MVP Southgate Project

Docket No. CP19-XX-000

Resource Report 10 – Alternatives

November 2018

MVP Southgate Project
Resource Report 10 – Alternatives

Resource Report 10 – Filing Requirements	
Information	**Location in Resource Report**
Minimum Filing Requirements	
1. Address the "no action" alternative (Sec. 380.12(l)(1)).	Section 10.2
2. For large projects, address the effect of energy conservation or energy alternatives to the project (Sec. 380.12(l)(1)).	Section 10.3
3. Identify system alternatives considered during the identification of the project and provide the rationale for rejecting each alternative (Sec. 380.12(l)(1)).	Section 10.4
4. Identify major and minor route alternatives considered to avoid impact on sensitive environmental areas (e.g., wetlands, parks, or residences) and provide sufficient comparative data to justify the selection of the proposed route (Sec. 380.12(l)(2)(ii)).	Section 10.5 and 10.6
5. Identify alternative sites considered for the location of major new aboveground facilities and provide sufficient comparative data to justify the selection of the proposed site (Sec. 380.12(l)(2)(ii)).	Section 10.7
Additional Information Often Missing and Resulting in Data Requests	
6. Ensure that project objectives that serve as the basis for evaluating alternatives are consistent with the purpose and need discussion in Resource Report 1.	Section 10.1.2
7. Identify and evaluate alternatives identified by stakeholders.	Section 10.5.3
8. Clearly identify and compare the corresponding segments of route alternatives and route variations to the segments of the proposed route that they would replace if adopted.	Section 10.5

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	Atlantic Coast Pipeline
Bcf/d	billion cubic feet per day
Certificate	Certificate of Public Convenience and Necessity
East Tennessee	East Tennessee Natural Gas, LLC
EIA	U.S. Energy Information Administration
FERC or Commission	Federal Energy Regulatory Commission
LNG	liquefied natural gas
MMcf/d	million cubic feet per day
MMDth/d	million dekatherms per day
Mountain Valley	Mountain Valley Pipeline, LLC
MW	megawatt
NWI	National Wetland Inventory
Piedmont	Piedmont Natural Gas Company
PSNC Energy	PSNC Energy, a wholly owned subsidiary of SCANA Corporation
Project or Southgate Project	MVP Southgate Project
Transco	Transcontinental Gas Pipe Line Company, LLC
U.S.	United States

RESOURCE REPORT 10
SUMMARY OF ALTERNATIVES

10.1 INTRODUCTION

Mountain Valley Pipeline, LLC ("Mountain Valley") is seeking a Certificate of Public Convenience and Necessity from the Federal Energy Regulatory Commission ("FERC" or "Commission") pursuant to Section 7(c) of the Natural Gas Act to construct and operate the MVP Southgate Project ("Southgate Project" or "Project"). The Southgate Project facilities will be located in Pittsylvania County, Virginia and Rockingham and Alamance counties, North Carolina. See Resource Report 1 (General Project Description) for additional Project information.

10.1.1 Environmental Resource Report Organization

Resource Report 10 is prepared and organized according to the FERC Guidance Manual for Environmental Report Preparation (February 2017). This report describes the no action alternative (Section 10.2), other energy alternatives (Section 10.3), system alternatives (Section 10.4), route alternatives (Section 10.5), route variations (Section 10.6), aboveground facility alternatives (Section 10.7), and presents references (Section 10.8).

10.1.2 Purpose and Need

See Resource Report 1 (General Project Description) for additional information on the Project purpose and need.

10.2 NO ACTION ALTERNATIVE

The No Action Alternative for the Project would avoid the temporary and permanent environmental impacts associated with construction and operation of the Project. However, the No Action Alternative would not achieve the Project's purpose and need as stated in Resource Report 1 (General Project Description). Under the No Action Alternative, North Carolina and southern Virginia will not receive the significant benefits associated with the Project. In addition, the Project's anchor shipper, PSNC Energy, a wholly owned subsidiary of SCANA Corporation ("PSNC Energy") would experience a capacity shortfall as projected in its annual filing with the North Carolina Public Utilities Commission.

The Project would not be able to meet the specific transportation needs for natural gas as contracted by PSNC Energy if the Project is not constructed. On a broader scale, implementing the No Action Alternative would not support the goal of increasing consumer access to stable and reliable natural gas supplies in the southeastern U.S.

In recent years, the North American natural gas market has seen enormous growth in production and demand. The U.S. Energy Information Administration ("EIA") estimates that total natural gas consumption in the U.S will increase from 27.6 trillion cubic feet in 2017 to 35.6 trillion cubic feet in 2050, with a large portion of this increased demand occurring in the electric generation sector (EIA, 2018a). A sizable portion of growth in natural gas production is occurring in the Appalachian Basin, with Marcellus Shale production alone increasing from 10 billion cubic feet per day ("Bcf/d") in 2013 to approximately 20 Bcf/d in October 2017 (EIA, 2018b). The increased demand for natural gas is expected to be especially high in the southeastern U.S., and in particular, North Carolina, as its population continues to grow. The Project will

benefit North Carolina and southern Virginia by connecting the additional supply to the increased market demand. In doing so, the Project will bring clean-burning, domestically-produced natural gas supplies to support the growing demand for natural gas, provide increased supply diversity, and improve supply reliability.

If the purpose and need of the Project are to be met without construction of the Project facilities, other projects and activities would be needed resulting in their own environmental impacts. This would result in the transfer of environmental impacts from one project to another, but would not necessarily eliminate or reduce impacts. The No Action Alternative is not considered a viable option because it does not meet the objectives of the Project or its anchor shipper.

10.3 ENERGY ALTERNATIVES

Use of certain alternative fuels to supply the needs of the market served by the Project are not alternatives to the Project. As described below, renewable energy, energy conservation, alternative fossil fuels, nuclear, and fuel cells do not meet the Southgate Project purpose.

10.3.1 Renewable Energy Sources

Renewable energy sources, such as wind, solar, geothermal, and biomass are increasing in capacity and benefit the energy market by diversifying the fuels used to generate electricity. However, these sources are not interchangeable with natural gas. Renewable energy sources cannot meet the objectives of the Project or its anchor shipper to provide natural gas for typical local distribution uses (e.g., home heating, cooking and industrial uses). In addition, renewable energy does not meet the purpose of the Project to provide new natural gas transmission pipeline capacity that will increase competition and enhance the reliability and resiliency of the existing pipeline infrastructure in North Carolina and southern Virginia.

10.3.2 Energy Conservation

Energy conservation measures have an increasing role in reducing future energy demand in the U.S. The Energy Policy Act of 2005 provides guidelines to: (1) diversify America's energy supply and reduce dependence on foreign sources of energy; (2) increase residential and business' energy efficiency and conservation (e.g., Energy Star Program); (3) improve vehicular energy efficiency; and (4) modernize the domestic energy infrastructure.

Energy conservation reduces the demand or growth in demand for natural gas and other energy sources. It is possible that the development and implementation of additional cost-effective conservation measures could have some effect on the demand for natural gas. However, substantial new advances in technology would be needed before the magnitude of such energy conservation measures necessary to equal the amount of energy transported by the Project could be implemented. PSNC Energy already participates in energy conservation programs for its customers, as approved by the North Carolina Utilities Commission. Programs include discount rates and rebates on energy efficient equipment. Because PSNC Energy already participates in these programs, and the Southgate Project is designed to meet PSNC Energy's additional projected need, energy efficiency programs are not an alternative to the Project.

10.3.3 Alternative Fossil Fuels, Nuclear, and Fuel Cells

While other fossil fuels (e.g., coal and oil), nuclear power, and fuel cells can be viable alternatives to natural gas in generating electricity, these sources are not interchangeable with natural gas. These alternative

energy sources cannot meet the objectives of the Project or its anchor shipper to provide natural gas for typical local distribution uses (e.g., home heating, cooking and industrial uses). In addition, these alternative energy sources do not meet the purpose of the Project to provide new natural gas transmission pipeline capacity that will increase competition and enhance the reliability and resiliency of the existing pipeline infrastructure in North Carolina and southern Virginia.

10.4 SYSTEM ALTERNATIVES

System alternatives are alternatives to the proposed action that would make use of other existing, modified, or proposed pipeline systems to meet the purpose and need of the Project. If available as a viable alternative, a system alternative could make it unnecessary to construct all or part of the Project, although some modifications or additions to the alternative systems would be required to increase their capacity or provide receipt and delivery capability consistent with that of the Project. These modifications or additions would result in environmental impacts that may be less than, comparable to, or greater than those associated with construction of the Project. System alternatives that would result in significantly less environmental impact might be preferable to the Project. However, a viable system alternative must also be technically and economically feasible and practicable, and must satisfy necessary contractual commitments (including timing) made with shippers supporting the development of the Project. The systems evaluated as potential alternatives to the Project are discussed below.

10.4.1 Surface Transportation System Alternatives

A surface transportation system alternative would involve the liquefaction of natural gas at the receipt points along the pipeline and transportation of the liquefied natural gas ("LNG") volumes to the delivery points where regasification facilities would be installed. To liquefy and transport natural gas, the temperature and pressure design points are -260 degrees Fahrenheit and 4 pounds per square inch gauge. Converting the 300 million cubic feet per day ("MMcf/d") of natural gas volumes that the Project will deliver to PSNC in North Carolina to LNG would require a production and transportation of approximately 3.7 million gallons per day. Transportation of the LNG would involve trucking on local and interstate highways to a centralized delivery point and transporting to regasification facilities at the delivery points along the pipeline. Given a truck tanker capacity of 10,850 gallons, it would take approximately 345 trucks per day to transport this volume with a truck limiting load rate of approximately 300 gallons per minute. To transport the LNG volumes, a 24-hour per day, simultaneous loading operations of approximately nine trucks would be required. Any additional natural gas volume increase would result in an incremental increase in the number of trucks per day.

Truck transportation options are not as safe and reliable as pipelines, as discussed and demonstrated statistically in Resource Report 11 (Reliability and Safety). Installation of processing facilities to liquefy and subsequently re-gasify natural gas would require extensive permitting; require large tracts of land for a regasification facility, and result in associated air emissions from the liquefaction/regasification process and the truck or rail traffic. In addition, the development or improvement of the transportation network would be necessary to transport LNG gas would be required. Transporting LNG by rail is also not a viable option. Currently, there are no approved LNG rail tankers, and shipment of LNG in International Organization for Standardization containers by rail is very limited due to regulatory constraints. Therefore, new regulatory processes and approvals would be required before LNG rail shipments would be possible. Since the LNG by rail alternative would not be available to meet the timeframe required for energy demands by the market, use of this alternative is not a viable alternative to the Project. Therefore, transporting the

Project's natural gas volumes as LNG by trucks and rail/or is not considered a viable alternative to the Project pipeline facilities and was eliminated from further consideration.

10.4.2 Transco Pipeline System and Cardinal Pipeline

Transco Pipeline System

The Transcontinental Gas Pipe Line Company, LLC ("Transco") system encompasses approximately 10,200 miles from South Texas to New York City with a system peak design capacity of approximately 15 million dekatherms per day ("MMDth/d"). The Project's pipeline would be located adjacent to or in close proximity to Transco's system for approximately 23.0 miles, between approximate MP 0.4 and MP 32.9, in Virginia and North Carolina.

On April 11, 2018 Transco's filed an application with FERC for its proposed Southeastern Trail Expansion Project (Docket No. CP18-186). According to Transco, its Southeastern Trail Expansion Project would provide 296.4 MMcf/ of natural gas per day of additional firm transportation to serve markets in the Mid-Atlantic and Southeastern states by November 2020. Transco states that the project would provide additional reliable service to utility and local distribution companies in the southeast including Virginia and North Carolina. Customers served by the Southeastern Trail Expansion Project include: PSNC Energy (60 MMcf/d), South Carolina Electric and Gas (215 MMcf/d), Virginia Natural Gas (14.6 MMcf/d), and the Cities of Buford (3.8 MMcf/d) and LaGrange (3 MMcf/d) in Georgia. The project would involve construction and operation of approximately 7.7 miles of new natural gas pipeline (Manassas Loop) located along the existing Transco Mainline in Fauquier and Prince William Counties, Virginia; expansion of three existing compressor stations in Virginia (Stations 185, 175, and 165), and modification of 21 existing facilities in South Carolina, Georgia, and Louisiana. The project also includes the retirement and abandonment of 10 compressor units and related buildings and ancillary equipment at Transco's existing Compressor Station 165 in Pittsylvania County, Virginia. Transco's Compressor Station 165 is located approximately 3.0 miles west of the Project's proposed Lambert Compressor Station. No facilities associated with the Southeastern Trail Expansion Project are proposed in North Carolina.

Currently, Transco's pipeline system does not have the long-term firm capacity to serve the Project's anchor shipper (PSNC Energy) contracted amount. In addition, use of a Transco system alternative would require additional gas delivery infrastructure. To meet the needs of PSNC Energy, approximately 40 miles of new pipeline from the existing Transco system to the PSNC's Haw River Interconnect, as well as any necessary compressor station facilities and mainline pipeline upgrades, would need to be constructed. The Project provides a primary receipt and delivery forward haul transportation path that offers improved reliability as compared to the secondary-firm backhaul deliveries PSNC Energy currently receives from Transco. In addition, PSNC Energy considered other existing and proposed interstate pipeline providers, including Transco, to meet its needs. Finally, PSNC Energy committed to the firm transportation service of the Project to diversify its gas transportation supply. Therefore, the Project does not consider Transco's system to be a reasonable alternative to the Project.

Cardinal Pipeline System

The Cardinal Pipeline Company is a 105-mile, 24-inch intrastate pipeline that extends from Rockingham County, North Carolina to a point southeast of Raleigh, North Carolina, with a design capacity of 279,000 dekatherms per day. The Cardinal Pipeline System receives all its gas from Transco in North Carolina and redelivers this gas to Piedmont and PSNC Energy.

At its closest point, the Cardinal Pipeline System is approximately 2.0 miles west of MP 71.0 of the pipeline near Graham, North Carolina. To meet the objectives of the Southgate Project, this pipeline system would require additional gas delivery infrastructure in North Carolina and Virginia that would result in environmental impacts similar to those that would occur as proposed by the Project. In addition, PSNC Energy considered other existing and proposed interstate pipeline providers, including the Cardinal Pipeline System; however, PSNC Energy committed to firm transportation service associated with the Project and entered into binding long-term agreements that made PSNC Energy an anchor shipper for the Project. Therefore, the Southgate Project does not consider the Cardinal Pipeline System to be a reasonable alternative to the Project.

10.4.3 Atlantic Coast Pipeline Project

The Atlantic Coast Pipeline Project, which is currently under construction, is expected to be in service in late 2019. The project consists of approximately 600 miles of pipeline that originates in West Virginia, crosses Virginia, and then continues south into eastern North Carolina, ending in Robeson County. It also includes three new compressor stations. The Atlantic Coast Pipeline Project is designed to provide up to 1.5 MMDth/d of natural gas transportation service to consumers in Virginia and North Carolina including Dominion Energy, Duke Energy, Piedmont, Virginia Natural Gas, and PSNC Energy. This pipeline system is located approximately 100 miles east of the Southgate Project. To meet the objectives of the Southgate Project, and deliver additional volumes at the Dan River and Haw River interconnects, this pipeline system would require over 100 miles of new pipeline infrastructure in North Carolina and/or Virginia that would result in environmental impacts greater than those that would occur as a result of the Project. In addition, PSNC Energy considered other existing and proposed interstate pipeline providers, including Atlantic Coast Pipeline to meet its gas transportation demand. PSNC Energy committed to firm transportation service associated with the Project and entered into binding long-term agreements that made PSNC Energy an anchor shipper for the Project. Therefore, the Project does not consider the Atlantic Coast Pipeline to be a reasonable alternative to the Project.

10.4.4 East Tennessee Natural Gas System

The East Tennessee Natural Gas, LLC ("East Tennessee") pipeline system consists of approximately 1,536 miles of pipeline in the Southeast and Mid-Atlantic. The system begins in Tennessee and extends to an area just south of Roanoke, Virginia. A segment of the system extends into southwest Virginia and northern North Carolina through a 95-mile natural gas pipeline that interconnects with the Transco system near Eden, North Carolina. East Tennessee interconnects with Texas Eastern Transmission, Tennessee Gas Pipeline, Columbia Gulf, Southern Natural Gas and Midwestern Gas Transmission. The East Tennessee system currently provides direct access to natural gas producers in the Appalachian region through multiple pipeline interconnections on its mainline.

While East Tennessee interconnects with the Southgate Project at the LN 3600 Interconnect (approximately 1.1 miles west of MP 27.4) it cannot be considered a viable system alternative as it would need to build similar facilities as proposed by the Project to meet the Project objectives. Significant modifications to the East Tennessee system (and the existing pipelines interconnected to East Tennessee), including the construction of new pipeline facilities, would be needed to provide the necessary design pressure and capacity to serve the Project's anchor shipper (PSNC Energy). Therefore, the Project does not consider this pipeline system to be a reasonable alternative to the Project.

10.4.5 Piedmont Natural Gas

Piedmont Natural Gas is a local distribution company operating in North Carolina. The anchor shipper for the Project (PSNC Energy) is also a local distribution company operating in North Carolina. Transporting gas volumes from one local distribution company to another does not meet the purpose and need for the Project. Local distribution systems are designed to meet the needs of their customers, not the needs of other distribution systems. It would also not provide the incremental volumes that PSNC Energy needs to meet growing system demand, as discussed in the purpose and need section in Resource Report 1. Further, Piedmont's system could not satisfy any of the other reasons cited by PSNC Energy for becoming a Project shipper, including transportation cost, supply cost, supply diversity, reliability/resiliency, and operational efficiencies. Therefore, Piedmont's system is not a viable alternative for the Project.

10.4.6 PSNC Distribution System

The anchor shipper for the Project (PSNC Energy) is a local distribution company operating in three non-contiguous regions in North Carolina. As discussed in the purpose and need section in Resource Report 1, PSNC Energy solicited interest from existing and proposed interstate pipelines, and ultimately signed a long-term agreement with Mountain Valley for the Project, because it needs incremental volumes to meet growing system demand. PSNC Energy's existing pipelines are not a viable system alterative because they would not provide the incremental volumes PSNC Energy needs for its customers. In addition, as it is currently designed, during high demand times (i.e., peak winter demand scenarios) PSNC Energy's distribution system does not have the ability to serve all of its current customers through the Dan River Interconnect only. Due to current pipeline size and existing horsepower limitations, PSNC Energy requires supply of natural gas from both the Dan River Interconnect as well as the Haw River Interconnect to reliably serve its customers. Further, PSNC Energy's existing system could not satisfy any of the other reasons for becoming a Project shipper, including transportation cost, supply cost, supply diversity, reliability/resiliency, and operational efficiencies. Therefore, PSNC Energy's own distribution system is not a viable alternative for the Project.

10.5 ROUTE ALTERNATIVES

10.5.1 Pipeline Routing

During the route development of the Southgate Project an extensive desktop and field review of potential pipeline routes to identify viable pipeline corridors was conducted; and then further refined the review to determine the most feasible route within the most favorable corridor. One of the Project's primary objectives with respect to pipeline routing was to avoid or minimize, to the extent possible, crossings of major population centers and significant environmental resources. The Project also attempted to route its pipeline adjacent to existing rights-of-way, where feasible. The Project used field reconnaissance, aerial photography, topographic maps from the U.S. Geological Survey, and National Wetland Inventory maps during the route identification and evaluation processes.

The Southgate Project includes the installation of approximately 73 miles of natural gas pipeline and appurtenant facilities (e.g., compressor station, meter stations, valve settings and launcher/ receiver equipment) within a new permanent right-of-way. As discussed further below, the Project has evaluated major and minor route alternatives to maximize constructability, minimize impacts to sensitive resources and avoid encroachments. Mountain Valley is committed to further refinement of the pipeline alignment,

as necessary, to ensure minimization of Project-related impacts on affected landowners and the environment.

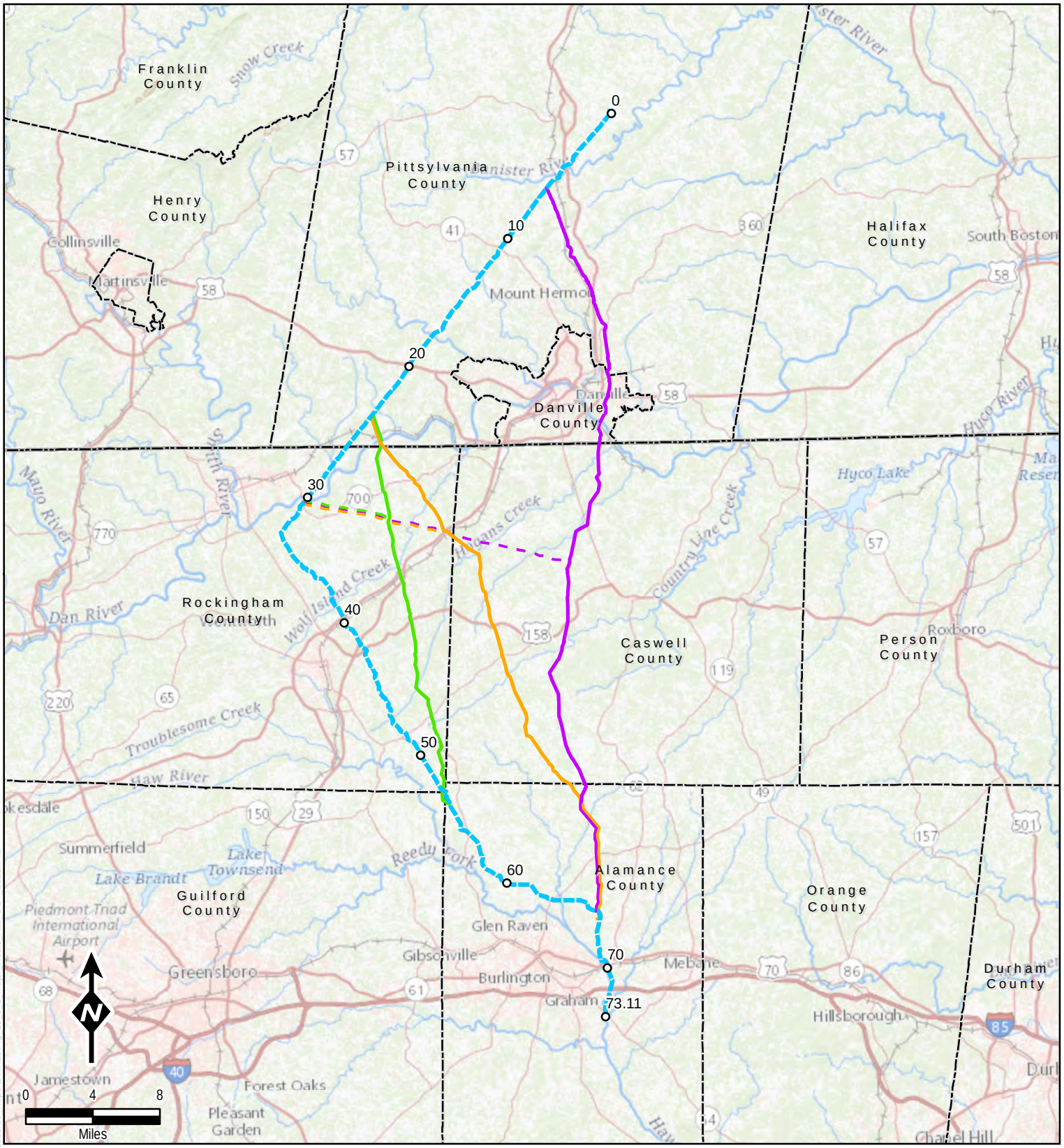
10.5.2 Major Pipeline Route Alternatives

Mountain Valley evaluated major pipeline route alternatives as part of the planning and design process for the Project, and based the evaluation on environmental and land use impacts, as well as permanent easement acquisitions and overall Project costs. The primary objective in performing this analysis is to develop the most direct route that could connect customers to the available supply system while avoiding or minimizing potential adverse environmental impacts and engineering constraints to the greatest extent practicable. The Project evaluated pipeline routing options based on potential adverse environmental impacts, existing land usage, constructability, safety, and feasibility considerations.

The selection of the major route alternatives involves several steps.

- Development of routing criteria;
- Identification of potential routing alternatives;
- Collection of data relative to each alternative;
- Evaluation of potential environmental and land use impacts;
- Evaluation of routing alternatives against routing criteria; and
- Determination of the most cost-effective technical solution

This section describes and evaluates the major route alternatives identified during the initial planning stage of the Project. The major route alternatives are shown on Figure 10.5-1 and summarized in Tables 10.5-1 through 10.5-3 below.



Legend

- Preferred Pipeline Route
- State Boundary
- County Boundary
- Alternative Route 1
- Alternative Route 1 Lateral
- Alternative Route 2
- Alternative Route 2 Lateral
- Alternative Route 3
- Alternative Route 3 Lateral

Data Sources: ESRI, USGS, EQT

1 inch = 8 miles
When Printed 8.5x11

Mountain Valley PIPELINE LLC

Figure 10.5-1

Major Route Alternatives

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

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10.5.2.1 Route Alternative 1

The Project evaluated Route Alternative 1 between MP 23.7 and MP 53.6 (see Figure 10.5-1). This alternative begins in Pittsylvania County, Virginia at MP 23.7 and extends in a southeasterly direction for approximately 1.9 miles to the North Carolina border. Within this segment, this alternative crosses Berry Hill Road/U.S. Highway 311, a railroad track, the Dan River, South River Road, and mixed forested and agricultural/open land. At the North Carolina border in Rockingham County, Route Alternative 1 continues in a south-southeasterly direction for approximately 21.7 miles. It crosses mixed forested and agricultural/open land; Berry Hill Ridge, Gravel Hill, and Dix roads; State Highway 700; Guerrant Springs Road; Worsham Mill Road; Quaqua Hill and Estes roads; U.S. Highway 29-BR, a railroad track, Benton Road, and U.S. Highway 29; and three existing utility easements. From this point, Route Alternative 1 continues in a south-southeasterly direction crossing U.S. Highway 58, Grooms Road, Tate Road, Rockingham Lake Road, and the Colonel Heritage Byway/State Route 150. Within this section, this alternative would be approximately 0.05 mile east of Williamsburg Wildlife Lake. From Colonel Heritage Byway/State Route 150, Route Alternative 1 continues to cross mixed forested and agricultural/open land; and County Line Creek; Trails End Road; State Route 87; Zeb, Kernodle, and Parkdale roads. Route Alternative 1 then extends south into Guilford County for approximately 0.6 mile and southeast into Alamance County for approximately 0.5 mile to rejoin the preferred route at MP 53.6. Route Alternative 1 includes an approximate 5.4-mile long lateral from the alternative route south of Guerrant Springs Road to an interconnect with PSNC Energy, east of Eden, North Carolina.

As shown in Table 10.5-1, the primary advantages of Route Alternative 1 are:

- crosses fewer miles of environmental justice communities;
- crosses fewer waterbodies and wetlands; and
- crosses slightly fewer areas with potential for shallow depth to bedrock.

The primary disadvantages of Route Alternative 1 are:

- greater length and associated land disturbance;
- collocates with existing rights-of-way for approximately 10.1 fewer miles;
- crosses more parcels and affects more residences within 50 feet of workspace; and
- affects significantly more forest land.

