. CPL South MP 93.2 would become the new aggregation point for Leidy Line system volumes and CPL North volumes.

The Diamond CPL North Alternative is approximately 23 miles longer than the corresponding sections of the proposed CPL North route and would likely require an additional compressor station along CPL North because it would bypass Compressor Station 517 along Transco's Leidy Line system. Table P-2 provides a summary comparison of the Diamond CPL North Alternative to the CPL North route.

Table P-2
Diamond CPL North Alternative Route Comparison

Factor	Diamond CPL North Alternative	Corresponding Section of CPL North	Difference from CPL North
Length of Corresponding Segment (miles)	79.9	57.4	+22.5
Co-location			
Length Adjacent to Interstate Pipeline ROW	0.0	21.2	-21.2
Length Adjacent to Midstream Pipeline ROW	0.0	4.8	-4.8
Length Adjacent to Electric Transmission Line ROW (miles)	47.3	0.0	+47.3
Length Adjacent to Roadway (miles)	1.4	0.1	+1.3
Total Length Co-located (miles)	48.7	26.1	+22.6
ROW Requirements			
Pipeline Construction Requirements (acres)[a]	968.4	696.0	+272.4
Pipeline Operation Requirements (acres)[b]	484.3	283.8	+200.5
Federal and State Land			
Federal Lands Crossed (number/miles)	0 / 0.0	0 /0.0	0 / 0.0
State Lands Crossed (number/miles)	1 / 1.4	2 / 1.6	-1 / -0.2
Land Use			
Forested Land Crossed (miles)[c]	47.7	37.5	+10.2
Forested Land Impacts (construction/operation) (acres)[d]	577.4 / 288.8	456.6 / 174.7	+120.8 / +114.1
Agricultural Land Crossed (miles)[c]	23.1	15.0	+8.1
Agricultural Land Impacted (construction/operation) (acres)[d]	281.0 / 140.3	180.6 / 84.8	+100.4./ +55.5
Other Land Crossed (miles)[c,e]	9.1	4.9	+4.2
Other Land Impacted (construction/operation)	110.0 / 55.2	58.8 / 24.3	+51.2 / +30.9
Waterbodies			
Waterbodies Crossed (number)[f]	72	51	+21
Major Waterbody Crossings (number >100 feet)[g]	8	2	+6
Wetlands			

Table P-2
Diamond CPL North Alternative Route Comparison

Factor	Diamond CPL North Alternative	Corresponding Section of CPL North	Difference from CPL North
Total Wetland Complexes Crossed (number)[h]	32	15	+17
Total Wetland Crossed (miles)[h]	1.7	0.7	+1.0
Palustrine Forested Wetland Complex Impacts (construction/operation) (acres)[h]	10.2 / 5.1	7.0 / 2.7	+3.2 / +2.4
Other Physical Features			
Road Crossings (number)	122	86	+36
Railroad Crossings (number)	7	2	+5

[a] Pipeline construction requirements based on a 100-foot-wide construction corridor and includes a 100-foot long buffer at begin and end points.
[b] Pipeline operation requirements based on a 50-foot-wide corridor in greenfield segments, and a 25-foot-wide corridor for segments co-located with Transco pipelines. Calculation includes a 50-foot long buffer at begin and end points.
[c] Forested land, agricultural land and other land crossed are based on geographic information system (GIS) centerline analysis using United States Geological Survey (USGS) National Land Cover Dataset (NLCD).
[d] Forest land, agricultural land, and other land impacted are based on GIS corridor analysis using USGS NLCD. Since multiple land use types may be present within the corridor, impact acreage for individual land uses will not be representative of distance crossed, which is based on centerline analysis.
[e] Other land based on USGS NLCD and includes land cover types: Barren Land, Developed High Intensity, Developed Low Intensity, Developed Medium Intensity, Developed Open Space, Emergent Herbaceous Wetlands, Herbaceous, Open Water, Shrub Scrub, Woody Wetlands.
[f] Waterbodies identified based on National Hydrography Dataset (NHD).
[g] Major waterbodies identified based on review of aerial photography.
[h] Wetlands identified using the National Wetland Inventory (NWI).

Key:
CPL = Central Penn Line
ROW = right-of-way

Transco did not select this alternative due, in part, to the following constraints:

- It would likely require a second new compressor station along the CPL North pipeline;
- The route crosses in proximity to Scranton, Wilkes-Barre, and Nanticoke, Pennsylvania, resulting in greater impacts on residential and other developed areas; and

- Total mileage of CPL North would increase by about 23 miles, and the length of CPL South would not be reduced.

Any configuration of the Diamond CPL North Alternative would still require construction of the portion of the alternative north of the intersection with the Leidy Line System. Due to the high density of populated areas north of the Leidy Line System, Transco did not evaluate additional configurations of the Diamond CPL North Alternative.

6.2 Williams Midstream CPL North Alternative

The Williams Midstream CPL North Alternative starts at the Zick Meter Station in Susquehanna County, Pennsylvania. The route continues west along the Williams Field Services (midstream) Appalachian Basin Area, generally co-locating with 10-inch- and 12-inch- diameter pipelines for approximately 11 miles. The majority of the route then runs adjacent to the existing Williams Field Services Springville 24-inch-diameter midstream pipeline until the route intersects with the Transco's Leidy System, where the route is co-located four (4) miles before terminating at its connection point, near MP 21.3 on the proposed CPL North route in Luzerne County, Pennsylvania. The Williams Midstream CPL North Alternative is approximately 10.9 miles longer than the CPL North proposed route. Table P-3 provides a summary comparison of the Williams Midstream CPL North Alternative and the CPL North proposed route.

Table P-3
Williams Midstream CPL North Alternative Route Comparison

Factor	Williams Midstream CPL North Alternative	Corresponding Section of CPL North	Difference from CPL North
Length of Corresponding Segment (miles)	46.2	36.0	10.2
Co-location			
Length Adjacent to Interstate Pipeline ROW	4.0	0.0	+4.0
Length Adjacent to Midstream Pipeline ROW	40.2	4.8	+35.4
Length Adjacent to Electric Transmission Line ROW (miles)	0.0	0.0	0.0
Length Adjacent to Roadway (miles)	0.0	0.1	-0.1
Total Length Co-located (miles)	44.2	4.9	+39.3
ROW Requirements			

