TETRA TECH

February 29, 2016

Pamela Shellenberger/Brian Scofield
U.S. Fish and Wildlife Service
110 Radnor Rd; Suite 101
State College, PA 16801

Subject: **Revised Bog Turtle Conservation Plan**
Sunoco Pipeline, L.P. - Pennsylvania Pipeline Project Multiple Counties
(Formerly part of the Mariner East 2 Pipeline Project - Project #2014-0200)

Dear Ms. Shellenberger/Mr. Scofield:

Tetra Tech, Inc. (Tetra Tech) has been retained by Sunoco Pipeline, L.P. (SPLP) to conduct environmental field surveys and permitting services for the proposed Pennsylvania Pipeline Project (PPP). On behalf of SPLP, Tetra Tech is providing a revised Bog Turtle Conservation Plan for the Pennsylvania Pipeline Project to the U.S. Fish and Wildlife Service (Service)-Pennsylvania Field Office in response to discussions during a January 26, 2016 meeting and within the Service's February 16, 2016 correspondence. In those discussions, and in discussions between the Service and Gary Mowad of Gary Mowad Environmental Consulting, it was agreed that an interim revision of the October 2, 2016 conservation plan was in order to address the Service's meeting and letter comments. It was also agreed that submission of the revised conservation plan would precede field visits and in office meetings.

The bog turtle is documented as occurring, or assumed to occur, at several sites in and in the vicinity of the Project areas. Project-related coordination with the Service yielded information on known occupied bog turtle sites so that early planning for avoidance and minimization could be considered. Early in the project planning, SPLP went to great lengths to avoid and minimize direct and indirect impacts to bog turtles and their habitats as presented within the October 2, 2016 conservation plan. After review of that plan, the Service outlined its initial determination in regards to impacts to the bog turtle in a February 16, 2016 correspondence with Tetra Tech. In that letter, the Service provide concurrence with most of the survey findings and avoidance measures, but expressed the need for possible additional bog turtle survey, information, and avoidance and minimization. This revised conservation plan addresses that letter.

In regards to known occupied and assumed presence wetlands in and in the vicinity of the Project, the Project has been rerouted and redesigned to further reduce potential impacts to these wetlands. HDDs under C7, C8, and H1 have been eliminated and the direct impact of C44 avoided. Wetlands A55 and A54 have been combined to a single HDD so that the overall number of HDDs is reduced and activity in the area of these wetlands is minimized. Also, additional information is provided in the conservation plan in regards to two assumed presence wetlands (C37, C36) and one USFWS provided occupied wetland (C43). We feel that after further evaluation from the Service, concerns for direct and indirect impacts to the bog turtle will be alleviated in these areas (C37, C36, and C43) without the need for additional study.

The revised conservation plan also provides additional information in regards to directly impacted wetlands possessing bog turtle habitat that are potentially hydrologically connected to known occupied sites. The additional information provides detailed descriptions on the wetlands inputs and outputs, the quality of hydrological connections, as well as the quantity and quality of suitable bog turtle habitats at these wetlands. We feel that after further evaluation from the Service of this additional information, concerns for direct and indirect impacts to the bog turtle will be alleviated in these areas without the need for additional study.

Although we provide our determinations and conclusions within the revised conservation plan in regards to the wetlands discussed within the February 16, 2016 correspondence, SPLP welcomes the Service to field visit any of these areas to further discuss or collect additional information. Thank you for your assistance in this matter and we look forward to your review of the revised conservation plan. If you have any questions regarding this request, please feel free to contact me at 412.921.8167 or preston.smith@tetratech.com.

Sincerely,

Preston R. Smith
Manager, Wetlands and Ecological Services

Attachment:

Bog Turtle Conservation Plan

CC: Chris Embry, Sunoco Logistics;
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Monica Styles, Sunoco Logistics;
Gary Mowad, GMEC;
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Robin Dingle, Tetra Tech;
File 112IC05958

ATTACHMENT

Bog Turtle Conservation Plan

Bog Turtle (*Glyptemys muhlenbergii)* Conservation Plan

Pennsylvania Pipeline Project

Prepared for:

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1.0 INTRODUCTION

On behalf of Sunoco Pipeline L.P. (SPLP), Tetra Tech, Inc. (Tetra Tech) has prepared this Bog Turtle (*Glyptemys muhlenbergii*) Conservation Plan for the Pennsylvania Pipeline Project (PPP or Project). This plan provides background information and presents the proposed conservation measures developed in coordination with the U.S Fish and Wildlife Service (USFWS) Pennsylvania Ecological Services Field Office to minimize unavoidable impacts to potential habitat utilized by the Endangered Species Act listed threatened bog turtle. This plan describes the Project, summarizes bog turtle survey results, and discusses avoidance and minimization measures that will be used to minimize impacts to bog turtles to insignificant and discountable levels.

1.1 PROJECT DESCRIPTION

SPLP proposes to construct and operate the PPP to expand existing pipeline systems and provide natural gas liquid (NGL) transportation of up to 350,000 barrels per day. The Project involves the phased installation of approximately 561 miles of two parallel pipelines within a 306-mile, 50-foot-wide right-of-way (ROW) from Houston, Washington County, Pennsylvania to SPLP's Twin Oaks facility in, Delaware County, Pennsylvania with the purpose of interconnecting with existing SPLP Mariner East pipelines. Initially, a 20-inch diameter pipeline would be installed within the ROW from Houston, PA to the Twin Oaks facility (306 miles) and a second, up to 20-inch diameter pipeline, is proposed be installed in the same ROW. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Twin Oaks facility, paralleling the initial line for approximately 255 miles. Although installation of the pipelines will be staggered to a small degree, they will be installed within the same construction sequence and same season. In addition to the pipeline facilities, some aboveground facilities such as block valves and pump stations will be required to complete the Project. A general Project location map and full Project description is provided in Appendix A. The Service has been provided updated Project ArcGIS shapefiles of Project areas and aquatic resources throughout the coordination process.

1.2 LAND REQUIREMENTS

The proposed Project would result in temporary access during the construction period of proposed facilities. Construction of the pipeline would require a 75-foot wide Right-of-Way (ROW) that would contain a 50-foot wide post-construction ROW that is permanently maintained and a 25-foot wide temporary workspace that would be used to facilitate the installation of the pipelines. Following installation, the 25-foot temporary workspace unit would be restored and allowed to return to its pre-construction state unless it is within an existing, permanently maintained ROW. Additional temporary work space (ATWS) would also be needed at some areas to facilitate construction. The sizes of these workspaces would depend on site-specific requirements. All workspaces would be clearly defined within Project mapping and within agency and municipality applications. Following construction, ATWS's would be restored and allowed to return their pre-construction state unless they are within an existing, permanently maintained ROW.

Construction of the Project's aboveground facilities and the use of non-public access roads would have land requirements. New pump stations would generally require 3-4 acres of land and modifications to existing pump stations would require 2-3 acres of additional land. Support sites, such as pipe/contractor yards, are to be sited on previously disturbed areas and generally range from 5-15 acres in size. Temporary use would primarily be limited to existing non-public roads, driveways, and farm lanes that may require improvements such as widening and reinforcing sections to accommodate large vehicles. Permanent access roads to stations or valve settings may also be required. All proposed temporary and permanent access roads would be clearly defined within Project mapping and within agency and municipality applications. Following construction, temporary work spaces would be restored and allowed to return their pre-construction state unless they are within an existing, permanently maintained ROW.

2.0 CONSERVATION PLAN

On behalf of SPLP, Tetra Tech contracted several Service-recognized bog turtle surveyors to complete Phase I surveys, and Phase II and Phase III surveys (if necessary) at all wetlands within and in the vicinity of all Project workspaces, including access roads and pump stations within the range of the bog turtle. The gathered background information and survey results provided the knowledge base for the implementation of pre-construction and construction avoidance planning.

2.1 FIELD SURVEYS

2.1.1 Agency Information

The bog turtle is documented as occurring at several sites in and in the vicinity of the Project areas. Project-related coordination with the Service yielded information on known occupied bog turtle sites so early planning for avoidance and minimization could be considered. The Service provided a list of sites in an email to Preston Smith dated April 21, 2014. These Service-identified wetlands as well as all other wetlands where Project surveys confirmed species presence, are considered as 'occupied' bog turtle sites. Additionally, four wetlands that were Phase I positive were reviewed during a field visit by USFWS personnel on April 29, 2014. These were determined "not likely to adversely affect the bog turtle" as communicated in an email to Preston Smith on May 6, 2014. In addition, the Service has outlined its determination in regards to bog turtles in a correspondence with Tetra Tech in a February 16, 2016 letter. In that letter, the Service provide concurrence with most of the survey findings and avoidance measures, but expressed the need for possible additional survey, information, and avoidance and minimization. This conservation plan addresses that letter.

2.1.2 Survey Efforts

Wetlands delineations were completed along the Project area from November 2013 to January 2016. Results of these efforts were provided to bog turtle surveyors with the understanding that all wetlands without prior data (e.g., already known occupied) required Phase I evaluation with follow-on Phase II and Phase III surveys if necessary depending on the Phase I results. This evaluation was restricted to the eight counties (Cumberland, York, Dauphin (limited to the Swatara Creek Watershed), Lebanon, Lancaster, Berks, Chester, and Delaware) within the range of the bog turtle along the PPP alignment.

