

**A Comparison of the Water Resource Impacts
Associated with
Alternative Alignments of the
Proposed Atlantic Sunrise Pipeline
On and Near the Nesbitt Property**

Luzerne and Wyoming Counties, Pennsylvania

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INTRODUCTION AND SUMMARY

The Transcontinental Gas Pipeline Company, LLC (Transco) proposes to construct about 184 miles of petroleum pipelines in eastern Pennsylvania in a generally north-south direction, beginning in Susquehanna County and terminating in Lancaster County. The overall project is referred to as the Atlantic Sunrise Pipeline Project, and it consists of several sections. The northern section is referred to as the Central Penn Line North (CPL North). Three alternative alignments of the CPL North route pass through or near a property of approximately 2,800 acres owned by Geraldine T. Nesbitt, along the border of Luzerne and Wyoming Counties in northeastern Pennsylvania. This report provides a professional review and evaluation of the impacts associated with the proposed alignment across the Nesbitt property and compares them with impacts associated with two proposed alternative alignments.

The Nesbitt property consists largely of sensitive environmental features, including mature forest, several high quality watersheds with numerous waterways, diverse wetlands, a 120-acre lake (Lake Catalpa), and areas of steep slopes. The property is within two identified Natural Areas according to the Pennsylvania Natural Heritage Program and includes documented habitat for rare and endangered species (PA-DCNR 2016). Additionally, there are documented historic and prehistoric archaeological resources located throughout the property. The proposed development of a new 30-inch petroleum pipeline, within a construction corridor up to 90 feet wide, would result in significant irreparable adverse impacts to the unique and sensitive resources of the Nesbitt property. The impacts on the Nesbitt property associated with the proposed pipeline are unnecessary because there are feasible alternatives available to the project sponsor which entail less damaging impacts to water resources and other environmental features.

PROPERTY IDENTIFICATION AND LOCATION

The Nesbitt property is located in northeastern Pennsylvania in the eastern part of the Susquehanna River basin (**Figure 1**). It is in the glaciated eastern section of the Appalachian Plateau physiographic province of Pennsylvania. The property forms parts of four municipalities in two counties (Dallas and Franklin Townships in Luzerne County; Monroe and Northmoreland Townships in Wyoming County). An excerpt from the Center Moreland PA 1:24,000 USGS (1983) topographic quadrangle is attached (**Figure 2**) showing the location of the Nesbitt property and the immediate vicinity. The coordinates at the center of the Nesbitt property are 41° 24' 09.1995" N. latitude and 75° 57' 34.8850" W. longitude. The property is within the headwaters of several waterways that primarily drain either to Leonard Creek (to the west) or to Whitelock Creek (to the east).

The property is located to the east of State Route 309, south of Monkey Hollow Road, west of Demunds Road, and north of Lake Catalpa Road. It is about 9.5 miles northwest of

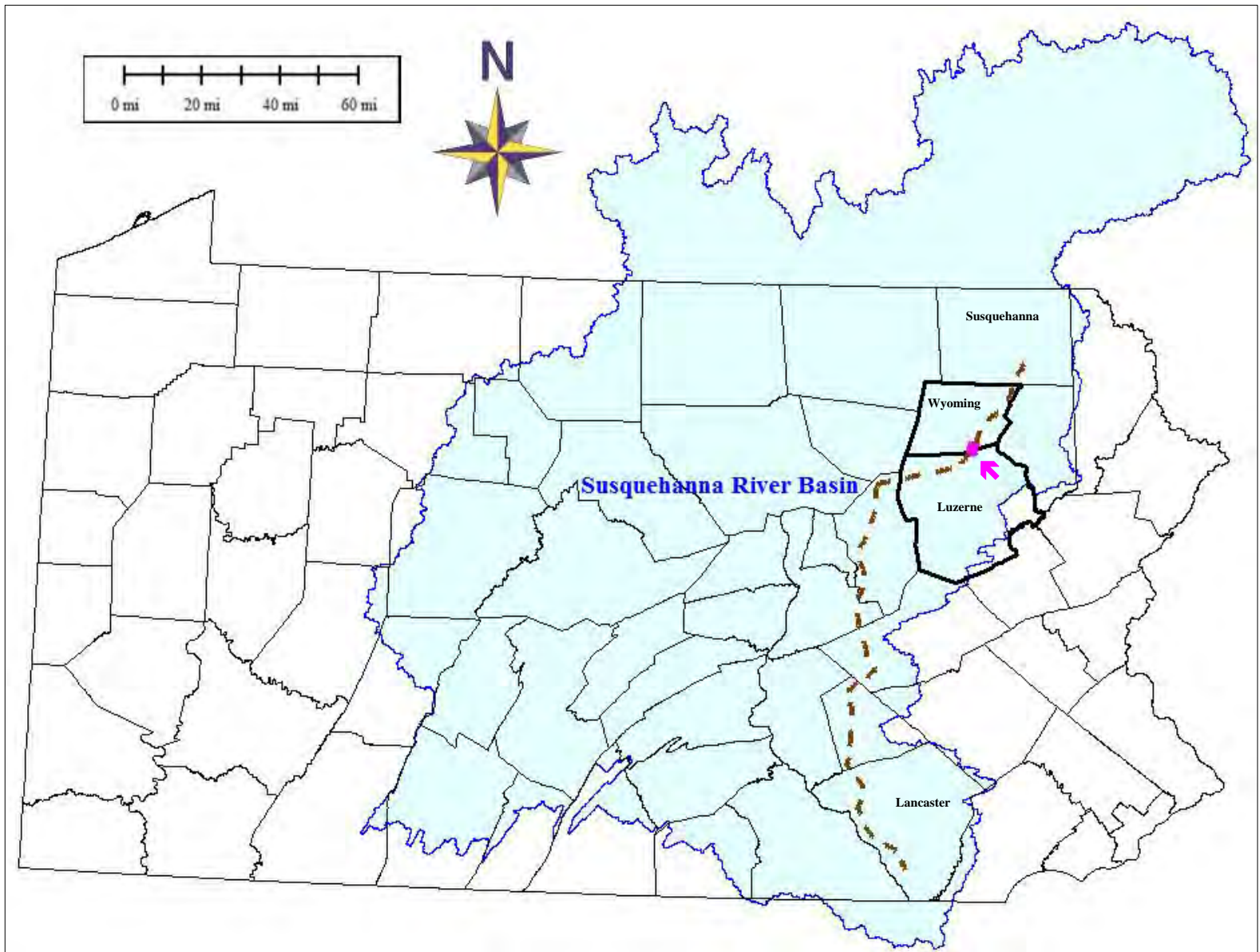


FIGURE 1. PA LOCATION MAP. Identification of the Nesbitt property (at arrow) in northeastern Pennsylvania along the border of Luzerne and Wyoming Counties. It is in the eastern section of the Susquehanna River Basin (blue). The route of the proposed Atlantic Sunrise pipeline also is shown (brown dash).