Table P-3
Williams Midstream CPL North Alternative Route Comparison

Factor	Williams Midstream CPL North Alternative	Corresponding Section of CPL North	Difference from CPL North
Pipeline Construction Requirements (acres)[a]	560.0	436.6	+123.6
Pipeline Operation Requirements (acres)[b]	267.9	218.3	+49.7
Federal and State Land			
Federal Lands Crossed (number/miles)	0 / 0.0	0 / 0.0	0 / 0.0
State Lands Crossed (number/miles)	0 / 0.0	0 / 0.0	0 / 0.0
Land Use			
Forested Land Crossed (miles)[c]	25.6	20	+5.6
Forested Land Impacts (construction/operation) (acres)[d]	310.0 / 151.7	244.4 / 121.7	+65.6 / +30.0
Agricultural Land Crossed (miles)[c]	15.9	13.0	+2.9
Agricultural Land Impacted (construction/operation) (acres)[d]	192.4 / 92.5	156.7 / 78.7	+35.7 / +13.8
Other Land Crossed (miles)[c,e]	4.7	3.0	+1.7
Other Land Impacted (construction/operation) (acres)[d,e]	57.6 / 22.8	35.5 / 17.9	+22.1 / +4.9
Waterbodies			
Waterbodies Crossed (number)[f]	37	24	+13
Major Waterbody Crossings (number >100 feet)[g]	6	2	+4
Wetlands			
Total Wetland Complexes Crossed (number)[h]	20	10	+10
Total Wetland Crossed (miles)[h]	0.7	0.4	+0.3
Palustrine Forested Wetland Complex Impacts (construction/operation) (acres)[h]	4.2 / 1.5	3.8 / 1.9	+0.4 / -0.4
Other Physical Features			
Road Crossings (number)	65	50	+15
Railroad Crossings (number)	3	2	+1

Table P-3
Williams Midstream CPL North Alternative Route Comparison

Factor	Williams Midstream CPL North Alternative	Corresponding Section of CPL North	Difference from CPL North

[a] Pipeline construction requirements based on a 100-foot-wide construction corridor and includes a 100-foot long buffer at begin and end points.
[b] Pipeline operation requirements based on a 50-foot-wide corridor in greenfield segments, and a 25-foot-wide corridor for segments co-located with Transco pipelines. Calculation includes a 50-foot long buffer at begin and end points.
[c] Forested land, agricultural land and other land crossed are based on geographic information system (GIS) centerline analysis using United States Geological Survey (USGS) National Land Cover Dataset (NLCD).
[d] Forest land, agricultural land, and other land impacted are based on GIS corridor analysis using USGS NLCD. Since multiple land use types may be present within the corridor, impact acreage for individual land uses will not be representative of distance crossed, which is based on centerline analysis.
[e] Other land based on USGS NLCD and includes land cover types: Barren Land, Developed High Intensity, Developed Low Intensity, Developed Medium Intensity, Developed Open Space, Emergent Herbaceous Wetlands, Herbaceous, Open Water, Shrub Scrub, Woody Wetlands.
[f] Waterbodies identified based on National Hydrography Dataset (NHD).
[g] Major waterbodies identified based on review of aerial photography.
[h] Wetlands identified using the National Wetland Inventory (NWI).

Key:
CPL = Central Penn Line
ROW = right-of-way

Transco did not select this route due to the following constraints:

- The midstream pipeline routes have several tight turns that would be impractical for the route of the 30-inch-diameter CPL North pipeline, making co-location through certain areas of the alternative infeasible; and
- The alternative crosses through more densely populated areas than the CPL North route, particularly on the south end where the alternative route is not co- located with the Springville pipeline. This would result in significant impacts on residential and other developed areas.

6.3 Western CPL South Alternative

The Western CPL South Alternative starts in Lycoming County, Pennsylvania, near MP L123.0 of the Leidy Line system. The route runs south for approximately 123 miles and terminates at the existing Transco Compressor Station 195 in York County, Pennsylvania.

Approximately 50 miles of the route is co-located with other utility ROWs, with the remaining approximately 73 miles being primarily greenfield. The Western CPL South Alternative is approximately 2 miles shorter than the CPL South proposed route.

The Western CPL South Alternative would require an extension of CPL North westward, to the west side of Compressor Station 517. This modification is required to ensure that CPL North gas volumes could enter the Leidy Line system at the prevailing system pressure. Moving the aggregation point of CPL North and Leidy Line system volumes to the west side of Compressor Station 517 would increase the horsepower required at Compressor Station 610 by 25,000 hp. Table P-4 provides a summary comparison of the Western CPL South Alternative and the CPL South proposed route.

Table P-4
Western CPL South Alternative Route Comparison

Factor	Western CPL South Alternative	Corresponding Section of CPL South	Difference from CPL South
Length of Corresponding Segment (miles)	122.9	126.3	-3.4
Co-location			
Length Adjacent to Interstate Pipeline ROW (miles)	0.9	2.6	-1.7
Length Adjacent to Midstream Pipeline ROW (miles)	0.4	0.0	+0.4
Length Adjacent to Electric Transmission Line ROW (miles)	40.2	4.0	+36.2
Length Adjacent to Roadway (miles)	7.8	0.1	+7.7
Total Length Co-located (miles)	49.3	6.6	+42.7
ROW Requirements			
Pipeline Construction Requirements (acres)[a]	1,490.0	1,531.1	-41.1
Pipeline Operation Requirements (acres)[b]	742.1	765.6	-23.5
Federal and State Land			

Table P-4
Western CPL South Alternative Route Comparison

Factor	Western CPL South Alternative	Corresponding Section of CPL South	Difference from CPL South
Federal Lands Crossed (number/miles)	1 / 2.7	1 / 0.6	0 / +2.1
State Lands Crossed (number/miles)	15 / 12.9	3 / 1.9	+13 / +11.0
Land Use			
Forested Land Crossed (miles)[c]	50.7	38.9	+11.8
Forested Land Impacts (construction/operation) (acres)[d]	613.6 / 306.0	469.4 / 235.1	+144.2 / +70.9
Agricultural Land Crossed (miles)[c]	52.1	76.4	-24.3
Agricultural Land Impacted (construction/operation)	629.2 / 314.9	925.9 / 463.3	-296.7 / -148.4
Other Land Crossed (miles)[c,e]	20.1	11.0	+9.1
Other Land Impacted (construction/operation)	247.2 / 121.2	135.8 / 67.2	+111.4 / +54.0
Waterbodies			
Waterbodies Crossed (number)[f]	148	99	+49
Major Waterbody Crossings (number >100 feet)[g]	11	3	+8
Wetlands			
Total Wetland Complexes Crossed	31	8	+23
Total Wetland Crossed (miles)[h]	1.6	0.4	+1.2
Palustrine Forested Wetland Complex Impacts (construction/operation) (acres)[h]	5.7 / 2.9	1.3 / 0.7	+4.4 / +2.2
Other Physical Features			
Road Crossings (number)	251	232	+19
Railroad Crossings (number)	13	12	+1

Table P-4
Western CPL South Alternative Route Comparison

Factor	Western CPL South Alternative	Corresponding Section of CPL South	Difference from CPL South

[a] Pipeline construction requirements based on a 100-foot-wide construction corridor and includes a 100-foot long buffer at begin and end points.
[b] Pipeline operation requirements based on a 50-foot-wide corridor in greenfield segments, and a 25-foot-wide corridor for segments co-located with Transco pipelines. Calculation includes a 50-foot long buffer at begin and end points.
[c] Forested land, agricultural land and other land crossed are based on geographic information system (GIS) centerline analysis using United States Geological Survey (USGS) National Land Cover Dataset (NLCD).
[d] Forest land, agricultural land, and other land impacted are based on GIS corridor analysis using USGS NLCD. Since multiple land use types may be present within the corridor, impact acreage for individual land uses will not be representative of distance crossed, which is based on centerline analysis.
[e] Other land based on USGS NLCD and includes land cover types: Barren Land, Developed High Intensity, Developed Low Intensity, Developed Medium Intensity, Developed Open Space, Emergent Herbaceous Wetlands, Herbaceous, Open Water, Shrub Scrub, Woody Wetlands.
[f] Waterbodies identified based on National Hydrography Dataset (NHD).
[g] Major waterbodies identified based on review of aerial photography.
[h] Wetlands identified using the National Wetland Inventory (NWI).