The investigations were conducted by numerous consultants, beginning with Phase I (habitat) surveys by Wildlife Specialists, LLC (bog turtle Surveyor: Stan Boder) in 2013. The majority of PPP bog turtle surveys were conducted in 2014, by a survey team of three sub-consultants; Aqua-Terra Environmental Ltd. (Aqua-Terra; bog turtle Surveyor: James Drasher), Environmental Consultation Services, Inc. (ECSI; bog turtle Surveyor: Kevin Keat), and Jason Tesauro Consulting, LLC (Tesauro Consulting; bog turtle Surveyor: Jason Tesauro), and Skelly and Loy, Inc. (Skelly and Loy; bog turtle Surveyors: Ben Berra, Andy Brookens, and Logan Zugay). The 2014 surveys included Phase I habitat evaluations, Phase II presence/absence surveys and Phase III trapping surveys. A final round of surveys was conducted in 2015 and early 2016 by Aqua-Terra, Skelly & Loy, and Tesauro Consulting to investigate remaining wetlands that needed Phase I and/or Phase II surveys. During the various phases and years of the bog turtle survey process, reports were prepared and submitted to the Service. There were instances where a very small number of landowners restricted access for bog turtle field surveys. These wetlands are considered 'assumed' sites for the species, in accordance with Service recommendations.

2.1.3 Summary of Survey Findings

During the PPP field survey efforts, approximately 430 wetlands or complexes were investigated for suitable bog turtle habitat (Phase I) up through the end of August 2015. Of these wetlands, 98 were found to have the combination of soils, vegetation, and hydrology typical of habitat occupied by bog turtles (i.e., Phase I positive) and 332 were found not to have these appropriate habitat characteristics

(i.e., Phase I negative). The Service agreed with the determinations for the initial 430 wetlands within their February 16th correspondence. It should be noted that survey results for several wetlands that were delineated and surveyed for bog turtles after August 2015 to accommodate Project changes have yet to be submitted to the Service. These wetlands are all Phase I negative and survey results will be submitted to the Service for review.

Species presence surveys (Phase II and Phase III) were initiated at 95 Phase I positive wetlands and three were inaccessible to perform the follow-on survey. Based on the results of these surveys, and the Project alignment at the time of the USFWS review, there are eight wetlands within the Project's limits of disturbance (LOD) and two wetlands within 300 feet of the LOD that are occupied or presumed occupied by bog turtles. These areas are referenced within the Services February 16th correspondence and present here in Table 1.

Table 1. Occupied and assumed presence wetlands that will be directly or indirectly affected by the action for project alignment prior to January 26, 2016 meeting.

Wetlands	BT Occupancy	Location
A54 (A53*)	Occupied	Within LOD
A55	Occupied	Within LOD
C6	Occupied	Within 300 feet
C7	Occupied	Within LOD
C8	Occupied	Within LOD
C36	Assumed Presence	Within 300 feet
C37	Assumed Presence	Within LOD
C43	Occupied	Within LOD
H1	Assumed Presence	Within LOD
C44	Occupied	Within LOD

*A53 is part of A54 (see Figure 1a). It is no longer referred to as wetland A53, just A54.

2.2 CONSERVATION MEASURES

SPLP has went to great lengths to avoid and minimize direct and indirect impacts to bog turtles. The wetlands that are in the vicinity or traversed by the Project and presented in Table 1 represent an initial iteration of the least environmentally damaging practicable alternative; the original alignments crossed or came in the vicinity of far more occupied wetlands. In particular, large reroutes around Marsh Creek State Park and the occupied wetlands at the Middle Creek Wildlife Management Area would have resulted in far greater impacts to this species. The initial overall Project alternative was presented to and evaluated by the Service who, in turn, provided further comment and recommendation. Those comments and further recommendations were discussed with the Service during a January 26, 2016 meeting and within the Service's February 16, 2016 correspondence. SPLP has taken those comments and correspondences seriously and this conservation plan going forward represents a further reduction in potential impacts to this species.

The following sections outline SPLP's pre-construction, construction, and post-construction avoidance, minimization, and conservation best management practice (BMP) commitments to minimize impacts to the bog turtle. These include, but are not limited to alternative Project siting and construction methodology, on-site construction sequencing, pre-construction surveys, post construction monitoring, and post-construction habitat searches.

2.2.1 Pre-construction

General Minimization and Avoidance

From the onset of the Project, SPLP has instructed Project designers to consider environmental impacts in regard to all aspects of the proposed Project and to avoid and minimize sensitive resources wherever possible while allowing safe installation. Pipeline engineers were provided a list of restrictions, recommendations, and requirements to consider during the design phase. Major considerations were co-location with existing utility corridors, limiting the construction corridor to the minimum amount practicable, use of HDD technology, and avoidance and minimization at sensitive habitats.

During the development of the Project route, SPLP worked with routing agents and property owners to minimize and avoid forested uplands and wetlands, conservation easements, and other sensitive habitats where possible. SPLP also co-located the Project alignment with other similar disturbances wherever possible, and paralleled existing SPLP maintained utility corridors for the majority of the route so that this existing maintained areas could be utilized as workspace for the PPP. SPLP has co-located the Project with a currently existing SPLP right-of-way (ROW) for approximately 80% of the Project. This is a significant means for avoiding new impacts to sensitive resources (i.e., forested wetlands, forest areas, streams) and for minimizing environmental impacts for the entire Project. SPLP has also co-located with foreign utility lines whenever possible when routing pulls away from the existing SPLP ROW. In addition, SPLP has implemented a number of route variations through environmental feedback, both minor and major, to further reduce the impacts associated with the Project. Many of these route variations are driven by environmental factors such as wetland areas occupied by sensitive species such as bog turtles. One such reroute eliminated the need to cross the Marsh Creek wetland complex. A second reroute minimized the number of wetlands traversed by the Project in the vicinity of Middle Creek.

Due to the linear nature and length of the proposed Project and the abundance of wetland and stream resources in Pennsylvania, total avoidance of all wetland crossings was not possible or practicable for this Project. However, through substantial project planning (including route selection, design of workspaces, and selection of construction and restoration methods), SPLP has avoided and minimized impacts to wetlands to the maximum extent practicable.

As stated, an important factor for wetland impact minimization was SPLP's siting of the proposed PPP ROW to parallel and overlap an existing ROW for the majority of its course. This reduced impacts to undisturbed wetland resources, by restricting portions of the construction activities to a 50-foot-wide ROW and maintaining the permanent operational ROW at 50 feet. At almost all wetland and stream crossings the construction ROW has been reduced to 50-feet wide. This is the minimum width needed to safely install the two pipelines. Additional temporary workspace areas (ATWS), permanent access roads, and permanent fills have been located outside wetland areas to further reduce long term impacts to wetlands.

Outside of routing alternatives there are construction methodologies and best management practices (BMPs) that can be implemented to reduce impacts to sensitive resources, including wetlands and streams. One of those construction alternatives implemented by SPLP to avoid and minimize environmental impacts, is the horizontal directional drill (HDD) method at areas of unique sensitivity (i.e., bog turtle habitat, rare plant populations, large rivers or reservoirs, forested wetlands, and cultural resource sites). Without HDD, typical construction methods through these areas would involve conventional pipeline trenching (i.e. open cut trenching) construction methods, resulting in significant temporary and permanent cover type conversion impacts. Specifically, conventional construction throughout the entire Project length would have required clearing, grading, and the excavation and disturbance of approximately 100 acres of wetlands and approximately 87,000 feet of stream crossings (linear length of stream in construction ROW). In comparison, with the currently proposed locations of

HDD construction, impacts have been reduced to approximately 38 acres of wetlands and approximately 52,800 feet of stream crossings.

The HDD method was considered to be a great construction method alternative for bog turtle habitats after reroute alternatives had been exhausted. Surface impacts to bog turtle wetlands traversed by the current alignment will be eliminated using successful HDD methods. The primary potential environmental impact associated with HDD involves the unintended release of drilling fluids, known as inadvertent return. Drilling fluids comprise mainly freshwater and bentonite clay and are referred to as drilling mud. If an inadvertent return occurs at the location of a wetland, it can result in the discharge of varying amounts of drilling mud into the resource. While the potential for inadvertent returns cannot be eliminated, SPLP conducted geotechnical drilling studies in the vicinity of the Project. This information was utilized in the case-by-case design of the HDD profile for each site by directing drill locations and depths to layers of stable materials to reduce the potential for inadvertent returns throughout the Project area. Cohesive soils, such as clays, dense sands, and competent rock are considered ideal materials for containment of drilling mud. In non-cohesive soils, such as gravel, a greater depth of cover is required.