The presence of existing infrastructure must be considered when evaluating route alternatives and comparing relevant impacts, including environmental justice. When collocated with existing infrastructure or utility corridors, the incremental impacts of an additional pipeline are significantly less compared to routing through a greenfield area. Collocation minimizes potential impacts on the general population and environmental justice communities alike. Mountain Valley developed the Southgate Project preferred route to collocate to the maximum extent practicable and avoid unnecessary greenfield impacts. Overall, the preferred route is collocated for 6.9 miles of the 21.6 miles within environmental justice communities, resulting in significantly fewer greenfield impacts, including greenfield impacts on environmental justice communities. Considering all relevant impacts, the Southgate Project preferred route would not cause significant impacts or disproportionate impacts on environmental justice communities and is advantageous to the alternative route. Because the primary disadvantages outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-1

Comparison of the Preferred Route and Route Alternative 1

Feature	Preferred Route	Route Alternative 1	Difference
General			
Total length (miles) a/	29.8	30.1	+0.3
Length adjacent to existing ROW (miles)	14.7	4.6	-10.1
Land affected during construction (acres) a/	361.7	364.7	+3.0
Land affected during operation (acres) a/	180.9	182.4	+1.5
Land Use			
Populated areas within ½ mile (number)	0	0	0
National Forest System lands crossed (miles)	0	0	0
National Forest Wilderness crossed (miles)	0	0	0
State lands crossed (forests, parks, wildlife management areas) (miles)	0	0	0
Scenic Trail crossings (number)	0	0	0
Designated Natural and Scenic Rivers, Nationwide Rivers Inventory, significant fisheries, ponds/lakes (number)	1	0	-1
NRHP designated or eligible historic districts crossed (miles)	0	0	0
Landowner parcels crossed (number)	148	154	+6
Residences within 50 feet of construction work space (number)	5	11	+6
Environmental Justice Areas (miles)	21.6	10.1	-11.5
Resources			
Agricultural land crossed (miles) c/	8.2	9.2	+1.0
Open land crossed (miles)	14.8	13.2	-1.6
Developed land crossed (miles)	0.3	0.2	-0.1
Forested land crossed (miles)	14.5	16.3	+1.8
Forested land affected during construction (acres)	175	198.6	+23.6
Forested land affected during operation (acres)	87.8	99.2	+11.4
Total Wetlands (NWI) crossed (feet)	1240	726	-514
PEM NWI wetlands affected by construction (acres) b/	0.2	0	-0.2
PEM NWI wetlands affected by operation (acres) a/	0.1	0	-0.1
PSS NWI wetlands affected by construction (acres) b/	0.7	0.6	-0.1
PSS NWI wetlands affected by operation (acres) a/	0.5	0.4	-0.1
PFO NWI wetlands crossed (feet)	755	391	-364
PFO NWI wetlands affected by construction (acres) b/	1.3	0.8	-0.5
PFO NWI wetlands affected by operation (acres) a/	0.9	0.5	-0.4
Perennial waterbody crossings (number)	16	14	-2
Crossings of major waterbodies (>100 feet) (number)	0	0	0

Table 10.5-1

Comparison of the Preferred Route and Route Alternative 1

Feature	Preferred Route	Route Alternative 1	Difference
Presence of critical habitat or federally endangered or threatened species (Yes/No). Number of species.	No/0	No/0	0
Shallow bedrock crossed (miles)	4.0	3.8	-0.2
Karst area crossed (miles)	0	0	0

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW. Includes a 5.4-mile long lateral from Alternative 1 to an interconnect with PSNC Energy, east of Eden, North Carolina.

b/ Assuming 75-foot-wide construction ROW.

c/ Includes pasture/hay and cultivated crops.

Populated Areas = census designated places, consolidated cites, and incorporated places.

ROW = right-of-way. NWI = National Wetland Inventory. NRHP = National Register of Historic Places.

PEM = Palustrine Emergent Wetland; PSS = Palustrine Scrub-Shrub Wetland; PFO = Palustrine Forested Wetland.

Information Sources:

GIS – Analysis based on Geodatabase layers and shapefiles.

NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page

VA Parcel Boundaries and Standard Fields - https://www.arcgis.com/home/item.html?id=f1dccaf1f42e40cbba791feae2e23690

NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html

NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/

USGS – U.S. Geological Survey - http://www.usgs.gov/

NHD – National Hydrography Dataset - http://nhd.usgs.gov/

USDA - https://data.fs.usda.gov/geodata/edw/datasets.php

NRHP - National Register of Historic Places - https://www.nps.gov/nr/research/data_downloads.htm

ESRI - GIS Mapping - http://www.esri.com/

10.5.2.2 Route Alternative 2

The Project evaluated Route Alternative 2 between MP 23.7 and MP 66.1 (see Figure 10.5-1). This alternative begins in Pittsylvania County, Virginia at MP 23.7 and extends in a southeasterly direction for approximately 2.0 miles to the North Carolina border. Within this segment, this alternative crosses Berry Hill Road/U.S. Highway 311, a railroad track, the Dan River, South River Road, and mixed forested and agricultural/open land. At the North Carolina border, Route Alternative 2 continues in a south-southeasterly direction for approximately 7.0 miles within Rockingham County. It crosses mixed forested and agricultural/open land; Gravel Hill Road, Goose Pond Road, State Highway 700, an unnamed road, Service Road, U.S. Highway 29, a railroad track, and Old Highway 29. It then traverses Caswell County for approximately 17.3 miles and crosses mixed forested and agricultural/open land. It crosses several roadways including Anderson and Chapman roads, Hogans Creek, Park Springs Road, Allison Grove Road, and U.S. Highway 158. From this point, it continues in a south-southeasterly direction and crosses Bethesda Church Road twice, Holster Branch, Colonel Heritage Byway/State Route 150, Cherry Grove Road, Stadler Road, Milesville Road, Kerrs Chapel Road, and Old Stoney Mountain Road. Route Alternative 2 then continues in Alamance County for approximately 8.7 miles and rejoins the at MP 66.1. Within this section, this alternative crosses Toms Creek, Union Ridge Road, Jefferies Cross Road, State Route 63, and mixed forested and agricultural/open land. It continues in a southerly direction and crosses McCray Road, Deep Creek Church Road, North Fonville Road, Sandy Cross Road, and rejoins the preferred route at MP 66.1. Route Alternative 2 includes an approximate 8.8-mile long lateral from the alternative route north of U.S. Route 29 to an interconnect with PSNC Energy, east of Eden, North Carolina.

As shown in Table 10.5-2, the primary advantages of Route Alternative 2 are:

- crosses fewer miles of environmental justice communities;
- crosses fewer parcels;
- affects less open and developed land;
- affects fewer designated waterbodies; and
- crosses one less major waterbody.

The primary disadvantages of Route Alternative 2 are:

- greater length and land disturbance;
- collocates with existing rights-of-way for approximately 5.4 fewer miles;
- affects more residences within 50 feet of workspace;
- affects significantly more forested land;
- crosses significantly more wetlands including 3.5 acres of forested wetlands; and
- crosses more shallow bedrock areas.

As described in Section 10.5.2.1 above, the presence of existing infrastructure must be considered when evaluating route alternatives and comparing relevant impacts, including environmental justice. Overall, the preferred route is collocated for 6.9 miles of the 21.6 miles within environmental justice communities, resulting in significantly fewer greenfield impacts, including greenfield impacts on environmental justice communities. Considering all relevant impacts, the Southgate Project preferred route would not cause significant impacts or disproportionate impacts on environmental justice communities and is advantageous to the alternative route. Because the primary disadvantages outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-2

Comparison of the Preferred Route and Route Alternative 2

Feature	Preferred Route	Route Alternative 2	Difference
General			
Total length (miles) a/	42.3	43.4	+1.2
Length adjacent to existing ROW (miles)	20.0	14.6	-5.4
Land affected during construction (acres) a/	513.3	525.5	+12.2
Land affected during operation (acres) a/	256.6	262.7	+6.1
Land Use			
Populated areas within ½ mile (number)	0	0	0
National Forest System lands crossed (miles)	0	0	0
National Forest Wilderness crossed (miles)	0	0	0
State lands crossed (forests, parks, wildlife management areas) (miles)	0	0	0
Scenic Trail crossings (number)	0	0	0
Designated Natural and Scenic Rivers, Nationwide Rivers Inventory, significant fisheries, ponds/lakes (number)	2	0	-2
NRHP designated or eligible historic districts crossed (miles)	0	0	0

Table 10.5-2

Comparison of the Preferred Route and Route Alternative 2

Feature	Preferred Route	Route Alternative 2	Difference
Landowner parcels crossed (number)	220	191	-29
Residences within 50 feet of construction work space (number)	7	11	+4
Environmental Justice Areas (miles)	21.6	3.7	-17.9
Resources			
Agricultural land crossed (miles) c/	14.2	13.3	-0.9
Open land crossed (miles)	21.7	21.5	-0.2
Developed land crossed (miles)	0.6	0.4	-0.2
Forested land crossed (miles)	19.6	21.1	+1.5
Forested land affected during construction (acres)	237.4	256.1	+18.7
Forested land affected during operation (acres)	118.9	128	+9.1
Total Wetlands (NWI) crossed (feet)	1,972	3,047	+1,075
PEM NWI wetlands affected by construction (acres) b/	0.8	0	-0.8
PEM NWI wetlands affected by operation (acres) a/	0.6	0	-0.6
PSS NWI wetlands affected by construction (acres) b/	0.7	0.5	-0.2
PSS NWI wetlands affected by operation (acres) a/	0.5	0.4	-0.1
PFO NWI wetlands crossed (feet)	790	2,763	+1,973
PFO NWI wetlands affected by construction (acres) b/	1.4	4.9	+3.5
PFO NWI wetlands affected by operation (acres) a/	0.9	3.3	+2.4
Perennial waterbody crossings (number)	18	19	+1
Crossings of major waterbodies (>100 feet) (number)	1	0	-1
Presence of critical habitat or federally endangered or threatened species (Yes/No). Number of species.	No / 0	No / 0	0
Shallow bedrock crossed (miles)	4.0	4.3	+0.3
Karst area crossed (miles)	0	0	0

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW. Includes an 8.8-mile long lateral from Alternative 2 to an interconnect with PSNC Energy, east of Eden, North Carolina.

b/ Assuming 75-foot-wide construction ROW.

c/ Includes pasture/hay and cultivated crops.

Populated Areas = census designated places, consolidated cites, and incorporated places.

ROW = right-of-way. NWI = National Wetland Inventory. NRHP = National Register of Historic Places.

PEM = Palustrine Emergent Wetland; PSS = Palustrine Scrub-Shrub Wetland; PFO = Palustrine Forested Wetland.

Information Sources:

GIS – Analysis based on Geodatabase layers and shapefiles.

NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page

VA Parcel Boundaries and Standard Fields - https://www.arcgis.com/home/item.html?id=f1dccaf1f42e40cbba791feae2e23690

NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html

NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/

USGS – U.S. Geological Survey - http://www.usgs.gov/

NHD – National Hydrography Dataset - http://nhd.usgs.gov/

USDA - https://data.fs.usda.gov/geodata/edw/datasets.php

NRHP - National Register of Historic Places - https://www.nps.gov/nr/research/data_downloads.htm

ESRI - GIS Mapping - http://www.esri.com/

10.5.2.3 Route Alternative 3

The Project evaluated Route Alternative 3 between MP 6.1 and MP 66.1 (see Figure 10.5-1). This alternative begins in Pittsylvania County, Virginia at MP 6.1 and extends in a southerly direction for approximately 16.7 miles to the North Carolina border where it crosses mixed forested and agricultural/open land. Within this segment, this alternative primarily parallels an existing Duke Energy electric transmission easement and crosses White Oak Creek, Dry Fork Road, Hither Land and Court, R and L Smith Road, and Mountain View Road. Near Mountain View Road, this alternative deviates from the electric transmission easement to the west to minimize loss of vegetative buffer between the easement and nearby residences. Approximately 0.2 mile south of this location, this alternative deviates to the west to avoid utility congestion in the neighborhoods along Springlake Place, Springdale Drive, and Deerwood Drive. From this point, Route Alternative 3 continues in a southerly direction and crosses County Road 946, East Witt Road, Railroad Lane, and U.S. Highway 29-BR. Between Railroad Lane and U.S. Highway 29-BR, this alternative makes another deviation from the electric transmission easement to the west to avoid multiple utility easements on a residential property. From this point, this alternative crosses Landrum Road, U.S. Highway 29, Twin Arch Drive, and Old Richmond Road/State Route 30.

Route Alternative 3 then crosses the Danville City limits including residential, commercial, and industrial areas; several roadways, and mixed forested and agricultural/open land. Once south of Danville, this alternative enters Caswell County, North Carolina for approximately 21.9 miles where it crosses mixed forested and agricultural/open land. It crosses Walter's Mill Road twice, Hogan's Creek, an unnamed road, Moon Creek Lane, and Old State Highway 86-North. It continues in a south-southwesterly direction and crosses State Route 86, Foster Road, East Prong Moon Creek, Hodges Dairy Road, and Colonel Heritage Byway/State Route 150. Route Alternative 3 would be approximately 0.2 mile west of the Caswell Airpark. It crosses County Road, County Line Creek, Cherry Gove Road, Senior Alfred Road, Byrd's Sawmill Road, Kerr's Chapel Road, and two Duke Energy electric transmission easements. Route Alternative 3 then continues in Alamance County for approximately 8.7 miles and rejoins the at MP 66.1. Within this section, this alternative crosses Roscoe Road, Toms Creek, Union Ridge Road, Jefferies Cross Road, State Route 63, and mixed forested and agricultural/open land. It continues in a southerly direction and crosses McCray Road, Deep Creek Church Road, North Fonville Road, Sandy Cross Road, and rejoins the preferred route at MP 66.1. Route Alternative 3 includes an approximate 16.6-mile long lateral from the alternative route, approximately 2.3 miles south of Foster Road, to an interconnect with PSNC Energy, east of Eden, North Carolina.

As shown in Table 10.5-3, the primary advantage of Route Alternative 3 is:

- crosses fewer miles of environmental justice communities;
- affects fewer designated waterbodies;
- crosses fewer mile of agricultural land and one less major waterbody; and
- crosses fewer miles of potential karst.

The primary disadvantages of Route Alternative 3 are:

- greater length and land disturbance;
- collocates with existing rights-of-way for approximately 1.5 fewer miles;
- crosses more parcels and affects more residences within 50 feet of workspace;
- affects significantly more forested land;

- crosses more wetlands including forested wetlands; and waterbodies;
- crosses one more major waterbody; and
- crosses more shallow bedrock areas.

As described in Section 10.5.2.1 above, the presence of existing infrastructure must be considered when evaluating route alternatives and comparing relevant impacts, including environmental justice. Overall, the preferred route is collocated for 6.9 miles of the 21.6 miles within environmental justice communities while Route Alternative 3 is collocated for 7.8 miles of the 19.1 miles within environmental justice communities, resulting in fewer greenfield impacts, including greenfield impacts on environmental justice communities. Considering all relevant impacts, the Southgate Project preferred route would not cause significant impacts or disproportionate impacts on environmental justice communities and is advantageous to the alternative route. Because the primary disadvantages outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-3

Comparison of the Preferred Route and Route Alternative 3

Feature	Preferred Route	Route Alternative 3	Difference
General			
Total length (miles) a/	60.0	63.4	+3.4
Length adjacent to existing ROW (miles)	26.9	25.4	-1.5
Land affected during construction (acres) a/	726.7	769.0	+42.3
Land affected during operation (acres) a/	363.4	384.5	+21.1
Land Use			
Populated areas within ½ mile (number)	0	1	+1
National Forest System lands crossed (miles)	0	0	0
National Forest Wilderness crossed (miles)	0	0	0
State lands crossed (forests, parks, wildlife management areas) (miles)	0	0	0
Scenic Trail crossings (number)	0	0	0
Designated Natural and Scenic Rivers, Nationwide Rivers Inventory, significant fisheries, ponds/lakes (number)	2	0	-2
NRHP designated or eligible historic districts crossed (miles)	0	0	0
Landowner parcels crossed (number)	309	369	+60
Residences within 50 feet of construction work space (number)	13	23	+10
Environmental Justice Areas (miles)	21.6	19.1	-2.5
Resources			
Agricultural land crossed (miles) c/	0.5	0.4	-0.1
Open land crossed (miles)	31.9	27.3	-4.6
Developed land crossed (miles)	0.6	1	+0.4
Forested land crossed (miles)	26.9	34.7	+7.8
Forested land affected during construction (acres)	324.6	422.1	+97.5
Forested land affected during operation (acres)	162.8	210.6	+47.8
Total Wetlands (NWI) crossed (feet)	2,196	3,159	+963

Table 10.5-3

Comparison of the Preferred Route and Route Alternative 3

Feature	Preferred Route	Route Alternative 3	Difference
PEM NWI wetlands affected by construction (acres) b/	1.1	0.6	-0.5
PEM NWI wetlands affected by operation (acres) a/	0.8	0.4	-0.4
PSS NWI wetlands affected by construction (acres) b/	0.7	2.1	+1.4
Total PSS NWI wetlands affected by operation (acres) a/	0.5	1.2	+0.7
PFO NWI wetlands crossed (feet)	790	1,614	+824
PFO NWI wetlands affected by construction (acres) b/	1.4	2.8	+1.4
PFO NWI wetlands affected by operation (acres) a/	0.9	1.9	+1.0
Perennial waterbody crossings (number)	28	31	+3
Crossings of major waterbodies (>100 feet) (number)	1	0	-1
Presence of critical habitat or federally endangered or threatened species (Yes/No). Number of species.	No / 0	No / 0	0
Shallow bedrock crossed (miles)	4.8	10.4	+5.6
Karst area crossed (miles)	2.0	0.6	-1.4

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW. Includes a 16.6-mile long lateral from Alternative 3 to an interconnect with PSNC Energy, east of Eden, North Carolina.

b/ Assuming 75-foot-wide construction ROW.

c/ Includes pasture/hay and cultivated crops.

Populated Areas = census designated places, consolidated cites, and incorporated places.

ROW = right-of-way. NWI = National Wetland Inventory. NRHP = National Register of Historic Places

PEM = Palustrine Emergent Wetland; PSS = Palustrine Scrub-Shrub Wetland; PFO = Palustrine Forested Wetland.

Information Sources:

GIS – Analysis based on Geodatabase layers and shapefiles.

NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page

VA Parcel Boundaries and Standard Fields - https://www.arcgis.com/home/item.html?id=f1dccaf1f42e40cbba791feae2e23690

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NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/

USGS – U.S. Geological Survey - http://www.usgs.gov/

NHD – National Hydrography Dataset - http://nhd.usgs.gov/

USDA - https://data.fs.usda.gov/geodata/edw/datasets.php

NRHP - National Register of Historic Places - https://www.nps.gov/nr/research/data_downloads.htm

ESRI - GIS Mapping - http://www.esri.com/

10.5.3 FERC Requested Route Alternatives

The FERC requested that Mountain Valley evaluate six route alternatives to avoid or reduce impacts along its preferred pipeline route. The desktop analysis included: length of pipeline; acreage of permanent and temporary rights-of-way; number of parcels crossed; number of residences within 25 and 50 feet of the edge of the construction right-of-way; number of waterbodies and wetlands crossed, and the length of each crossing; acres of agricultural and forested land affected; and the miles of right-of-way that would be parallel or adjacent to existing rights-of-way. The desktop analyses of these alternatives are presented below.

FERC Alternative 1 (MP 63.9 to MP 72.9)

The Project evaluated FERC Alternative 1 between MP 63.9 and MP 72.9 (see Figure 10.5-2, Appendix 10-A). At MP 63.9, FERC Alternative 1 extends in a southerly direction for approximately 4.69 miles to MP 68.6 of the preferred route. Within this section, the alternative crosses agricultural and forested land, Deep Creek Church Road, Sandy Cross Road, and Meeting Ground Road. It then collocates with the existing Cardinal Pipeline Company, LLC ("Cardinal Pipeline") on the east side of the Haw River for approximately 2.2 miles. At MP 68.6 of the preferred route, FERC Alternative 1 extends southwest for approximately 0.1 mile and crosses agricultural land and the Haw River. At this point, the alternative remains on the west side of the Haw River and turns in a more southerly direction continuing to be collocated with the existing Cardinal Pipeline for approximately 3.4 miles. Within this segment, the alternative crosses mixed forested and agricultural land, West Main Street, parallels the eastern boundary of the Challenge Golf Club for approximately 1.3 miles, and crosses Interstate 40/85. FERC Alternative 1 turns west, southwest, south, and southeast and crosses forested and agricultural land, State Highway 54/E. Harden Street, Cooper Road, and the Haw River to rejoin the preferred route at MP 72.9.

As shown in Table 10.5-4, the primary advantages of FERC Alternative 1 are:

- less length and land disturbance;
- crosses fewer parcels and affects fewer residences within 50 feet of workspace;
- collocates with existing rights-of-way for approximately 5.7 more miles; and
- affects fewer acres of forested agricultural land.

The primary disadvantages of FERC Alternative 1 are:

- crosses more waterbodies and eight more wetlands; and
- affects significantly more acres of wetlands.

Constructability concerns of FERC Alternative 1 are:

- two crossings of the Haw River;
- limited area for workspace layout at the Haw River crossings and along the alternative route due to an existing golf course, existing utility infrastructure and residential areas;
- new temporary access road to the alternative route.

Because the primary disadvantages, coupled with the constructability concerns, outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-4

Comparison of the Preferred Route and FERC Alternative 1

Feature	Preferred Route	FERC Alternative 1	Difference
Total length (miles)	9.1	8.7	-0.4
Construction right-of-way (acres) a/	110.1	105.6	-4.5
Permanent right-of-way (acres) a/	55.0	52.8	-2.2
Total number of parcels crossed	103	58	-45
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	1 / 3	1 / 1	0 / -2

Table 10.5-4

Comparison of the Preferred Route and FERC Alternative 1

Feature	Preferred Route	FERC Alternative 1	Difference
Number of waterbodies crossed	18	23	+5
Number of NWI wetlands crossed	1	9	+8
Total NWI wetland crossing length (feet)	25	3,990	+3,965
NWI wetlands within construction ROW (acres) b/	0.2	6.8	+6.6
Agricultural land within construction ROW (acres) c/	29.2	20.5	-8.7
Forested land within construction ROW (acres)	57.7	55.1	-2.6
Length parallel or adjacent to existing ROW (miles)	0.25	5.95	+5.7

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/

FERC Alternative 2 (MP 69.1 to MP 73.0)

The Project evaluated FERC Alternative 2 between MP 69.1 and MP 73.0 (see Figure 10.5-3, Appendix 10-A). This portion of FERC Alternative 2 is the same as FERC Alternative 1 from MP 69.1 and MP 72.5 described above. At MP 68.6, FERC Alternative 2 turns southwest for approximately 0.1 mile and crosses agricultural land and the Haw River. It then turns in a more southerly direction and is collocated with the existing Cardinal Pipeline for approximately 3.4 miles and crosses mixed forested and agricultural land, West Main Street, parallels the eastern boundary of the Challenge Golf Club for approximately 1.3 miles, and crosses Interstate 40/85. FERC Alternative 2 then turns west, southwest, south, and southeast and crosses forested and agricultural land, State Highway 54/E. Harden Street, Cooper Road, and the Haw River to rejoin the preferred route at MP 73.0.

As shown in Table 10.5-5, the primary advantages of FERC Alternative 2 are:

- crosses 17 fewer parcels,
- affects fewer residences within 25 and 50 feet of workspace;
- collocates with existing rights-of-way for approximately 3.4 more miles; and
- affects 1.5 fewer acres of forested land.

The primary disadvantages of FERC Alternative 2 are:

- greater length and land disturbance;
- crosses four more waterbodies and nine more wetlands; and
- affects significantly more acres of wetlands and 0.9 more acre of agricultural land.

Constructability concerns of FERC Alternative 2 are:

- two crossings of the Haw River; and
- limited area for workspace layout at the Haw River crossings and along the alternative route due to an existing golf course, existing utility infrastructure and residential areas.

Because the primary disadvantages, along with the potential constructability concerns, outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-5

Comparison of the Preferred Route and FERC Alternative 2

Feature	Preferred Route	FERC Alternative 2	Difference
Total length (miles)	3.8	4.0	+0.2
Construction right-of-way (acres) a/	46.5	48.8	+2.3
Permanent right-of-way (acres) a/	23.2	24.4	+1.2
Total number of parcels crossed	51	34	-17
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	1 / 3	0 / 0	-1 / -3
Number of waterbodies crossed	8	12	+4
Number of NWI wetlands crossed	0	9	+9
Total NWI wetland crossing length (feet)	0	4,163	+4,163
NWI wetlands within construction ROW (acres) b/	0.1	6.9	+6.8
Agricultural land within construction ROW (acres) c/	6.6	7.5	+0.9
Forested land within construction ROW (acres)	23.4	21.9	-1.5
Length parallel or adjacent to existing ROW (miles)	0.2	3.6	+3.4

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/

FERC Alternative 3 (MP 65.8 to MP 67.5)

The Project evaluated FERC Alternative 3 between MP 65.8 and MP 67.5 (see Figure 10.5-4, Appendix 10-A). The FERC Alternative 3 deviates from the original route at MP 65.45 and extends east-southeast for approximately 0.4 mile. At MP 65.8 of the preferred route, the FERC Alternative 3 extends southeast and east for approximately 0.3 mile and crosses agricultural and forested land and North Fonville Road. It

then turns in a more southerly direction for approximately 1.3 miles and crosses agricultural and forested land, Sandy Cross Road, and an existing electric transmission easement. It rejoins the Preferred Route at MP 67.5.

As shown in Table 10.5-6, the primary advantages of FERC Alternative 3 are:

- crosses less fewer parcels; and
- affects 0.4 fewer acre of forested land.

The primary disadvantages of FERC Alternative 3 are:

- greater length and land disturbance; and
- affects 2.9 more acres of agricultural land.

Constructability concerns of FERC Alternative 3 are:

- none identified based on initial review.

The Project further evaluated FERC Alternative 3 and incorporated approximately 1.7 miles of the alternative route into the Mystic Valley Reroute described in Section 10.5.4 below.

Table 10.5-6

Comparison of the Preferred Route and FERC Alternative 3

Feature	Preferred Route	FERC Alternative 3	Difference
Total length (miles)	1.5	2.0	+0.5
Construction right-of-way (acres) a/	18.9	24.7	+5.8
Permanent right-of-way (acres) a/	9.4	12.3	+2.9
Total number of parcels crossed	16	14	-2
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	0 / 0	0 / 0	0 / 0
Number of waterbodies crossed	3	3	0
Number of NWI wetlands crossed	0	0	0
Total NWI wetland crossing length (feet)	0	0	0
NWI wetlands within construction ROW (acres) b/	0	0	0
Agricultural land within construction ROW (acres) c/	9.5	12.4	2.9
Forested land within construction ROW (acres)	10.9	10.5	-0.4
Length parallel or adjacent to existing ROW (miles)	0	0	0

Table 10.5-6

Comparison of the Preferred Route and FERC Alternative 3

Feature	Preferred Route	FERC Alternative 3	Difference

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/

FERC Alternative 4 (MP 65.8 to MP 70.8)

The Project evaluated FERC Alternative 4 between MP 65.8 and MP 70.8 (see Figure 10.5-5, Appendix 10-A). At MP 65.6, FERC Alternative 4 extends in an easterly direction for approximately 3.8 miles and crosses agricultural and forested land. Within this segment, the alternative route crosses North Fonville Road, State Highway 49, and Johnson Road. It then turns in a south-southwest direction for approximately 5.8 miles and crosses agricultural and forested land, and several road / railroads including Mebane Rodgers Road/State Route 1921, Dewitt Drive, Bason Road/State Route 1927, U.S. Highway 70/E. Main Street, a railroad track, Stone Street Extension/State Route 1936, and Tollingwood Road. It rejoins the preferred route at MP 70.8.