Key:
CPL = Central Penn Line
ROW = right-of-way

Transco did not select this route due to the following constraints:

- This route crosses 15 state lands, compared to three crossings of state lands for the proposed route;
- Transco engineers flew the length of the Susquehanna River as it borders Lancaster County, Pennsylvania and were unable to find a suitable location to install the pipeline across the river using HDD. A crossing of the Susquehanna River in Lancaster County would be necessary for this alternative to interconnect with the southern endpoint for the Project on the Transco Mainline system;
- The route is in proximity to Harrisburg and Hershey, Pennsylvania, resulting in increased impacts on residential and other developed areas;
- The route is in proximity to the Three Mile Island Nuclear Generating Station in Dauphin County, Pennsylvania; and
- The alternative would require an additional 25,000 hp at proposed Compressor Station 610.

FIGURE P-2

7.0 WYOMING COUNTY SPECIFIC ROUTE ALTERNATIVES

As part of developing the proposed pipeline route for the Project, Transco considered two minor alignment alternatives for the Project in Wyoming County. Minor route alternatives have been developed in response to comments received from landowners, stakeholders, or to attempt to avoid or minimize impacts to sensitive resources. Identification and evaluation of minor route alternatives has been on-going since the inception of the Project. Alternatives were developed as they arose during the development phase of the Project, therefore alternative numbering is not sequential per county. Furthermore, mileposts may have changed and should only be considered reference points as they may not be reflective of the current Project alignment.

CPL North Alternative 2

CPL North Alternative 2 was considered early in the development phase of the Project. During its evaluation, Transco discovered that this alternative intersects an underground railroad tunnel. Figure P-3 shows the location of CPL North Alternative 2, and Table P-5 provides a comparison of CPL North Alternative 2 with the corresponding segment of the October 2014 route. Transco concluded that crossing beneath an underground railroad tunnel is not technically feasible; therefore it is no longer being considered and will not be evaluated further. Since the CPL North Alternative 2 was only compared to the October 2014 and was removed from further consideration, it was not compared to the current route provided in this application.

Table P-5
CPL North Alternative 2
Minor Route Alternatives Comparison

Factor	CPL North Alternative 2 (proposed route)	Corresponding Section of October 2014 Route	Difference from October 2014 Route
Length of corresponding segment (miles)	5.3	5.8	-0.5
Co-location			
Length adjacent to Interstate Pipeline ROW (miles)	0.0	0.0	0.0
Length adjacent to Midstream Pipeline ROW (miles)	0.0	0.0	0.0
Length adjacent to electric transmission line ROW (miles)	0.0	0.0	0.0

Table P-5
CPL North Alternative 2
Minor Route Alternatives Comparison

Factor	CPL North Alternative 2 (proposed route)	Corresponding Section of October 2014 Route	Difference from October 2014 Route
Length adjacent to roadway (miles)	0.2	0.0	+0.2
Total length co-located (miles)	0.2	0.0	+0.2
ROW Requirements			
Pipeline construction requirements (acres)[a]	64.2	70.3	-6.0
Pipeline operation requirements (acres)[b]	32.1	35.2	-3.0
Federal and State Land			
Federal lands crossed (number / miles)	0 / 0.0	0 / 0.0	0 / 0.0
State lands crossed (number / miles)	0 / 0.0	0 / 0.0	0 / 0.0
Land Use			
Forested land crossed (miles)[c]	2.6	3.1	-0.5
Forested land impacts (construction / operation) (acres)[d]	31.3 / 15.6	38.7 / 19.2	-7.4 / -3.6
Forest interior crossed (miles)[c,e]	0.0	< 0.1	< -0.1
Forest interior impacts (construction / operation) (acres)[d,e]	0.0 / 0.0	0.1 / <0.1	-0.1 / < -0.1
Agricultural land crossed (miles)[c]	2.5	2.4	+0.1
Agricultural land impacted (construction / operation) (acres)[d]	30.8 / 15.4	28.1 / 14.2	+2.7 / +1.2
Other Land Crossed (miles)[c,f]	0.2	0.3	-0.1
Other Land Impacted (construction/operation)	2.1 / 1.1	3.5 / 1.8	-1.4 / -0.7
Residences within 50 feet of the construction workspace (number)[g]	0	0	0
Landfills, quarries, and other mining operations within 0.25 mile (number)	2	2	0
Waterbodies			
Waterbodies crossed (number)[h]	3	3	0
Major waterbody crossings (number >100	1	1	0
Wetlands			
Total wetland complexes crossed (number)[j]	0	1	-1
Total wetland crossed (miles)[j]	0.0	0.1	-0.1
Palustrine forested wetland complex impacts (construction / operation)	0.0 / 0.0	0.7 / 0.0	-0.7 / 0.0
Cultural Resources			

Table P-5
CPL North Alternative 2
Minor Route Alternatives Comparison

Factor	**CPL North Alternative 2 (proposed route)**	**Corresponding Section of October 2014 Route**	**Difference from October 2014 Route**
Sites crossed that are eligible or potentially eligible for listing on the National Register of Historic Places	0	0	0
Other Physical Features			
Road crossings (number)	4	7	-3
Railroad crossings (number)	1	1	0
Other Environmental Features			
Steep slopes crossed (30 degrees or greater) (miles)[l]	0.0	< 0.1	< -0.1
Side slope construction (miles)[m]	0.0	0.1	-0.1

[a] Pipeline construction requirements based on a 100-foot-wide construction corridor and includes a 100-foot long buffer at begin and end points.

[b] Pipeline operation requirements based on a 50-foot-wide corridor in greenfield segments, and a 25-foot-wide corridor for segments co-located with Transco pipelines. Calculation includes a 50-foot long buffer at begin and end points.

[c] Forested land, forest interior, agricultural land and other land crossed are based on geographic information system (GIS) centerline analysis using United States Geological Survey (USGS) National Land Cover Dataset (NLCD).

[d] Forest land, forest interior, agricultural land, and other land impacted are based on GIS corridor analysis using USGS NLCD. Since multiple land use types may be present within the corridor, impact acreage for individual land uses will not be representative of distance crossed, which is based on centerline analysis.

[e] Forest interior determined by assessment of forest cover from USGS NLCD, where forest interior was considered 300 feet from forest breaks and outer forest edge. Interior forest is a sub-type of Forested Land.