Erosion and sedimentation controls will be installed and maintained in accordance with Pennsylvania's Erosion and Sediment Control Regulations and PADEP's Erosion and Sediment Control Best Management Practice (BMP) Manual to minimize direct and indirect impacts on wetlands and streams. These controls, procedures, and BMPs are emulated within the Project's Erosion and Sedimentation Control Plan, which will receive full PADEP and County Conservation Department review and approvals. In addition, SPLP has developed a stand-alone Inadvertent Return Contingency Plan that outlines the pre-construction and construction procedures for reducing the risk of inadvertent returns, as well as the procedures for inspecting, reporting, containing, and restoring discovered returns.

Bog Turtle Occupied and Assumed Presence Wetlands

After all initial reroutes and avoidance measures were implemented, the number of assumed/occupied bog turtle wetlands/complexes within 300 feet of the Project were reduced from 20 to 10 (Table 1). That alternative was initially reviewed by the Service. However, after consideration of the Service's comments at the January 26, 2016 meeting and within their February 16, 2016 correspondence, the initially proposed impacts were further reduced resulting in a revision of Table 1 and is presented in Table 2.

Table 2. Occupied and assumed presence wetlands that will be directly or indirectly affected by the action for project alignment after the January 26, 2016 meeting.

Wetlands	BT Occupancy	Location
A54	Occupied	Within LOD
A55	Occupied	Within LOD
C6	Occupied	Within LOD
C7	Occupied	Within 300 feet
C8	Occupied	Within 300 feet
C36	Assumed Presence	Within 300 feet
C37	Assumed Presence	Within LOD
C43	Occupied	Within LOD
Hl	Assumed Presence	Within 300 feet
C44	Occupied	Within 300 feet

This overall Project alternative will result in five wetlands occurring within the LOD and five wetlands avoided by the LOD. The five wetlands that remain within the Project work areas (LODs) are A55, A54, C6, C43, and C37. Figure 1a-e represents the current plans in these areas. The changes to the

alternative that have occurred since the Service's original review are summarized here organized by the general vicinity of the wetlands:

A54/A55 – this area has been exhaustively evaluated for alternatives to avoid impacts to these wetlands. The agricultural conservation easements in this area have constrained the effort and has forced SPLP to parallel their existing 8-inch line in this area. However, as an alternative to reduce the overall number of HDDs and construction activity in this area, the initially proposed two separate drills of the pipes under A54 and A55 has been consolidated to a single drill. This will allow the pipes to be deeper along a greater length when crossing underneath these wetlands and reduces the number of entry and exit holes. This change has even further reduced the potential for inadvertent returns outside of what has already been incorporated into the design (i.e., geotechnical evaluation). Also the workspace and access between these two sensitive areas will be off-limits to construction activity/disturbance and would only be utilized in case of an emergency. This greatly reduces the activity in this area and further reduces the potential for impacts.

The drill would enter/exit 250 feet from the edge of the western most boundary of the wetland A55. The drill would pass 25 feet under the western most boundary of wetland A55PEM and 60 feet under the eastern most boundary. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through is estimated to be silty sand and clay at the western end of the wetland and weathered sandstone beneath the central and eastern portion of the wetland. The drill would continue beneath the western most boundary of the wetland A54 and would enter/exit 125 feet from the eastern most edge of wetland A54. The drill would pass 60 feet under the western most boundary of wetland A54 and 20 feet under the eastern most boundary. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through is estimated to be clay, silty clay and silty sand at the eastern end of the wetland and weathered siltstone/sandstone beneath the central and western portions of the wetland. Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable. Figure 1A in Appendix C depicts the revised action in this area and the HDD drawing is provided in Appendix E.

This area will be subjected to implementing all during construction BMPs, monitoring, and the HDD timing restriction as outlined in Section 2.2.2.

C6, C7, C8 – SPLP has rerouted the Project in this area to remove the planned HDD and no longer are traversing wetland C7 or C8 with the Project. Wetland C6 was found to be unavoidable, but would be crossed with a conventional "dry" bore and this method does not use drilling fluid to facilitate the crossing. There will be no surface disturbance to C6. Figure 1B in Appendix C depicts the revised action in this area. The bore drawing is provided in Appendix E.

This area will be subjected to implementing all during construction BMPs and monitoring as outlined in Section 2.2.2. Due to the elimination of inadvertent returns, a timing restriction is not warranted.

C44 – SPLP has now routed the Project around this wetland. This wetland has been historically disturbed, due to agricultural practices and surrounding developments within its drainage basin, and has approximately 0.5 acre of designate survey area (DSA). A Phase II survey was conducted in 2014, and that effort is consistent with the 4-6 man-hours/acre of DSA listed in the survey protocol. It should also be noted that Skelly and Loy surveyed this wetland in 2003 as part of an unrelated development (known as Brookside), and did not find any bog turtles in C44. Additionally, since the DSA associated with C44 is not greater than 2 acres, per the draft Phase III Trapping Survey protocols, a Phase III survey is not warranted. Given that this wetland is now being avoided by direct disturbance, has been Phase II surveyed twice, and does not meet the criteria for a Phase III, a Phase III survey is not warranted. Figure 1C in Appendix C depicts the revised action in this area.

As a precaution, this area will be subjected to implementing all during construction BMPs and monitoring as outlined in Section 2.2.2.

C43 – This area has been exhaustively evaluated for alternatives to avoid traversing this wetland. After further evaluation of this wetland by Skelly and Loy, there is limited suitable habitat (less than .2 acre), is of low quality, and occurs in the existing maintained ROW. This area is immediately adjacent to Upper Uwchlan's Hickory Park and the wetland does exhibit some anthropogenic impacts due to the development of the park. This includes impacts from stormwater and pedestrian traffic in the wetland from a trail system that includes gabion baskets, culverts, and foot-bridges. This wetland was provided to us as occupied by the Service, likely due to proximity of a known location. SPLP would like to request the Service re-evaluate this wetland as an occupied location and would facilitate any site visits to facilitate the evaluation. Figure 1D in Appendix C depicts the action in this area. As a precaution, this area will be subjected to implementing all during construction BMPs and monitoring. However, contingent upon the Service's re-evaluation of the site as unoccupied, a timing restriction is not warranted. The HDD drawing is provided in Appendix E.

C36, C37, and H1 – Wetlands C36 and C37 were identified as assumed presence due to access constraints that prevented Phase I assessments. C36 is located approximately 85 feet from the HDD path and 510 feet from the nearest proposed land disturbance. A February 2016 evaluation of C36 and C37 has preliminary indication that they do not possess the characteristics of suitable bog turtle habitat. Snow cover prevented a complete evaluation from being performed. Once the snow cover recedes a complete Phase I evaluation will be performed.

Wetland H1 is Phase I positive wetland and does possess the characteristics of suitable bog turtle habitat. Presence is assumed at this time due to the lack of further study. The HDD that originally traversed underneath H1 for approximately 100 feet at depth of 86 to 90 feet, has been revised and pulled away from the wetland to its maximum extent without compromising the drill. The HDD, as currently designed, does not traverse under this wetland. The nearest line is 11 feet from the wetlands edge. The second pipe is 21 feet from the wetland edge. The drills remain at depth of 86 to 90 feet and are sited through bedrock and well below the ground water that is estimated to be between 25 and 38 feet based on the geotechnical study (see HDD drawing in Appendix E). After a February 2016 field visit of this wetland by Ben Berra of Skelly and Loy, it was estimated that primary, core habitat does not begin until 140 feet into this wetland from the edge nearest to the pipe alignment. Figure 1E in Appendix C depicts the revised action in this area. The revised HDD drawing is provided in Appendix E.

Contingent upon a Phase I negative result for wetlands C36 and C37, and given the fact that the pipelines no longer traverse under the wetland H1, are 140 feet from primary/core habitat, are very deep, and are in bedrock, the threat of inadvertent return occurring in or in the vicinity of H1 has been greatly reduced and nearly eliminated. The threat to the bog turtle, if occurring in Wetland H1, would be considered insignificant and discountable. However, because H1 remains an assumed presence wetland, this area will be subjected to implementing all during construction BMPs and monitoring as outlined in Section 2.2.2. A timing restriction is not warranted due to the new alignment of the HDD, depth of the HDD, and alignment through bed rock under H1.

Bog Turtle Phase II Negative with Potential Hydrological Connections Wetlands Planning

In its February 16, 2016 letter, the USFWS indicated that bog turtles usually occur in small, discrete populations occupying suitable wetland habitat dispersed along a watershed. The USFWS explained a concern for those wetlands that possess suitable habitat being directly impacted by the Project as possibly harboring bog turtles due to hydrological connections with occupied habitats. Those Project wetlands are listed and discussed below as C16, H14/H13, A52, A56, B19/20, and C38/C40. Although Phase II bog turtle surveys conducted in 2014 and 2015 failed to detect the species in these wetlands, the Service indicated that the Phase II survey protocol is usually adequate to determine species presence or probable absence, but given the quality and quantity of habitat and its location in a watershed of known occurrences, a single Phase II survey is not adequate to confirm absence of the

species. The Service requested more information on these wetlands, including a possible need to perform a site visit in a January 26, 2016 meeting and within the February 16, 2016 correspondence. As a result, Skelly and Loy evaluated the hydrological connections and provided more background on the quality and quantity of the suitable habitat and Phase II surveys in the discussions below.