As shown in Table 10.5-7, the primary advantages of FERC Alternative 4 are:

- affects fewer residences within 25 and 50 feet of workspace;
- collocates with existing rights-of-way for an additional 1.8 miles.

The primary disadvantages of FERC Alternative 4 are:

- greater length and land disturbance;
- affects three more parcels;
- crosses two more waterbodies and four more wetlands; and
- affects 0.5 more acre of wetlands 24 more acres of agricultural land, and 18.4 more acres of forested land.

Potential constructability concerns of FERC Alternative 4 are:

- none identified based on initial review.

Because the primary disadvantages outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-7

Comparison of the Preferred Route and FERC Alternative 4

Feature	Preferred Route	FERC Alternative 4	Difference
Total length (miles)	5.0	9.4	+4.4
Construction right-of-way (acres) a/	61.3	114	+52.7
Permanent right-of-way (acres) a/	30.6	57.0	+26.4
Total number of parcels crossed	63	60	-3
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	1 / 2	0 / 0	-1 / -2
Number of waterbodies crossed	12	14	+2
Number of NWI wetlands crossed	1	5	+4
Total NWI wetland crossing length (feet)	25	321	+296
NWI wetlands within construction ROW (acres) b/	0.2	0.7	+0.5
Agricultural land within construction ROW (acres) c/	12.4	36.3	+23.9
Forested land within construction ROW (acres)	35	53.4	+18.4
Length parallel or adjacent to existing ROW (miles)	0.2	2.0	+1.8

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/

FERC Alternative 5 (MP 71.8 to MP 73.1)

The Project evaluated FERC Alternative 5 between MP 71.8 and MP 73.1 (see Figure 10.5-6, Appendix 10-A). At MP 71.8, FERC Alternative 5 extends in an east/southeast direction for approximately 0.6 mile and crosses agricultural and forested land and Jimmie Kerr Road. It then turns in a south-southwest direction for approximately 1.7 miles and crosses agricultural and forested land, Cherry Lane, Jimmie Kerr Road, and State Highway 54/E. Harden Street before rejoining the preferred route at MP 73.1.

As shown in Table 10.5-8, the primary advantage of FERC Alternative 5 is:

- affects fewer residences within 50 feet of workspace.

The primary disadvantages of FERC Alternative 5 are:

- greater length and land disturbance; and

- affects three more parcels and 8.7 additional acres of agricultural land.

Potential constructability concerns of FERC Alternative 5 are:

- none identified based on initial review.

Because the primary disadvantages outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-8

Comparison of the Preferred Route and FERC Alternative 5

Feature	Preferred Route	FERC Alternative 5	Difference
Total length (miles)	1.3	2.2	+0.9
Construction right-of-way (acres) a/	16.2	26.3	+10.1
Permanent right-of-way (acres) a/	8.1	13.1	+5.0
Total number of parcels crossed	17	20	+3
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	1 / 1	0 / 0	-1/ -1
Number of waterbodies crossed	3	3	0
Number of NWI wetlands crossed	0	0	0
Total NWI wetland crossing length (feet)	0	0	0
NWI wetlands within construction ROW (acres) b/	0	0	0
Agricultural land within construction ROW (acres) c/	3	11.7	+8.7
Forested land within construction ROW (acres)	9.5	9.5	0
Length parallel or adjacent to existing ROW (miles)	0.1	0	-0.1

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/

FERC Alternative 6 (MP 58.2 to MP 62.0)

The Project evaluated FERC Alternative 6 between MP 58.2 and MP 62.0 (see Figure 10.5-7, Appendix 10-A). At MP 58.2, FERC Alternative 6 extends south and is collocated with a Duke Energy electric transmission easement for approximately 2.9 miles. It crosses agricultural and forested land, Burch Bridge Road and Iseley School Road. The alternative is collocated with an existing utility easement between Iseley School Road and Huffinese Drive (approximately 0.9 mile). It continues in an easterly direction and crosses agricultural and forested land before it rejoins the preferred route at MP 62.0.

As shown in Table 10.5-9, the primary advantages of FERC Alternative 6 are:

- affects 4.0 fewer acres of agricultural land; and
- collocates with existing rights-of-way for an additional 1.6 miles.

The primary disadvantages of FERC Alternative 6 are:

- greater length and land disturbance;
- affects seven more parcels;
- affects more residences within 25 and 50 feet of workspace;
- crosses five more waterbodies and one more wetland; and
- affects 0.2 more acre of wetlands and 3.6 additional acres of forested land.

Potential constructability concerns of FERC Alternative 6 are:

- none identified based on initial review.

Because the primary disadvantages outweigh the primary advantages, the Project eliminated this alternative from further consideration as its preferred pipeline route.

Table 10.5-9

Comparison of the Preferred Route and FERC Alternative 6

Feature	Preferred Route	FERC Alternative 6	Difference
Total length (miles)	3.7	4.4	+0.7
Construction right-of-way (acres) a/	45.6	53.3	+7.7
Permanent right-of-way (acres) a/	22.7	26.6	+3.9
Total number of parcels crossed	21	28	+7
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	0 / 0	1 / 1	+1 / +1
Number of waterbodies crossed	5	10	+5
Number of NWI wetlands crossed	1	2	+1
Total NWI wetland crossing length (feet)	35	131	+96
NWI wetlands within construction ROW (acres) b/	0.1	0.3	+0.2
Agricultural land within construction ROW (acres) c/	21.8	17.8	-4
Forested land within construction ROW (acres)	21.3	24.9	+3.6
Length parallel or adjacent to existing ROW (miles)	0.9	2.5	+1.6

Table 10.5-9

Comparison of the Preferred Route and FERC Alternative 6

Feature	Preferred Route	FERC Alternative 6	Difference

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/

10.5.4 Mystic Valley Reroute (Preferred Route)

Between MP 64.0 and MP 67.5 in Alamance County, North Carolina, the Project evaluated the Mystic Valley Reroute (preferred route) to avoid a U.S. Army Corps of Engineers Cripple Creek Mitigation Bank and address landowner concerns along its original route (filed under PF18-4-000 on August 20, 2018). The Mystic Valley Reroute deviates from the Project's original route at MP 64.0 and extends generally east, southeast, and south. From MP 64.0 to MP 65.8, it crosses open, agricultural, forest land; and Hidden Valley Trail/Road, Faucette Lane, and Deep Creek Church Road. At MP 65.8, the Mystic Valley Reroute intersects with the FERC Alternative 3 route described above and extends generally southeast. It crosses agricultural and forested land and North Fonville Road. It then turns in a more southerly direction and crosses agricultural and forested land, Sandy Cross Road, and an existing electric transmission easement before it rejoins the original route at MP 67.5 (see Figure 10.5-4).

As shown in Table 10.5-10, the primary advantages of the Mystic Valley Reroute (preferred route) are:

- crosses less agricultural land;
- addresses landowner concerns; and
- affects less forest land.

The primary disadvantages of the Mystic Valley Reroute (preferred route) are:

- greater length and land disturbance.

Potential constructability concerns of the Mystic Valley Reroute (preferred route) are:

- none identified based on initial review.

While the Mystic Valley Reroute (preferred route) results in similar environmental impacts as the original route, it avoids a U.S. Army Corps of Engineers Cripple Creek Mitigation Bank and addresses landowner concerns along its original route. Therefore, it was incorporated into the Project's preferred pipeline route.

Table 10.5-10

Comparison of the Original Route and Mystic Valley Reroute (Preferred Route)

Feature	Original Route	Mystic Valley Reroute (Preferred Route)	Difference
General			
Total length (miles) a/	2.99	3.49	+0.5
Length adjacent to existing ROW (miles)	0	0	0
Land affected during construction (acres) a/	36.4	42.5	+6.1
Land affected during operation (acres) a/	18.1	21.2	+3.1
Land Use			
Populated areas within ½ mile (number)	0	0	0
National Forest System lands crossed (miles)	0	0	0
National Forest Wilderness crossed (miles)	0	0	0
State lands crossed (forests, parks, wildlife management areas) (miles)	0	0	0
Scenic Trail crossings (number)	0	0	0
Designated Natural and Scenic Rivers, Nationwide Rivers Inventory, significant fisheries, ponds/lakes (number)	0	0	0
NRHP designated or eligible historic districts crossed (miles)	0	0	0
Landowner parcels crossed (number)	27	27	0
Residences within 50 feet of construction work space (number)	0	0	0
Environmental Justice Areas (miles)	1.1	1.1	0
Resources			
Agricultural land crossed (miles) c/	19.1	19.2	-0.1
Open land crossed (miles)	1.9	1.7	+0.2
Developed land crossed (miles)	0	0	0
Forested land crossed (miles)	1.1	1.7	-0.6
Forested land affected during construction (acres)	14	20.1	-6.1
Forested land affected during operation (acres)	6.8	10	-3.2
Total Wetlands (NWI) crossed (feet)	0	0	0
PEM NWI wetlands affected by construction (acres) b/	0	0	0
PEM NWI wetlands affected by operation (acres) a/	0	0	0
PSS NWI wetlands affected by construction (acres) b/	0	0	0
PSS NWI wetlands affected by operation (acres) a/	0	0	0
PFO NWI wetlands crossed (feet)	0	0	0
PFO NWI wetlands affected by construction (acres) b/	0	0	0

Table 10.5-10

Comparison of the Original Route and Mystic Valley Reroute (Preferred Route)

Feature	Original Route	Mystic Valley Reroute (Preferred Route)	Difference
PFO NWI wetlands affected by operation (acres) a/	0	0	0
Perennial waterbody crossings (number)	0	0	0
Crossings of major waterbodies (>100 feet) (number)	0	0	0
Presence of critical habitat or federally endangered or threatened species (Yes/No). Number of species.	No / 0	No / 0	0
Shallow bedrock crossed (miles)	0	0	0
Karst area crossed (miles)	0	0	0

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
Populated Areas = census designated places, consolidated cites, and incorporated places.
ROW = right-of-way. NWI = National Wetland Inventory. NRHP = National Register of Historic Places.
PEM = Palustrine Emergent Wetland; PSS = Palustrine Scrub-Shrub Wetland; PFO = Palustrine Forested Wetland.
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
VA Parcel Boundaries and Standard Fields - https://www.arcgis.com/home/item.html?id=f1dccaf1f42e40cbba791feae2e23690
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
USDA - https://data.fs.usda.gov/geodata/edw/datasets.php
NRHP - National Register of Historic Places - https://www.nps.gov/nr/research/data_downloads.htm
ESRI - GIS Mapping - http://www.esri.com/

10.6 ROUTE VARIATIONS

Route variations differ from route alternatives as they consist of alignment adjustments that enhance constructability, reduce impacts on localized features, sensitive resources, terrain, and/or provide appropriate space to allow for the safe operation and maintenance of the pipeline. They are typically shorter than route alternatives and may not always display a clear environmental advantage other than avoiding or reducing the impact to site-specific features or resources. After selection of the preferred route, the Project evaluated potential route variations using both desktop and field survey data to address construction constraints and to reduce impacts to landowners and sensitive environmental resources.

The FERC requested that the Project evaluate two route variations to minimize effects on the Robert Pollok-Hill View Farms at approximately MP 15.0 in Pittsylvania County, Virginia and residences between MP 40.2 and MP 41.0 in Rockingham County, North Carolina. These variations are described below.

10.6.1 Robert Pollock-Hill View Farms Variation

The Project evaluated the Robert Pollok-Hill View Farms Variation between MP 14.7 and MP 15.7 to reduce impact on the farm (see Figure 10.6-1). At MP 14.7, this variation extends west of the preferred route and continues in a southwest direction for approximately 1.0 mile. It parallels an existing utility easement, crosses mostly agricultural and open land, Whitmell School Road/County Road 750, and rejoins the preferred route at MP 15.7.

As shown in Table 10.6-1, the primary advantages of the Robert Pollok-Hill View Farms Variation are:

- collocates with existing rights-of-way for an additional 1.0 mile; and
- affects less agricultural land.

The primary disadvantages of the Robert Pollok-Hill View Farms Variation are:

- none identified based on initial review.

Potential constructability concerns of the Robert Pollok-Hill View Farms Variation are:

- none identified based on initial review.

While the Project did not fully incorporate the Robert Pollok-Hill View Farms Variation as a result of the alternative analysis, approximately 1,300 feet of access road and approximately 0.3 acre of additional temporary workspace were removed between MP 14.7 and MP 15.7.

Table 10.6-1

Comparison of the Preferred Route and Robert Pollok-Hill View Farms Variation

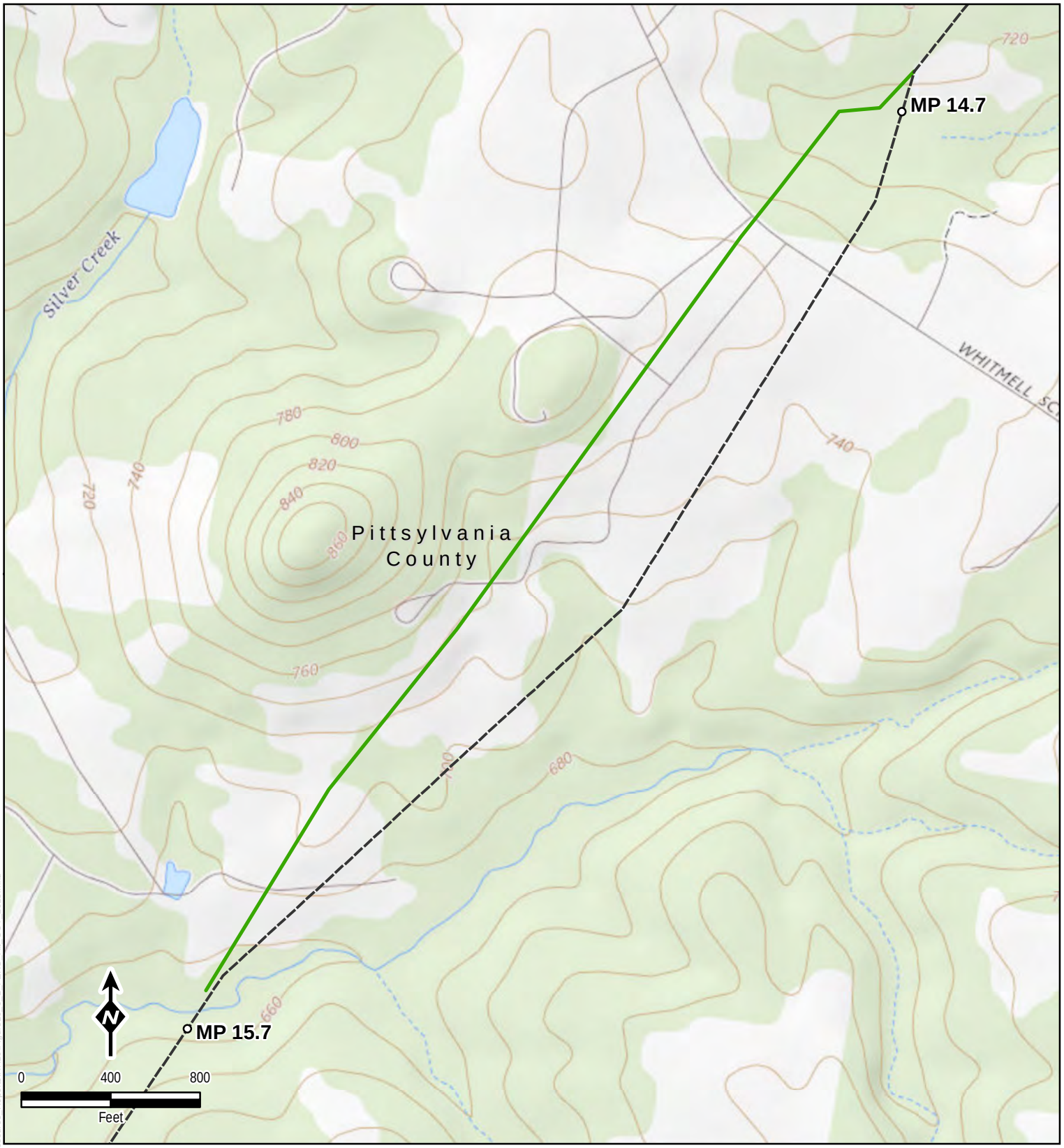
Feature	Preferred Route	Robert Pollok-Hill View Farms Variation	Difference
Total length (miles)	1.0	1.0	0
Construction right-of-way (acres) a/	12.3	12.3	0
Permanent right-of-way (acres) a/	6.1	6.1	0
Total number of parcels crossed	6	6	0
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	0/0	0/0	0/0
Number of waterbodies crossed	0	0	0
Number of NWI wetlands crossed	0	0	0
Total NWI wetland crossing length (feet)	0	0	0
NWI wetlands within construction ROW (acres) b/	0	0	0
Agricultural land within construction ROW (acres) c/	9.4	8.6	-0.8
Forested land within construction ROW (acres)	2.0	2.0	0
Length parallel or adjacent to existing ROW (miles)	0	1	+1

Table 10.6-1

Comparison of the Preferred Route and Robert Pollok-Hill View Farms Variation

Feature	Preferred Route	Robert Pollok-Hill View Farms Variation	Difference

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/



Legend

- Mileposts
- Preferred Pipeline Route
- Robert Pollock-Hill Farms Variation
- County Boundary

Data Sources: ESRI, USGS, EQT

1 inch = 600 feet
When Printed 8.5x11

Mountain Valley PIPELINE LLC

Figure 10.6-1
Sheet 1 of 1

Robert Pollock-Hill Farms Variation
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

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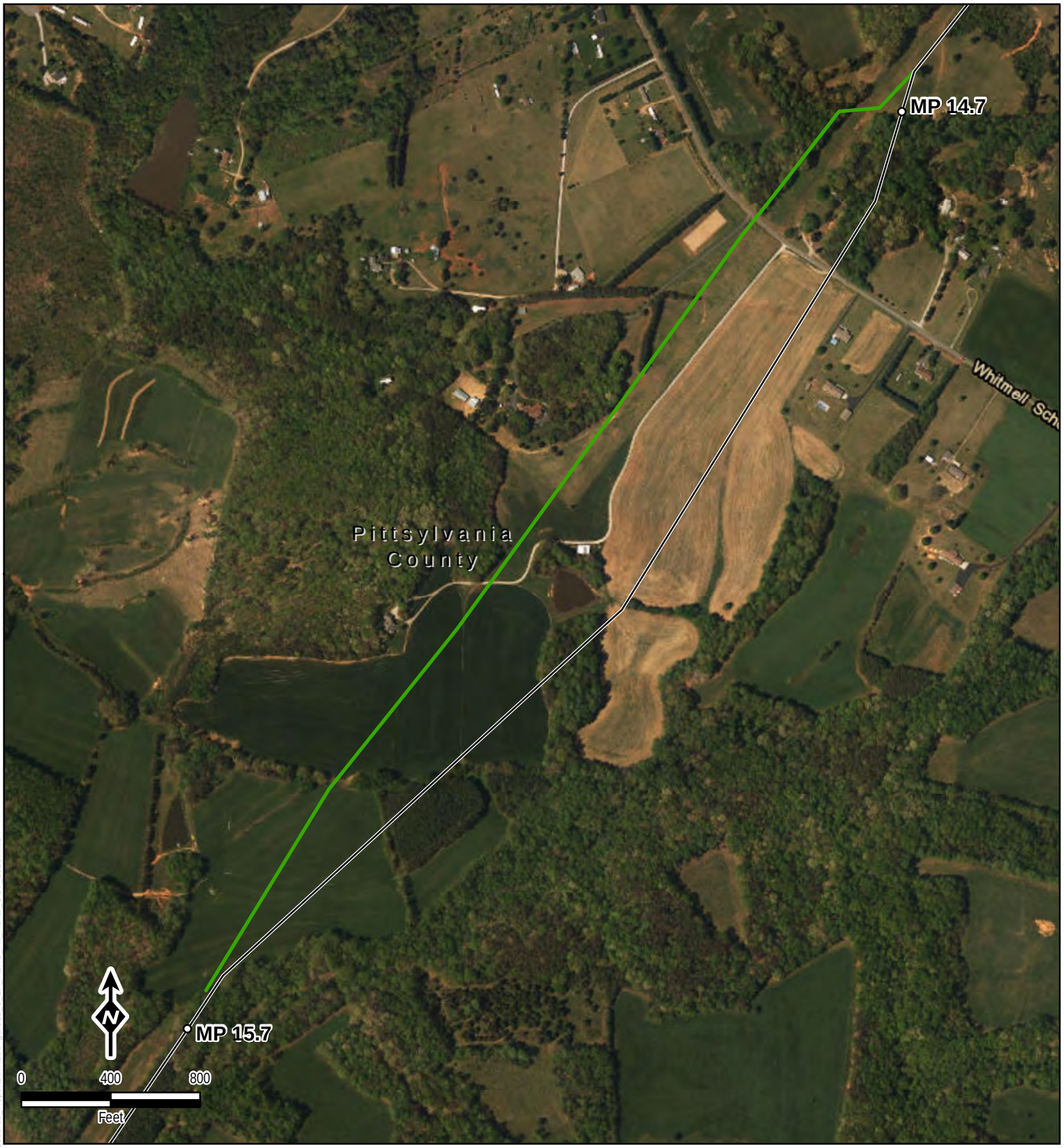

Legend

- Mileposts
- Preferred Pipeline Route
- Robert Pollock-Hill Farms Variation
- County Boundary

Data Sources: ESRI, USGS, EQT

1 inch = 600 feet
When Printed 8.5x11

Mountain Valley PIPELINE, LLC

Figure 10.6-1A

Sheet 1 of 1

Robert Pollock-Hill Farms Variation
(ESRI World Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018

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10.6.2 MP 40.0 to MP 41.4 Variation

The Project evaluated a route variation between MP 40.0 and MP 41.4 to reduce the number of residences potentially affected by the Project (see Figure 10.6-2). At MP 40.0, this variation extends south-southwest for approximately 0.5 mile and crosses forested and open land and Narrow Gauge Road. It then turns east-southeast for approximately 1.1 miles and crosses mostly forested land before it rejoins the preferred route at MP 41.4.

As shown in Table 10.6-2, the primary advantages of the MP 40.0 and MP 41. 4 Variation are:

- affects two fewer parcels;
- affects fewer residences within 25 and 50 feet of workspace; and
- affects less forested land.

The primary disadvantages of the MP 40.0 and MP 41. 4 Variation are:

- greater length and associated land disturbance; and
- affects more wetlands and agricultural land.

Potential constructability concerns of the MP 40.0 and MP 41. 4 Variation are:

- none identified based on initial review.

Because the primary disadvantages outweigh the primary advantages, the Project eliminated this variation from further consideration as its preferred pipeline route.

Table 10.6-2

Comparison of the Preferred Route and MP 40.0 to MP 41.4 Variation

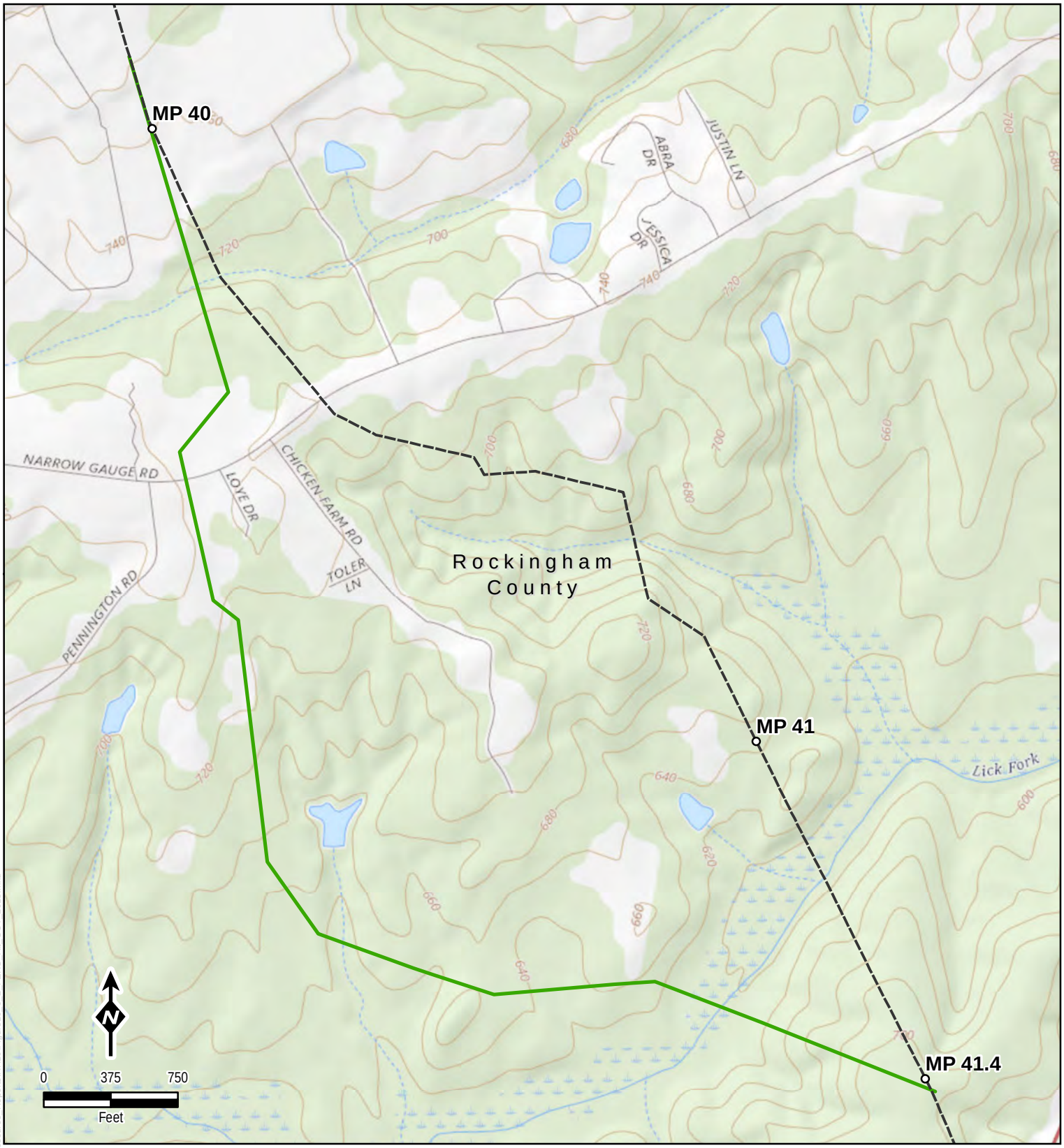
Feature	Preferred Route	MP 40.0 to MP 41.4 Variation	Difference
Total length (miles)	1.4	1.6	+0.2
Construction right-of-way (acres) a/	17.4	19.8	+2.4
Permanent right-of-way (acres) a/	8.7	9.9	+1.2
Total number of parcels crossed	10	8	-2
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	1/1	0/0	-1/-1
Number of waterbodies crossed	3	3	0
Number of NWI wetlands crossed	1	1	0
Total NWI wetland crossing length (feet)	243	303	+60
NWI wetlands within construction ROW (acres) b/	0.4	0.5	+0.1
Agricultural land within construction ROW (acres) c/	1.0	2.2	+1.2
Forested land within construction ROW (acres)	13.1	11.8	-1.3
Length parallel or adjacent to existing ROW (miles)	0.5	0.2	-0.3

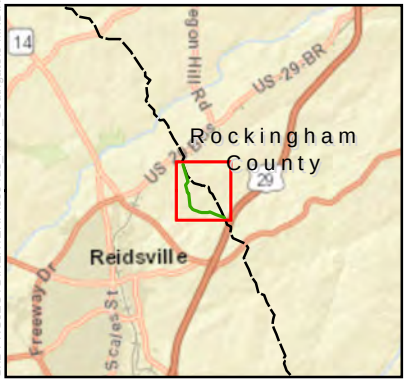
Table 10.6-2

Comparison of the Preferred Route and MP 40.0 to MP 41.4 Variation

Feature	Preferred Route	MP 40.0 to MP 41.4 Variation	Difference

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/





Legend

- Mileposts
- Preferred Pipeline Route
- MP 40.0 to MP 41.4 Variation
- County Boundary

Data Sources: ESRI, USGS, EQT

1 inch = 750 feet
When Printed 8.5x11

Mountain Valley PIPELINE, LLC

Figure 10.6-2
Sheet 1 of 1

MP 40.0 to MP 41.4 Variation
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

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10.6.3 MP 69.5 to MP 69.7 Variation (Preferred Route)

The Project evaluated a route variation between MP 69.5 and MP 69.7 (preferred route) to avoid a significant part of the Town of Haw River's vision for revitalizing the downtown / Main Street core area that the original route crossed. The MP 69.5 to MP 69.7 Variation from the Project's original route at MP 69.5 and extends generally southeast and south. It crosses open, forest, and developed land and East Main Street, a railroad track, and driveway and rejoins the original route at MP 69.7 (see Figure 10.6-3).