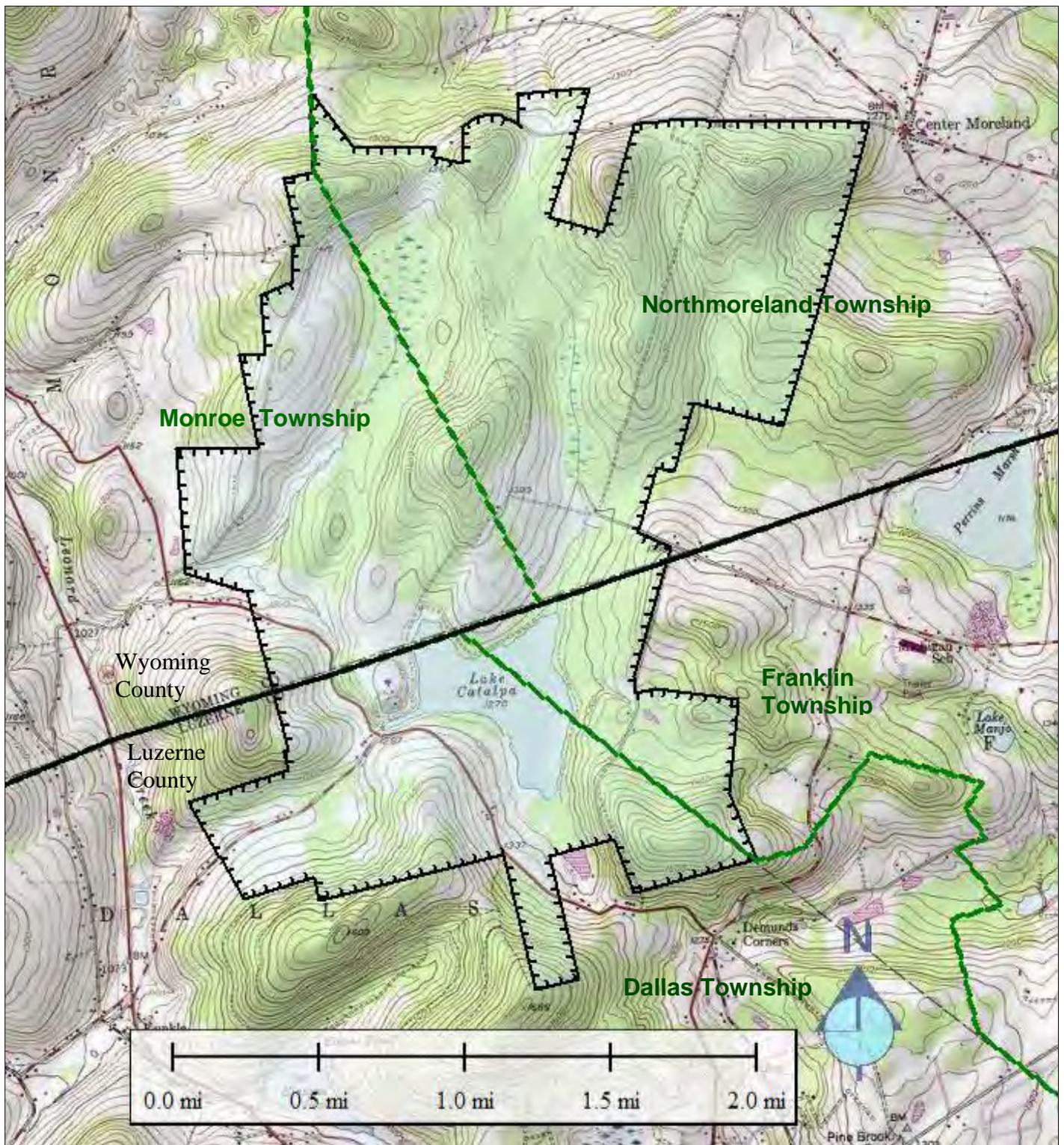


FIGURE 2. USGS LOCATION MAP Identification of the Nesbitt property (blue shading, toothed outline) in Dallas and Franklin Townships (Luzerne County) and Monroe and Northmoreland Townships (Wyoming County), Pennsylvania. Basemap is the Center Moreland PA topographic quadrangle.

Wilkes-Barre, about 11 miles west of Scranton, and about 88 miles northeast of Harrisburg. Onsite surface elevations range from about 1,170 to nearly 1,700 feet above sea level. The lowest elevations are where drainageways exit the site (in the west where the unnamed tributaries flow toward Leonard Creek, and in the northeast near Center Moreland where unnamed tributaries flow toward Whitelock Creek). Elevations along the northern border of the property generally range from about 1,300 to 1,400 feet. The highest elevation (about 1,680 feet) is in the southern corner of the rectangular section of the site that extends south from Lake Catalpa Road.

WATER RESOURCES

Waterways

The Nesbitt property is in the northeastern section of the Susquehanna River basin in Pennsylvania, about 5.5 miles west of the Susquehanna River (PA-designated WWF [warm water fishes]). It is in the headwaters of several major named streams of very high quality. Most of the property (about 79%) is within the drainage area of Leonard Creek (PA-designated HQ-CWF [high quality-cold water fishes]), which flows south to north about one-half mile to the west of the property. Two main unnamed tributaries to Leonard Creek rise onsite: one in the northcentral section (this one flows through Lake Catalpa) and the other in the northwestern section of the property. Those tributaries flow generally southward and westward, and join before exiting the western side of the property.

About 16% of the property drains to Whitelock Creek (PA-designated CWF) which arises in the northeastern section of the property and flows generally to the east. Several small sections along the northern part (about 4%) of the Nesbitt property drain northward toward Marsh Creek (HQ-CWF). A very small area in the southeastern section (1%) of the Nesbitt property flows either southeastward toward Sutton Creek (CWF) or southward toward Trout Brook (CWF) .

Whitelock Creek (including the reach that extends onto the Nesbitt property), Leonard Creek, and Marsh Creek all are designated natural reproduction trout waters according to the Pennsylvania Fish & Boat Commission. As such, any wetlands within their floodplains are considered "exceptional value" wetlands in accordance with Pa Code 105.17(1)(iii). All exceptional value wetlands also are Exceptional Value waters according to the Commonwealth's antidegradation policies at Pa Code 93.4b(b)(2), which makes them Tier 3 Outstanding National Resource Waters for federal purposes.

The NHD (National Hydrography Dataset) identifies only major streams and some of their tributaries, but many more watercourses are subject to federal and state protective regulations (those with defined bed and banks, with perennial or intermittent flow, and that

support two or more taxa of aquatic invertebrates). The major named waterways on and near the property, according to the NHD, are shown on **Figure 3**.

In addition to the streams identified by NHD, there are many smaller drainageways on the Nesbitt property and elsewhere. LiDAR¹ (Light Detection and Ranging) topographic mapping for this area was used by Schmid & Company in a GlobalMapper GIS program to identify additional drainageways on and near the Nesbitt property. **Figure 4** identifies additional drainageways on and near the Nesbitt property based on this LiDAR information, including many that Transco has identified along its alternative routes.

Wetlands

Wetlands have been field-delineated along the section of the proposed CPL North route that crosses the Nesbitt property. Wetlands initially were delineated by consultants for Transco during August 2015. Schmid & Company and Icarus Ecological Services, Inc. inspected the Transco wetland delineations during November 2016 and made several adjustments to reflect additional on-ground conditions of hydric soils, hydrophytic vegetation, and wetland hydrology. Schmid & Company revised sections of three wetlands within the proposed Transco ROW corridor, increasing the total wetland acreage by 0.46 acre to 3.43 acres (15.5% more than the 2.96 acres delineated by Transco). Almost all (98.8%) of the wetlands in the pipeline corridor on the Nesbitt property are forested, contrary to the assertions by Transco that 86.6% are forested. A formal Jurisdictional Determination (JD) was requested by the landowner on 27 December 2016 from the Baltimore District, Army Corps of Engineers (Kunz 2016) to confirm the nature and extent of wetlands (and waterways) within the pipeline corridor on the Nesbitt property.