C16 – Contains two small headwater seeps that flows through the wetland from west to east, and exits the wetland along its northeastern limits (Appendix D: Figure 2A). From there the hydrology is concentrated into S-C35 for a short distance (less than 50 feet) prior to its confluence with an on-stream pond (Pond-C5) located north and east of C16. Hydrology associated with Pond-C5 ultimately drains to the east via an unmapped watercourse towards Hopeland Road (and paralleling the existing 8-inch pipeline maintained areas approximately 500 feet to the north). After this unmapped and unnamed watercourse crosses Hopeland Road, it continues to flow east/northeast for approximately 500 feet until it drains into another man-made impoundment (unmapped) that is located approximately 1,000 feet north of the existing ROW and wetlands H13 and H14. This hydrology appears to then become part of a diffuse drainage system associated with a wetland complex (offsite portions of H13/H14), all of which is located on the main stem of Middle Creek (S-C85/C86), just north of the Middle Creek Reservoir.

This wetland is a small complex located on a hillside (less than favorable landscape position for bog turtles) with a very small DSA. A Phase II survey was conducted in 2014 by Jay Drasher, and the effort associated with this survey exceeded the 4-6 man-hours/acre of DSA listed in the survey protocol. The quality and size of this wetland, along with the supporting Phase II survey, does not warrant additional study.

H14/H13 – These wetlands contain headwater seep hydrology that flows in diffuse drainage patterns and well defined watercourses (S-C85/C86) in a generally southern direction towards Middle Creek Reservoir (Appendix D: Figure 2B). The hydroperiod associated with the seeps in H14 have been observed to be only seasonal, and the hydroperiod in H13 has been noted to similarly seasonal (and only slightly more productive). In 2014, through observation made during multiple field visits, both wetlands were described as lacking a constant supply of cool groundwater, and exhibited strong hydrological fluctuations due to rain events. Hydrologic contributions upstream of H14/H13 include wetlands, man-made impoundments, and Middle Creek. The hydrology associated with H14/H13 flows in a southern direction and ultimately contributes to the Middle Creek Reservoir (located approximately 2,300 south of the existing 8-inch ROW. The Middle Creek basin's hydrologic characteristics in proximity to the PPP have been significantly altered as a result of the PGC's waterfowl management activities (including impoundments, roadways, ditching, etc.).

Access to these wetlands was not authorized in 2016 due to PGC waterfowl management activities, but valid Phase II surveys were conducted in 2014 by Jay Drasher, and the effort associated with this survey exceeded the 4-6 man-hours/acre of DSA listed in the survey protocol. Mr. Drasher noted that these wetlands were marginal in regards to hydrology, and even suspended surveys in H14 due to unsuitable conditions. The DSA is not greater than 2 acres. The quality and size of the DSA at these wetlands, along with the supporting Phase II survey, does not warrant additional study.

A52 – This wetland has been significantly modified as part of agricultural activities over the years and its hydrologic characteristics have not been unaffected. The majority of this wetland appears to have been drained by a series of channelized drainage ditches, some of which have been developed or improved recently. Hydrologic contributions upslope of this wetland include additional modified drainages. A52 in proximity to the PPP includes three main drainage areas, all of which have been altered/ditched, one of which also includes a man-made pond (Appendix D: Figure 2C). The ditches in A52 combine into one main channel (S-A76) that flows from north to south through the wetland. Since the ditches associated with A52 have been excavated or have downcut over the years to significant depths (2 to 4 feet), the shallow groundwater table in this wetland complex appears to have become depressed as well. Very limited suitable bog turtle habitat remains in this degraded wetland complex due to the hydrologic alterations and the limited amount of groundwater seeps that

remain. The drainage through A52 flows in a generally southern direction, and downslope of the PPP concentrates to form a single watercourse (sans wetland) that is an unnamed tributary to large wetland complexes associated with Cocalico Creek and Blue Lake (approximately 3,000 feet south of the PPP). A52 has no direct hydrologic connections with other PPP wetlands located to the west (A54) or east (A56).

This wetland has been disturbed due to agricultural practices and has a very small DSA. A Phase II survey was conducted in 2014 by Drasher, and the effort associated with this survey far exceeded the 4-6 man-hours/acre of DSA listed in the survey protocol. Given the quality of the hydrologic connections, the quality and size of the DSA at this wetland, and the supporting negative Phase II survey, additional study is not warranted.

A56 – This wetland has been modified as part of agricultural activities over the years and its hydrologic characteristics have not been unaffected. Hydrologic contributions upslope of this wetland include additional agriculturally modified drainages. A56 in proximity to the PPP includes one main drainage channel (S-A87) as well as a man-made pond (Appendix D: Figure 2C). Limited perennial groundwater seeps are located on the western side of S-A87, and contribute to the base-flow of the channel. Suitable bog turtle habitat is limited in this degraded wetland complex due to the hydrologic alterations and the reduced amount of perennial groundwater seeps that remain. The primary habitat area is associated with a seep area that appears to have been historically ditched, but not maintained. The drainage through A56 flows in a generally southern direction, and downslope of the PPP concentrates to form a single watercourse (sans wetland) that is an unnamed tributary to Blue Lake (Cocalico Creek Drainage) approximately 3,000 feet south of the PPP. A56 has no direct hydrologic connections with other PPP wetlands located to the west (A54 and A52) or east.

This wetland has been disturbed due to agricultural practices and has an approximate DSA of 0.65 acre. A Phase II survey was conducted in 2014 by Drasher, and the effort associated with this survey far exceeds the 4-6 man-hours/acre of DSA listed in the survey protocol. Given the quality of the hydrologic connections, the quality and size of the DSA at this wetland, and the supporting negative Phase II survey, additional study is not warranted.

B19/B20 – Hydrology in wetland B19/20 consists of a few small seeps with hydroperiods that may not be persistent year-round. The upslope drainages to B19/20 are primarily wooded, and the general flow of hydrology through these wetlands is west to east. One primary channel (S-B18) and two other channels (S-B19 and S-B20) flow in an easterly direction through the wetland B19/B20 complex (Appendix D: Figure 2E). The primary channel (S-B18) ultimately flows under the Pennsylvania Turnpike (I-76) and confluences with Marsh Creek approximately 1,200 feet east of the PPP. It should be noted that the unnamed channel connecting B19/20 to Marsh Creek must flow under Fairview road and the Pennsylvania Turnpike prior to confluencing with Marsh Creek.

These wetlands contain less than ideal potential bog turtle habitat (hillside landscape position, marginal vegetation, etc.) and less than 1 acre of DSA. A Phase II survey was conducted in 2014 by Drasher, and the effort associated with this survey is consistent with the 4-6 man-hours/acre of DSA listed in the survey protocol. Given the quality of the hydrologic connections, the quality and size of the DSA at this wetland, and the supporting negative Phase II survey, additional study is not warranted.

C38/C40 – These wetlands are associated with seeps and springs, and flashy, eroded watercourses. Wetlands C38 and C40 are hydrologically connected downslope of the PPP via offsite wetland habitat, and watercourses S-C72 (drains through W-C38) and S-C73 (drains through W-C40) (Appendix D: Figure 2E). Upslope of the PPP and the adjacent Pennsylvania Turnpike, the drainage basin to C38 consists of a highly developed residential subdivision and agricultural lands. The drainage basin upslope of the Pennsylvania Turnpike associated with C40 consists of the delineated W-Q79 and its associated watercourses (S-Q88 and Q87). Perennial watercourse Q88 (Black Horse Creek) is the same watercourse identified as C73 on the south side of the Pennsylvania Turnpike. The Black Horse

Creek drainage basin contains a wooded riparian area surrounded by highly developed areas of residential communities. Although there are perennial seeps and springs associated with wetlands C38 and C40, the watercourses associated with these wetlands are incised 2 to 3 feet and have promoted the drainage and depression of the shallow groundwater table (and subsequently reducing potential bog turtle habitat supported by perennial spring/seep hydrology). Watercourses C73 (Black Horse Creek) and C72 drain in a south/southwestern direction through C38/40 and confluence just north of the bridge carrying Little Conestoga Road over Black Horse Creek (located approximately 730 feet from the PPP). Downstream of Little Conestoga Road, Black Horse Creek drains into a finger of Marsh Creek Lake.

These wetlands contain about 1.5 acres of DSA, most of which is, "suboptimal for bog turtles", per Jay Drasher's Phase II evaluation. A Phase II survey was conducted in 2014 by Drasher, and the effort associated with this survey is consistent with the 4-6 man-hours/acre of DSA listed in the survey protocol. Given the quality of the hydrologic connections, the quality and size of the DSA at this wetland, and the supporting negative Phase II survey, additional study is not warranted.

Training

Environmental training will be required for all personnel working in the ROW. Training will include a section on wildlife protection focusing on sensitive species such as the bog turtle. Training will involve the identification of the LOD, specific construction requirements, and any timing restrictions placed on HDD activities at bog turtle wetlands.