As shown in Table 10.6-3, the primary advantages of the MP 69.5 to MP 69.7 Variation are:

- avoids the Town of Haw River town revitalization area;
- affects one less residence within 25 feet of workspace; and
- affects a town fire hall and small business.

The primary disadvantages of the MP 69.5 to MP 69.7 Variation are:

- greater length and associated land disturbance; and
- limited construction work area due to exposed sewage and water line.

Potential constructability concerns of the MP 69.5 to MP 69.7 Variation are:

- foreign utility line crossing, limited work area at town fire hall and small business, and residence located east of North Main Street.

While the MP 69.5 to MP 69.7 Variation (preferred route) results in similar environmental impacts as the original route, it avoids the Town of Haw River's vision for revitalizing the downtown/Main Street core area and addresses town concerns along its original route. Therefore, it was incorporated into the Project's preferred pipeline route.

Table 10.6-3

Comparison of the Original Route and MP 69.5 to MP 69.7 Variation (Preferred Route)

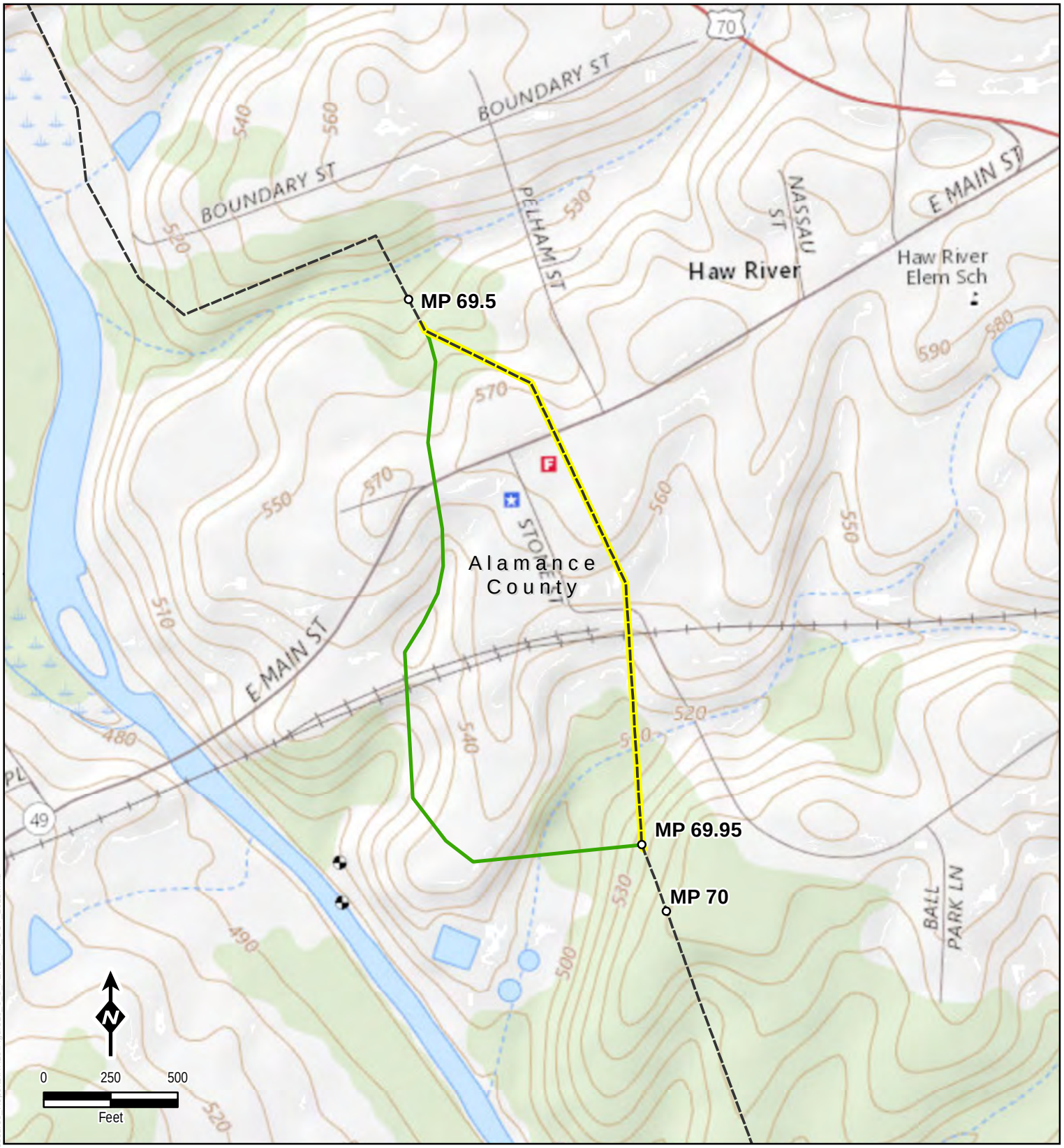
Feature	Original Route	MP 69.5 to MP 69.69 Variation (Preferred Route)	Difference
Total length (miles)	0.5	0.4	+0.1
Construction right-of-way (acres) a/	6.5	5.4	+1.1
Permanent right-of-way (acres) a/	3.2	2.6	+0.6
Total number of parcels crossed	12	14	-2
Number of residences within 25 and 50 feet of the edge of the construction ROW (and associated additional temporary workspace)	2/3	3/3	-1/0
Number of waterbodies crossed	1	1	0
Number of NWI wetlands crossed	0	0	0
Total NWI wetland crossing length (feet)	0	0	0
NWI wetlands within construction ROW (acres) b/	0	0	0
Agricultural land within construction ROW (acres) c/	0	0	0
Forested land within construction ROW (acres)	1.8	1.8	0

Table 10.6-3

Comparison of the Original Route and MP 69.5 to MP 69.7 Variation (Preferred Route)

Feature	Original Route	MP 69.5 to MP 69.69 Variation (Preferred Route)	Difference
Length parallel or adjacent to existing ROW (miles)	0	0	0

a/ Assuming 100-foot-wide construction ROW and 50-foot-wide permanent ROW.
b/ Assuming 75-foot-wide construction ROW.
c/ Includes pasture/hay and cultivated crops.
ROW = right-of-way. NWI = National Wetland Inventory
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NC Parcel Boundaries and Standard Fields - http://data.nconemap.gov/geoportal/catalog/search/resource/details.page
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/



Legend

- Mileposts
- Preferred Pipeline Route
- MP 69.5 to MP 69.95 Variation
- Original Route
- County Boundary

Data Sources: ESRI, USGS, EQT

1 inch = 500 feet
When Printed 8.5x11

Mountain Valley PIPELINE LLC

Figure 10.6-3
Sheet 1 of 1

MP 69.5 to MP 69.95 Variation
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

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10.6.4 Route Variations Incorporated into the Project Pipeline

The Southgate Project has currently identified route variations during preliminary routing, stakeholder outreach efforts, and landowner and/or and agency requested route deviations. The Project has incorporated 191 of these route variations into the current preferred route to address landowner concerns, environmental resources, potential culturally sensitive areas, and constructability issues. These are shown in Table 10.6-4 in Appendix 10-B.

The Project continues to evaluate these variations and will continue to refine the route as necessary through the remainder of the field survey process. In addition, the Project will continue to coordinate with stakeholders with respect to developing route variations for site-specific concerns and will provide the FERC with a summary of alignment revisions in supplemental filings, as applicable.

10.7 ABOVEGROUND FACILITY ALTERNATIVES

10.7.1 Compressor Station Alternatives

The Project conducted a hydraulic analysis to determine the optimum horsepower and compression to provide the increased volumes of natural gas necessary to meet the purpose and need of the Project. As a result, the Project determined that two new compressor stations were necessary to meet the compression requirements for the increased delivery volume and delivery locations. The compressor station site selection-process used multiple factors including: engineering design and construction, pipeline design limitations, land/workspace requirements, site elevation, road access, interconnecting pipe, land availability, and environmental effects.

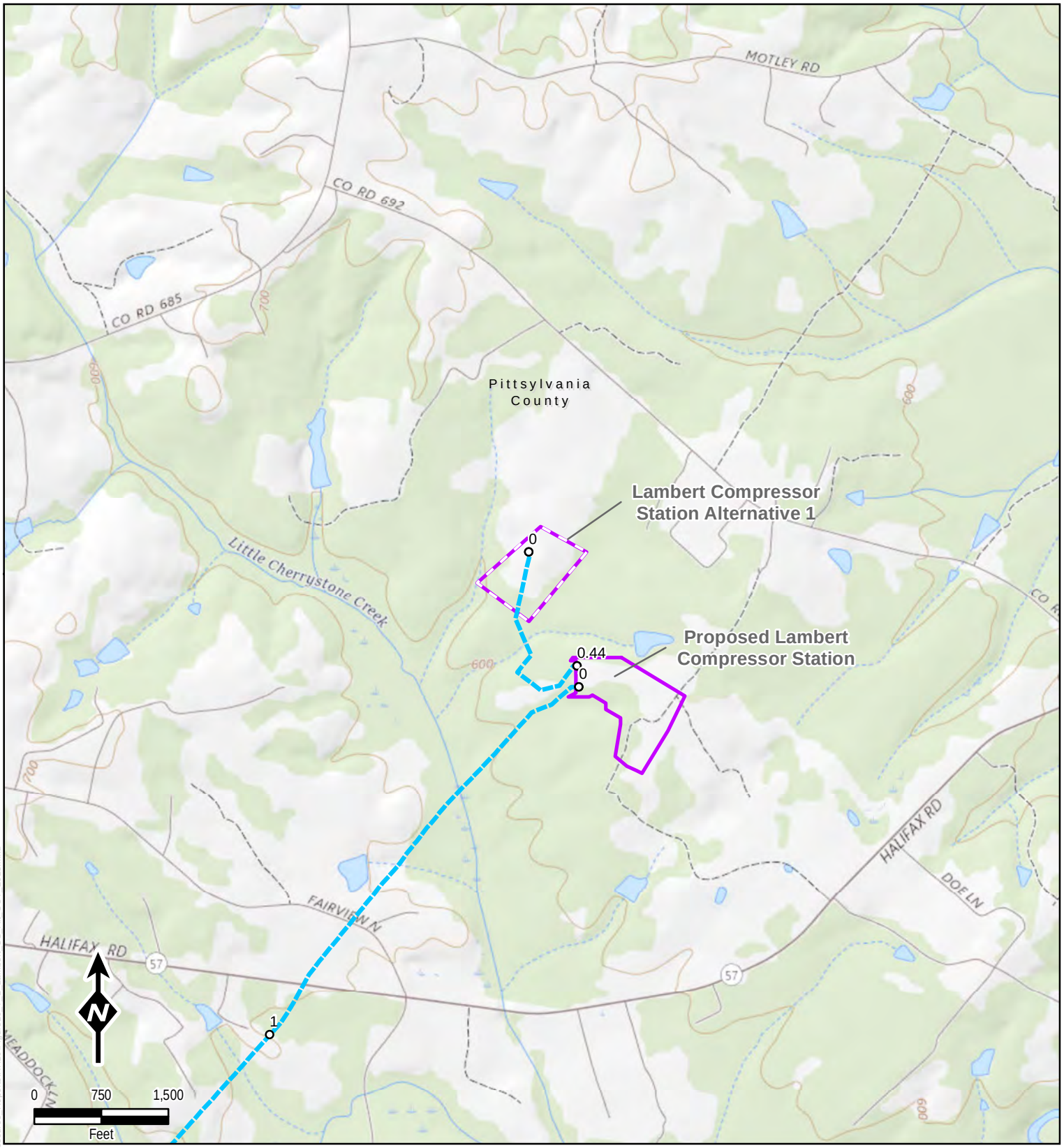
The Project evaluated alternative site for its proposed Lambert Compressor Station site, as described below.

10.7.1.1 Lambert Compressor Station Alternative

The Project considered one alternative site for the location of the Lambert Compressor Station in Pittsylvania County, Virginia. The proposed Lambert Compressor Station site is located at MP 0.0 of the pipeline route (see Figure 10.7-1). Land use at the proposed compressor station site consists of forested and agricultural land. Table 10.7-1 provides an analysis of the proposed Lambert Compressor Station site and the alternative site.

Lambert Compressor Station Alternative 1

The Lambert Compressor Station Alternative 1 site is located near MP 0.0 of the pipeline approximately 0.4 mile northwest of the proposed compressor station site (see Figure 10.7-1). The alternative site consists of forested land, is surrounded by forested land, and would require a new permanent access road from Transco Road/County Road 692 located approximately 0.4 mile to the northeast. An existing electric powerline is located approximately 0.6 mile to the northwest of the alternative site. Two residences are located approximately 0.3 and 0.4 mile northeast and northwest of the alternative site, respectively, and a third residence is located approximately 0.5 mile to the southwest. Transco's compressor facilities (Stations 165 and 166) are located approximately 0.2 mile to the east of the Lambert Compressor Station Alternative 1 site.



Legend

- Mileposts
- Proposed Pipeline Route
- Lambert Compressor Station Alternative
- Proposed Lambert Compressor Station
- State Boundary
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 1,500 feet
When Printed 8.5x11

Mountain Valley PIPELINE LLC

Figure 10.7-1

Lambert Compressor Station Alternative
(USGS Topographic)

TRC
Results you can rely on

600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure10_7_1_Lambert_CS_Alt_OCT_2018.mxd

As shown in Table 10.7-1, the primary advantages of the Lambert Compressor Station Alternative 1 are:

- smaller site size and associated land disturbance;
- shorter pipeline length to reach the site; and
- shorter access road length to reach the site.

The primary disadvantages of the Lambert Compressor Station Alternative 1 are:

- unknown availability of land;
- more noise sensitive areas within 1.0 mile of the site.

Potential constructability concerns of the Lambert Compressor Station Alternative 1 are:

- future natural gas infrastructure associated with the Mountain Valley Pipeline to be placed within the site.

In addition, approximately 90 percent of the Lambert Compressor Station Alternative 1 site is vegetated with trees and shrubs while the proposed site consists of open land and is approximately 30 percent vegetated with trees and shrubs. The vegetation at both sites would provide a visual buffer. The nearest residence/noise sensitive areas are located approximately 1,300 and 3,300 feet from the alternative and proposed site, respectively. Activities at the alternative site could affect waterbodies and would require the removal of approximately 25,000 cubic yards of material (soil and rock) from the site. The proposed site will not affect waterbodies and would require the removal of approximately 16,500 cubic yards of material from the site. Because the Lambert Compressor Station Alternative 1 would be within 1.0 mile of more noise sensitive areas, be located in an area of future natural gas infrastructure, and does not offer an environmental or constructability advantage, the Project eliminated this alternative site from further consideration as its preferred compressor station site.

Table 10.7-1

Comparison of the Proposed Lambert Compressor Station Site and Alternative 1

Feature	Proposed Lambert Compressor Station	Alternative 1
Land availability (Yes/No)	Yes	Unknown
Total land to be acquired (estimated acres)	127.5	Unknown
Construction workspace (acres)	14.7	14.5
Operation workspace (acres)	3.8	3.8
Length of pipeline required to reach the site (miles)	0.4	<0.1
Length of access road required to reach the site (miles)	0.6	0.4
Existing land use (type)	Forested/Agriculture	Forested
Construction/operation impact on prime farmland soils (acres)	12.8 / 3.7	14.5 / Unknown
Construction/operation impact on NWI wetlands (acres)	0 / 0	0 / 0
Presence of critical habitat or federally endangered or threatened species (Yes/No)	No	No
Presence of NRHP-eligible sites (Yes/No)	No	No

Table 10.7-1

Comparison of the Proposed Lambert Compressor Station Site and Alternative 1

Feature	Proposed Lambert Compressor Station	Alternative 1
Number of NSAs within 1 mile of the site	45	55
Zoning	Unknown	Unknown

NWI = National Wetland Inventory; NRHP = National Register of Historic Places; NSAs = Noise Sensitive Areas;
Information Sources:
GIS – Analysis based on Geodatabase layers and shapefiles.
NLCD – 2006 National Land Cover Data - http://www.epa.gov/mrlc/nlcd-2006.html
NWI – National Wetlands Inventory - http://www.fws.gov/wetlands/
USGS – U.S. Geological Survey - http://www.usgs.gov/
NHD – National Hydrography Dataset - http://nhd.usgs.gov/
ESRI - GIS Mapping - http://www.esri.com/

10.7.2 Electric Driven Compressor Units

The proposed Project compressor stations will include centrifugal turbines powered by natural gas with the natural gas obtained directly from the pipeline. While electric motor-driven compressors can power compressor stations in some instances, this is not feasible for the Project due to the lack of sufficient electricity required for each compressor station site.

To use electric driven compressor units, electric power at high voltage would need to be supplied by overhead transmission lines to a substation that would be located at each compressor station site. The compressor stations are not located near existing high voltage electric transmission lines. The substation would step down the voltage for electric driven compressor motors and other miscellaneous loads. Additionally, electric driven motors located at each compressor station could require a liquid cooled variable frequency drive, primarily to start the motor and then for speed control of the compressor. For these reasons, the use of electric driven compressor units is not a reasonable alternative for the proposed Project compressor stations.

10.7.3 Meter Station Alternatives

The proposed Lambert Interconnect, LN 3600 Interconnect, T-15 Dan River Interconnect, and T-21 Haw River Interconnect locations reflect customer and system requirements. There are no alternatives that would satisfy all of these requirements; therefore, no alternatives were considered.

10.8 REFERENCES

U.S. Energy Information Agency (EIA). 2017a. State Profile and Energy Estimates – Virginia. Available online at: https://www.eia.gov/state/analysis.php?sid=VA Accessed June 3, 2018.

U.S. Energy Information Agency (EIA). 2017b. State Profile and Energy Estimates – North Carolina. Available online at: https://www.eia.gov/state/analysis.php?sid=NC Accessed June 3, 2018.

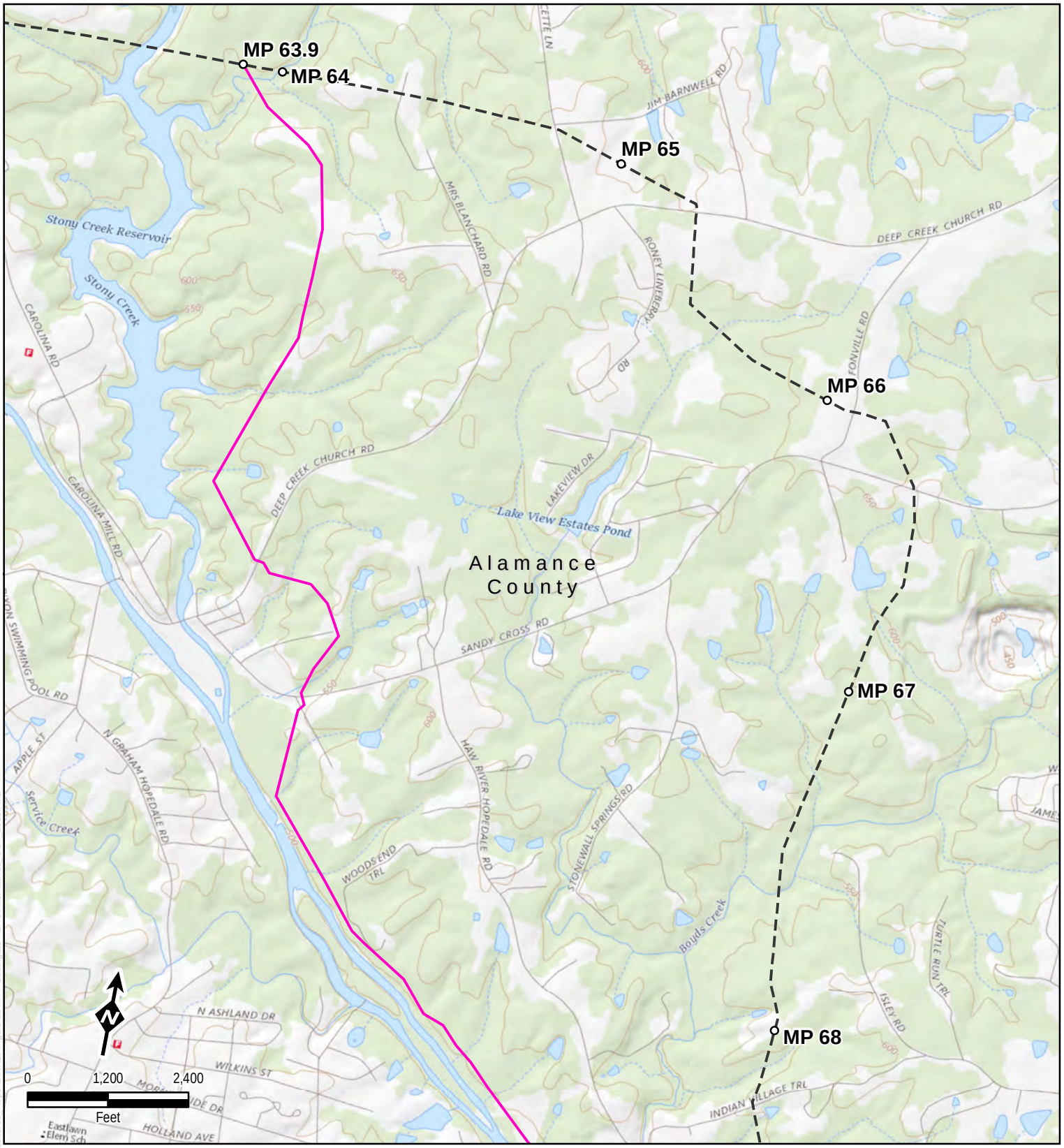
MVP Southgate Project

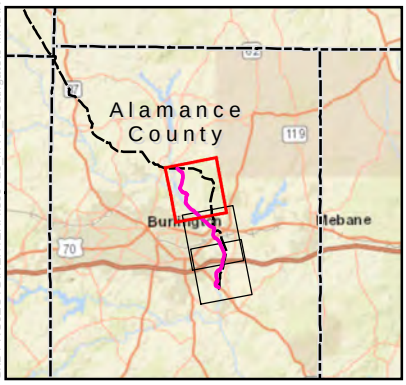
Docket No. CP19-XX-000

Resource Report 10

Appendix 10-A

FERC Requested Route Alternative Figures





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 1
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

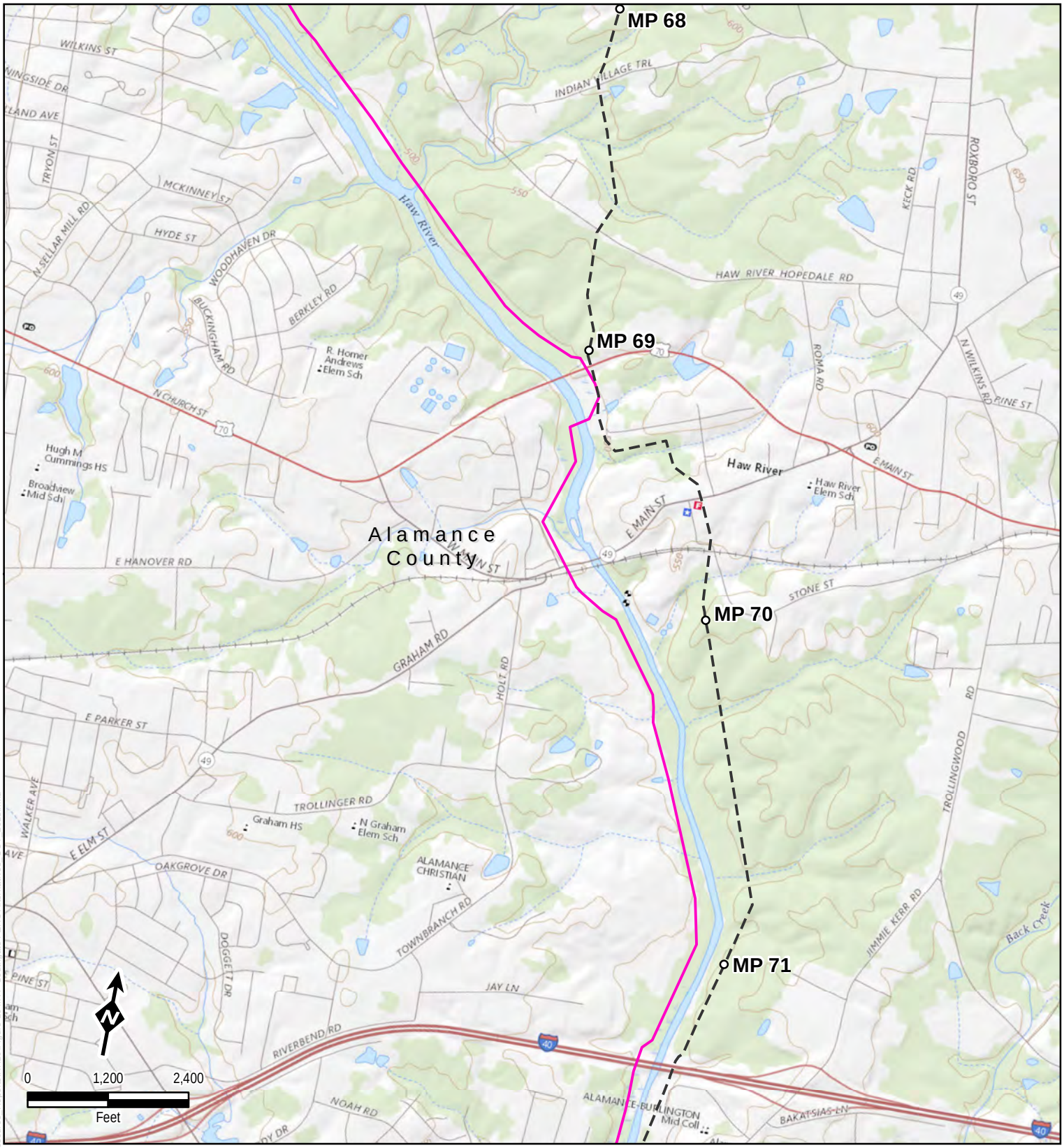
Mountain Valley PIPELINE, LLC

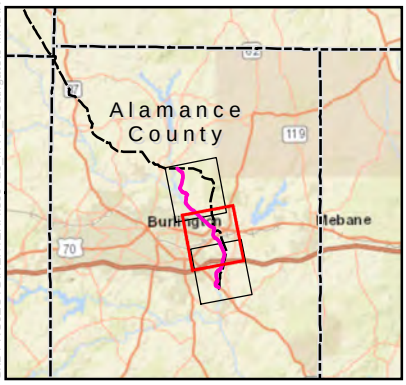
Figure 10.5-2
Sheet 1 of 3

FERC Alternative 1
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 1
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