PROPOSED ATLANTIC SUNRISE ROUTE AND ALTERNATIVES

In the vicinity of the Nesbitt property, Transco recently has been considering three alternative alignments (**Figure 5**). The initially-proposed alignment of the pipeline², as described in Corps Public Notice PN-16-30 (dated 16 May 2016), extends approximately 4.9 miles, of which 4.2 miles are on the Nesbitt property. It crosses the southern and eastern sections of the Nesbitt property, most of which are remote from existing roads, farmfields, ROWs, homes, or other disturbances. In Public Notice PN-16-68 (dated 21 December 2016), the Corps described four main alternative alignments along the Atlantic Sunrise pipeline that were being investigated by the applicant. One of the four, known as

¹ LiDAR data is available from the PA Map Program of the Pennsylvania Department of Conservation and Natural Resources (PA-DCNR), Bureau of Topographic and Geologic Survey. It consists of a raster digital elevation model based on 2006-2008 photography with a horizontal ground resolution of 3.2 feet.

² The alignment through the Nesbitt property was approved by FERC during February 2017 and has subsequently been referred to in the FERC records as the "Certificated Route".

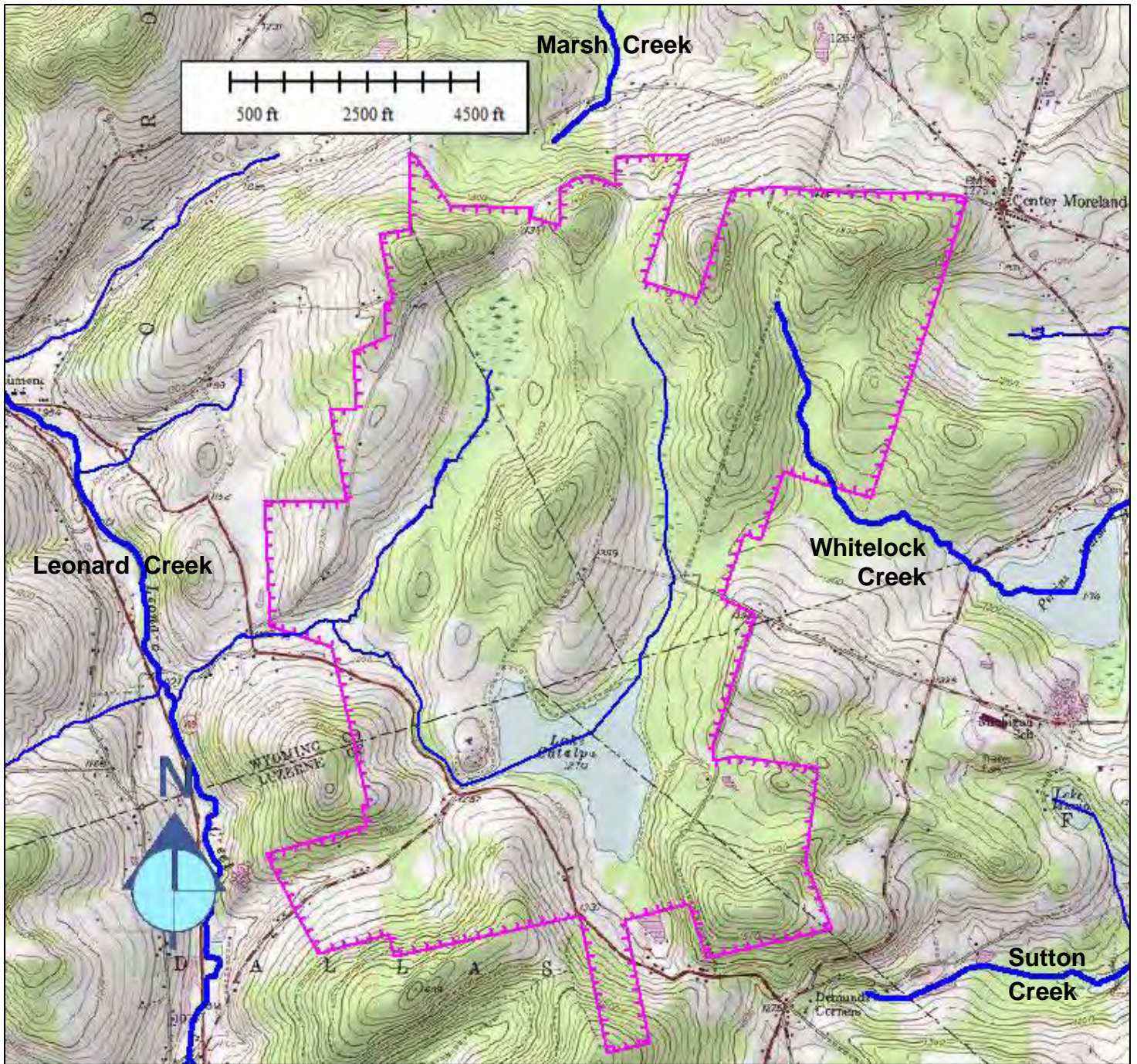


FIGURE 3. Major named streams (heavy blue) and their tributaries (thin blue) on and near the Nesbitt property (purple outline) according to the National Hydrography Dataset (NHD). Basemap is the USGS topographic map.