2.2.2 Construction

A Bog Turtle Specialist (Specialist) will be on site during all construction activities occurring across or in the vicinity of bog turtle wetlands. Those bog turtle wetlands that will be monitored are listed Table 1 and include A54 (HDD), A55 (HDD), C6 (dry-bore), C7 (adjacent wetland), C8 (adjacent wetland), C36 (adjacent wetland), C37 (HDD), C43 (HDD), and H1 (adjacent wetland). The Specialist's responsibility will be to monitor the pre-construction, construction, and restoration activities to ensure that this conservation plan is being implemented to its fullest extent and that work areas are not being exceeded and Project plans are being carried out. The Specialist will also ensure that construction personnel are trained and that the proper bog turtle BMPs are implemented, maintained, and clean-up.

The Specialist will inspect the surveyed (e.g. staked) LODs and marked access roadways prior to disturbance to ensure that they match Project plans. The Specialist may need to clear vegetation to a height of 4 inches in some areas prior the start of construction to allow for effective monitoring. Surveys for bog turtles will occur prior to commencing any work related activities including the installation of protective silt fencing. Daily surveys will be conducted in each active work space prior to construction each day.

The boundaries of bog turtle habitat in close proximity to work areas will be temporarily marked to ensure that no activities are unintentionally conducted within bog turtle wetlands. Vertical curbing made of silt fence (minimum 10 inches in height) will be installed along the entire wetland/upland boundary in work areas adjacent to bog turtle wetlands to prevent stormwater from flowing from work areas into the main wetland and to prevent bog turtles from accessing the proposed work spaces. The interior and exterior of these barriers will be kept free of vegetation and will be monitored daily. This silt fencing will also be used to "wall-off" any upland areas in the vicinity of bog turtle wetlands to further prevent bog turtles from entering project workspaces. The fencing locations, installation, maintenance, and cleanup will be closely monitored by the Specialist.

To protect water quality, stringent soil and water protection measures will be required and implemented during construction. In addition, when revegetating and stabilizing soils, an appropriate seed mix will be used to avoid the propagation of invasive and exotic plant species. These commitments will be emulated within the Projects Erosion and Sedimentation Control and Pollution and Prevention plans

that will receive state and county approvals. These erosion control measures will also remain after construction is complete and will be monitored until the Projects area is sufficiently vegetated. The Specialist's will inspect the areas of these BMPs for bog turtles prior to final clean-up.

The primary minimization measure that SPLP will implement is the HDD, and are designed to eliminate surface disturbance to bog turtle wetlands. Three HDDs are planned that involve bog turtle wetlands: the first HDD crosses both A54 and A55 (Appendix C; Figure 1A), the second crosses just C43 (Appendix C; Figure 1D), and the third crosses only C37 (Appendix C; Figure 1E). All three HDDs involve the installation of two pipelines and will occur in the same construction season. No other bog turtle wetlands occur in the vicinity of these HDDs expect at the HDD under C37, wetlands C36 and H1 are in vicinity of the HDD (Appendix C; Figure 1E).

However to further lend protection to this species, a seasonal restriction on HDDs at bog turtle wetlands will be imposed. As mentioned previously, the primary potential environmental impact associated with HDD involves inadvertent returns. A potential risk of an inadvertent return occurring in a bog turtle wetland is a hibernating turtle being forced from its hibernacula into winter elements. Therefore, SPLP will conduct HDDs at bog turtle wetlands only during their active season between April 1 and October 1. This will prevent the incidental direct take of hibernating bog turtles.

Should an inadvertent return occur, SPLP has developed a bog turtle-specific contingency plan (Appendix F). This plan outlines procedures to be implemented to avoid potential impacts to the bog turtle at the relevant HDD locations. A listing of HDD sites is provided in Attachment C of that plan with the special bog turtle HDDs highlighted. Construction personnel will be provided detailed construction plans for each HDD and will be required to implement all erosion and sedimentation control measures in this contingency plan.

2.2.3 Post-construction

Post-construction measures include restoring and stabilizing uplands in proximity to bog turtle wetlands. Disturbed soils in adjacent uplands will be stabilized and restored per the Erosion and Sedimentation Control and Pollution and Prevention Plans. Post-construction monitoring of these areas will be conducted to ensure that proper revegetation of native plant species occurs. SPLP does not anticipate any potential impacts to occupied bog turtle habitat and does not anticipate the need for restoration actions within any of the listed bog turtle wetlands.

After the completion of construction activities, one post-construction survey will be conducted by a Service-recognized bog turtle surveyor to monitor the identified populations. The post-construction site visit will document completed Project activities in the vicinity of the identified populations and follow Phase II survey protocols. A brief letter report summarizing the results of the post-construction monitoring will be submitted to the Service.

No mowing, signs will be placed along the boundary of the in-ROW bog turtle wetlands to prevent mowing within the wetland during post-construction routine pipeline ROW operation and maintenance activities. Additional signs will be placed at the edge of Zone 2 (300 feet from the edge of the wetland) to demarcate the limit of herbicide application within the ROW. Mowing within the Zone 2 areas will only occur between October 1 and April 15 to avoid impacts to nests and eggs and hatchlings.

3.0 CONCLUSION

This bog turtle Conservation Plan for the Pennsylvania Pipeline Project provides SPLP's commitment to avoidance, minimization, and conservation measures to prevent impacts to the bog turtle within the Project area. SPLP has conducted extensive background research and field surveys to identify bog turtle occurrence and habitats within and adjacent to all Project work areas. These surveys provided the foundation for the development of this plan.

SPLP has gone to great lengths to route the Project around occupied or assumed occupied sites. Of the 20 wetlands known or assumed to be occupied, 10 are found within 300 feet of the Project. Of those 10, five are adjacent (within 300 feet of the Project) and five will be traversed by the pipelines. As a standard practice for avoiding impacts to the bog turtle, SPLP will cross four known occupied or assumed/occupied bog turtle wetlands utilizing HDD technology during the turtle's active period (April 1 to October 1). A fifth occupied wetland will be traversed with dry-bore. SPLP will also commit to protection of these habitats through operation of the pipelines through the installation of no mowing signs and limiting herbicide applications. The remaining five adjacent wetlands will be protected through implementation of the BMPs outlined within this conservation plan.

Through the design of the Project, SPLP has minimized disturbance to bog turtle wetlands as much as operationally possible by implementing pipeline reroutes around and HDD under bog turtle wetlands. The primary concern with HDD is the release of drilling mud into a sensitive resource. While the potential for inadvertent returns cannot be eliminated, SPLP has or will implement pre-construction and construction minimization measures to reduce the potential for negative indirect or direct impacts on bog turtles. Given these measures, direct take of bog turtle is not reasonably likely to occur. Additionally, the Project's habitat modification will not reach the threshold of take established in the regulatory definition of harm, thus indirect take will not occur as well.

Based on SPLP commitments to the protection and conservation of bog turtles and what is known about the presence and/or potential presence of this species in the vicinity of the Project areas, we conclude that the PPP has reduce potential impacts to insignificant and discountable levels and the Project is not likely to take or adversely affect the bog turtle.

APPENDIX A
Project Description and Overview Map

PENNSYLVANIA PIPELINE PROJECT

"PROJECT DESCRIPTION"

Sunoco Pipeline, L.P. (SPLP) proposes to construct and operate the Pennsylvania Pipeline Project (Project) that would expand existing pipeline systems to provide natural gas liquid (NGL) transportation of up to 350,000 barrels per day. The Project involves the installation of approximately two parallel pipelines within a 306-mile, 50-foot-wide right-of-way (ROW) from Houston, Washington County, Pennsylvania to SPLP's Marcus Hook facility in Delaware County, Pennsylvania with the purpose of interconnecting with existing SPLP Mariner East pipelines. A 20-inch diameter pipeline would be installed within the ROW from Houston to Marcus Hook (306 miles) and a second, up to 20-inch diameter pipeline, will also be installed in the same ROW. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Marcus Hook facility, paralleling the initial line for approximately 255 miles.

PURPOSE AND NEED

The Project will provide transportation service for up to 700,000 barrels per day of NGL's with the combined pipelines from the Utica and Marcellus Shale formations for both domestic and international markets. This Project will transport propane, butane and ethane. SPLP's upstream customers currently extract natural gas in the form of methane from the aforementioned geologic formations for distribution to the community. The natural gas will provide fuel for power generation, heating and cooking. NGLs are separated from the natural gas stream before it is shipped on the natural gas piping network. Upstream shippers are currently limited by the shortage of NGL transport systems. The Project will supply additional transportation services to ship these NGLs to an existing port facility. In addition, the Project will provide along its route across Pennsylvania various exit points for supply of desperately needed propane supplies, at affordable prices, to local Pennsylvania distributors for use as heating and/or cooking fuel by consumers in Pennsylvania and neighboring states, especially during peak demand periods when supplies would otherwise become short.. In addition, when completed, the Pennsylvania Pipeline Project will promote sustained economic development and jobs-creation throughout multiple regions in Pennsylvania.