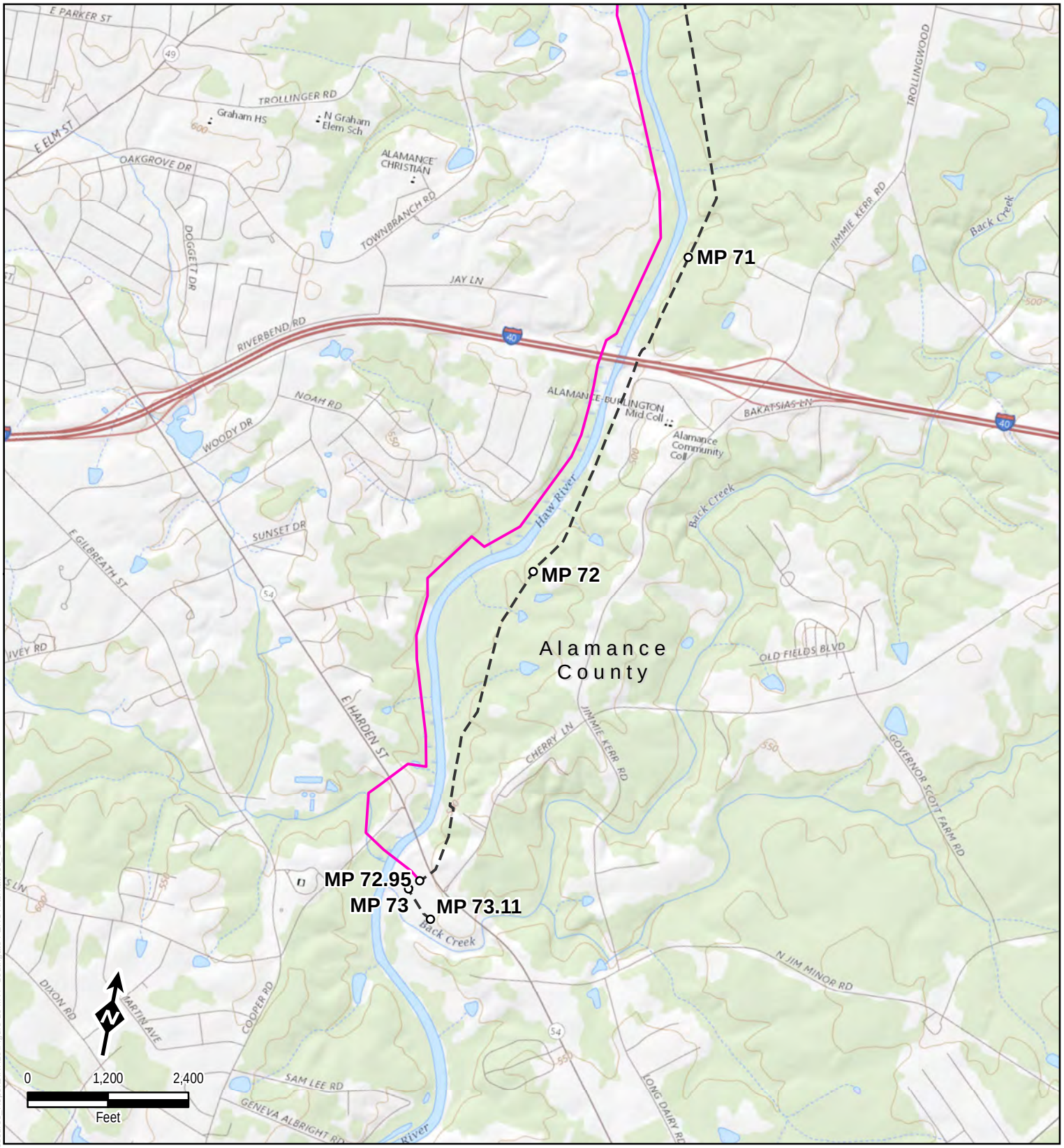
Mountain Valley PIPELINE, LLC

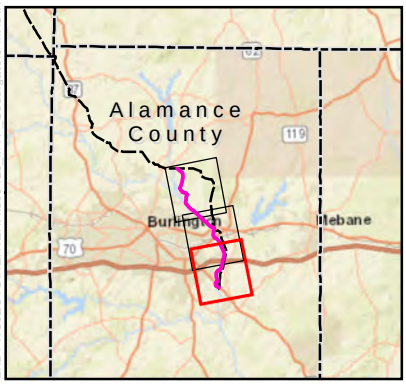
Figure 10.5-2
Sheet 2 of 3

FERC Alternative 1
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 1
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE, LLC

Figure 10.5-2
Sheet 3 of 3

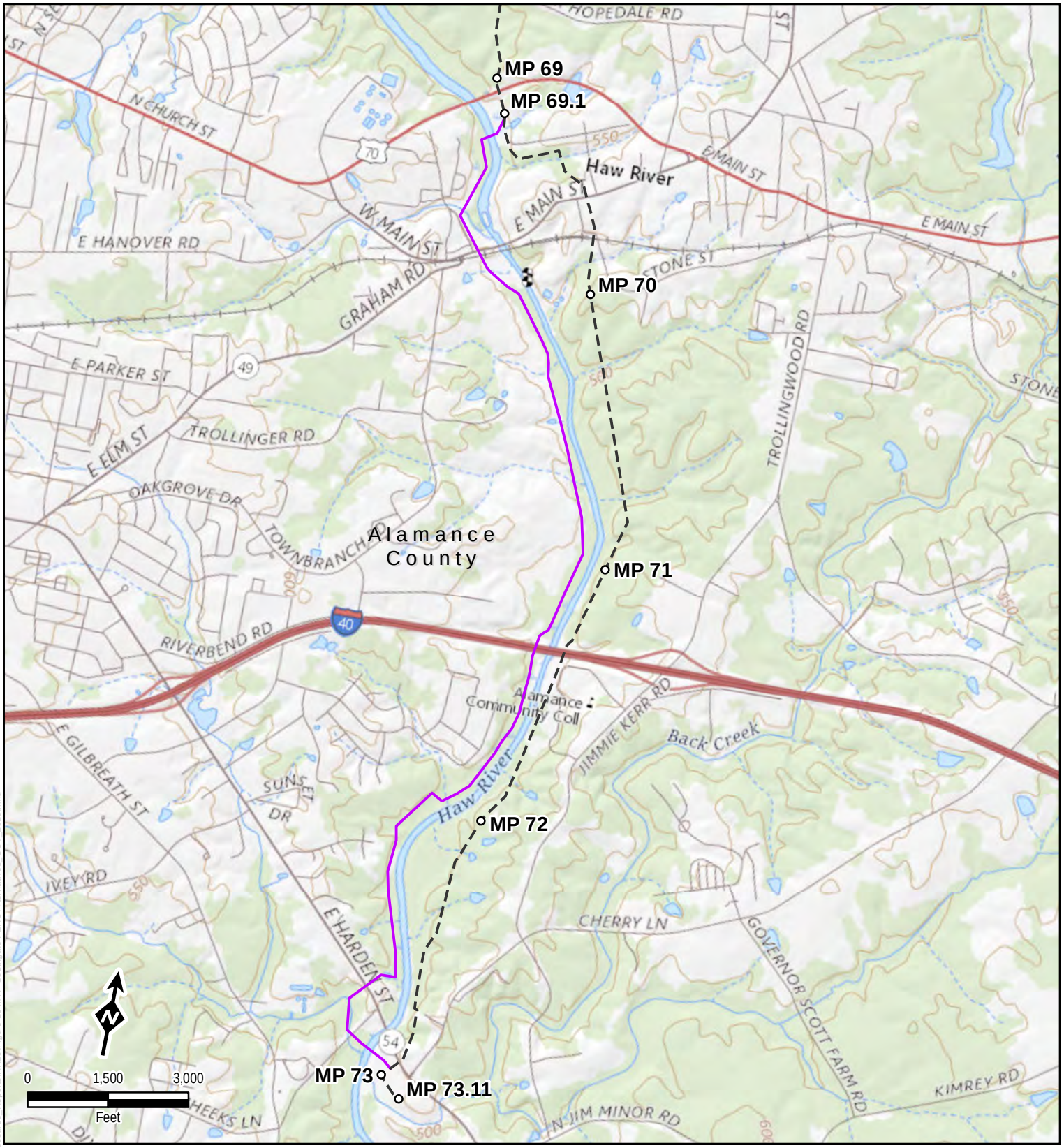
FERC Alternative 1
(USGS Topographic)

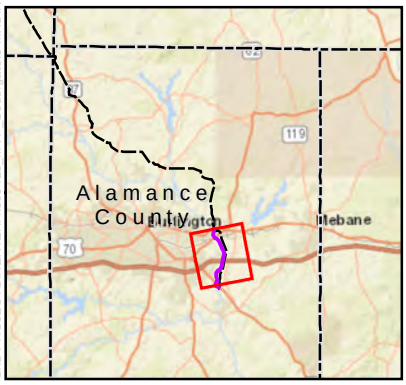
TRC
Results you can rely on

600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 2
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,500 feet
When Printed 8.5x11

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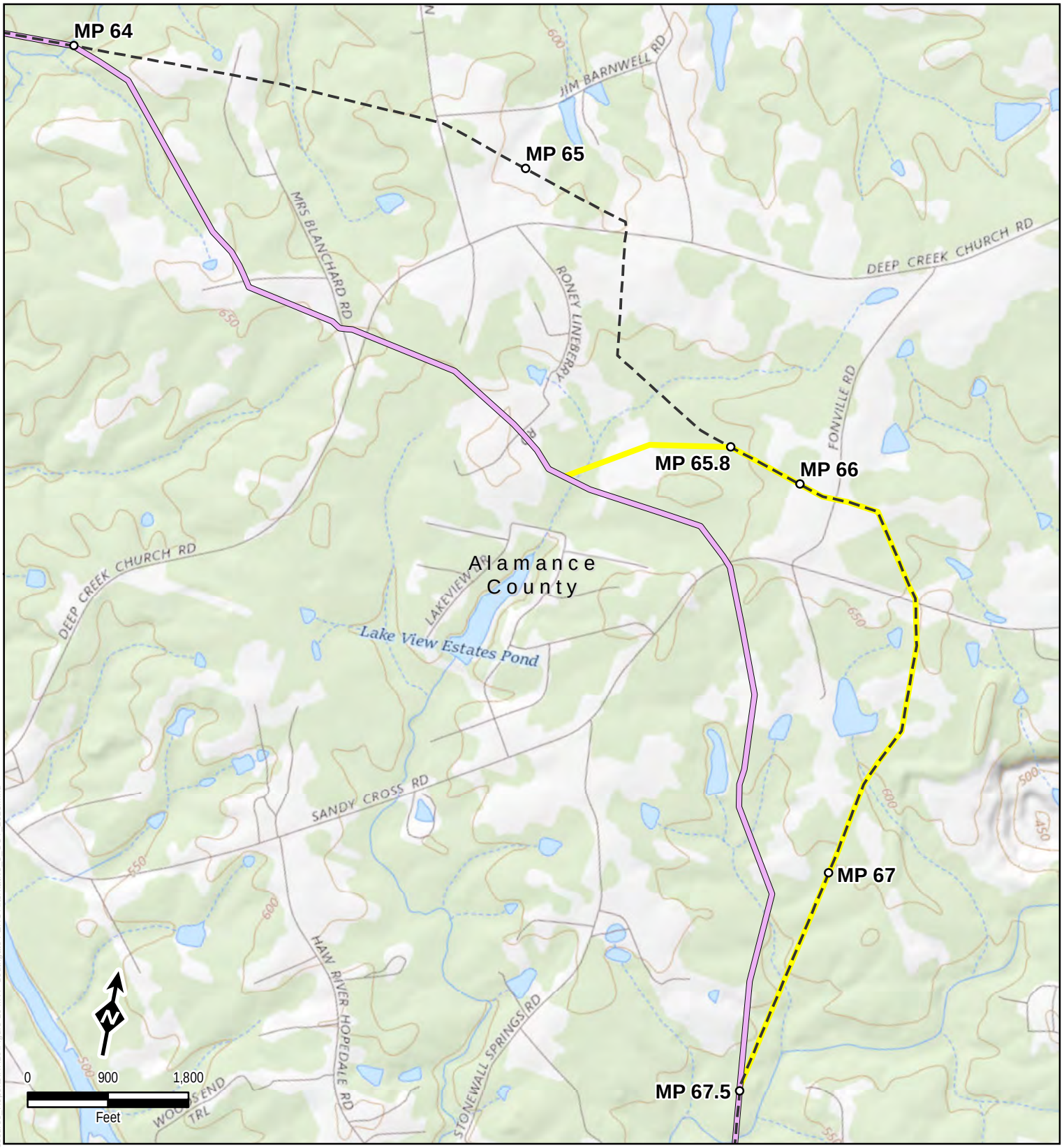
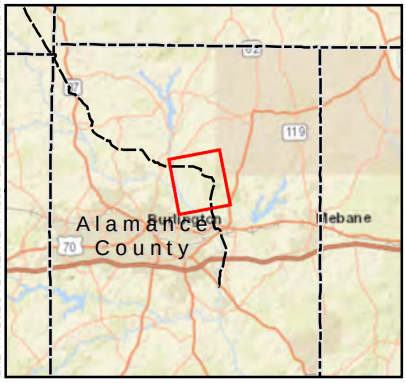
Figure 10.5-3
Sheet 1 of 1

FERC Alternative 2
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018





Legend

- Mileposts
- Mystic Valley Reroute (Preferred Pipeline Route)
- FERC Alternative 3
- Original Route
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 1,500 feet
When Printed 8.5x11

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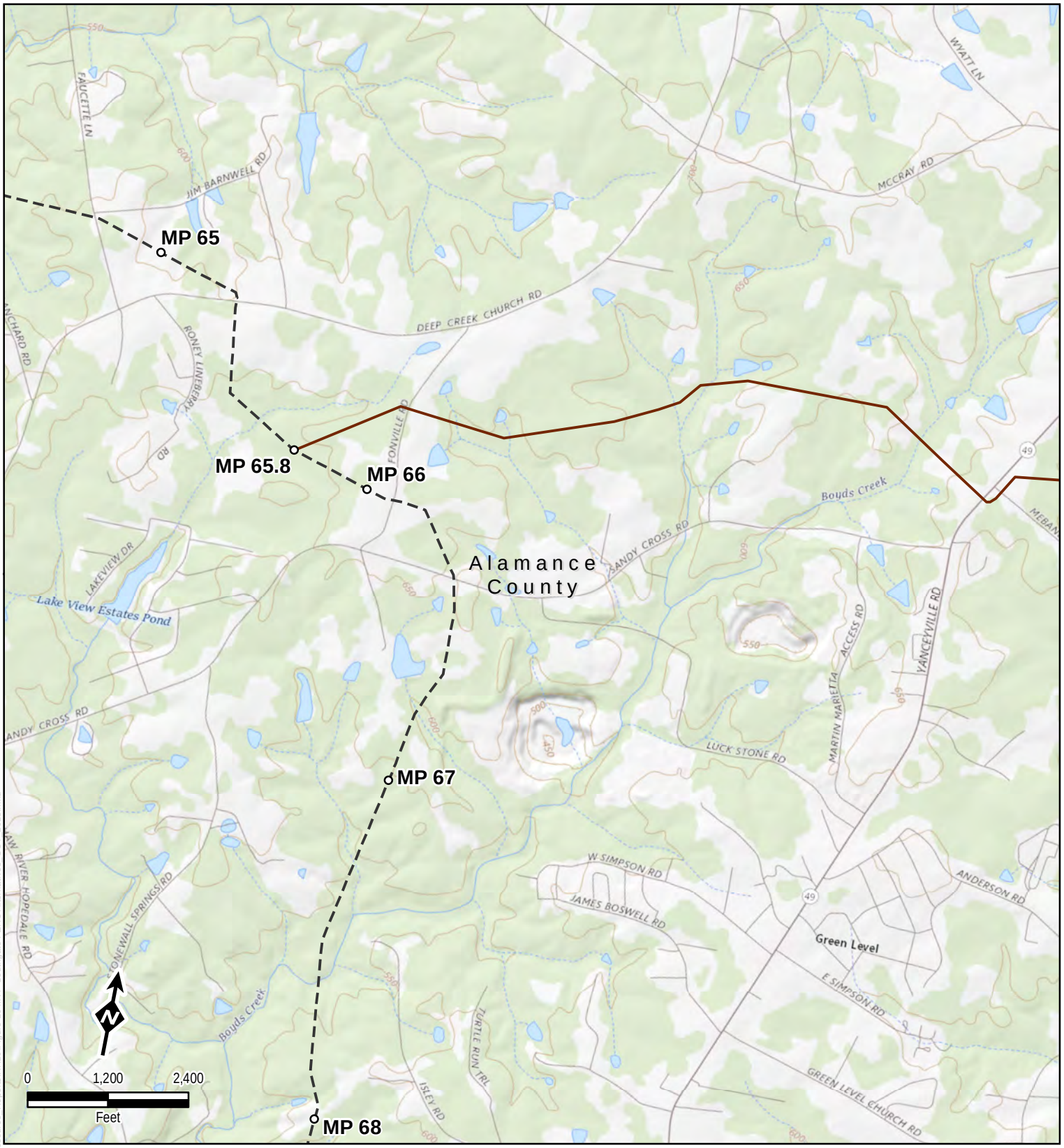
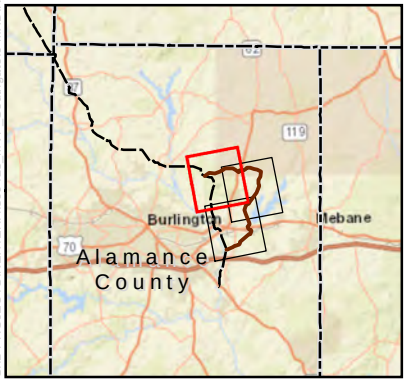
Figure 10.5-4
Sheet 1 of 1

FERC Alternative 3
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternative_3_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 4
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

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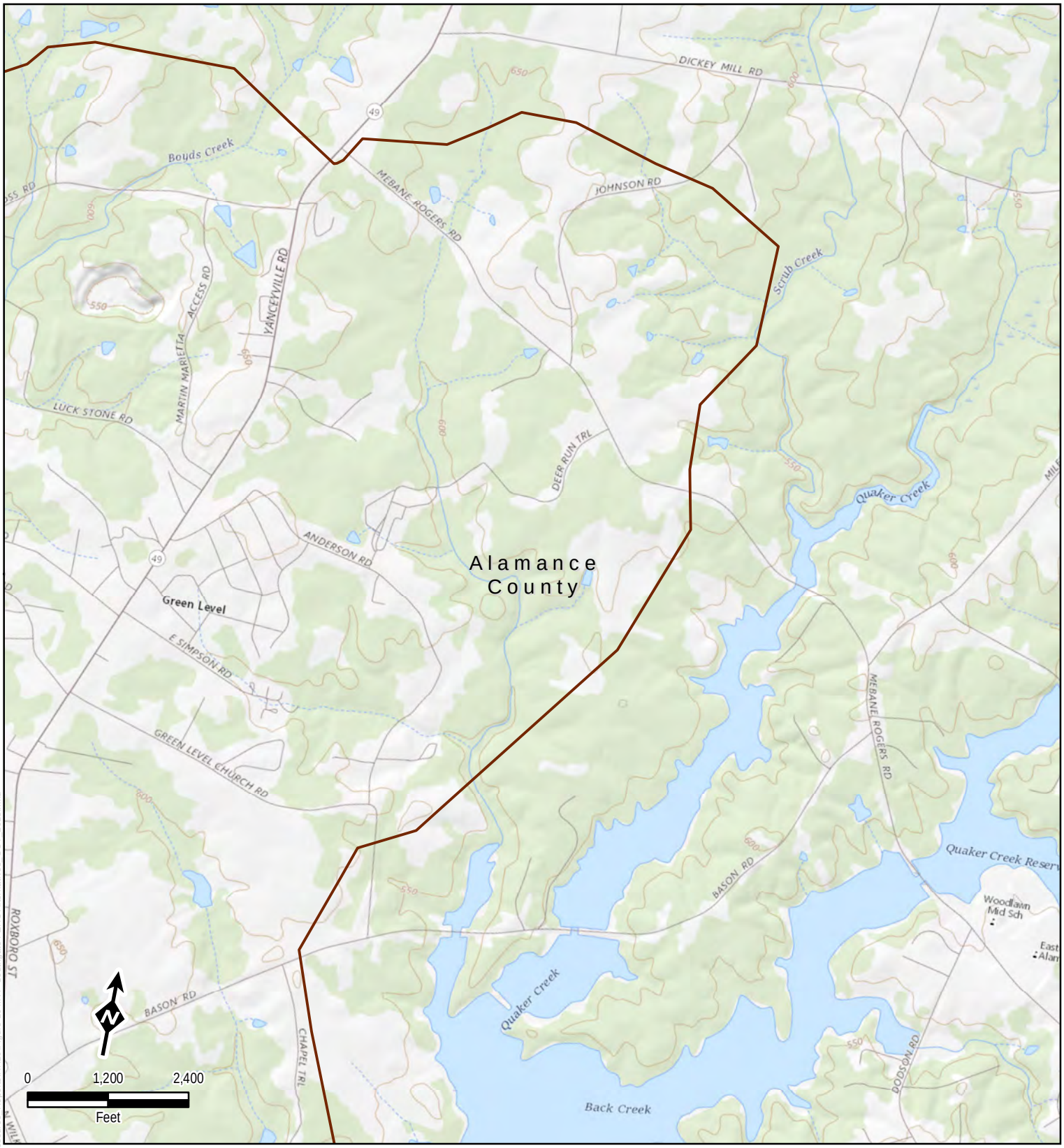
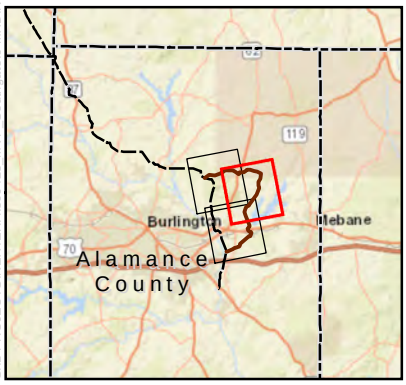
Figure 10.5-5
Sheet 1 of 3

FERC Alternative 4
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018





Legend

- FERC Alternative 4
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

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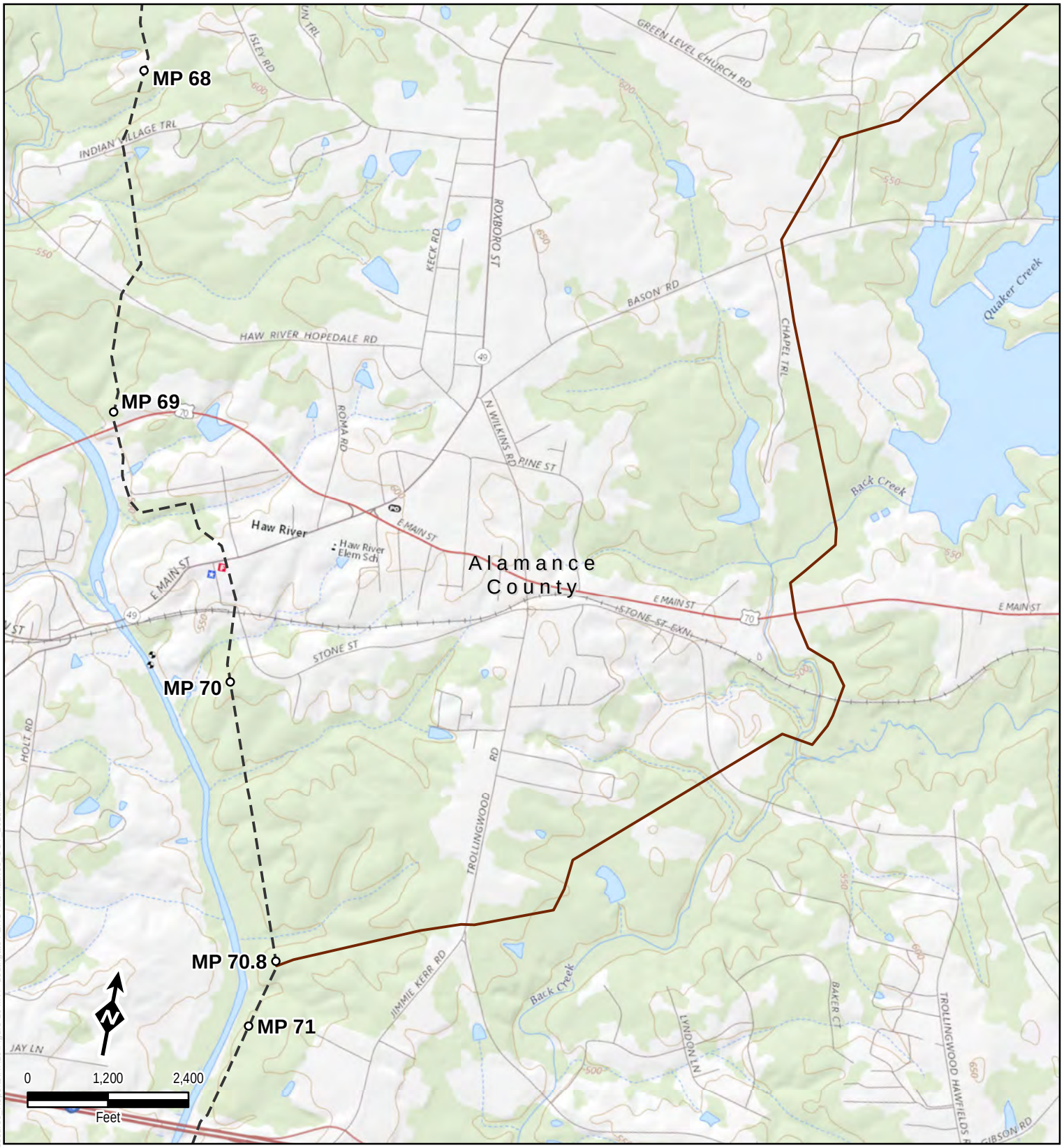
Figure 10.5-5
Sheet 2 of 3

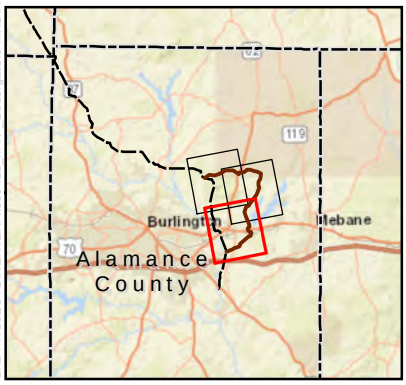
FERC Alternative 4
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 4
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