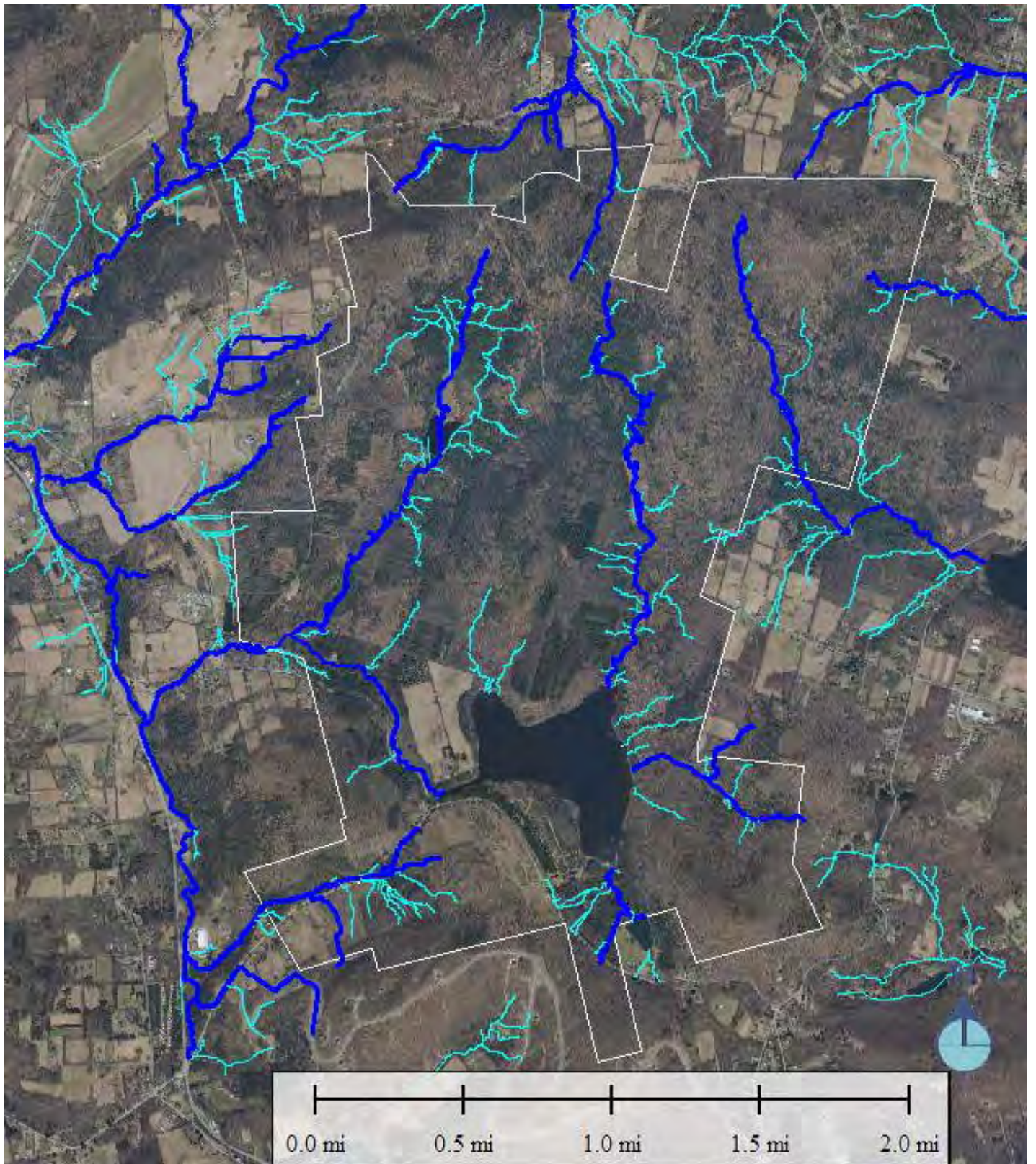


FIGURE 4. Principal waterways (dark blue lines), primarily based on NHD (see Figure 3) as well as additional drainageways (light blue lines), primarily derived from LiDAR topographic information, on and near the Nesbitt property (white outline).

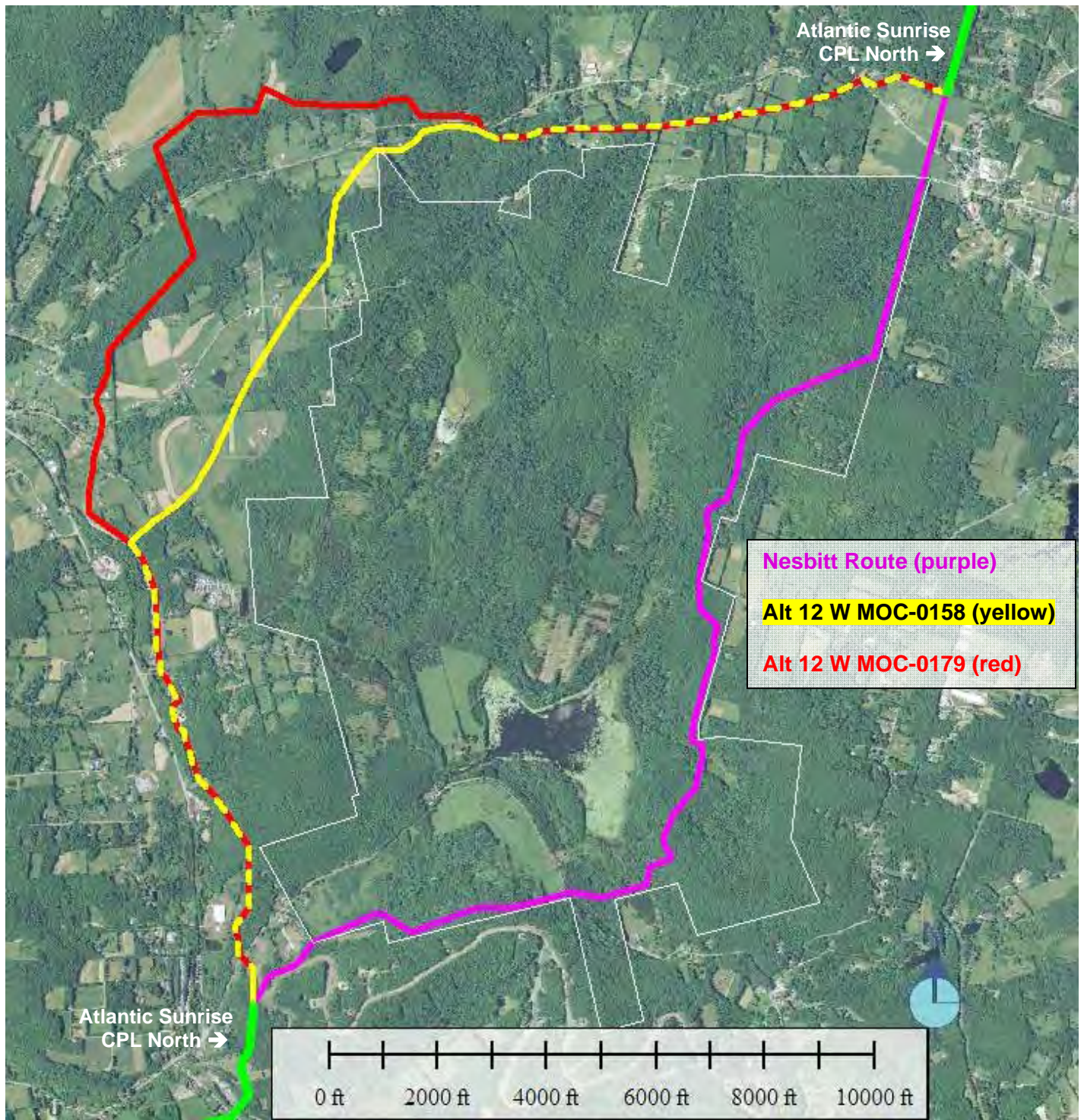


FIGURE 5. Identification of the three alternative routes, as depicted on a recent summer (leaf-on) aerial photograph. Nesbitt property is outlined in white. The three routes join the Atlantic Sunrise CPL North corridor (green lines) where noted. The beginning and ending alignments of the two 12 West Alternatives are the same (yellow and red dash).

"Alternative 12A (Nesbitt alternative)", involved a route that would avoid the Nesbitt property and extend around it to the west and north. Subsequently, very minor modifications of Alternative 12A (by then called Alternative 12 West, and most recently called MOC-0158) were proposed for consideration. That alternative extends 5.5 miles. In Public Notice PN-17-15 (dated 31 March 2017), the Corps described a new alternative alignment that avoids the Nesbitt property and is largely the same as "MOC-0158", but which deviates from it along a 3-mile segment that extends further to the northwest. This newest alignment is identified as "Revised Alternative 12W, or MOC-0179³", and extends 6.5 miles. The proposed installation of each of these alternative alignments is to be by open cut trench. This evaluation evaluates and compares impacts associated with the Nesbitt alignment, MOC-0158, and MOC-0179 to the extent possible using available information.

EVALUATION OF THE NESBITT ROUTE AND 12 WEST ALTERNATIVES

The Nesbitt route is the shortest (4.9 miles) of the three and reportedly was initially favored by Transco primarily because it involves fewer landowners (it mainly crosses the Nesbitt property). The two 12W alternatives are slightly longer than Nesbitt: by 0.6 mile (MOC-0158) and by 1.6 miles (MOC-0179). The overall length of the proposed Atlantic Sunrise pipeline is 183.7 miles, so even the longer alternative MOC-0179 represents less than a 1% increase in the total length. Each of the 12W alternatives allows significant collocation with existing pipeline or transmission line rights-of-way that have previously been disturbed (1.1 miles for MOC-0158 and 1.5 miles for MOC-0179). Collocation is a practice which Transco claims it has incorporated elsewhere along the proposed Atlantic Sunrise route to the maximum extent practicable in order to minimize project impacts. The Nesbitt alignment, however, enables zero collocation. As discussed further below, the minor deviation in length associated with either of the alternatives to the Nesbitt route is fully justified by the significant environmental and cultural impacts that would be avoided.