FACILITIES AND SUPPORT SITES

Pipeline Facilities

The Project includes two new, up-to 20-inch diameter pipelines with maximum operating pressures (MOPs) of 1,480 pounds per square inch gauge (psig) installed within or adjacent to 306 miles of existing ROW corridors. The majority of the new ROW will be co-located adjacent to existing utility corridors, including approximately 230 miles of pipeline that will be co-located in the existing SPLP Mariner East pipeline system that is currently used for the transportation of NGL's. The following provides the details of the proposed pipeline facilities:

- Pipeline 1: Houston, Pennsylvania to Marcus Hook, Pennsylvania – This is an incremental expansion of the capacities of Sunoco Logistics to transport NGL's to the Marcus Hook facility. This Phase of the Project will include a 20 inch diameter steel pipeline and pump stations. The route of the pipeline is either inside or

adjacent to the existing Sunoco pipeline corridor and is approximately 306 miles long.

- Pipeline 2: Delmont, Pennsylvania to Marcus Hook, Pennsylvania –The pipeline route for the second pipeline will include 255 miles of pipeline that will parallel Pipeline 1.

Table 1. Pennsylvania Pipeline Project Pipeline Facilities

Type of Facility	Description	State	Pipeline 1 Length (miles)	Pipeline 2 Length (miles)	County
Pipeline	Installation of a 20-inch new butane/propane line from Houston PA to Marcus Hook, PA and up to 20-inch new ethane line in parallel from Delmont, PA to Marcus Hook, PA	PA	**19.9** **9.1** **37.8** **18.8** **23.3** **23.5** **26.2** **3.0** **10.4** **33.1** **6.5** **11.5** **19.7** **7.5** **20.4** **24.0** **11.7**	**0.0** **0.0** **15.0** **18.8** **23.3** **23.5** **26.2** **3.0** **10.4** **33.1** **6.5** **11.5** **19.7** **7.5** **20.4** **24.0** **11.7**	Washington Allegheny Westmoreland Indiana Cambria Blair Huntingdon Juniata Perry Cumberland York Dauphin Lebanon Lancaster Berks Chester Delaware
	Project Total		**306.4**	**254.6**	

Aboveground Facilities

Aboveground facilities in **Pennsylvania**:

- Houston, Pennsylvania has an existing facility which will connect to the pipeline. This Project will install meters on the outlets from existing storage, injection pumps, control valves, associated piping and accessory structures. Some new land disturbance may be required to accommodate this modification.

- Delmont, Pennsylvania has an existing site and this Project will expand the pump station with added booster pumps, associated piping and accessory structures. Some new land disturbance within the existing station site may be required to accommodate this modification.

- Ebensburg, Pennsylvania, SPLP will construct a new pump station with booster pumps, leak detection metering, associated piping and accessory structures adjacent to an existing station.

- Mount Union, Pennsylvania has an existing pump station and this Project will expand the pump station with added booster pumps, associated piping and accessory structures. Some new land disturbance may be required to accommodate this modification.

- Doylesburg, Pennsylvania has an existing pump station and this Project will expand the pump station with added booster pumps, associated piping and accessory structures. Some new land disturbance may be required to accommodate this modification.

- Middletown, Pennsylvania has an existing pump station and this Project will expand the pump station with added booster pumps, associated piping and accessory structures. Some new land disturbance may be required to accommodate this modification.

- Beckersville, Pennsylvania has an existing pump station and this Project will add to the pump station with leak detection metering, associated piping and accessory structures. Some new land disturbance may be required to accommodate this modification.

- Twin Oaks, Pennsylvania is an existing site and this Project will install custody transfer meters and control valves. Some new land disturbance may be required to accommodate this modification.

- There are 53 Mainline Valve sets planned for this Project, which will be placed at as many existing valve sites as possible. Some new land disturbance may be required to accommodate this modification.

Table 2. Pennsylvania Pipeline Project - Aboveground Facilities

Type of Facility	New/ Modification	Description	State	County
Pump Station	Modification	Houston	PA	Washington
Pump Station	Modification	Delmont	PA	Westmoreland
Pump Station	New	Ebensburg	PA	Cambria
Pump Station	Modification	Mt. Union	PA	Huntingdon
Pump Station	Modification	Doyelsburg	PA	Perry
Pump Station	Modification	Middletown	PA	Dauphin
Pump Station	Modification	Beckersville	PA	Berks
Meter Site	Modification	Twin Oaks	PA	Delaware

Support Sites (Company Material Storage Yards)

Pipe for the project will be stored at three existing storage yards. They are:

1. Durabond facility in McKeesport, PA.
2. Letterkenny Army Depot in Chambersburg, PA
3. York storage yard in Manchester, PA

Materials for fabrication of the above ground facilities on the project will be stored at an existing warehouse area located at Beach Bottom, WV. and at an existing warehouse at the Letterkenny Army Depot in Chambersburg, PA. Contractors will draw material from these Company yards as required during the construction of the project.

Support Sites (Pipe / Contractor Yards and Access Roads)

The contractor pipe yards will be used for equipment, miscellaneous pipe, and material storage, as well as temporary field offices and pipe preparation/field assembly areas during construction. Site selection and acquisition will continue throughout the planning and permitting stages of the Project. Contractors will be required to site pipe and contractor yards in previously developed areas that will require no new land disturbance.

Support Sites (Access Roads)

To the extent possible, SPLP will use existing public and private roads for temporary construction access to the mainline pipeline Right-of-Ways (ROWs) and aboveground facilities. SPLP is currently in the process of identifying potential temporary and permanent access roads and will provide detailed information relative to access road location, length, and land acreage requirements within all agency filings. SPLP will seek and obtain the necessary property rights and approvals from landowners and government agencies prior to the use or construction of such roads.

LAND REQUIREMENTS

The proposed Project would result in temporary access during construction of the proposed facilities. In general, during construction of the new pipeline, the width of the construction ROW would typically be 75 feet. The 75-feet would consist of a 50-foot-wide post-construction, permanently maintained ROW and 25-feet of temporary workspace to facilitate installation of the pipelines. The 25-feet would be restored and allowed to revert back to its pre-construction condition unless it is co-located with an existing permanently maintained ROW. Additional temporary work space (ATWS) would be needed at some areas to facilitate construction and would depend on site-specific requirements. All Workspaces would be clearly defined within project mapping and within agency and municipality applications. In the post-construction phase, ATWS's will be allowed to revert, or be restored to, pre-construction conditions.

Construction of the Project's aboveground facilities and the use of non-public access roads would have land requirements. Typically, new pump stations require approximately 3-4 acres of land and modifications to existing pump stations may require 2-3 acres of additional land. Support sites, such as pipe/contractor yards, are to be sited on previously disturbed areas and typically range from 5-25 acres in size. Temporary use would primarily be limited to existing non-public roads, driveways, and farm lanes that would require nothing or minor improvements. Permanent

access roads to stations or valve settings may also be required. All proposed temporary and permanent access roads would be clearly defined within project mapping and within agency and municipality applications. In the post-construction phase, temporary workspaces will be allowed to revert, or be restored to, pre-construction conditions.

Pennsylvania Pipeline Project

Sunoco Logistics

Mariner East Pipeline - Pennsylvania Pipeline Project

Sunoco Pipeline, L.P. (SPLP) proposes to construct and operate the Pennsylvania Pipeline Project (Project) that would expand existing pipeline systems to provide natural gas liquid (NGL) transportation of up to 350,000 barrels per day. The Project involves the installation of approximately two parallel pipelines within a 306-mile, 50-foot-wide right-of-way (ROW) from Houston, Washington County, Pennsylvania to SPLP's Marcus Hook facility in Delaware County, Pennsylvania with the purpose of interconnecting with existing SPLP Mariner East pipelines. A 20-inch diameter pipeline would be installed within the ROW from Houston to Marcus Hook (306 miles) and a second, up to 20-inch diameter pipeline, will also be installed in the same ROW. The second line is proposed to be installed from SPLP's Delmont Station, Westmoreland County, Pennsylvania to the Marcus Hook facility, paralleling the initial line for approximately 255 miles. In addition to the pipelines, modification and construction of new above ground facilities would be required to meet Project goals.

Buffalo District USACE

PADEP Northwest Regional Office

PADEP Northcentral Regional Office

PADEP Southwest Regional Office

Pittsburgh District USACE

PADEP Southcentral Regional Office

Baltimore District USACE

PADEP Southeast Regional Office

Philadelphia District USACE

Norfolk District USACE

Norfolk District USACE

Warren, McKean, Potter, Tioga, Crawford, Forest, Venango, Elk, Cameron, Lycoming, Mercer, Clarion, Jefferson, Clinton, Montour, Lawrence, Clearfield, Centre, Union, Butler, Armstrong, Snyder, Northumberla, Beaver, Indiana, Mifflin, Juniata, Cambria, Blair, Huntingdon, Perry, Dauphin, Berks, Bucks, Allegheny, Westmoreland, Lebanon, Montgomery, Washington, Somerset, Bedford, Fulton, Franklin, Adams, York, Lancaster, Chester, Delaware, Camden, Harrisburg, Cumberland

Allegany, Garrett, Morgan, Washington, Carroll, Harford, Cecil, New Castle, Gloucester, Salem, Mineral, Hampshire, Berkeley, Frederick, Jefferson, Baltimore, Baltimore City, Howard, Kent, Queen Anne's, Tucker, Grant, Hardy, Winchester, Clarke, Loudoun, Montgomery, Anne Arundel, Shenandoah, Warren, District of Columbia, Fairfax City, Arlington, Caroline, Talbot, Pendleton, Fauquier, Manassas Park, Manassas, Fairfax, Prince George's, Rappahannock, Prince William, Calvert, Page, Rockingham, Highland, Madison, Culpeper, Stafford, Charles, Harrisonburg, Augusta, Greene, Orange, King George, St. Mary's

Legend

- PPP 1
- PPP 2
- USACE Districts
- State Boundary
- County Boundary

PADEP Regions

- Northcentral
- Northeast
- Northwest
- Southcentral
- Southeast
- Southwest

Miles

0 10 20 30 40 50

N W E S

Source: World Street Map from ESRI Online. USACE Districts from USACE. State and County Boundaries from ESRI.