[f] Other land based on USGS NLCD and includes land cover types: Barren Land, Developed High Intensity, Developed Low Intensity, Developed Medium Intensity, Developed Open Space, Emergent Herbaceous Wetlands, Herbaceous, Open Water, Shrub Scrub, Woody Wetlands.

[g] Residences identified based on review of aerial photography; in cases where it was not clear whether a structure was a residence or other built feature (e.g., barn, storage facility), the structure was assumed to be a residence.

FIGURE P-3

CPL North Alternative 4

CPL North Alternative 4 was developed and adopted into the proposed route to avoid multiple wetland crossings and improve waterbody crossing angles. CPL North Alternative 4 and the corresponding segment of the October 2014 route are shown in Figure P-4. Table P-6 provides a comparison of CPL North Alternative 4 with the corresponding segment of the October 2014 route.

CPL North Alternative 4 is approximately the same length as the October 2014 route but eliminates 150 feet of parallel workspace adjacent to a waterbody and reduces impacts to a PFO wetland complex. Due to the reduction of impacts on wetlands and parallel waterbodies, CPL North Alternative 4 was accepted and incorporated into the proposed route as discussed in this application.

Table P-6
CPL North Alternative 4
Minor Route Alternatives Comparison

Factor	CPL North Alternative 4 (proposed route)	Corresponding Section of October 2014 Route	Difference from October 2014 Route
Length of corresponding segment (miles)	2.2	2.2	0.0
Co-location			
Length adjacent to Interstate Pipeline ROW (miles)	0.0	0.0	0.0
Length adjacent to Midstream Pipeline ROW (miles)	0.0	0.0	0.0
Length adjacent to electric transmission line ROW (miles)	0.0	0.0	0.0
Length adjacent to roadway (miles)	0.0	0.0	0.0
Total length co-located (miles)	0.0	0.0	0.0
ROW Requirements			
Pipeline construction requirements (acres)[a]	26.8	26.7	+0.1
Pipeline operation requirements (acres)[b]	13.4	13.3	+0.1
Federal and State Land			
Federal lands crossed (number / miles)	0 / 0.0	0 / 0.0	0 / 0.0
State lands crossed (number / miles)	0 / 0.0	0 / 0.0	0 / 0.0
Land Use			
Forested land crossed (miles)[c]	1.8	1.3	+0.5

Table P-6
CPL North Alternative 4
Minor Route Alternatives Comparison

Factor	CPL North Alternative 4 (proposed route)	Corresponding Section of October 2014 Route	Difference from October 2014 Route
Forested land impacts (construction / operation) (acres)[d]	21.7 / 10.8	15.6 / 7.7	+6.1 / +3.1
Forest interior crossed (miles)[c,e]	0.5	0.4	+0.1
Forest interior impacts (construction / operation) (acres)[d,e]	6.2 / 3.1	5.0 / 2.5	+1.2 / +0.6
Agricultural land crossed (miles)[c]	0.0	0.2	-0.2
Agricultural land impacted (construction / operation) (acres)[d]	0.0 / 0.0	1.9 / 0.9	-1.9 / -0.9
Other Land Crossed (miles)[c,f]	0.4	0.7	-0.3
Other Land Impacted (construction/operation) (acres)[d,f]	5.1 / 2.6	9.2 / 4.7	-4.1 / -2.1
Residences within 50 feet of the construction workspace (number)[g]	0	0	0
Landfills, quarries, and other mining operations within 0.25 mile (number)	0	0	0
Waterbodies			
Waterbodies crossed (number)[h]	3	3	0
Major waterbody crossings (number >100 feet)[i]	0	0	0
Wetlands			
Total wetland complexes crossed (number)[j]	0	1	-1
Total wetland crossed (miles)[j]	0.0	0.1	-0.1
Palustrine forested wetland complex impacts (construction / operation) (acres)[j]	0.0 / 0.0	1.4 / 0.7	-1.4 / -0.7
Cultural Resources			
Sites crossed that are eligible or potentially eligible for listing on the National Register of Historic Places (number)[k]	0	0	0
Other Physical Features			
Road crossings (number)	5	3	+2
Railroad crossings (number)	0	0	0
Other Environmental Features			
Steep slopes crossed (30 degrees or greater) (miles)[l]	0.0	0.0	0.0
Side slope construction (miles)[m]	0.0	0.0	0.0

Table P-6
CPL North Alternative 4
Minor Route Alternatives Comparison

Factor	CPL North Alternative 4 (proposed route)	Corresponding Section of October 2014 Route	Difference from October 2014 Route

[a] Pipeline construction requirements based on a 100-foot-wide construction corridor and includes a 100-foot long buffer at begin and end points.

[b] Pipeline operation requirements based on a 50-foot-wide corridor in greenfield segments, and a 25-foot-wide corridor for segments co-located with Transco pipelines. Calculation includes a 50-foot long buffer at begin and end points.

[c] Forested land, forest interior, agricultural land and other land crossed are based on geographic information system (GIS) centerline analysis using United States Geological Survey (USGS) National Land Cover Dataset (NLCD).

[d] Forest land, forest interior, agricultural land, and other land impacted are based on GIS corridor analysis using USGS NLCD. Since multiple land use types may be present within the corridor, impact acreage for individual land uses will not be representative of distance crossed, which is based on centerline analysis.

[e] Forest interior determined by assessment of forest cover from USGS NLCD, where forest interior was considered 300 feet from forest breaks and outer forest edge. Interior forest is a sub-type of Forested Land.

[f] Other land based on USGS NLCD and includes land cover types: Barren Land, Developed High Intensity, Developed Low Intensity, Developed Medium Intensity, Developed Open Space, Emergent Herbaceous Wetlands, Herbaceous, Open Water, Shrub Scrub, Woody Wetlands.

[g] Residences identified based on review of aerial photography; in cases where it was not clear whether a structure was a residence or other built feature (e.g., barn, storage facility), the structure was assumed to be a residence.

[h] Waterbodies identified based on National Hydrography Dataset.

[i] Major waterbodies identified based on review of aerial photography.

[j] Wetlands identified using the National Wetland Inventory.

[k] National Register of Historic Places sites were identified using desktop data.

[l] Length determined perpendicular to slope contour.

[m] Length determined parallel with slope contour. Developed using USGS 10-foot contours.

Key:
CPL = Central Penn Line
ROW = right-of-way

FIGURE P-4

8.0 ROUTE DEVIATIONS CONSIDERED

A route deviation is a minor adjustment to the proposed route, typically to avoid a specific feature (e.g., topography, sensitive habitat, structures) and/or to accommodate requests by affected landowners. A route deviation differs from a minor route alternative in that a route deviation diverges from the proposed alignment for a short distance in the same general area as the proposed route. Transco developed route deviations in response to landowner and other stakeholder comments and site-specific conditions identified during field surveys and desktop analyses.

Transco adopted, as part of the proposed route, 25599 deviations, including 64 deviations to the October 2014 route during the early development of the Project and, 35 deviations to the March 2015 route, and 156 deviations to the June 2015 Route.