A reasonable comparison and evaluation of the three alternative alignments is difficult due to the fact that, until very recently, there has been very little information publicly available that was common to all three alignments. For its application to the Federal Energy Regulatory Commission (FERC), Transco developed considerable information about the Nesbitt route and the previous 12 West Alternative (MOC-0158), which was made available to the Corps, other reviewing agencies, and the general public. Indeed, a voluminous Final Environmental Impact Statement (FEIS) prepared by FERC (2016) and Supplemental Information Filings (SIFs) prepared by the applicant (Transco 2016a,b) detailed side by side comparisons of numerous features and characteristics of the two routes. By contrast, until mid-April 2017, almost no information was available regarding the latest 12W alternative (MOC-0179), and what information there was did not directly compare with information

³ In mid-April 2017, the MOC-0179 route was renamed "Alternative 13", and by letter dated 19 April 2017 to FERC, Transco requested a variance to its FERC certification to authorize use of the Alternative 13 route.

previously provided for the other alternatives.

In the Table provided in Corps PN-17-15, the newest 12 West Alternative (MOC-0179) is listed as "revised 3/3/17", so it apparently was conceived less than 2 months ago. The FERC approval had been issued a month prior to that (on 3 February 2017), so there had been little opportunity or incentive for Transco to develop detailed information for the MOC-0179 alternative. Further complicating any reasonable evaluation is the fact that relevant information about wetlands and other waters that had previously been presented for MOC-0158 apparently was inaccurate, and now has been revised significantly following field verification by Transco. Finally, we have been told that what little information currently is available for MOC-0179 regarding streams and wetlands has not yet been field-verified, and that a supplement containing the results of field verification is not expected to be submitted to the Corps for another 4-6 weeks or so. These constraints make a confident evaluation and comparison of impacts almost impossible at this time.

To date there has been no careful agency review of the accuracy of the limits and characterization of water resources claimed to exist within the corridors of any of the three alternative routes (or anywhere else along the 184-mile proposed pipeline route as far as we know). For the one area where we have detailed first-hand knowledge (the pipeline corridor through the Nesbitt property), we know that the extent of jurisdictional wetlands has been undermapped by more than 15%, that some forested (PFO) wetlands have been mischaracterized as PEM or PSS, and that the number of watercourses may be undercounted by as much as 38%. On behalf of the landowner, on 27 December 2016 we submitted a formal request to the Baltimore District Corps for a Jurisdictional Determination (JD) to correct and confirm the limits of jurisdictional wetlands and other waters of the United States in the proposed pipeline corridor at the Nesbitt property (Kunz 2016).

ROUTE COMPARISONS: Streams

As noted above, the National Hydrography Dataset identifies only the largest streams and some of their tributaries. Based on NHD mapping, the Nesbitt alignment and MOC-0158 each would cross only one waterway, and MOC-0179 would cross three waterways (see below). In reality, however, there are many more watercourses than just those mapped by NHD (see Figure 4 above). Indeed, the Corps PN-17-15 identifies 8 stream crossings for the Nesbitt route and 14 stream crossings for each of the two alternatives. Based on our GIS analysis of LiDAR-derived topographic information, we believe there may be additional (as-yet unidentified) watercourses to be crossed along each of the proposed alignments: 7 additional ones along the Nesbitt route, 1 additional one along MOC-0158, and 2 additional ones along MOC-0179 (see below). Our pending Corps JD is expected to confirm the number and location of regulated streams [and wetlands] along the proposed pipeline route on the Nesbitt property. A similar careful examination of jurisdictional waters along the two

other routes also would be justified, for the reasons discussed below.

The number of waterways reported to be crossed by the various routes keeps changing, without technical support or explanation from Transco. In a Supplemental Information Filing (SIF) it prepared in October 2016 comparing Nesbitt with another (now-eliminated) Alternative 12 West, Transco identified a total of 7 streams to be crossed by the Nesbitt route. In a Supplemental Information Filing (SIF) it prepared in November 2016, Transco revised the number of stream crossings at Nesbitt (to 8) and listed the number for MOC-0158 as 10. In Corps PN-17-15 (31 March 2017), the number of streams to be crossed by MOC-0158 has been revised to 14, a 40% increase, while the number for Nesbitt remains at 8, and the number listed for MOC-0179 is reported to be 14. In the mid-April assessment from Transco (2017), the number of streams to be crossed by MOC-0158 was reduced to 10, the number of crossings associated with MOC-0179 (*a.k.a.*, Alternative 13) was reduced to 12, and the number of stream crossings associated with the Nesbitt route was reduced to 7.

	STREAM CROSSINGS		
	<u>Nesbitt</u>	<u>12W MOC-0158</u>	<u>12W MOC-0179</u>
Crossings of Streams Identified only by NHD	1	1	3

Total Crossings per Transco Oct. 2016	7	N/A	N/A
Total Crossings per Transco Nov. 2016	8	10	N/A
Total Crossings per Corps PN-17-15	8	14	14
Total Crossings per Transco Apr. 2017	7	10	12
Probable Other Crossings (per LiDAR)	<u>7</u>	<u>1</u>	<u>2</u>
Total Associated Crossings	14-15	11-15	14-16

It is not clear what criteria Transco used to define waterways. It also is not known why the number of waterway crossings for MOC-0158 increased by 40% between November 2016 and March 2017. The revision may have been based on supplemental field verification by Transco. If that is the case, it is likely that the revised number of waterways along MOC-0158, and the preliminary number of waterways identified along MOC-0179, were influenced by field inspections conducted during late winter/early spring 2017, a time when ground wetness and streamflow locally were especially high. Given that the number of waterways along the Nesbitt route was not similarly re-investigated at the same time, it is likely that the comparison in the Table in PN-17-15 is invalid because the number of stream crossings attributed to the Nesbitt route may be too low (or those of the alternatives are too high). Although the probable total number of stream crossings associated with each route appears to be roughly comparable (approximately 15 each, see above), it is clear that the Corps needs to conduct a JD inspection of all three routes, as close in time to one another as possible, to make a final determination of the number of stream crossings associated

with each, so that it can use credible information in its decisionmaking.

The *nature* of the waterways to be crossed by each route is an equally, if not more, important consideration than the simple number of waterways to be crossed. Generalized land uses within corridors along each of the three proposed alternative routes were examined by both Transco and Icarus Ecological Services, Inc. The specific land uses reported by each and the width of the study corridors may not be precisely the same, but they reveal a similar pattern for disturbed versus undisturbed uses. The undisturbed/natural land uses identified include several different forest types, meadow, and marsh. Disturbed land uses include residences, agriculture, pasture, roads, stormwater facilities, and rights-of-way. The numbers in the table below utilize the highest number of stream crossings identified for each route (see above).

Eleven of the 12 waterways to be crossed on the Nesbitt property itself are entirely within undisturbed land uses (9 forest and 2 meadow or marsh); the 12th crosses a successional (former) pasture. The three other crossings are not on the Nesbitt property itself but are along the same route. By contrast, most of the streams to be crossed by the two 12 West alternatives are located along or entirely within disturbed land use areas. Some of those waterways are farm or roadside ditches. As the applicant itself points out (Transco 2017): *"While most stream crossings along both routes [Nesbitt and MOC-0179] are high-quality cold water fisheries, many of the stream crossings along CPL North Alternative 13 [i.e., MOC-0179] would occur in previously disturbed areas of stream reach... the Certificated Route [Nesbitt]... primarily crosses relatively undisturbed stream reaches with extensive riparian forest buffers."* A summary comparison of the land uses at each of the proposed waterway crossings is provided below.