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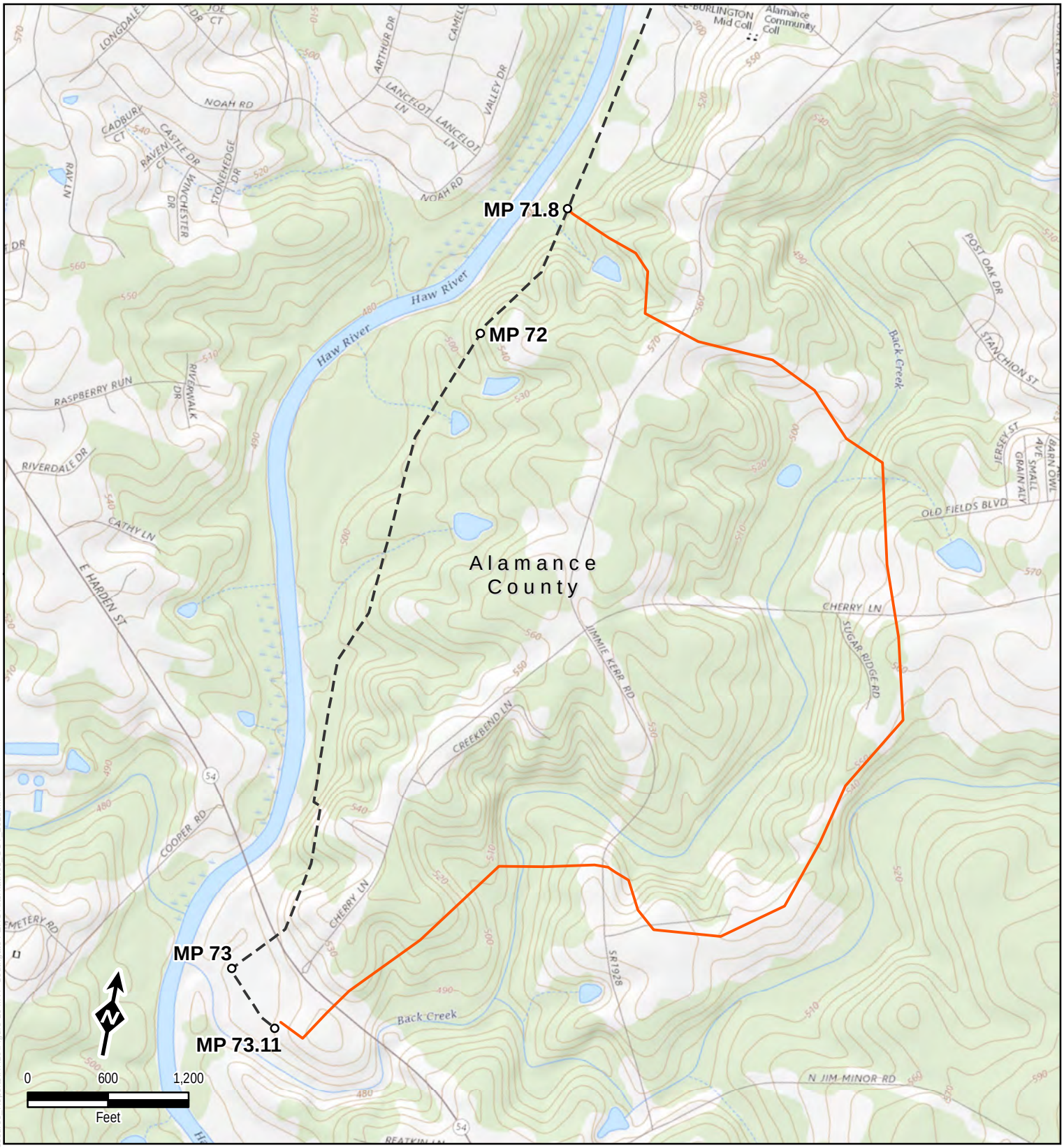
Figure 10.5-5
Sheet 3 of 3

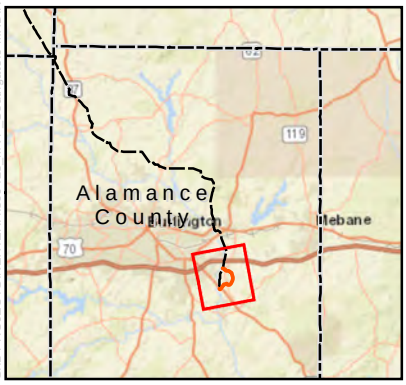
FERC Alternative 4
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 5
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 1,000 feet
When Printed 8.5x11

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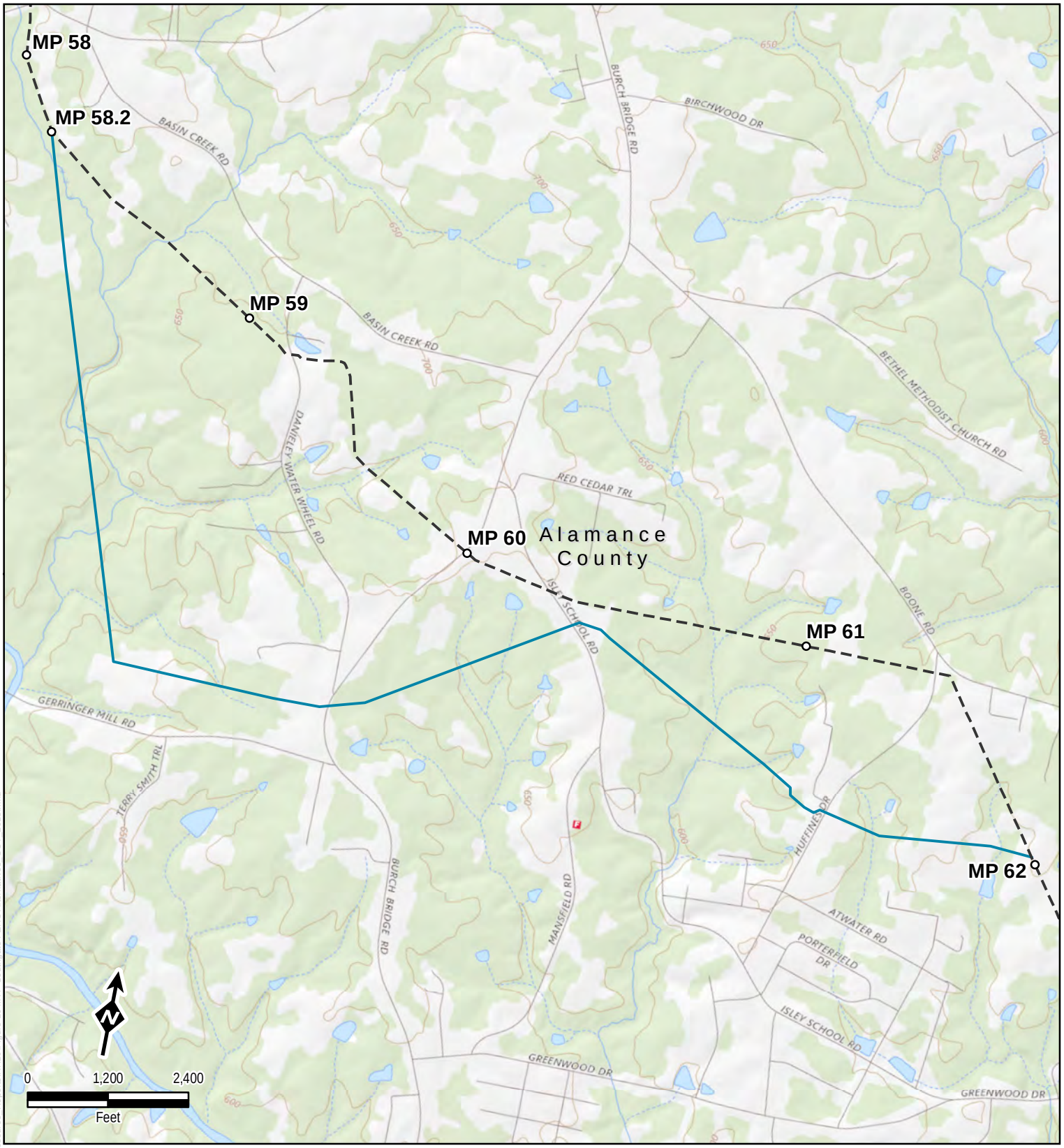
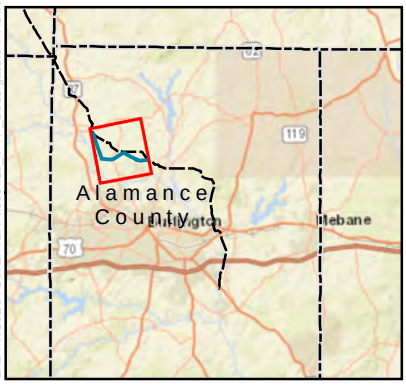
Figure 10.5-6
Sheet 1 of 1

FERC Alternative 5
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 6
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

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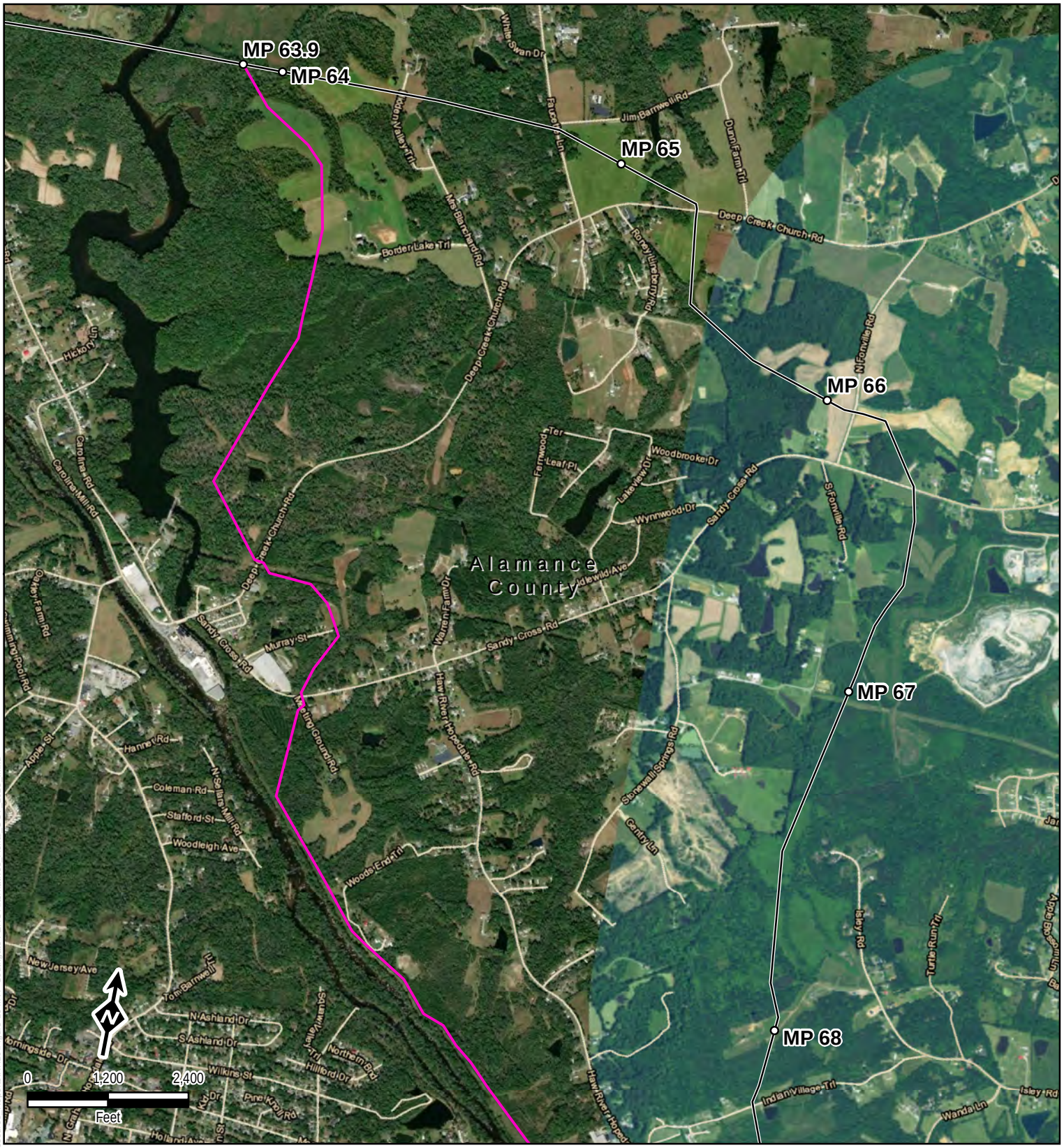
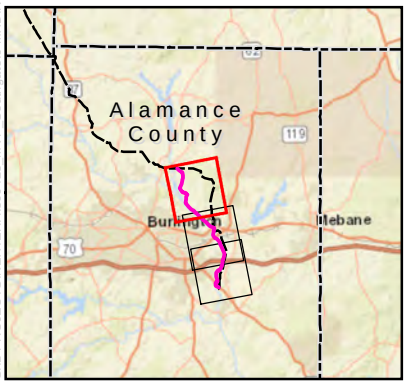
Figure 10.5-7
Sheet 1 of 1

FERC Alternative 6
(USGS Topographic)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_OCT_2018.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 1
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

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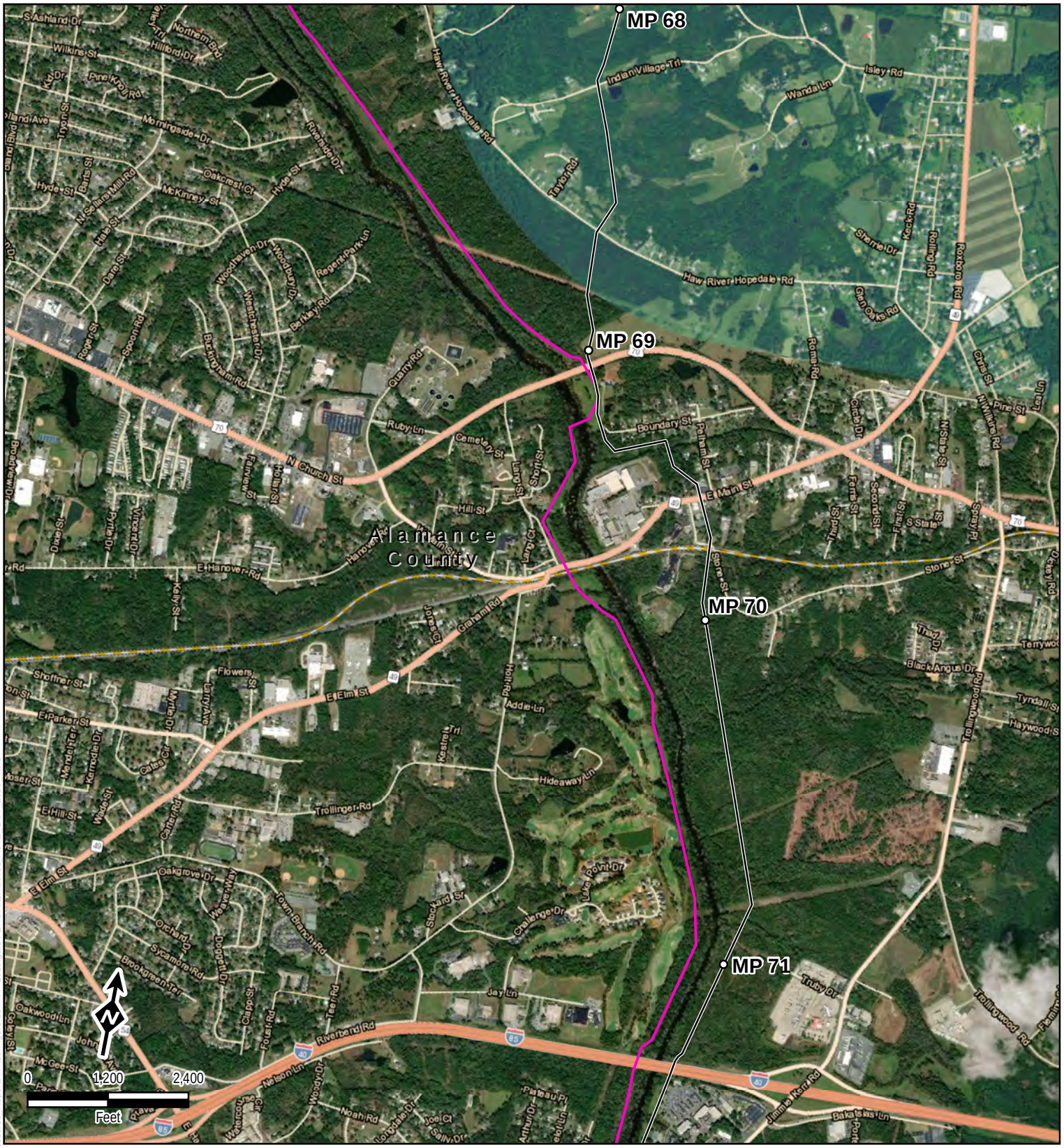
Figure 10.5-2A
Sheet 1 of 3

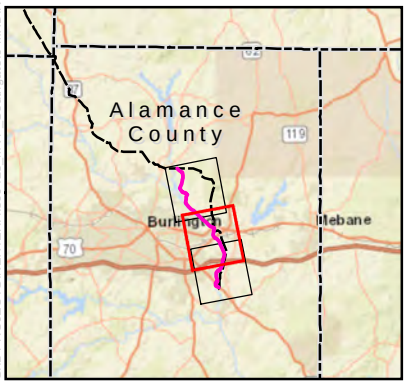
FERC Alternative 1
(ESRI WOrld Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_Aerial_OCT_2018_.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 1
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE, LLC

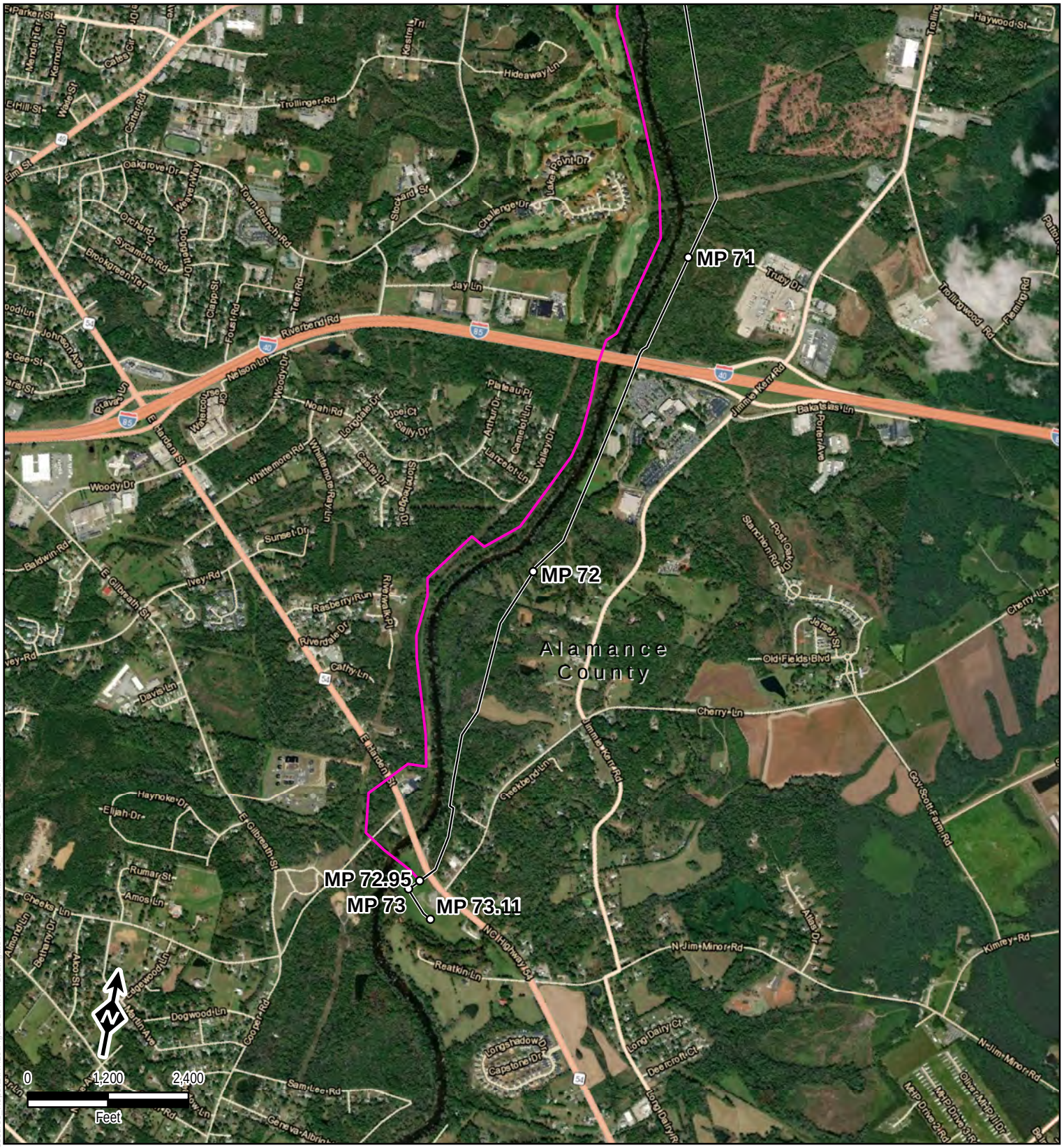
Figure 10.5-2A
Sheet 2 of 3

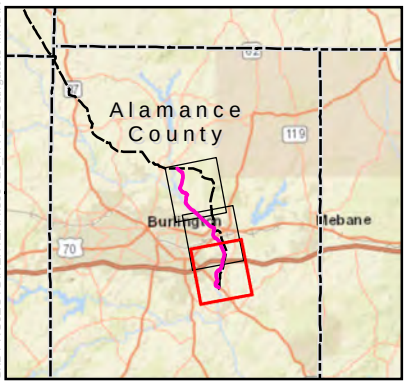
FERC Alternative 1
(ESRI WOrld Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_Aerial_OCT_2018_.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 1
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE, LLC

Figure 10.5-2A
Sheet 3 of 3

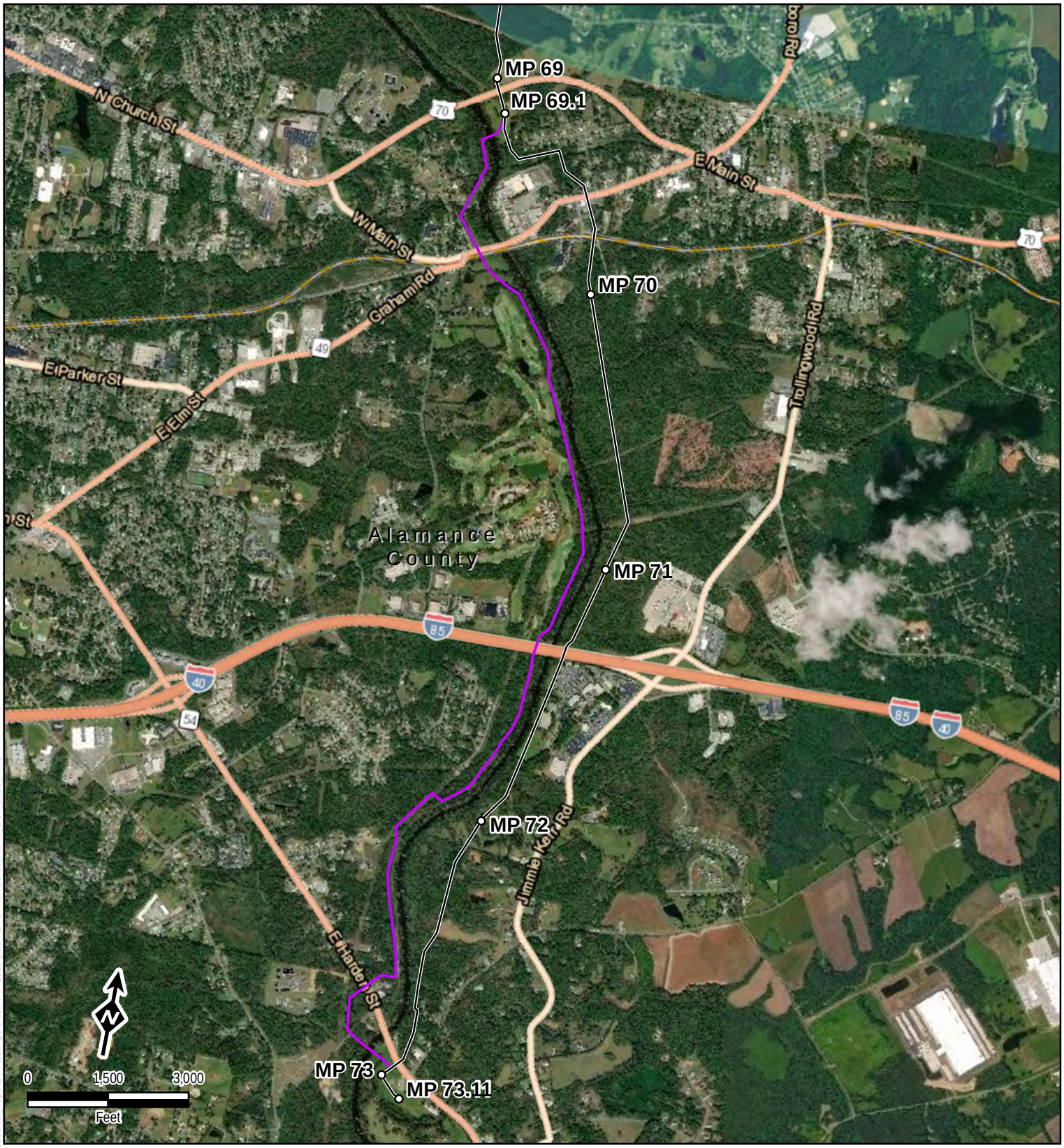
FERC Alternative 1
(ESRI WOrld Imagery)

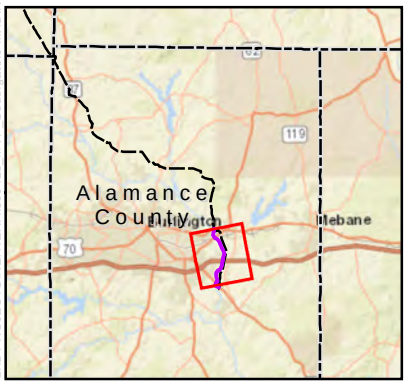
TRC
Results you can rely on

600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_Aerial_OCT_2018_.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 2
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