A summary of deviations considered for the Atlantic Sunrise Project is as follows:

- **CPLN – 30 42 total = 12 from June 2015 Route, 7 from March 2015 Route; 23 from October 2014 Route**
- **CPLS – 11468 total = 46 from June 2015 Route, 27 from March 2015 Route; 41 from October 2014 Route**
- **Unity – 1 from March 2015 Route**
- **Chapman - 0 from March 2015 Route**

Table P-7 summarizes the route deviations considered within Wyoming County and the reason for the deviation.

Table P-7
Summary of Route Deviations Accepted into the Proposed Routes for the Atlantic Sunrise Project In Wyoming County

Reference ID	County	Milepost	Length (miles)	Distance from Proposed Centerline (feet)	Reason for Deviation
M#-0042	Wyoming	31.0 - 31.5	0.5	500	Maintain co-location with existing pipeline
M#-0048	Wyoming	34.4 - 35.4	1.0	205	Susquehanna River Crossing HDD adjustment

Table P-7
Summary of Route Deviations Accepted into the Proposed Routes for the Atlantic Sunrise Project In Wyoming County

Reference ID	County	Milepost	Length (miles)	Distance from Proposed Centerline (feet)	Reason for Deviation
#D-0022	Wyoming	38.0 - 38.3	0.1	28	Landowner request to abut property line
#M-0029	Wyoming	40.4 - 40.8	0.4	405	Avoid proposed residential development
#D-0020	Wyoming	40.8 - 41.1	0.3	90	Minimize impact on wetland and increase distance to residence
#D-0021	Wyoming	43.0 - 43.6	0.6	145	Avoid impact on rock wall and parallel property line
#M-0047	Wyoming	44.5 - 45.1	0.6	246	Required for connection to Compressor Station 605
#M-0038	Wyoming	45.9 - 46.5	0.6	753	Landowner request to avoid spring; improve angle for railroad crossing
M#-0043	Wyoming	48.0 - 48.7	0.7	281	Minimizes impact on wetland, increase distance from power line anchors. Landowner request
M#-0050	Wyoming	49.1 - 49.5	0.4	597	Avoid culturally sensitive areas
#M-0033	Wyoming/ Susquehanna	49.9 - 51.5	1.6	1,130	Avoid impact on two PFO wetland complexes
#M-0051	Wyoming	49.2 - 49.3	0.1	96	Improves Tunkhannock Creek crossing approach
#M-0054	Wyoming	42.6 - 43.0	0.4	220	Avoids two rock walls
#M-0058	Wyoming	46.4 – 46.8	0.5	120	Improve stream crossing angle
#M-0071	Wyoming	30.5 – 34.3	3.69	26	Adjust portions centerline based on civil survey
#M-0063	Wyoming	44.9 – 45.1	0.31	150	Align pipeline CN-MLV-05 and pipeline with Compressor Station 605 design
#M-0080	Wyoming	M-0051 0.2 – 50.5	1.58	1615	Avoid cultural site
#M-0120	Wyoming	M-0071 1.1 – M-0071 1.2	0.03	28	Improves angle of road crossing at Schoolhouse Road

9.0 WETLAND AND WATERBODY CONSTRUCTION ALTERNATIVES

During design of the Project, Transco attempted to avoid and minimize wetland and waterbody impacts that would result from construction and installation of the Project by reducing the construction right-of-way to 75 feet in most wetlands and by proposing to maintain the right-of-way in accordance with the FERC Wetland and Waterbody Construction and Mitigation Procedures. Transco is also addressing feasibility of trenchless installation measures at major waterbody crossings and in locations where wetlands or waterbodies are located in close proximity to a road crossing. Some of the critical factors taken into consideration to determine if trenchless construction methods would be successful include surface conditions, workspace requirements, subsurface conditions, ground surface elevation, water allocations, inadvertent returns, drilling fluid disposal, risks, constructability, schedule and post-construction accessibility. The following details generally discusses the factors considered when determining the crossing method for certain resources.

Horizontal Directional Drill

The Horizontal Directional Drill (HDD) method allows for trenchless construction across an area by drilling a hole below the conventional pipeline depth and pulling the pipeline through a pre-drilled hole. A number of factors need to be evaluated when considering use of the HDD method including: minimum drill length, typical area of disturbance for set-up of an HDD, and feasibility/risk factors.

Minimum Drill Length

The pipeline radius of curvature for the drill path is proportional to the diameter of the pipeline, which affects how tight the bend in the drill hole can be and, thus, the minimum length of the crossing. The exit and entry angles are relatively flat (8 to 12 degrees from horizontal) to avoid excessive lifting heights to install the pipe and to avoid buckling the pipe at the inflection point in the entry hole. A number of factors determine the minimum drill hole length, with the key factors being:

- Required clearance depth below the obstacle(s) to be crossed;
- Pipeline radius of curvature;
- Adjacent terrain and/or topography;
- Desired entry/exit angles; and
- Required layout for the drilling equipment and pullback string.

Deeper drill holes require longer drill hole lengths to achieve minimum necessary clearance. Similarly, the minimum drill hole length is longer for larger pipe, which has a greater radius of curvature. The depths can also be dictated by the site geology. Transco typically designs the radius of curvature to be 1,200 times the pipe diameter (i.e., a 42-inch-diameter pipeline will have a design radius of curvature of 4,200 feet). The exit and entry points are chosen to be installed in a relatively flat, open area at similar elevations. The HDD will produce a minimum drill hole length of approximately 1,600 feet and profile depth of 75 feet below the entry point (at entry angle of 10 degrees). At entry angles greater than 10 degrees, the minimum depth from the entry point increases, (i.e., 92 feet for a 12 degree entry angle), and hence increases the minimum length (i.e., 1,800 feet for a 12 degree entry angle). The drill hole lengths can vary due to actual site conditions, such as subsurface conditions and topography. The topography of the Project area requires a minimum drill hole length of 1,900 to 2,300 feet. The duration of drilling and construction will vary due to subsurface geologic and hydrologic conditions, layout, and drill hole length. For example, the rate of penetration of the drill bit through hard rock such as granite will be slower than through a softer material such as shale.

Typical HDD Disturbance Areas

HDDs may still require portions of the ROW to be cleared to allow the pipeline pullback section to be assembled (strung) and pulled through the drill hole. Similarly, clearing vegetation may be necessary to provide a line-of-sight to the pipeline ROW for both construction and long-term operation. For example, a 2,100-foot-long drill hole would require a minimum of approximately 5 acres to be cleared and graded to provide adequate and safe workspace at the entry and exit points to accommodate the HDD equipment, drilling mud pits, ancillary support equipment, and a 2,200-foot by 40- or 60-foot work strip for pipe stringing/pullback operations. Temporary workspace areas at the entry and exit workspaces typically measure 200 feet by 250 feet for pipelines with a 24-inch diameter or greater. The pipe stringing workspace must be aligned with the drill hole so that lateral forces are minimized during the pipeline pullback. If a pipeline ROW curves on the approach to an HDD crossing, the pullback section will have an additional impact on areas outside of the ROW where the pullback workspace deviates at an angle to the construction ROW. Additional heavy equipment would be required to handle the pipe around any curves. There would also be an added risk of damaging the pipe coating if the pipe were to slide off the roller assemblies.