P:\GIS\Projects\112\C05958-PPP\MXD\PPP_Overview04302015

APPENDIX B
Geotechnical Report for HDDs across Bog Turtle Wetlands

PENNSYLVANIA PIPELINE PROJECT

Horizontal Directional Drill Geotechnical Study Summary

-with Bog Turtle Area Evaluations

General

Risk of pipeline construction impacts to sensitive habitats and species can be minimized utilizing HDD technology to place pipelines below surface elevations, preferably within bedrock where possible. It removes the potential for pipeline exposure and rupture in a safe manner without modifying or impacting sensitive areas, wetlands, streambeds, banks and the adjacent riparian buffer zone. Having an understanding of the underlying material location and composition allows engineers to determine drill feasibility as well as design the HDD in a manner that minimizes drilling problems, increase drilling efficiency, and decrease the likelihood for potential surface disturbance, such as an inadvertent return of drilling fluids or groundwater. Geotechnical borings provide data in regards to the subsurface geology to complete that understanding. A geotechnical evaluation can provide the following information to feed into the HDD design:

- Percentage of gravel within soils along the pipeline trajectory;
- Location of bedrock along the pipeline trajectory;
- The rock quality designation of bedrock if present;
- Presence of cobbles greater than 4" along the pipeline trajectory;
- Presence of mixed face soil/bedrock along the pipeline trajectory;
- Risk of return of drilling fluid to the surface;
- Evaluation of soil strength to resist drilling fluid pressure; and
- Likelihood to maintain borehole stability.

As mentioned, in assessing the suitability of HDD for a specific location, an understanding of the site geology is fundamental. This is accomplished by background research documents and a field geotechnical investigation. This will forecast the types of materials to be expected as well as the potential for anomalous impediments (boulders, cobble fields, etc.) influencing the HDD construction process. Geotechnical information, along with several other data points (e.g., topography, surface hydrology), allows for proper selection of the entry and exit locations, entry and exit angles, and proper curvature and depths assuring the most suitable HDD path is selected allowing safe long-term installation of the pipe while minimizing the potential for returns of drilling fluids to the surface during installation.

To the extent practicable, SPLP has completed geotechnical borings along the alignment of all of the Project's HDDs and has used this data to feed back into the design for the HDD plans. The geotechnical borings results at each HDD are provided to the design engineers within a *Geotechnical Subsurface Investigation Report of Findings.* That report is part of a *Pipeline Calculation Document*, also prepared for each HDD, which is a compilation of all HDD data points to determine that all specifications are adequate for safe installation and operation of the HDD. That report receives Professional Engineer certification.

Bog Turtle Area HDDs

HDDs under bog turtle occupied wetlands is a primary avoidance measure. However, inadvertent return of drilling fluids to the surface of these wetlands is the primary threat to bog turtles. Therefore SPLP has implemented measures to ensure the potential for returns are reduced, including geotechnical investigations. At each of the bog turtle wetland, a summary of the HDD evaluation is provided below.

HDD PA-LA-0014.0000 (W-A55 and W-A54)

After consideration of the all data points, including the sensitivity of the area and geotechnical results, the preliminary design of this drill has been found to be adequate for safe installation and operation (see Attachment A for the drill design and the geotechnical investigation report).

The drill would enter/exit 250 feet from the edge of the western most boundary of the wetland A55PEM. The drill would pass 25 feet under the western most boundary of wetland A55PEM and 60 feet under the eastern most boundary of Wetland A55PEM. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through is estimated to be silty sand and clay at the western end of the wetland and weathered sandstone beneath the central and eastern portion of the wetland.

The drill would continue beneath the western most boundary of the wetland A54PEM and would enter/exit 125 feet from the eastern most edge of wetland A54PEM. The drill would pass 60 feet under the western most boundary of wetland A54PEM and 20 feet under the eastern most boundary of Wetland A54PEM. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through is estimated to be clay, silty clay and silty sand at the eastern end of the wetland and weathered siltstone/sandstone beneath the central and western portions of the wetland. Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable. Implementing this design, along with adherence to the *Pennsylvania Pipeline Project Inadvertent Return Contingency Plan – with Special Bog Turtle Procedures* will ensure the bog turtle is not impacted as result of this HDD.

HDD PA-CH-0111.0000 (W-C43)

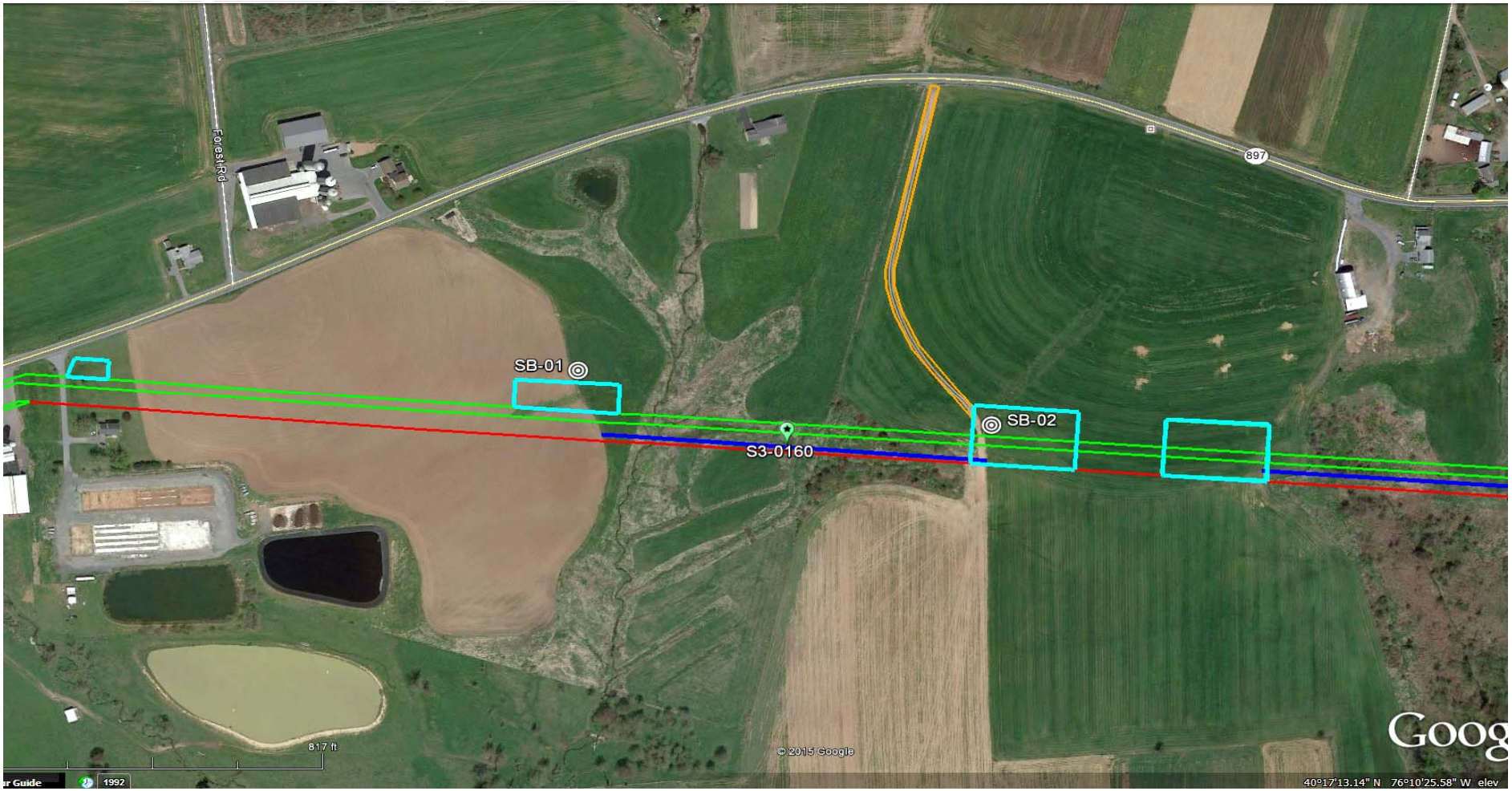
After consideration of the all data points, including the sensitivity of the area and geotechnical results, the preliminary design of this drill has been found to be adequate for safe installation and operation (see Attachment A for the drill design and the geotechnical investigation report).