Land Use at Stream Crossing	NUMBER OF WATERWAY CROSSINGS		
	Nesbitt	12W MOC-0158	12W MOC-0179
Undisturbed Uses both sides	11	4	6
Forest	9	4	6
Meadow/Marsh	2	0	0
Part forest/part disturbed	2	6	6
Disturbed Uses both sides	<u>2</u>	<u>5</u>	<u>4</u>
Total Crossings	15	15	16
Percent in Undisturbed Land	73%	27%	38%
Percent in Disturbed Land	27%	73%	62%

The land uses along the centerlines and within the corridors of the three routes further support the above conclusions. When compared with either of the 12W alternatives, the Nesbitt route will result in significantly greater adverse impacts due to new disturbances. The amount of interior forest proposed to be crossed by an alternative is an excellent

indicator of the amount of undisturbed land in the corridor. Transco (2017) appears to appreciate the value and sensitivity of interior forest when it quotes from the FERC FEIS: *"Interior forest has a higher habitat value for some wildlife species, may take decades to establish, and is generally considered more rare in the environment compared to edge forest, which has a lower habitat value for many species and can be created immediately with disturbance."* Indeed, the streams and wetlands on the Nesbitt property almost exclusively are located within interior forest, which further enhances their functional value. Using Transco's numbers, the Nesbitt route is clearly the least preferable because it would entail the most impact by far of interior forest (see below). MOC-0179, by contrast, would have the least impact on interior forest, only 19% as much as Nesbitt.

Similarly, the extent to which a given alignment is collocated with existing pipeline or other ROWs is another good indicator of the amount of disturbed land within the proposed corridor. MOC-0179 would allow the maximum amount of collocation with existing disturbed ROWs (1.5 miles, 23% of its local alignment), versus no collocation at all associated with the Nesbitt route. As with the numbers for waterways crossings, the impact numbers below sometimes differ depending upon the source.

<u>Land Use</u>	MILES CROSSED PER TRANSCO (except as noted)		
	Nesbitt	12W MOC-0158	12W MOC-0179
Forest	4.1	3.2	4.1
Interior forest	2.0	0.8	0.2
Agricultural land	0.3	2.1	1.3
Other disturbed uses*	0.1	0.6	1.1
ROW Collocation (mi.)	0.0	1.1	1.5
(% of alignment collocated)	(0)	(20%)	(23%)
Interior forest (ac. of impact)	24.2	11.2**	4.5**

* per Schmid & Co. measurements of Icarus land uses

** PN-17-15 reports 4.04 acres for each of these

Based on the above comparisons, the Nesbitt route would be least preferable because it crosses the most streams in forested or other undisturbed areas (11, vs 4 or 6), it crosses the most interior forest, and offers the least collocation. The 12W MOC-0158 route would be more preferable because it crosses the fewest number of waterways in entirely undisturbed forest areas (4), the fewest miles of forest overall, the most agricultural land, and most of its stream crossings are surrounded by already disturbed land uses (73%). The 12W MOC-0179 is close to MOC-0158 and almost equally preferable, with significantly fewer forested stream crossings, more disturbed-area stream crossings, and significantly less interior forest impact compared to Nesbitt.

ROUTE COMPARISONS: Wetlands

As with streams, the number of wetlands to be impacted by each of the alternative alignments reportedly has been revised, without technical support or explanation.

	WETLAND CROSSINGS		
	<u>Nesbitt</u>	<u>12W MOC-0158</u>	<u>12W MOC-0179</u>
Total Crossings per Transco Oct. 2016	7	N/A	N/A
Total Crossings per Transco Nov. 2016	11	12	N/A
Total Crossings per Corps PN-17-15	11	18	13
Total Crossings per Transco Apr. 2017	11	18	11

The total number of wetlands reported to be crossed by MOC-0158 increased by 50% (from 12 to 18) between November 2016 and March 2017, presumably due to supplemental field verification by Transco. As with the large upward revision of the number of waterway crossings (discussed above), it is likely that the number of wetlands identified along MOC-0179, and the revised number of wetlands along MOC-0158, were influenced by field inspections during late winter/early spring 2017 when ground wetness locally was especially pronounced due to recent precipitation and snowmelt.

As noted above, a formal Jurisdictional Determination (JD) has been requested from the Baltimore District Army Corps of Engineers to correct the Transco delineation of wetlands and streams along the proposed pipeline corridor on the Nesbitt property. The wetlands mapped by Transco along most of the two proposed Alternative 12 West routes were not inspected by Schmid & Company, primarily because access to many of those properties was not available. No JD was obtained or requested for the alternative ROWs by Transco. We question the accuracy of at least one area apparently delineated by Transco along MOC-0179 as herbaceous wetland: at Milepost 3.90, during our site inspection on 3 April 2017, we observed temporarily saturated conditions in this area but did not find any low chromas, mottling, or other field indicators of hydric soils (the soil survey maps an excessively drained Wyoming soil series here).

Given the above, we are reluctant to rely on the Transco-delineated extent of wetlands along the two 12 West alternative routes. Based on what we observed first-hand in the wetlands at the Nesbitt property, in particular with respect to areas of mapped hydric soils in the county soil surveys (Bush 1981, Eckenrode 1982), it is possible to estimate the extent of wetlands along the two Alternative 12 West routes. Actual wetlands commonly are found/delineated in areas where there are mapped hydric soils (map units with major components that are hydric -- typically poorly and very poorly drained soils), and also where there are map units with significant inclusions of hydric soils (typically 5% or more). Such soil inclusions locally tend to be found in depressions and drainageways. The wetlands identified on the Nesbitt property follow that pattern. Indeed, where the proposed pipeline

crosses field-delineated wetlands on the Nesbitt property (a total of 993 linear feet), most of that distance (85%) is where hydric soils or soils with hydric inclusions have been mapped in the county soil surveys.

The total extent of hydric soils and soils with hydric inclusions (**Figure 6**) is greater along the proposed pipeline route on the Nesbitt property (3,484 linear feet, 14% of the total route length) than on either MOC-0158 (2,829 linear feet, 10% of the total route length) or on MOC-0179 (1,469 acres, 4% of the total route length). Thus, it is reasonable to expect that the extent of wetlands to be crossed by either of the proposed Alternative 12 West routes is significantly less than the extent of wetlands to be crossed by the Nesbitt route.

	Nesbitt	12W MOC-0158	12W MOC-0179
Wetlands - known (linear ft along centerline)	993	?	?
Soils: Hydric + Inclusions (linear ft along centerline)	3,484	2,829	1,469

If the same proportional extent of wetlands is found along all the routes, then the length of wetlands crossed (extrapolated) is as follows:

	Nesbitt	12W MOC-0158	12W MOC-0179
Wetlands - extrapolated (linear ft along centerline)	993	806	419

Based on the above calculation, MOC-0179 would be most preferable route (has least impact on wetlands), followed by MOC-0158. The Nesbitt route clearly is the least preferable because it would directly impact the most wetlands (23% more than MOC-0158, and 137% more than MOC-0179).

The acreages of impacts reported by Transco for palustrine forested (PFO) wetlands and total wetlands along the Nesbitt route have not changed, but those of the other two alternatives have. In all cases, the proportion of impacts to forested (versus other types of) wetlands is significantly higher for the Nesbitt route than for either of the other two, which again reflects the largely undisturbed nature of the landscapes on the Nesbitt property.