HDD Feasibility & Risk Factors

Site-specific geotechnical factors have a substantial effect on HDD feasibility. Subsurface characteristics must be fully evaluated with on-site borings and sample testing to determine whether the HDD would be deemed technically infeasible. Furthermore, geotechnical factors, including but not limited to rock hardness, rock quality, and borehole stability, have a substantial effect on the duration of construction for an HDD.

HDD risks increase as pipe diameter increases. The risks increase disproportionately for larger diameter pipelines, such as the 42-inch-diameter pipeline proposed for portions of the Project. Drill hole failure (collapse of the drill hole) during pipeline pullback operations is one of the greatest risks to the successful completion of an HDD. A drill hole failure can cause an accidental release of drilling mud. The loss of tooling downhole also poses a substantial risk of failure for large-diameter HDD installations. The risk of lost tooling downhole increases disproportionately with increased hole diameter because of the higher rotary torque required to ream a larger-diameter hole. HDDs are often used to avoid direct impacts on a sensitive environmental resource, such as a wetland, waterbody, or special status species habitat. If the impact of a release is greater than the risk of an open-cut crossing, and the risk of release cannot be reduced to an appropriate level, then an open-cut crossing may be preferable to an HDD crossing.

Methods to reduce HDD failure risks include the following:

- Ensuring that the geologic formation through which the drill is planned is stable and suitable for HDD. For example, a formation containing flowing sand or cobbles and boulders will often result in a borehole collapse or a stuck pipe, and thus is unsuitable for drilling.
- Minimizing the number of pipeline strings required to be welded during the pullback process (where the pipeline is pulled back through the drilled borehole). A single-string pullback is preferred for HDDs because it avoids the need to stop the pullback activity in order to weld up two or more separate pipe strings. A single string pullback allows for a continuous force to be applied to the pipe during the pullback, and reduces the risk of

the pipeline becoming stuck in the borehole (due to the potential for a localized collapse of the borehole around the pipeline).

- Designing the entry and exit point at or near the same elevation. When a significant elevation difference exists between the entry and exit points, a portion of the drilled hole will not be filled with drilling fluid. In rock formations, the risk of drill tool failure increases because the tools may not be adequately cooled and lubricated through the dry section of the hole despite drilling fluid being pumped during operations. In soil formations, the risk of hole collapse is highly elevated, which may lead to ground surface settlement along the HDD alignment, damage to structures, drilling fluid release, or a stuck pipe during pullback operations.

Other Construction Limitations

HDDs for large-diameter pipelines (e.g., 30- to 42-inch) typically require 20,000 to 30,000 gallons of water per day for use in the creation of drilling mud. If surface water is not available at the site, it must be identified and trucked in daily from a municipal water source. Duration from site preparation to pipe tie-in following the HDD can be at least 6 months. Furthermore, the number of HDDs on a project can be limited due to the number of available drilling rigs in the United States. For these and other reasons, Transco limits its use of HDDs to crossings of highly sensitive resources.

Operations Implications

Due to the radius of curvature required to install a large diameter pipeline using the HDD technique, the pipe is usually installed at depths greater than 70 feet below the ground surface, which poses substantial operational implications. If in-line inspection activities indicate that maintenance or repairs are needed for a section of pipe that has been installed using the HDD technique, the pipeline's installation depth would render it inaccessible for repairs. In these cases, the section of pipe would have to be replaced. Replacement would result in additional environmental impacts, usually from having to install a second HDD parallel and adjacent to the original HDD section, assuming adequate clearance (space) is available for a replacement HDD section to be installed. As an industry practice, for long-term operations and maintenance purposes, an HDD is only utilized where no other construction method is deemed feasible and where adequate space exists for a replacement pipeline in the event the HDD section must be replaced (e.g., at very large river crossings).

Conventional Bore

The conventional bore method for cased or uncased pipeline crossings is typically employed under roads or railroad crossings, but may also be employed at shallow wetland or waterbody crossings. Soil conditions, the length of the flight auger string, and equipment torque generally limit this method to a maximum length of approximately 400 feet. This installation method involves digging a bore pit on each side of the feature to be crossed and typically requires a minimum setback from the feature for worker safety and slope stability purposes. The bore pit and receiving pit vary in size but are usually about 20 feet wide by 60 feet long. This provides the necessary space for the boring machine to insert a pipe joint or pipe string (two or more joints welded together) into the borehole. The bore pit depth generally ranges from 10 to 12 feet but may be greater, depending on topography, to accommodate the minimum of 5 feet of cover over the bored pipeline segment. The depth would be greater for wetlands or waterbodies with an adjacent slope.

Auger boring equipment is usually track-mounted. The track is set to the required line and grade for the proposed bore path and requires a stable bore pit bottom. The bore pit bottom is often stabilized with crushed stone or other material. Minor adjustments can be made by setting the track and keeping it stable, which is critical for a successful bore. As such, keeping groundwater out of the bore pit is important. Once the bore pit is excavated, the boring machine is placed in the bore pit and conventional horizontal auger drilling commences to ream the borehole before the pipe can be installed. The boring machine rides along the track as the bore pipe is advanced (or pushed) into the borehole. The boring machine generates thrust by pushing from either the back wall of the bore pit lined with sheet piles or piles driven behind the track.

A rotating auger cutting bit attached to the lead bore pipe section cuts the soil ahead of the bore pipe as it advances. The rotating auger inside the bore pipe discharges the soil out the rear of the pipe. After the lead bore pipe section has reached its maximum distance, a second auger section is coupled (or pinned) to the first auger section. The second bore pipe section is then placed over the second auger section and welded to the first bore pipe section. The bore pipe is then advanced again by applying thrust and simultaneously rotating the auger bit inside the bore pipe. This process is repeated until the desired bore length is achieved and the bore pipe extends into the receiving pit. The auger cutting head is then removed, and the remaining soil is removed from within the bore pipe section.

A conventional bore method may be "dry" (no water or drilling fluid used) or "wet" (requiring the use of water or a bentonite-based drilling fluid), depending on soil conditions. No wet conventional bores are proposed for the Project. After the bored pipeline section is installed, additional excavation is necessary to tie the bored pipeline section to the pipeline section conventionally installed by open trench.

While the pipeline industry considers this a dependable method for crossing under elevated road beds, highways, and railroad beds, it is not generally preferred for use in areas with shallow or near-surface groundwater. These crossings require large bore pits adjacent to saturated areas with potentially low soil shear strength, particularly near wetlands. Large bore pits in these areas would require shoring of pit walls and implementation of significant dewatering measures. Crossings of these features also would result in an increased risk of the bore-pit walls slumping and/or borehole misalignment due to track settlement. The duration of construction for bored crossings of wetlands and waterbodies typically ranges from 3 to more than 4 weeks, depending on the crossing length, topography, soil conditions, and the need for blasting in areas of shallow bedrock. A conventional open-cut crossing of wetlands and waterbodies is generally much quicker, taking days rather than weeks, which minimizes the duration of disturbance of the feature. For these reasons, Transco rejected the conventional auger bore method as a preferred construction method for crossing wetlands, forested areas, and waterbodies where conventional trenching construction is feasible.