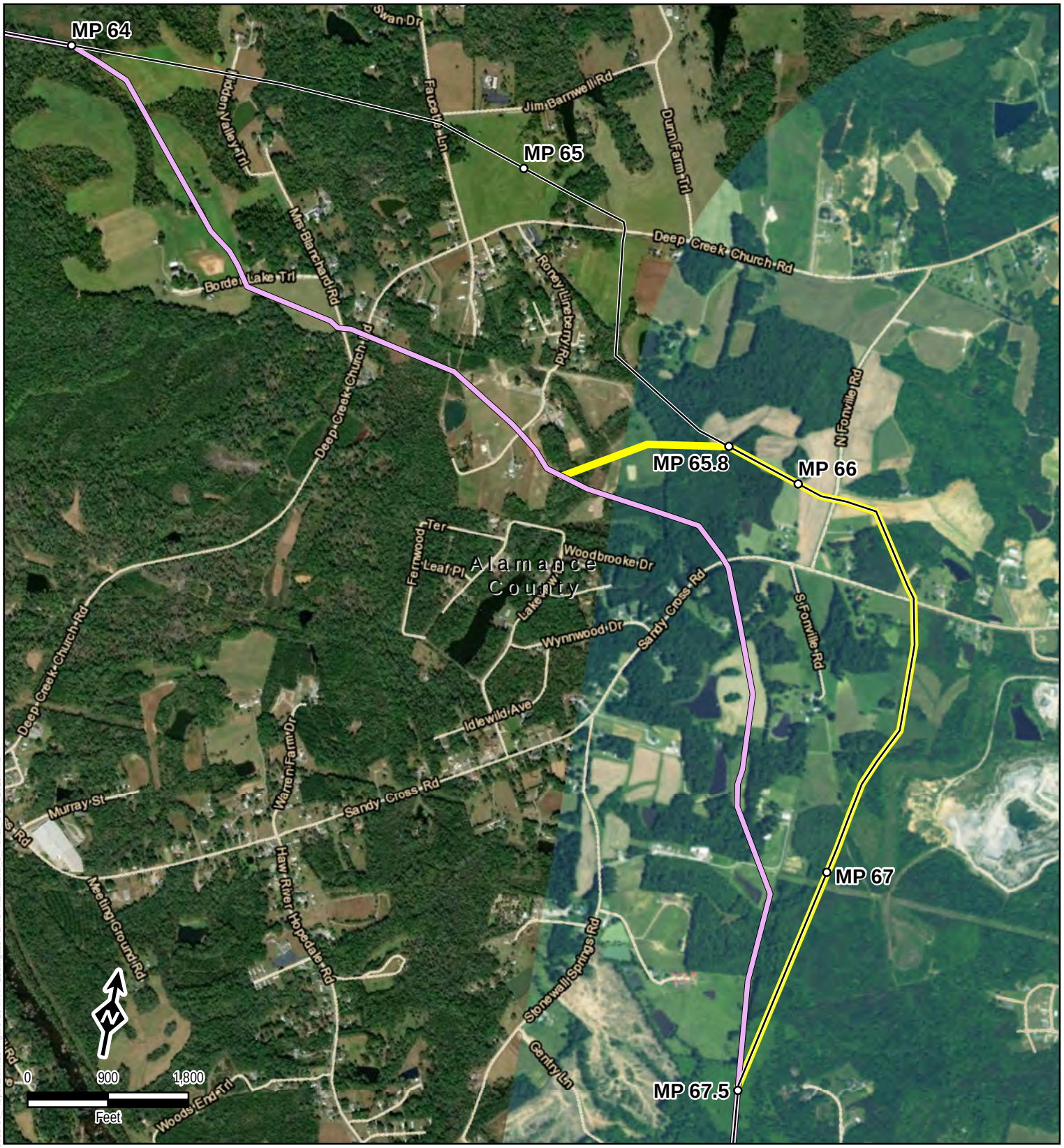
1 inch = 2,500 feet
When Printed 8.5x11

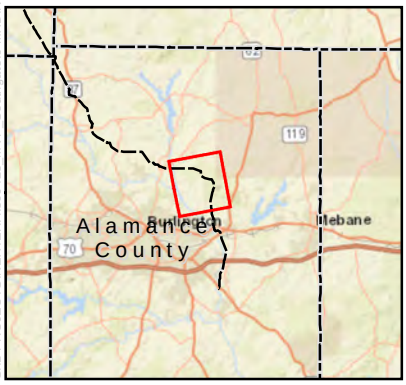
Mountain Valley PIPELINE LLC

Figure 10.5-3A
Sheet 1 of 1

FERC Alternative 2
(ESRI WOrld Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018





Legend

- Mileposts
- Mystic Valley Reroute (Preferred Pipeline Route)
- FERC Alternative 3
- Original Route
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 1,500 feet
When Printed 8.5x11

Mountain Valley PIPELINE LLC

Figure 10.5-4A
Sheet 1 of 1

FERC Alternative 3
(ESRI World Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382
October 2018

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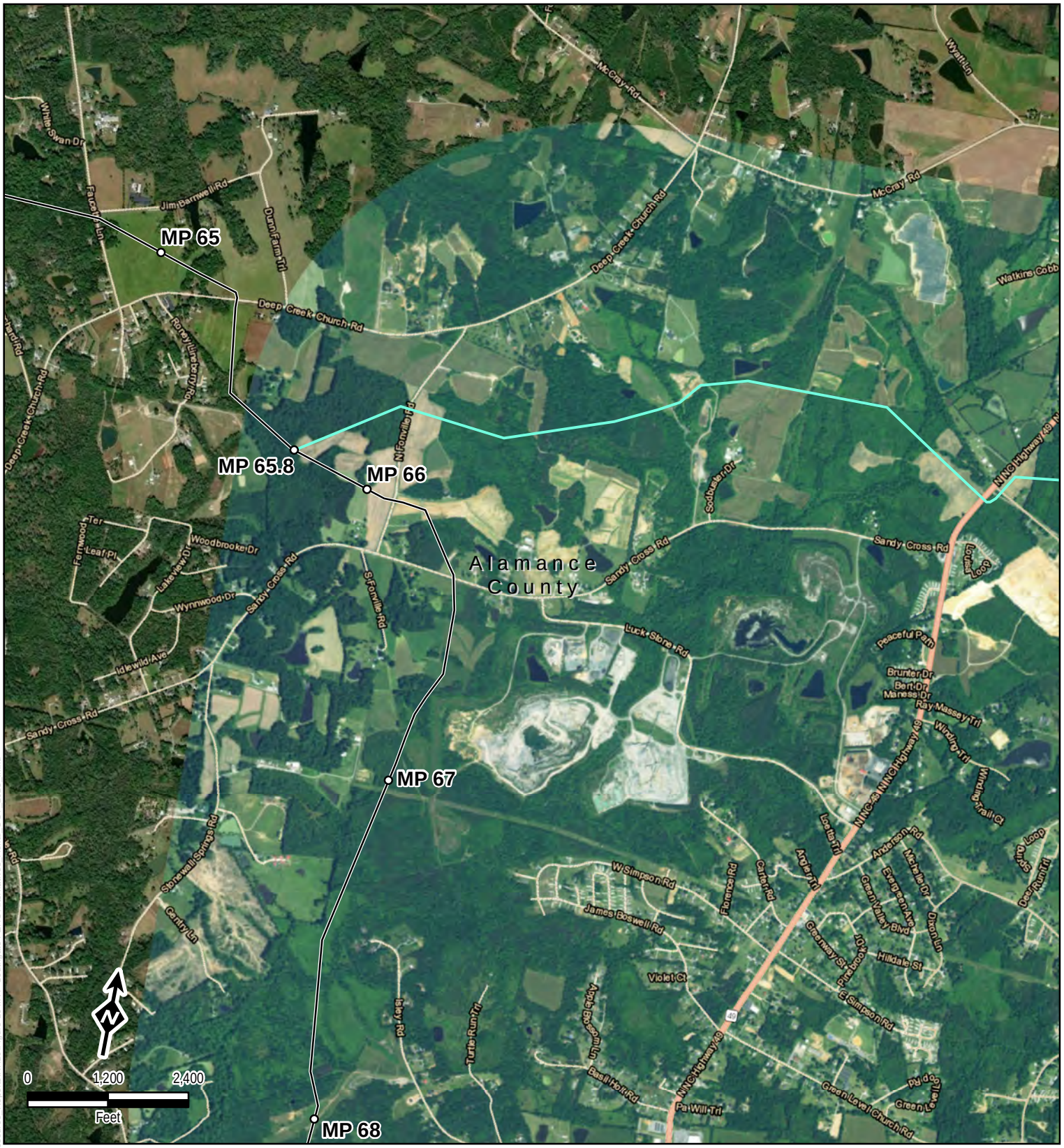
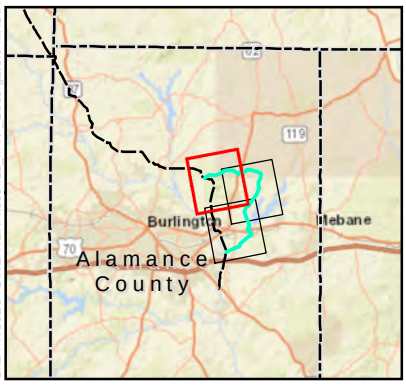




Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 4
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE, LLC

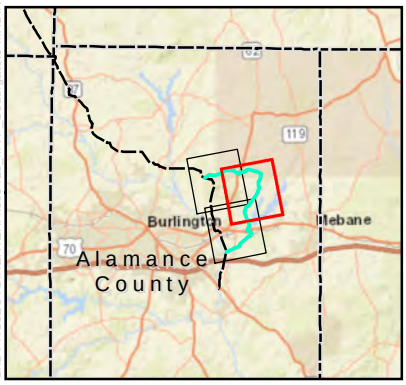
Figure 10.5-5A
Sheet 1 of 3

FERC Alternative 4
(ESRI WOrld Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_Aerial_OCT_2018_.mxd



Legend

FERC Alternative 4

County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE LLC

Figure 10.5-5A
Sheet 2 of 3

FERC Alternative 4
(ESRI WOrld Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_Aerial_OCT_2018_.mxd

Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 4
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

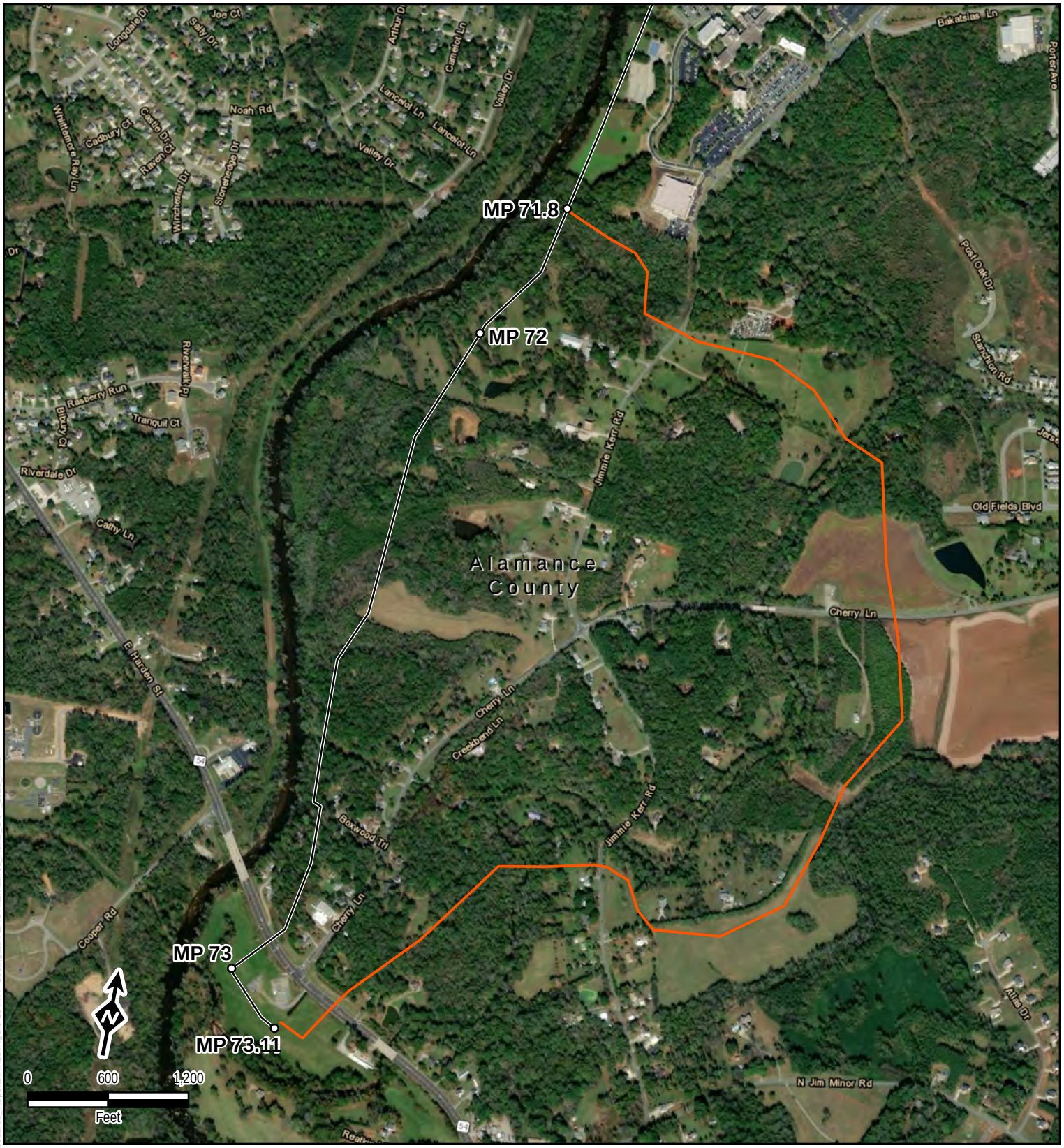
Mountain Valley PIPELINE LLC

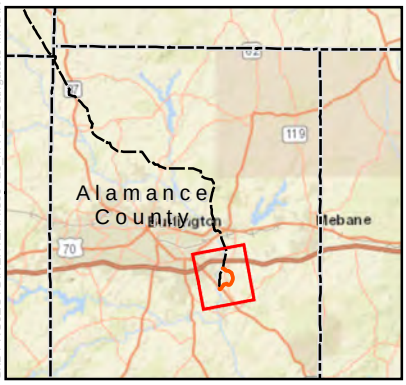
Figure 10.5-5A
Sheet 3 of 3

FERC Alternative 4
(ESRI WOrld Imagery)

TRC
600 Willowbrook Ln
West Chester, PA 19382

October 2018





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 5
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 1,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE LLC

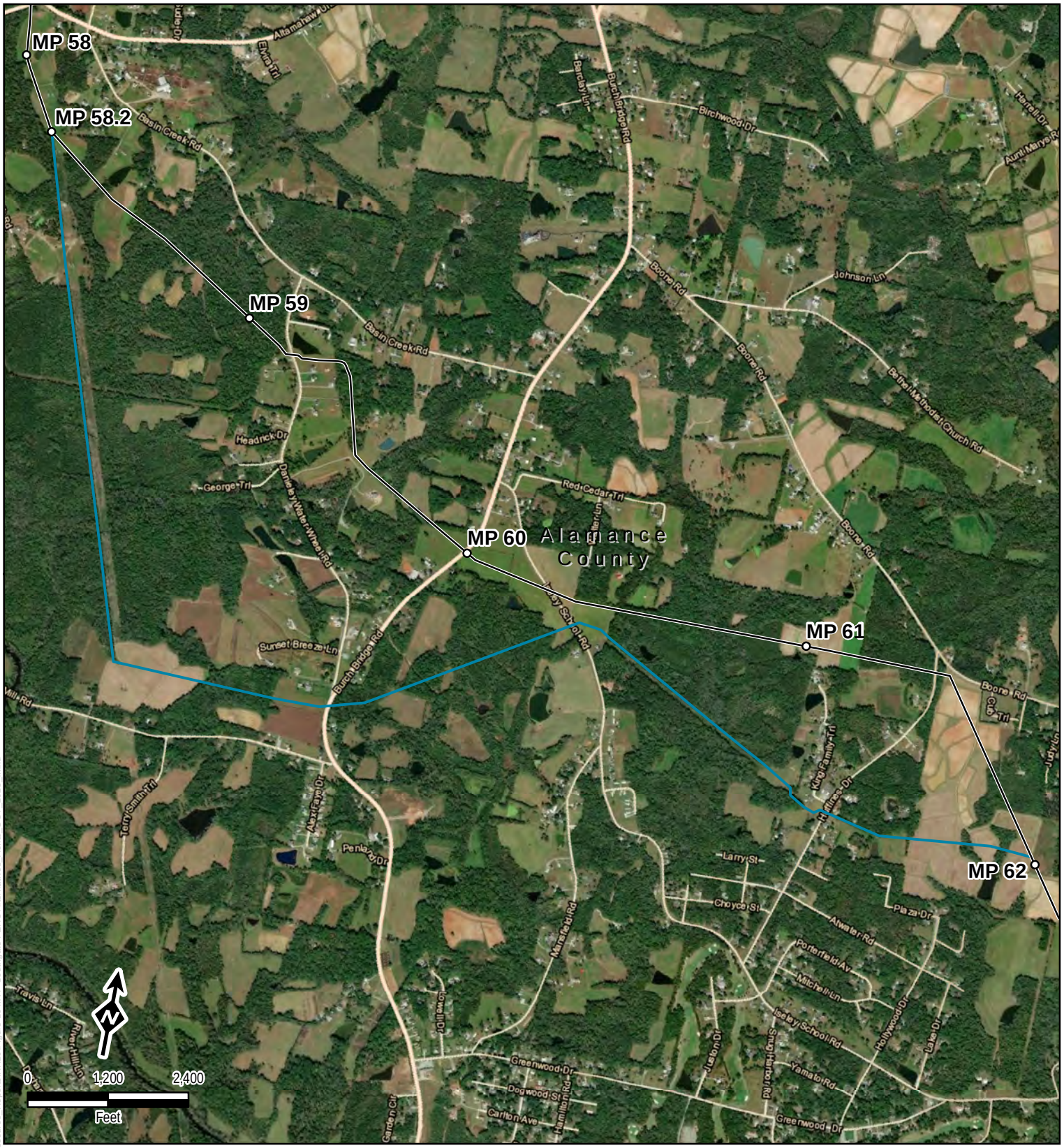
Figure 10.5-6A
Sheet 1 of 1

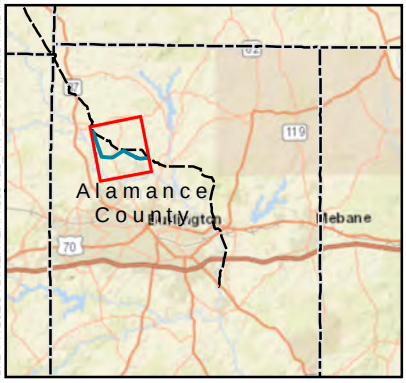
FERC Alternative 5
(ESRI WOrld Imagery)

TRC
Results you can rely on

600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_Aerial_OCT_2018_.mxd





Legend

- Mileposts
- Preferred Pipeline Route
- FERC Alternative 6
- County Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 2,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE LLC

Figure 10.5-7A
Sheet 1 of 1

FERC Alternative 6
(ESRI WOrld Imagery)

TRC
Results you can rely on

600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1-PROJECTS\NEXTERA\300423_MVP_Southgate\6-MXD\Resource_Reports\RR10\Figure 10 MVP Southgate FERC Alternatives_Aerial_OCT_2018_.mxd

MVP Southgate Project

Docket No. CP19-XX-000

Resource Report 10

Appendix 10-B

Route Variations Incorporated into the MVP Southgate Project Pipeline

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
VA-PI-001.000 VA-PI-002.000	MVP-RA-228-1624	0	0	0.00	H-605 Lambert Compressor Station Suction Line	H-605 Lambert Compressor Station Suction Line
VA-PI-002.000	MVP-RA-228-1627	0	0	0.00	Lambert Compressor Station Discharge Line	Lambert Compressor Station Discharge Line
VA-PI-008.000 VA-PI-009.000	MVP-RA-143-1526	1	1.25	0.25	Adjusted centerline (“CL”) to be next to existing right-of-way (“ROW”)	Adjusted CL to be next to existing ROW
VA-PI-012.000	MVP-RR-257-1422	2.25	2.25	0.00	Adjusted the access road TA-PI-005 to end at a additional temporary workspace (“ATWS”) that is outside of a wetland	Adjusted the access road TA-PI-005 to end at a ATWS that is outside of a wetland
VA-PI-014.000	MVP-RA-143-1527	2.35	2.7	0.35	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-022.000 VA-PI-023.000	MVP-RR-257-1425	3.4	3.4	0.00	Extended access road TA-PI-006 to a public road	Extended access road TA-PI-006 to a public road
VA-PI-022.000 VA-PI-023.000	MVP-RR-228-1312	3.55	3.55	0.00	Contoured this work box to fit stream/wetland angles	Adjusted the ATWS to contour to stream/wetland
VA-PI-029.000 VA-PI-030.000 VA-PI-031.000 VA-PI-032.000	MVP-RA-143-1528	4.25	4.4	0.15	Removed Point of Intersections (“PI's”)	The removal of the PI's makes it better for a horizontal directional drill (“HDD”) or a conventional bore
VA-PI-032.000	MVP-RA-143-1529	4.6	4.9	0.30	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-034.000	MVP-RA-143-1530	5	5.1	0.10	Minimized creek crossing and adjust PI away from creek crossing	Minimized creek crossing and adjust PI away from creek crossing
VA-PI-034.000 VA-PI-034.000.RR VA-PI-035.000	MVP-RA-183-0855	5	5.3	0.30	Adjusted CL to avoid being in stream for approximately 600 feet.	Adjusted CL to avoid being in stream for approximately 600 feet.
VA-PI-034.000	MVP-RA-221-1831	5	5	0.00	Trimmed ATWS to 30' x 100' to avoid sensitive resource area	Trimmed ATWS to 30' x 100' to avoid sensitive resource area as much as possible
VA-PI-034.000	MVP-RA-221-1835	5	5	0.00	Removed. Reduce / avoid impact on sensitive resource area	Access road not needed
VA-PI-034.000 VA-PI-034.100.AR	MVP-RA-253-1423	5.1	5.1	0.00	Modified access road layout	Adjusted access road to follow the existing road
VA-PI-035.000	MVP-RA-218-1715	5.3	5.3	0.00	Access road removed	Access road not needed

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
VA-PI-035.000 VA-PI-036.000	MVP-RA-253-1606	5.5	5.5	0.00	Removed TA-PI-044	Access road not needed
VA-PI-035.100.AR VA-PI-036.000 VA-PI-037.000	MVP-RR-270-1240	5.9	5.9	0.00	Extend access road to a public road	Extend access road to a public road
VA-PI-037.000	MVP-RA-153-1208	6.3	6.5	0.20	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-041.000	MVP-RA-153-1215	7.2	7.3	0.10	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-041.000 VA-PI-042.000 VA-PI-044.000	MVP-RA-228-1315	7.2	7.5	0.30	Straighten out and follow existing pipelines	Adjusted CL to be next to existing ROW
VA-PI-043.000	MVP-RA-218-1732	7.6	7.6	0.00	Removed TA-PI-020	Access road not needed
VA-PI-053.000	MVP-RR-183-0902	9.6	9.6	0.00	Adjusted access road to avoid cemetery	Adjust access road to avoid cemetery
VA-PI-053.000	MVP-RA-254-1528	9.6	9.6	0.00	Modified access road layout	Adjusted access road to follow the existing road
VA-PI-053.000	MVP-RR-183-0859	9.65	10	0.35	Adjusted centerline to avoid large cemetery	Adjusted CL to avoid large cemetery
VA-PI-075.000 VA-PI-075.001.ASC VA-PI-076.000	MVP-RR-221-1024	11	11.5	0.50	Alternate route to avoid sensitive resource area	Adjusted the route to avoid potential sensitive resource area
VA-PI-077.000	MVP-RR-255-1641	11.65	11.9	0.25	Adjusted centerline to avoid cemetery	Adjusted CL to avoid cemetery
VA-PI-079.000	MVP-RA-218-2017	12.2	12.2	0.00	Removed access road	Access road not needed
VA-PI-082.000	MVP-RA-219-1725	12.4	12.4	0.00	Reduced ATWS to property lines to avoid cemetery	Reduced ATWS to property lines to avoid cemetery
VA-PI-082.000	MVP-RA-219-1839	12.6	12.6	0.00	Removed access road	Access road not needed
VA-PI-082.000	MVP-RA-219-1846	12.65	12.65	0.00	Removed access road	Access road not needed
VA-PI-084.000	MVP-RA-153-1249	12.8	13.1	0.30	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
VA-PI-092.200.AR	MVP-RR-219-0800	14.15	14.15	0.00	The landowner requested that the access road not to go past their house and barn but from the gates at the road along the property line	Adjusted the access road at the land owners request
VA-PI-092.200.AR	MVP-RA-254-1542	14.15	14.15	0.00	Removed section of access road	Adjusted access road to not go near land owners house
VA-PI-094.000	MVP-RA-153-1254	14.2	14.4	0.20	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-094.000 VA-PI-095.000 VA-PI-096.000	MVP-RA-153-1257	14.7	14.85	0.15	Adjusted CL to reduce the number of PIs.	Adjusted CL to reduce the number of PIs.
VA-PI-096.000, VA-PI-099.000	MVP-RA-218-2043	14.8	15.2	0.40	Adjusted to route to the west based on the property evidence gathered and run the line north to a point of intersection with original route. Avoid VA-PI-097.000.ABU.	Adjusted to route to the west, run the line north to a point of intersection with original route. Avoid VA-PI-097.000.ABU.
VA-PI-100.000 VA-PI-099.000 VA-PI-101.000	MVP-RA-153-1303	15.2	15.45	0.25	Adjusted CL to reduce the number of PIs in this location.	Adjusted CL to reduce the number of PIs in this location.
VA-PI-099.000	MVP-RR-218-2047	15.2	15.2	0.00	Landowner does not want the access road going by his house.	Adjusted access road to not go near land owners house
VA-PI-099.000 VA-PI-099.100.AR	MVP-RA-253-1127	15.4	15.4	0.00	Remove section of TA-PI-037	Adjusted the route of the access road to not go past the land owners house
VA-PI-102.000.ABU VA-PI-103.000	MVP-RA-179-1227	15.7	15.85	0.15	Adjusted CL to be next to existing pipeline ROW. According to the LDAR info the slope is ~14.9% (8.2 deg)	Adjusted CL to be next to existing ROW
VA-PI-103.000 VA-PI-104.000.ABU VA-PI-106.000	MVP-RA-199-1127	15.9	16.05	0.15	Avoided sensitive resource area.	Adjusted route to avoid sensitive resource area
VA-PI-106.000	MVP-RA-253-1124	16.1	16.1	0.00	Removed TA-PI-040	Access road not needed

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
VA-PI-115.000 VA-PI-118.000	MVP-RA-219-1808	16.8	17.2	0.40	At 16.9, propose to cross the creek at a more perpendicular angle.	Adjusted the route to reduce the amount of environmental impact
VA-PI-118.000	MVP-RA-253-1035	17.4	17.4	0.00	Removed TA-PI-044	Access road not needed
VA-PI-120.000 VA-PI-121.000 VA-PI-122.000.ABU VA-PI-123.000 VA-PI-124.000	MVP-RA-163-1213	18	18.4	0.40	Adjusted CL to be next to the existing pipeline ROW. There is an old farm house and barn next to the existing pipeline ROW, potential karst area.	Adjusted CL to be next to the existing pipeline ROW. There is an old farm house and barn next to the existing pipeline ROW, potential karst area.
VA-PI-121.000	MVP-RA-197-1303	18	18	0.00	Adjusted CL of access road TA-PI-046 to avoid sensitive resource area	Adjusted CL of access road TA-PI-046 to avoid sensitive resource area
VA-PI-121.000 VA-PI-122.000.ABU VA-PI-123.000 VA-PI-124.000	MVP-RA-239-1745	18.2	18.35	0.15	Adjusted CL to avoid A frame electric poles	Adjusted CL to avoid A frame electric poles
VA-PI-124.000	MVP-RA-239-1750	18.3	18.3	0.00	MLV3	MLV3
VA-PI-150.000	MVP-RA-228-1319	19.8	19.9	0.10	Crossed the existing lines square	Crossed the existing lines square
VA-PI-150.000 VA-PI-151.000 VA-PI-152.000 VA-PI-155.000 VA-PI-156.000	MVP-RA-153-1458	19.9	20.3	0.40	This will reduce the number of Pi's needed and this route will miss the structure.	This will reduce the number of Pi's needed and this route will miss the structure.