	WETLAND IMPACTS (acres)		
	Nesbitt	12W MOC-0158	12W MOC-0179
PFO Wetland impacts Transco Oct. 2016	1.5	N/A	N/A
PFO Wetland impacts Transco Nov. 2016	1.5	0.1	N/A
PFO Wetland impacts Corps PN-17-15	1.5	1.2	0.9
PFO Wetland impacts Transco Apr. 2017	1.5	0.9	0.9
Total Wetland impacts Transco Nov. 2016	1.7	0.9	N/A
Total Wetland impacts Corps PN-17-15	1.7	3.1	1.7
Total Wetland impacts Transco Apr. 2017	1.7	3.1	1.6

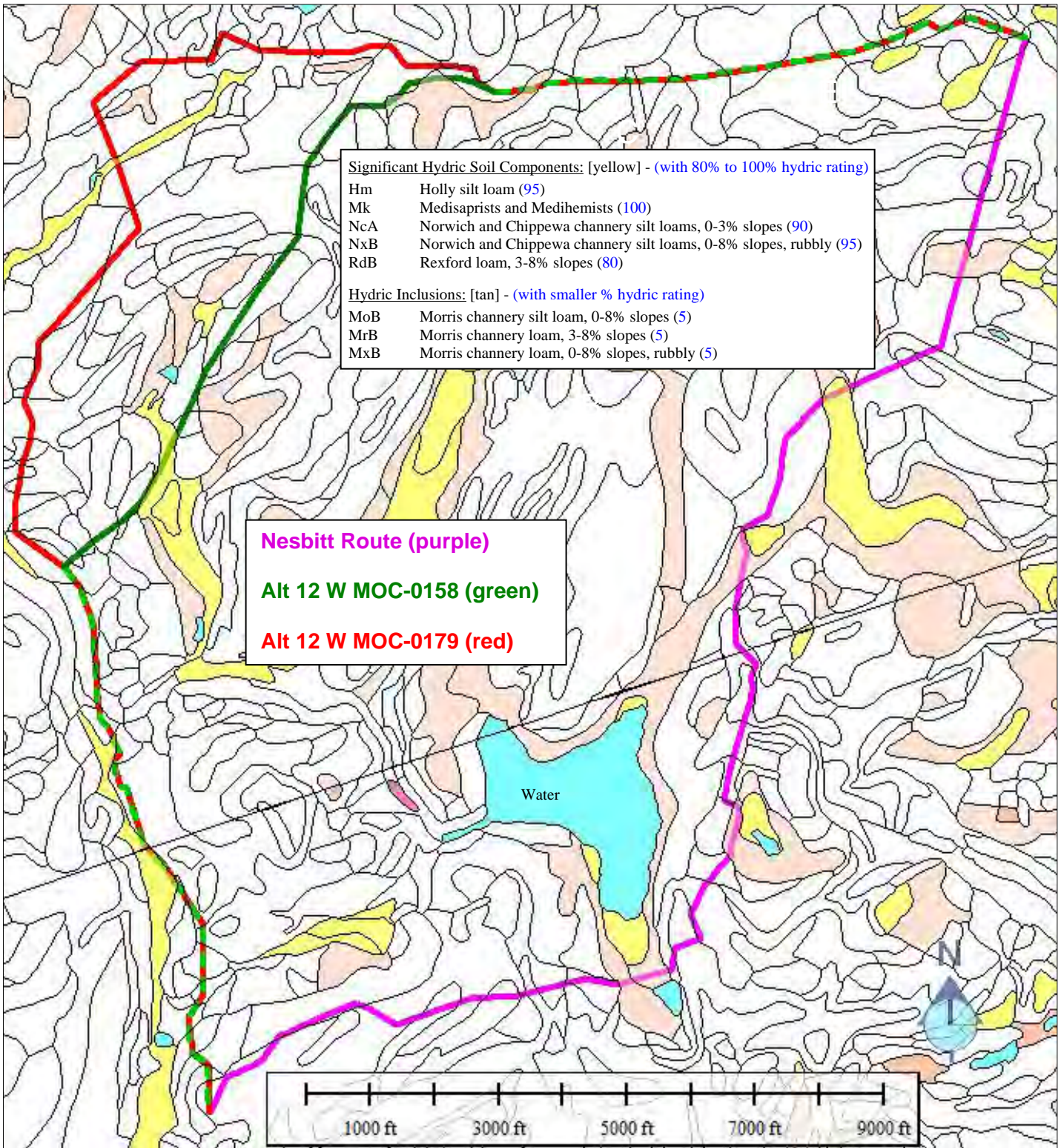


FIGURE 6: SOILS MAP. Areas in the vicinity of the subject alternative pipeline alignments near the Nesbitt property where the USDA-NRCS Web Soil Survey maps for Luzerne and Wyoming counties identify soils with significant hydric components (80% to 100% -- shaded yellow) and soils with lesser amounts of hydric inclusions (tan), which together provide a reasonable proxy for the approximate locations of wetlands. Where the two Alternative 12 West routes overlap they are identified by dashed red and green.

PFO wetland impacts associated with MOC-0158 have changed significantly, from 0.1 acre in November 2016, to 1.2 acres per Corps PN-17-15 (an 1,100% increase), and then down to 0.9 acre in April 2017. Total wetland impacts associated with MOC-0158 also changed significantly, from 0.9 acre in November 2016, to 3.1 acres (a 244% increase) per PN-17-15 (March 2017) and Transco's April 2017 assessment. There has been a slight downward revision in the reported acreage of total wetland impacts for MOC-0179 between the Corps PN and the Transco April 2017 assessment. These unexplained revisions to the numbers raise questions as to the accuracy of the underlying delineations, which could be rectified by a Corps JD inspection of all three routes at approximately the same time. **If we accept the final numbers provided by Transco for acreage impacts to PFO wetlands, then the Nesbitt route would cause the greatest damage, and either MOC-0158 or MOC-0179 would be the less environmentally damaging (more preferable) alternative.**

Besides simple acreage numbers, another important consideration is the habitat provided by the wetlands to be disturbed. The wetland habitats along the Nesbitt route are of significantly higher quality because they are largely internal forest or marsh undisturbed by past or ongoing developed land uses. All of the proposed construction is by open trenching and backfill, entailing major temporary disturbance of the ROW as well as permanent conversion of land to maintained treeless conditions. As noted by Transco (2017):

The Certificated Route [Nesbitt alignment] would impact various habitats located on the Nesbitt property which have been designated by the PA DCNR as natural communities of special concern, including Hemlock/Mixed Hardwood Palustrine Forests, the Lake Catalpa Swamp Natural Heritage Area and the Perrins Marsh Natural Heritage Area. CPL North Alternative 13 [MOC-0179] was routed to avoid these sensitive habitats.

Most (more than 54%) of the wetlands delineated along the Nesbitt route segment are within the designated core habitat area of the Perrins Marsh Natural Habitat Area (NHA), which extends across the northeastern section of the Nesbitt property (**Figure 7**). The Perrins Marsh NHA was described by the Nature Conservancy (2001) and the Pennsylvania Natural Heritage Program (2001), and its core habitat area has been officially recognized by the PA-DCNR (2016). NHAs are sites that have been identified as critical habitat for species or natural communities of concern. The Perrins Marsh NHA contains a PA-Rare aquatic plant, first identified in 1993. A thriving population of a second PA-Endangered plant population was identified at the site during a 1999 site visit --- it is the first known occurrence of the plant species in eastern Pennsylvania. Perrins Marsh also provides habitat for a diverse population of dragonflies and damselflies. A 1994 survey of the site identified twelve species of dragonflies and two species of damselflies. Eleven of the species were observed for the first time in Luzerne County. The proposed Nesbitt route crosses 1.0 mile of the core habitat area of the Perrins Marsh NHA. Neither of the 12W alternatives cross this NHA.