Summary of Trenchless Installation Methods

As described in Appendix P-2, ~~**While**~~ a successful HDD or bore ***may have***~~**has**~~ certain environmental benefits, **but** the overall environmental impact can be greater, particularly if the stream is small and can be crossed using dry crossing methods in a short period of time (i.e., 24 to 48 hours). Also, trenchless crossings may not be feasible at all locations because of suboptimal substrate or geologic conditions. For these reasons, Transco plans to use conventional construction methods to cross the majority of waterbodies along the Atlantic Sunrise Project.

In the absence of environmental or construction concerns requiring the use of other crossing methods, conventional open cut methods are is the most efficient construction method for crossing wetlands and waterbodies. Dry-crossing construction techniques will be implemented on the majority of streams crossed by the Project. Dry-crossing techniques minimize impacts to fisheries by reducing the potential for sediment to mix with the existing flow of stream water and by allowing unobstructed stream flow during construction.

Wet Open-Cut

In the absence of environmental or construction concerns requiring the use of other crossing methods, conventional open cut methods are the most efficient construction method for crossing waterbodies. Dry-crossing construction techniques will be implemented on the majority of waterbodies crossed by the Project. Dry-crossing techniques minimize impacts to fisheries by reducing the potential for increases in turbidity and by allowing unobstructed stream flow during construction.

The dry open-cut crossing method is an approved installation method in the DEP Erosion and Sediment Control Best Management Practice (BMP) Manual and has been proposed at locations where engineering has determined the method is appropriate, feasible and safe to construct. However, a dry crossing method is not viable for number of stream crossings due to technical restrictions, site-specific environmental factors, or safety concerns. ~~**Table P-6 provides a list of the streams where a wet open-cut is the preferred installation method.**~~

~~**Table P-8**~~
~~**Waterbodies Proposed to be Crossed Using Wet Open-Cut Method**~~

~~Waterbody Name~~	~~Milepost~~	~~County~~	~~Stream Type~~
~~UNT to Hess Hollow~~	~~2.88~~	~~Columbia~~	~~Perennial~~
~~Hess Hollow~~	~~2.9~~	~~Columbia~~	~~Perennial~~
~~Kitchen Creek~~	~~7.3~~	~~Luzerne~~	~~Perennial~~
~~UNT to Leonard Creek~~	~~25.6~~	~~Luzerne~~	~~Perennial~~

~~**Table P-8**~~

~~**Waterbodies Proposed to be Crossed Using Wet Open-Cut Method**~~

~~Waterbody Name~~	~~Milepost~~	~~County~~	~~Stream Type~~
~~UNT to Susquehanna River~~	~~37.70~~	~~Wyoming~~	~~Perennial~~
~~UNT to Qureg Run~~	~~54.3~~	~~Lebanon~~	~~Perennial~~
~~UNT to Frozen Run~~	~~104.25~~	~~Columbia~~	~~Intermittent~~
~~UNT to Beaver Run~~	~~124.4~~	~~Lycoming~~	~~Perennial~~

~~**The Wet Open-Cut method would involve the use of conventional pipeline construction techniques to install the pipeline which will be weighted to ensure negative buoyancy. The stream crossings would be completed in the "wet"; i.e., excavation, backfilling and equipment operation would occur in the flowing stream without any diversion of flow. This is a common installation method in the pipeline industry that is reliable and offers the key benefit of a significantly shorter construction duration in-stream relative to the other installation options. Although, in-stream construction activities result in temporarily higher concentrations of suspended sediment as compared to isolated or dry installations, these peak suspended sediment concentrations and turbidity values decline rapidly following in-stream activities without any residual effects (as in Moyer and Hyer, 2009).**~~

~~**The Wet Open-Cut installation method proposed for the limited number of stream crossings relies on standard construction techniques with minimal safety or installation risks while decreasing the duration of in-stream construction relative to other installation options. The Wet Open-Cut installation would have an estimated duration of 48 hours with an anticipated 12 to 24 hours of direct in-stream work prior to restoration.**~~

These installations would be scheduled around storm events, since the construction duration is limited and can be completed where water flows and depths are slightly greater, where other conventional methods may not be feasible. In addition, ROW impacts are reduced since there is less need for additional temporary workspace.

The ~~Wet~~ Open-Cut installation method provides for the optimal pipeline configuration with respect to operation and maintenance. The proposed pipe would be installed a minimum of five feet below the streambed and is therefore easily accessible for routine maintenance or emergency access during operation. Trenchless methods, such as HDD and conventional bore installations, do not offer this operational benefit due to the installation depth and would require replacement of the entire pipe segment should an integrity issue arise during operation.

~~**The disturbance of streambed materials during in-stream pipeline construction has the potential to affect water quality and aquatic life through the re-suspension and subsequent deposition of sediment (Reid and Anderson, 1999). Wet Open-Cut pipeline installations (i.e., those which occur without any isolation or diversion of flow away from the work area -- excavation, pipeline installation and backfilling occur within the active, flowing channel) have been shown to have relatively minor, short-term impacts on aquatic communities.**~~

~~**Suspended sediment concentrations and turbidity levels can increase rapidly at the onset of in-stream activities but are not uniformly elevated throughout the construction process. Pipeline construction causes discrete pulses of suspended sediment concentrations associated with specific in-stream activities. These peak suspended sediment concentrations and turbidity values decline rapidly following in-stream activities without any residual effects (as in Moyer and Hyer, 2009). Thus the potential Project-induced water quality effects would be short-lived, lasting only for the duration of in-stream construction activities. This work is timed to coincide with low-flow conditions in the stream, further reducing the potential for increased suspended sediment concentrations. The magnitude and duration of suspended sediment concentration and turbidity level increases depending on a number of site and project-specific factors, including construction activity, sediment settling rates, and stream size, flow, and bed composition. However, construction-related impacts are expected to be minimal compared to those caused by natural runoff events.**~~

~~**In-stream pipeline construction activities and the associated water quality issues can temporarily reduce the abundance and diversity of downstream benthic invertebrate and**~~

~~**fish communities due to emigration from affected areas (e.g. high invertebrate drift rates) and reductions in habitat suitability due to sediment deposition. These effects are temporary with full recovery to pre-disturbance conditions generally occurring within 1 to 2 years (Reid and Anderson 1999). These short-term impacts are minor and transitory when compared to the more chronic degradation of stream and river ecosystems caused by sediment loading from urban development and various agricultural, forestry, and mining practices (Waters, 1995). In some cases, the recovery of benthic invertebrate communities has been enhanced through streambed improvements at the crossing site (Reid and Anderson, 1999).**~~