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
VA-PI-150.000 VA-PI-151.000 VA-PI-152.000 VA-PI-153.000.ABU VA-PI-154.000.ABU VA-PI-160.000	MVP-RR-218-2110	19.9	20.4	0.50	Preferred by the landowner. He had no issues with us co-locating but stressed that he did not want us to go through the center of his pasture. There is ~75' between the Williams line and the garage on tract VA-PI-153.000.ABU	Adjusted the route at the land owners request
VA-PI-160.000	MVP-RR-257-1433	20.45	20.45	0.00	Adjusted access road TA-PI-052 to avoid sensitive resource area	Adjusted access road to avoid sensitive resource area
VA-PI-160.000 VA-PI-161.000 VA-PI-162.000 VA-PI-163.000	MVP-RA-155-1441	20.5	21.2	0.70	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-164.100.AR VA-PI-164.000.ABU	MVP-RA-218-1737	21.2	21.2	0.00	Removed TA-PI-054	Access road not needed
VA-PI-163.000 VA-PI-165.000	MVP-RA-155-1446	21.35	21.65	0.30	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-171.000 VA-PI-172.000 VA-PI-173.000	MVP-RA-155-1449	22.15	22.75	0.60	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-173.000	MVP-RA-249-1429	22.35	22.35	0.00	Removed ATWS 1172	ATWS not needed
VA-PI-173.000	MVP-RA-249-1444	22.35	22.35	0.00	Removed TA-PI-056	Access road not needed
VA-PI-173.000	MVP-RA-249-1437	22.45	22.45	0.00	ATWS 1174 Removed	ATWS not needed
VA-PI-173.000	MVP-RA-249-1447	22.45	22.45	0.00	TA-PI-057 Removed	Access road not needed
VA-PI-166.100.AR VA-PI-166.200.AR	MVP-RA-249-1450	22.6	22.6	0.00	TA-PI-058 Removed	Access road not needed

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
VA-PI-173.000 VA-PI-173.100.AR						
VA-PI-173.000	MVP-RA-249-1454	22.7	22.7	0.00	TA-PI-060 Removed	Access road not needed
VA-PI-174.000 VA-PI-175.000	MVP-RA-177-1447	23.1	23.7	0.60	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
VA-PI-178.000	MVP-RA-177-1449	24.4	24.7	0.30	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
NC-RO-002.000	MVP-RA-157-1313	26.25	26.45	0.20	Adjusted CL to be next to existing ROW	Adjusted CL to be next to existing ROW
NC-RO-005.000 NC-RO-006.000	MVP-RR-269-1541	27	28.3	1.30	Adjusted CL to avoid sensitive resource area and for LN3600	Adjusted CL to avoid sensitive resource area and for LN3600
NC-RO-005.000 NC-RO-006.000	MVP-RR-270-1244	27.4	27.4	0.00	Added access road	Added access road
NC-RO-006.000 NC-RO-006.001.CS2	MVP-RR-257-1435	28.1	28.1	0.00	Extended access road PA-RO-000 to public road	Extended access road PA-RO-000 to public road
NC-RO-006.000	MVP-RA-153-1309	28.3	28.3	0.00	Moved the ATWS to stay out of large wetland	The previous location of this ATWS was in a large wetland. This location had no wetlands
NC-RO-007.000	MVP-RA-159-1655	29.3	29.65	0.35	There is side hill construction in this area, adjust CL to be on top of the hill	There is side hill construction in this area, adjust CL to be on top of the hill
NC-RO-011.000 NC-RO-012.000.WBC NC-RO-013.000 NC-RO-014.000 NC-RO-015.000 NC-RO-016.000 NC-RO-018.000.ABU NC-RO-019.000	MVP-RR-269-1549	29.9	30.55	0.65	Adjusted CL for HDD profile and T15 location	Adjusted CL for HDD profile and T15 location

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-RO-011.000	MVP-RR-270-1247	29.9	29.9	0.00	Added ATWS for equipment and mats	Added ATWS for equipment and mats
NC-RO-011.000	MVP-RR-270-1248	29.9	29.9	0.00	Added ATWS for HDD area	Added ATWS for HDD area
NC-RO-011.000	MVP-RR-270-1250	29.9	29.9	0.00	Added ATWS for truck turning	Added ATWS for truck turning
NC-RO-011.000	MVP-RR-270-1251	29.9	29.9	0.00	Adjusted where the access road route	Adjusted where the access road route to HDD location
NC-RO-014.000	MVP-RR-228-1322	30.3	30.3	0.00	ATWS for Hydro test	ATWS for Hydro test
NC-RO-022.000 NC-RO-025.000	MVP-RR-257-1438	30.75	31.15	0.40	Adjusted route to avoid red tract and 2 large stream crossings	Adjusted route to avoid red tract and 2 large stream crossings
NC-RO-025.000 NC-RO-027.000 NC-RO-029.000	MVP-RA-159-1700	31.2	31.4	0.20	Adjusted CL to reduce the amount of stream impact and to avoid side hill construction	Adjusted CL to reduce the amount of stream impact and to avoid side hill construction
NC-RO-025.900.AR NC-RO-025.850.ABU NC-RO-025.800.ABU NC-RO-025.700.AR NC-RO-025.650.ABU NC-RO-025.600.AR NC-RO-025.500.AR NC-RO-025.400.AR NC-RO-025.300.AR NC-RO-025.200.AR NC-RO-025.100.AR NC-RO-026.000.ABU NC-RO-025.000	MVP-RA-219-1902	31.2	31.2	0.00	Removed access road TA-RO-083	Access road not needed
NC-RO-029.000 NC-RO-030.000	MVP-RA-179-1146	31.4	31.6	0.20	Adjusted CL to stay away from sensitive resource area and bring the PI closer to the top of the hill	Adjusedt CL to stay away from sensitive resource area and bring the PI closer to the top of the hill

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-RO-033.000 NC-RO-034.000	MVP-RA-159-1706	31.6	31.9	0.30	Adjusted CL to avoid side hill and multiple ravines	Adjusted CL to avoid side hill and multiple ravines
NC-RO-035.000 NC-RO-037.000	MVP-RA-159-1717	32	32.15	0.15	Adjusted CL to avoid side hill construction	Adjusted CL to avoid side hill construction
NC-RO-038.000	MVP-RR-257-1441	32.35	32.55	0.20	Adjusted route to co-locate with existing pipeline	Adjusted route to co-locate with existing pipeline
NC-RO-047.000 NC-RO-048.000 NC-RO-049.000 NC-RO-050.000 NC-RO-051.000 NC-RO-052.000 NC-RO-053.000 NC-RO-054.000 NC-RO-055.000 NC-RO-056.000 NC-RO-057.000	MVP-RA-162-1521	34.2	35.35	1.15	Adjusted CL to avoid side hill construction, baptism area around MP 34.6 and sensitive resource area around MP 34.9	Adjusted CL to avoid side hill construction, baptism area around MP 34.6 and sensitive resource area around MP 34.9
NC-RO-054.000 NC-RO-056.000 NC-RO-057.000	MVP-RR-193-1030	34.95	35.35	0.40	Adjusted CL to avoid multiple stream crossings and side hill construction	Adjusted CL to avoid multiple stream crossings and side hill construction
NC-RO-058.000 NC-RO-060.000 NC-RO-061.000	MVP-RA-162-1535	35.9	36.35	0.45	Adjusted CL to avoid side hill construction and to stay off "NO" tract	Adjusted CL to avoid side hill construction and to stay off "NO" tract
NC-RO-060.000 NC-RO-061.000	MVP-RA-228-1520	36	36	0.00	Removed ATWS 1304 because it is in a ravine.	ATWS not usable
NC-RO-060.000	MVP-RA-242-1543	36	36	0.00	Trimmed the work space out of the corner to stay off red tract	Trimmed the work space out of the corner to stay off red tract
NC-RO-077.000 NC-RO-081.000 NC-RO-080.000	MVP-RR-242-1509	37.6	37.85	0.25	Adjusted route to avoid red tract	Adjusted route to avoid red tract

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-RO-084.000 NC-RO-085.000 NC-RO-086.000 NC-RO-087.000 NC-RO-088.000 NC-RO-089.000 NC-RO-090.000	MVP-RA-143-1533	38	38.8	0.80	Avoided Side Hill Construction	Avoided Side Hill Construction
NC-RO-085.000	MVP-RA-230-1251	38.1	38.1	0.00	Changed ATWS 1328 to 240' x 90' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-091.000	MVP-RA-230-1254	38.85	38.85	0.00	Change ATWS 1337 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-091.000 NC-RO-092.000 NC-RO-094.000	MVP-RA-162-1541	39	39.35	0.35	Adjusted CL to avoid side hill construction	Adjusted CL to avoid side hill construction
NC-RO-092.000 NC-RO-094.000 NC-RO-095.000	MVP-RR-193-1501	39.2	39.6	0.40	Adjusted CL to bring the CL up the hill a little bit more and to get the WS out of the wetland/pond area	Adjusted CL to bring the CL up the hill a little bit more and to get the WS out of the wetland/pond area
NC-RO-100.000 NC-RO-101.000	MVP-RA-163-1116	40	40.2	0.20	Adjusted CL to stay away from washout ditch	Adjusted CL to stay away from washout ditch
NC-RO-101.000	MVP-RA-230-1302	40.15	40.15	0.00	Change ATWS 1350 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-101.000	MVP-RA-230-1305	40.2	40.2	0.00	Changed ATWS 1352 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-106.000	MVP-RA-230-1308	40.5	40.5	0.00	Changed ATWS 1355 to 90' Wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-108.000	MVP-RA-230-1311	40.6	40.6	0.00	Changed ATWS 1357 to 90' Wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-109.000	MVP-RA-153-1317	40.7	40.9	0.20	Adjusted CL to avoid side hill construction	Adjusted CL to avoid side hill construction

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-RO-111.000	MVP-RR-270-1253	41.4	41.4	0.00	Extended access road to public road	Extended access road to public road
NC-RO-111.000 NC-RO-111.000.RC NC-RO-112.000	MVP-RA-193-1511	41.45	41.8	0.35	Adjusted CL to straighten out the route and reduce the number of PIs needed	Adjusted CL to straighten out the route and reduce the number of PIs needed
NC-RO-111.000 NC-RO-112.000	MVP-RR-249-1522	41.55	41.75	0.20	Adjusted CL to be able to bore Hwy 29	Adjusted CL to be able to bore Hwy 29
NC-RO-112.000	MVP-RA-153-1320	41.6	41.8	0.20	Straighten out this road crossing to follow the power lines.	Straighten out this road crossing to follow the power lines.
NC-RO-111.000 NC-RO-112.000	MVP-RR-249-1517	41.65	41.65	0.00	ATWS for bore	ATWS for bore
NC-RO-112.000	MVP-RA-157-1325	41.9	42.2	0.30	Adjusted CL to stay away from small cemetery.	Adjusted CL to stay away from small cemetery.
NC-RO-112.200 NC-RO-112.300 NC-RO-112.400 NC-RO-117.000	MVP-RR-162-1547	42.3	43	0.70	Adjusted CL to avoid AT&T tower	Adjusted CL to avoid AT&T tower
NC-RO-117.000 NC-RO-118.000.ABU NC-RO-122.000	MVP-RR-177-1515	42.5	43.4	0.90	Adjusted CL to stay away from large cemetery	Adjusted CL to stay away from large cemetery
NC-RO-122.000	MVP-RA-230-1313	43.4	43.4	0.00	Changed ATWS 1391 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-122.100	MVP-RA-230-1315	43.45	43.45	0.00	Changed ATWS 1392 to 75' x 260' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-133.200	MVP-RA-230-1317	43.8	43.8	0.00	Changed ATWS 1396 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-133.000	MVP-RA-230-1320	44.1	44.1	0.00	Changed ATWS 1403 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-RO-138.000	MVP-RA-230-1322	44.8	44.8	0.00	Changed ATWS 1408 to 60' x 220' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-140.000 NC-RO-142.000	MVP-RA-153-1324	45.45	45.75	0.30	CL adjustment to route around pasture.	CL adjustment to route around pasture.
NC-RO-148.505.AR NC-RO-148.510.AR	MVP-RR-254-1405	46.75	46.75	0.00	Adjusted TA-RO-129 CL to MDS CL points of existing road and change the start of the access road off Frank Rd to follow existing gravel path	Adjusted access road to follow the existing road
NC-RO-149.000	MVP-RA-230-1324	47.05	47.05	0.00	Changed ATWS 1429 to 90' x 230' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-153.000	MVP-RA-153-1329	47.3	47.5	0.20	Straighten out to reduce the number of PIs	Straighten out to reduce the number of PIs
NC-RO-154.000	MVP-RR-257-1443	47.3	47.3	0.00	Extended access road TA-RO-130 to public road	Extended access road TA-RO-130 to public road
NC-RO-154.000	MVP-RA-153-1333	47.6	47.7	0.10	Straighten out to reduce the number of PIs	Straighten out to reduce the number of PIs
NC-RO-154.000	MVP-RA-230-1327	47.6	47.6	0.00	Changed ATWS 1437 to 90' Wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-156.000	MVP-RA-153-1338	48	48.1	0.10	Straighten out to reduce the number of PIs	Straighten out to reduce the number of PIs
NC-RO-156.000	MVP-RA-193-1529	48	48.1	0.10	Adjusted CL to keep CL on top of hill	Adjusted CL to keep CL on top of hill
NC-RO-162.000	MVP-RA-230-1329	48.7	48.7	0.00	Changed ATWS 1449 to 90' Wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-165.000	MVP-RA-253-1620	49.2	49.2	0.00	Adjusted TA-RO-135 CL to MDS CL points of existing road and round turns	Adjusted access road to follow the existing road

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-RO-171.000 NC-RO-171.100.AR	MVP-RA-242-1439	49.8	49.8	0.00	Removed access road TA-RO-138, runs through land owner's car port and past house. The access road is approx. 855' and the nearest road crossing is approx. 1330'.	Access road not needed
NC-RO-170.000 NC-RO-171.100.AR	MVP-RR-257-1446	49.8	49.8	0.00	Adjusted access road TA-RO-138 to avoid going under car port	Adjusted access road TA-RO-138 to avoid going under car port
NC-RO-181.000	MVP-RA-253-1624	51.4	51.4	0.00	Adjusted TA-RO-140 CL to MDS CL points of existing road and round turns	Adjusted access road to follow the existing road
NC-RO-181.000	MVP-RA-253-1626	51.6	51.6	0.00	Adjusted TA-RO-141 CL to MDS CL points of existing road and round turns	Adjusted access road to follow the existing road
NC-RO-183.000	MVP-RA-253-1628	51.7	51.7	0.00	Adjusted TA-RO-142 CL to MDS CL points of existing road and round turns	Adjusted access road to follow the existing road
NC-RO-186.000	MVP-RA-230-1331	52.55	52.55	0.00	Changed ATWS 1477 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-186.000	MVP-RA-230-1333	52.6	52.6	0.00	Changed ATWS 1478 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-000.005	MVP-RA-230-1335	52.6	52.6	0.00	Change ATWS 1479 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-RO-186.000	MVP-RR-257-1448	52.6	52.6	0.00	Changed access road TA-TO-146 to go from public road to TWS	Changed access road TA-TO-146 to go from public road to TWS
NC-AL-000.065	MVP-RA-250-1321	53.5	53.5	0.00	Trimmed this section of TA-AL-152	Trimmed this section of TA-AL-152
NC-AL-008.000 NC-AL-009.000	MVP-RR-165-1051	54.85	55.1	0.25	Adjusted CL to avoid pond / swamp area	Adjusted CL to avoid pond / swamp area
NC-AL-015.000 NC-AL-016.000	MVP-RA-206-1431	55.3	55.3	0.00	Removed - There is enough ATWS at the PI (ATWS 1509) that this ATWS is not needed.	ATWS not needed

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-AL-017.000.ABU NC-AL-018.000						
NC-AL-010.000 NC-AL-018.000	MVP-RA-230-1340	55.3	55.3	0.00	Changed ATWS 1509 to 75' x 230' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-018.000 NC-AL-019.000 NC-AL-021.000 NC-AL-022.000 NC-AL-023.000 NC-AL-024.000 NC-AL-025.000 NC-AL-025.100.AR NC-AL-027.000	MVP-RA-153-1347	55.5	56.35	0.85	Adjusted CL to reduce the number of PIs and to reduce the amount of tree clearing needed	Adjusted CL to reduce the number of PIs and to reduce the amount of tree clearing needed
NC-AL-018.000	MVP-RR-270-1255	55.6	55.6	0.00	Adjusted access road to be on existing path	Adjusted access road to be on existing path
NC-AL-028.000	MVP-RA-153-1356	56.4	56.4	0.00	Moved ATWS to the road crossing because the ATWS at MP 56.7 is on top of a pond	Moved ATWS to the road crossing because the ATWS at MP 56.7 is on top of a pond
NC-AL-028.000 NC-AL-033.000	MVP-RR-257-1513	56.8	56.8	0.00	Added access road	Added access road
NC-AL-035.000.ABU NC-AL-036.000	MVP-RA-242-1409	56.9	56.9	0.00	Removed access road TA-AL-160 runs on top of land owner's septic and in between their crop fields. The access road is approx. 2000' and the nearest road crossing is approx. 2740'.	Access road not needed
NC-AL-033.000	MVP-RR-257-1515	56.9	56.9	0.00	Added access road	Added access road
NC-AL-042.000 NC-AL-043.000	MVP-RA-186-1423	57.35	57.75	0.40	LiDAR suggests that the PI is in the pond. This adjustment is to avoid the pond	LiDAR suggests that the PI is in the pond. This adjustment is to avoid the pond
NC-AL-043.000	MVP-RR-257-1517	57.75	57.75	0.00	Extended access road TA-AL-161 to public road	Extended access road TA-AL-161 to public road

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-AL-051.000	MVP-RA-231-0828	58.6	58.6	0.00	Changed ATWS 1543 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-054.000 NC-AL-058.000	MVP-RA-228-1324	59.1	59.2	0.10	Extended PIs out of the road ROW	Extended PIs out of the road ROW
NC-AL-075.000	MVP-RA-231-0832	60.7	60.7	0.00	Change ATWS 1559 to 90' x 110' to fit inside survey corridor	Adjust ATWS to fit inside of survey corridor
NC-AL-076.100.AR NC-AL-076.200.AR NC-AL-076.400.AR NC-AL-076.500.AR NC-AL-076.000 NC-AL-074.450.AR NC-AL-076.000 NC-AL-074.100.AR NC-AL-074.000	MVP-RA-172-0945	60.8	60.8	0.00	The landowner walked with the civil crew to show them where he wants the access road to be.	The landowner walked with the civil crew to show them where he wants the access road to be.
NC-AL-076.100.AR NC-AL-076.000 NC-AL-074.450.AR NC-AL-074.000	MVP-RA-153-1402	60.9	60.9	0.00	This property owner has an existing access road to the backfield that has been logged and cleared.	The existing access could be squared up to Boone Road for better turning and the current route has a few tight turns in it that could be straightened out to reduce the number of turns for large trucks.
NC-AL-103.000 NC-AL-104.000 NC-AL-106.000 NC-AL-128.000 NC-AL-134.000 NC-AL-135.000 MVF-NC-AL-001.000 MVF-NC-AL-002.000 MVF-NC-AL-003.000 MVF-NC-AL-004.000 MVF-NC-AL-005.000 MVF-NC-AL-006.000 MVF-NC-AL-007.000 MVF-NC-AL-010.000 NC-AL-110.000.RC MVF-NC-AL-011.000	MVP-RR-240-1812	61	67.5	6.50	Mystic Valley Farm re-route	Mystic Valley Farm re-route

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
MVF-NC-AL-012.000.ABU MVF-NC-AL-013.000 MVF-NC-AL-016.000 MVF-NC-AL-017.000 NC-AL-120.000 NC-AL-119.000 FA34-AL-001.000 FA3-AL-002.000 FA3-AL-003.000 FA3-AL-005.000 FA3-AL-006.000 FA3-AL-007.000 FA3-AL-008.000 FA3-AL-009.000 FA3-AL-010.000						
NC-AL-085.000 NC-AL-086.000	MVP-RR-165-0832	62.25	62.5	0.25	The land owner mentioned that in the field of tract NC-AL-085.000 they would like to put a sub-division in the future	The land owner mentioned that in the field of tract NC-AL-085.000 they would like to put a sub-division in the future
NC-AL-086.000	MVP-RA-231-0841	62.65	62.65	0.00	Changed ATWS 1573 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-089.000 NC-AL-088.000.ABU	MVP-RA-231-0844	62.8	62.8	0.00	Changed ATWS 1575 to 90' x 330 to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-093.000	MVP-RA-231-0846	63	63	0.00	Changed ATWS 1577 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-096.000 NC-AL-097.000 NC-AL-098.000	MVP-RA-143-1534	63.1	63.5	0.40	Extended PI out of creek	Extended PI out of creek
NC-AL-101.000.ABU NC-AL-102.000.ABU	MVP-RA-231-0848	63.45	63.45	0.00	Changed ATWS 1582 to 90' x 230' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-102.000.ABU	MVP-RA-231-0852	63.5	63.5	0.00	Changed ATWS 1583 to 90' x 330' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-AL-103.000	MVP-RR-206-1421	63.7	63.7	0.00	This is an alternate access to TA-AL-172 and TA-AL-173 access roads.	The land owner requested that the access road be on the west side of the property instead of going around their house
NC-AL-103.000 NC-AL-103.100.AR	MVP-RA-250-1017	63.7	63.7	0.00	Trimmed TA-AL-172 to remove the section behind the house	Trimmed TA-AL-172 to remove the section behind the house
NC-AL-103.000	MVP-RA-250-1019	64	64	0.00	Removed TA-AL-173	Access road not needed
NC-AL-119.000 NC-AL-120.000	MVP-RA-247-1539	65.6	65.6	0.00	Mystic Valley Farm Access road 1	Mystic Valley Farm Access road 1
NC-AL-120.000	MVP-RA-231-0855	65.8	65.8	0.00	Changed ATWS 1605 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-121.000.ABU NC-AL-122.000	MVP-RA-231-0858	65.9	65.9	0.00	Change ATWS 1607 to 90' Wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-128.000	MVP-RA-247-1557	66.75	66.75	0.00	Mystic Valley Farm Access road 4	Mystic Valley Farm Access road 4
NC-AL-132.100.AR NC-AL-133.000 NC-AL-128.000 NC-AL-133.000	MVP-RA-247-1551	67.25	67.25	0.00	Mystic Valley Farm Access road 2	Mystic Valley Farm Access road 2
NC-AL-138.000 NC-AL-139.000 NC-AL-140.000 NC-AL-141.000 NC-AL-142.000	MVP-RR-186-1407	67.9	68.2	0.30	The LiDAR information suggests that the end of the pond is in the perm. ROW. This adjustment is to stay away from the pond	Adjust route to avoid pond
NC-AL-143.000	MVP-RA-231-0901	68.3	68.3	0.00	Changed ATWS 1629 to 90' Wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-143.000	MVP-RR-270-1257	68.3	68.3	0.00	Added perm. access road because Indian Village Trail is a private road	Added perm. access road because Indian Village Trail is a private road

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-AL-143.000	MVP-RA-231-0903	68.35	68.35	0.00	Changed ATWS 1631 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-143.000	MVP-RA-231-0907	68.4	68.4	0.00	Changed ATWS 1632 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-143.000	MVP-RA-231-0928	68.45	68.45	0.00	Changed ATWS 1634 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-148.000	MVP-RA-231-0930	68.7	68.7	0.00	Changed ATWS 1639 to 90' x 165' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-148.000	MVP-RA-231-0933	68.8	68.8	0.00	Changed ATWS 1641 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-148.000	MVP-RA-231-0937	68.85	68.85	0.00	Changed ATWS 1643 to 90' x 140' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-148.000 NC-AL-149.000	MVP-RA-231-0939	68.95	68.95	0.00	Changed ATWS 1646 to 85' x 220' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-149.000 NC-AL-150.000 NC-AL-151.000	MVP-RA-228-1327	69	69.1	0.10	Straighten out and move PI out of road ROW	Straighten out and move PI out of road ROW
NC-AL-169.000.ABU NC-AL-170.000.ABU NC-AL-176.000.ABU NC-AL-179.000.ABU NC-AL-180.000.ABU NC-AL-181.000.ABU NC-AL-183.000 NC-AL-184.000	MVP-RR-221-0832	69.5	69.9	0.40	Less impact for this route. Shorter distance, less fittings, less pipe, lessen foreign utility impact, less overhead utility relocation.	Less impact for this route. Shorter distance, less fittings, less pipe, lessen foreign utility impact, less overhead utility relocation.
NC-AL-182.000 NC-AL-182.100.ABU NC-AL-184.000	MVP-RA-156-1740	69.8	69.95	0.15	Adjusted CL to avoid abandoned building and to stay away from steep hill side	Adjusted CL to avoid abandoned building and to stay away from steep hill side
NC-AL-184.000	MVP-RA-231-0941	69.9	69.9	0.00	Changed ATWS 1659 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor

TABLE 10.6-4

Route Variations Incorporated into the MVP Southgate Project Pipeline

Tract ID	Reroute No.	Approx. Begin MP	Approx. End MP	Length (miles)	Variation Description	Justification
NC-AL-186.000 NC-AL-188.000	MVP-RA-219-1820	70.35	70.7	0.35	Proposed a couple minor shifts of centerline to account for side-hill terrain	Adjusted the line due to slight side hill
NC-AL-191.000	MVP-RA-231-0943	70.9	70.9	0.00	Changed ATWS 1670 to 90' wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-191.000	MVP-RA-231-0945	71	71	0.00	Changed ATWS 1672 to 90' Wide to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-191.000	MVP-RA-231-0947	71.05	71.05	0.00	Changed ATWS 1675 to 90' x 110' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-191.000	MVP-RA-231-0948	71.3	71.3	0.00	Changed ATWS 1676 to 80' x 280' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-192.000	MVP-RR-270-1300	71.55	71.55	0.00	Extended access road to a public road	Extended access road to a public road
NC-AL-192.000 NC-AL-193.000	MVP-RA-231-0950	71.8	71.8	0.00	Changed ATWS 1680 to 90' x 230' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-193.000 NC-AL-194.000	MVP-RA-231-0952	71.9	71.9	0.00	Changed ATWS 1681 to 90' x 260' to fit inside survey corridor	Adjusted ATWS to fit inside of survey corridor
NC-AL-199.000 NC-AL-200.000 NC-AL-201.000	MVP-RA-198-1549	72.4	72.7	0.30	According to the LiDAR info, there is side hill construction in this area (~32.5%, ~18 deg.) Adjust the CL to avoid the side hill construction	According to the LiDAR info, there is side hill construction in this area (~32.5%, ~18 deg.) Adjust the CL to avoid the side hill construction
NC-AL-210.000	MVP-RR-270-1302	73.1	73.1	0.00	Add edperm. access road for T21	Added perm. access road for T21
NC-AL-210.000	MVP-RR-270-1303	73.1	73.1	0.00	Changed location of T21 Site	Changed location of T21 Site