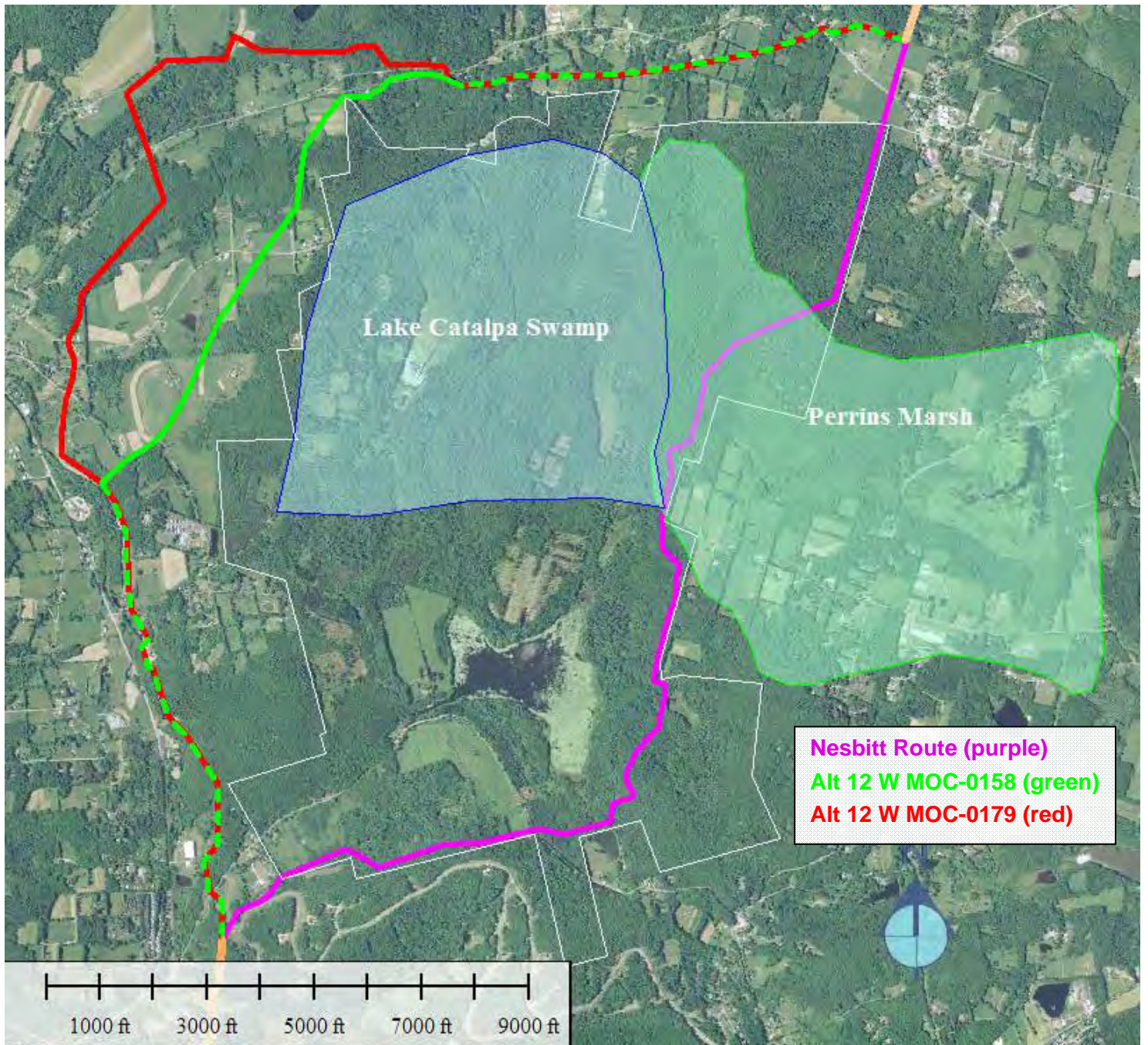


FIGURE 7. Identification of the designated core habitat areas of the Lake Catalpa Swamp Natural Heritage Area (NHA) and the Perrins Marsh NHA that extend across large sections of the Nesbitt property (white outline). The three alternative pipeline alignment segments also are shown --- the Nesbitt alignment (purple) is the only one that would adversely impact these important resources.

The proposed pipeline corridor of the Nesbitt route also crosses the southeasternmost corner of the Lake Catalpa Swamp NHA (Figure 7). According to the PA Natural Heritage Program (2001), this NHA site was first identified in 1997, and it represents a good to marginal-quality example of a Broadleaf-Conifer Swamp Natural Community. At the same time, a marginal quality PA-Rare plant species population was identified at this NHA site. The headwaters swamp contains diverse plant species including Eastern hemlock, cucumber tree, red spruce, yellow birch, paper birch, white pine, winterberry, maleberry, sphagnum moss, and sedges. Additional surveys and monitoring of the site reportedly are needed. Neither of the 12W alternatives cross or impact this NHA.

Clearly, the proposed wetland impacts associated with the Nesbitt route are significantly greater --- both quantitatively and qualitatively --- than those associated with either MOC-0158 or MOC-0179.

SUMMARY AND CONCLUSIONS

The Nesbitt property in Luzerne and Wyoming Counties, Pennsylvania, is about 2,800 acres in size. It consists largely of sensitive environmental features, including mature interior forest, several high quality watersheds, diverse wetlands, a 120-acre lake (Lake Catalpa), and areas of steep slopes. The property is within the designated core habitat areas of the Perrins Marsh Natural Heritage Area and the Lake Catalpa Swamp NHA, and also contains documented historic and prehistoric archaeological resources.

The construction of a new 30-inch petroleum pipeline, part of the Atlantic Sunrise project proposed by the Transcontinental Gas Pipeline Company, will result in significant irreparable adverse impacts to the resources of the Nesbitt property. The impacts associated with the proposed pipeline on the Nesbitt property can be avoided by the use of either of two alternative alignments (MOC-0158 or MOC-0179) proposed around the western and northern parts of the property. Either of those alignments would have dramatically less wetland impact, less forest impact, less interior forest disruption, and less impact to waterways. Furthermore, neither of the alternative alignments has the potential to adversely impact any known population of rare or endangered species. Rather, both of the alternative alignments have the advantage of collocating with more than 1 mile of existing pipeline or transmission rights-of-way, and of utilizing a high proportion of lands that already have been disturbed by development activities (residences, agriculture, and infrastructure).

In its 13 April 2017 comment letter to the US Army Corps of Engineers following numerous field inspections (Martinsen 2017), the US Environmental Protection Agency formally endorsed alternative MOC-0179 as the Least Environmentally Damaging Practicable Alternative (LEDPA), stating it "*avoids higher value interior forested wetland systems and crosses wetlands and waterways that have been recently disturbed and appear to have*

lower ecological value than the original alignment [Nesbitt] proposal". Our own analyses and evaluation of the available data regarding stream and wetland impacts lead us to concur with that assessment: alternative MOC-0179 would be the LEDPA.

AUTHORSHIP

This report was prepared by Stephen P. Kunz with the assistance of James A. Schmid. Both are senior ecologists with Schmid & Company, Inc. Mr. Kunz has worked full-time as a private sector ecological consultant since receiving a degree in human ecology from Rutgers University in 1977. Dr. Schmid is a biogeographer with more than 40 years of experience in ecological consulting. He received his BA from Columbia College and his MA and PhD from the University of Chicago. Both Mr. Kunz and Dr. Schmid are certified as *Senior Ecologists* by the Ecological Society of America and as *Professional Wetland Scientists* by the Society of Wetland Scientists.

Mr. Kunz and Dr. Schmid offer outstanding credentials as experts in ecology, wetlands, environmental regulation, and impact assessment. They have analyzed the environmental impacts of many kinds of proposed development activities in numerous states, including pipeline facilities, coal mining projects, industrial facilities, transportation facilities, commercial developments, and residential developments. They have written Environmental Impact Statements under contract to the US Environmental Protection Agency, Army Corps of Engineers, Interstate Commerce Commission, various agencies of State and local governments, and a diverse array of private sector entities. They also have commented on and prepared analyses of state and federal environmental regulations.

Additional information about Mr. Kunz and Dr. Schmid and their work over the past four decades can be found at www.schmidco.com.

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