In some specific cases the ~~**Wet**~~ Open-Cut installation is the most practical and environmentally preferable option. Transco carefully evaluated all of the streams crossed by the Project; the ~~**wet**~~ open-cut installation method is only proposed for crossings where it represents the safest, most reliable and environmentally-sound method for pipeline installation. Each crossing will be completed in accordance with the ECP, including the installation of BMPs and immediate bank stabilization to reduce turbidity. ~~**Each proposed wet open-cut crossing and its site specific justification is detailed below.**~~

~~**CPL North**~~

~~**Unnamed Tributary to Hess Hollow WW-T92-15001 at MP 2.88**~~

~~**This unnamed tributary to Hess Hollow is located at Mile Post 2.88 in Columbia County. The wet open-cut method is the preferred crossing method for this location due to the stream being confined within a saturated/flooded wetland. These conditions make it impractical to use a dam and pump or flume for this tributary. The saturated and unconsolidated soils will allow a high infiltration rate of water into the trench which makes pumping or fluming water infeasible or impractical.**~~

~~**Hess Hollow (WW-T02-15010) at Mile Post 2.9**~~

~~**Hess Hollow is located at Mile Post 2.9 in Columbia County. This waterbody is part of a larger saturated/flooded wetland complex. The saturated wetlands surrounding Hess Hollow Creek present safety concerns and limit the effectiveness of a dry open cut installation. Soils within the wetland and waterbody complex are saturated and**~~

~~**unconsolidated allowing a high infiltration rate of water into the ditch. These conditions make the diversion of stream flow using pumps of flumes impractical and dewatering of the workspace infeasible. Moreover, if the dry open cut were used at this location, additional workspace would be required within wetlands located adjacent to the stream to set up and store equipment to perform dam and pump or flume crossing method. The dry open cut will require more time for set up prior to excavating the pipeline trench. The duration of wetland and stream impacts for a dry open cut would extend over a significantly greater duration (approximately 8-10 days).**~~

~~**Wet open cut has been identified as the preferred method because dry open cut is infeasible due to saturated and unconsolidated soils. And the wet open cut will reduce the construction duration within the resource (approximately 24-48 hours) and will require a reduced limit of disturbance for the construction activity compared to the trenchless and dry open-cut methods, thereby reducing overall impacts to regulated features.**~~

~~**Kitchen Creek (WW-T02-15018) at Mile Post 7.3**~~
~~**Kitchen Creek is located at CPLN Milepost 7.3 in Luzerne County, Pennsylvania. This waterbody occurs within a "V-bottom" valley with steep banks (approximately 50% slope). High amounts of solid rock are present in the bottom of this creek.**~~

~~**Transco determined that a dry open cut installation was not practical at this location due to topographic conditions and the associated safety concerns. The steep banks at the crossing location do not allow for additional workspace necessary to accommodate the equipment and staging areas required for a dry open cut installation. The banks of the creek are too steep to safely mobilize and place the pre-fabricated pipe section required for a dry open cut. In addition, the installation of cofferdams necessary for a dry open cut crossing are not feasible due to high flow conditions in this section of Kitchen Creek.**~~

~~**The HDD method was also considered but was deemed infeasible due to the topography, poor access to the site and rocky conditions at the crossing. Additional impact to riparian buffers and a greater number of trees would need to be cleared in the adjacent**~~

~~**Ricketts Glen State Park to facilitate an HDD crossing setup, which will cause a greater impact than wet open cut method.**~~

~~**Unnamed tributary to Leonard Creek (WW-T17-18001) at Mile Post 25.6**~~

~~**This unnamed tributary to Leonard Creek is located at Mile Post 25.6 in Luzerne County, Pennsylvania. This tributary crossing is located within an area characterized by a large amount of rock and boulders on the stream bed, which make the dry open cut methods unfeasible because an effective seal for the cofferdam on the stream bottom cannot be achieved. Moreover, the banks of the tributary are steep and rocky which makes method dry crossing impractical as it will be difficult to seal the bottom of the coffer dam in this condition to prevent water from entering the workspace. The availability of additional work space for storage and equipment for dry open cut method is minimal as this tributary is confined between a major roadway (State Highway 309) on west side and a very steep bank on east side. The HDD method was determined to be unfeasible at this crossing due to the presence of large rocks and boulders.**~~

~~**A wet open cut is proposed as the preferred method due reduction in the construction duration (approximately 24-48 hours) and required activities compared to the trenchless and dry open-cut methods (approximately 8-10 days), thereby reducing impacts to regulated features.**~~

~~**Unnamed Tributary to the Susquehanna River (WW-T24-19001) at Mile Post 37.70**~~

~~**This unnamed tributary to the Susquehanna River is located at Mile Post 37.70 in Wyoming County. The wet open-cut method is the preferred crossing method for this location due to the stream being confined within a saturated/flooded wetland. These conditions make it impractical to use a dam and pump or flume for this tributary. The saturated and unconsolidated soils will allow a high infiltration rate of water into the trench which makes pumping or fluming water infeasible or impractical.**~~

~~**CPL South**~~

~~**Unnamed Tributary to Qureg Run (WW-T40-6004) at Mile Post 54.3**~~

~~**This unnamed tributary to Qureg Run is located at Mile Post 54.3 in Lebanon County. The wet open-cut preferred method is the preferred crossing method due to the stream being confined within a saturated/flooded wetland. These conditions make it impractical to use a dam and pump or flume for this tributary. The saturated and unconsolidated soils will allow a high infiltration rate of water into the trench which makes pumping or fluming water infeasible or impractical. Additionally, due to another pipeline at close proximity to the stream, a wet open-cut will expedite construction and minimize impact.**~~

~~**Unnamed Tributary to Frozen Run (WW-T90-13002) at Mile Post 104.25**~~

~~**This unnamed tributary to Frozen Run is located at Mile Post 104.25 in Columbia County. The wet open-cut preferred method is the preferred crossing method due to the stream being confined within a saturated/flooded wetland. These conditions make it impractical to use a dam and pump or flume for this tributary. The saturated and unconsolidated soils will allow a high infiltration rate of water into the trench which makes pumping or fluming water infeasible or impractical**~~

~~**Unity Loop**~~

~~**Unnamed tributary to Beaver Run (WW-T01-22008B) at Mile Post 124.4**~~

~~**Unnamed tributary to Beaver Run is located at Unity Loop Milepost 124.4 in Lycoming County, Pennsylvania. This tributary is confined within a large saturated/flooded wetland complex with no defined banks. Therefore, it is impractical to dam and pump or flume this tributary. Difficulty is associated with saturated and unconsolidated soils that will allow a high infiltration rate of water into the trench which makes pumping or fluming water infeasible or impractical. Moreover, additional workspaces will be required within wetlands to set up and store equipment to perform dam and pump or flume crossing methods. Additionally, the dry open cut will require a longer time for construction to set up the dam and pump or flume prior to excavating pipeline ditch and therefore wetland and stream will have impact to longer period of time (approximately 8-10 days) during construction.**~~

~~**Wet open cut is determined to be the preferred method due to reduction of impacts and the construction duration (approximately 24-48 hours) and required activities compared to the trenchless and dry open-cut methods, thereby reducing impacts to regulated features.**~~