The drill would enter/exit 1,000 feet from the edge of the western most boundary of wetland W-C43PEM/PFO and would enter/exit 110 feet from the eastern most edge of wetland W-C43PEM/PFO. The drill would pass 80 feet under the western most boundary of wetland W- C43PEM/PFO and 10 feet under the eastern most boundary of W-C43PEM/PFO. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through is estimated to be a silty sand or clay at either ends of the wetland and a graphitic felsic gneiss beneath the central portion of the wetland. Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable. Implementing this design, along with adherence to the *Pennsylvania Pipeline Project Inadvertent Return Contingency Plan – with Special Bog Turtle Procedures* will ensure the bog turtle is not impacted as result of this HDD.

HDD PA-CH-0124.0000 (W-C37)

After consideration of the all data points, including the sensitivity of the area and geotechnical results, the preliminary design of this drill has been found to be adequate for safe installation and operation (see Attachment A for the drill design and the geotechnical investigation report).

The Drill is offset to the south of Wetland H1PEM/PFO. The drill would enter/exit 2,500 feet from the edge of the western most boundary of the wetland H1PEM/PFO and would enter/exit 200 feet from the eastern most edge of wetland C37PEM/PFO. The drill would pass 11 feet to the south of Wetland H1PEM/PFO and at a depth of 86 feet at its closest point and 20 feet under the eastern most boundary of Wetland C37PEM/PFO. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through is estimated to be a silty sand at either ends of the wetland and gneiss bedrock beneath the central portion of the wetland. Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable. Implementing this design, along with adherence to the *Pennsylvania Pipeline Project Inadvertent Return Contingency Plan – with Special Bog Turtle Procedures* will ensure the bog turtle is not impacted as result of this HDD.



LEGEND:

◎ Geotechnical Soil Boring (SB) Locations

TETRA TECH

GEOTECHNICAL BORING LOCATIONS
HDD S3-0160
LANCASTER COUNTY, WEST COCALICO TOWNSHIP, PA
SUNOCO PENNSYLVANIA PIPELINE PROJECT

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	RT 897, DENVER, PA		Page 1 of 1
HDD No.:	S3-0160	Dates(s) Drilled: 12-13-14	Inspector: E. WATT
Boring No.:	SB-01	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 15.0	Total Depth (ft): 30.0
Boring Location Coordinates:		40° 17' 3.801" N	76° 10' 36.352" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.1			TOPSOIL (<1")					
1	3.0	5.0	0.1		14		REDDISH BROWN TO GRAYISH BROWN FINE TO MEDIUM SAND WITH	4	16	20	22	**36**
							A LITTLE SILT, TRACE FINE QUARTZ GRAVEL.					
2	8.0	10.0			24		REDDISH BROWN FINE TO COARSE SAND WITH SOME SILT, TRACE	2	14	10	12	**24**
						SM	CONGLOMERATE MATRIX.					
3	13.0	14.5			18		REDDISH BROWN FINE SAND AND SILT, WITH A LITTLE	4	25	50		**75**
							CONGLOMERATE MATRIX.					
4	18.0	19.4			14		REDDISH BROWN FINE SAND AND SILT, WITH A LITTLE	9	33	50/5"		**>50**
				21.5			CONGLOMERATE MATRIX.					
5	23.0	23.9	21.5		10	SC	REDDISH BROWN FINE SAND AND SILTY CLAY, WITH A LITTLE	2	50/5"			**>50**
				26.0			FINE TO COARSE UNWEATHERED GRAVEL (USCS: SC)					
6	28.0	28.8	26.0		9	CL	REDDISH BROWN SILTY CLAY AND FINE SAND, WITH A LITTLE	23	50/4"			**>50**
				30.0			FINE TO COARSE UNWEATHERED GRAVEL.					
							AUGERED TO 30'.					
							WET ON SPOON AT 15'.					
							WATER LEVEL THROUGH AUGERS AT 17'.					
							CAVED AT 28'.					

Notes/Comments:
Pocket Pentrometer Testing

DR: DECOMPOSED ROCK

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TETRA TECH
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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	MIDDLECREEK WILDLIFE MANAGEMENT AREA, NEWMANSTOWN, PA		Page 1 of 1
HDD No.:	S3-0160	Dates(s) Drilled: 11-20-14	Inspector: E. WATT
Boring No.:	SB-02	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 17.0	Total Depth (ft): 53.0
Boring Location Coordinates:		40° 17' 2.346" N	76° 10' 23.538" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.7			TOPSOIL (8")					
1	3.0	5.0	0.7		24		MAROON SILTY CLAY AND FINE SAND, TRACE QUARTZ FINE	3	10	11	10	**21**
						CL	GRAVEL.					
2	8.0	10.0			8		MAROON MICACEOUS SILTY CLAY WITH SOME FINE SAND.	3	4	3	3	**7**
				13.5			(USCS: CL).					
3	13.0	13.9	13.5		11		MAROON FINE TO MEDIUM SAND WITH A LITTLE CLAYEY SILT, TRACE	28	50/5"			**>50**
							FINE GRAVEL.					
4	18.0	18.9			12		MAROON FINE TO MEDIUM SAND WITH A LITTLE CLAYEY SILT, TRACE	14	50/5"			**>50**
							FINE GRAVEL.					
5	23.0	25.0			16		MARRON FINE SAND WITH SOME CLAYEY SILT, TRACE	3	11	28	50	**39**
							CONGLOMERATE.					
6	28.0	29.0			11		MAROON FINE TO MEDIUM SAND WITH SOME CLAYEY SILT, TRACE	9	50/6"			**>50**
						SM	CONGLOMERATE.					
7	33.0	34.0			12		MAROON FINE SAND AND CLAYEY SILT, TRACE CONGLOMERATE.	28	50/6"			**>50**
8	38.0	38.9			8		MAROON FINE SAND AND CLAYEY SILT, TRACE CONGLOMERATE.	8	50/5"			**>50**
							(USCS: SM)					
9	43.0	43.9			10		MAROON MEDIUM TO COARSE SAND WITH SOME CLAYEY SILT,	12	50/5"			**>50**
				44.0			TRACE FINE QUARTZ GRAVEL.					
10	44.6	45.0	44.0	45.0	4		PARTIALLY WEATHERED SILTSTONE/SANDSTONE.	50/5"				**>50**
							AUGER REFUSAL AT 44.6'.					
							ROCK CORING					
RUN 1	45.0	48.0	45.0		20		HIGHLY FRACTURED AND WEATHERED REDDISH BROWN	TCR: 55%, SCR: 0%, RQD: 0%				
				49.3			SILTSTONE.					
RUN 2	48.0	53.0	49.3		60		HIGHLY FRACTURED AND WEATHERED MAROON SILTSTONE AND	TCR: 100%, SCR: 12%, RQD: 9%				
				51.3			MEDIUM TO COARSE GRAINED SANDSTONE INTERBEDS.					
			51.3				MODERATELY TO HIGHLY FRACTURED, MODERATELY WEATHERED					
				53.0		FRACTURED ROCK	MARRON SILTSTONE AND QUARTZ PEBBLE CONGLOMERATE.					

Notes/Comments:

Pocket Pentrometer Testing
S2: 0.5 TSF

DR: DECOMPOSED ROCK

WET ON SPOON AT 17'
WATER LEVEL THROUGH AUGERS AT 18'
CAVED AT 37'.

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0160

HDD No.	Test Boring No.	Sample No.	Depth of Sample (ft.)		Water Content, % (ASTM D2216)	Percent Silts/Clays, % (ASTM D1140)	Atterburg Limits (ASTM D4318)			USCS Classif. (ASTM D2487)
			From	To			Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	
S3-0160	SB-01	2	8.0	10.0	10.9	29.2	-	-	-	-
		3	13.0	14.5	8.4	39.2	-	-	-	-
		4	18.0	19.4	7.0	41.2	-	-	-	-
		5	23.0	23.9	10.4	46.2	26	16	8	SC
		6	28.0	28.8	7.8	65.3	-	-	-	-
	SB-02 (Also S3-0170, SB-01)	2	8.0	10.0	16.7	78.1	27	16	11	CL
		4	18.0	18.9	11.3	19.7	-	-	-	-
		6	28.0	29.0	8.6	27.9	-	-	-	-
		8	38.0	38.9	10.7	44.4	18	18	NP	SM
		9	43.0	43.9	10.6	25.1	-	-	-	-

Notes:

1) Sample depths based on feet below grade at time of exploration.

REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0160

HDD No.	NAME	BORING NO.	REGIONAL GEOLOGY DESCRIPTION	GENERAL TOPOGRAPHIC SETTING	BEDROCK FORMATION	GENERAL ROCK TYPE	APPROX MAX FM THICKNESS (FT)	DEPTH TO ROCK (Ft bgs) based on nearby well drilling logs	NOTES / COMMENTS
S3-0160	Wetland A55	SB-01 SB-02	**Hammer Creek Formation** - Gray and pale red, fine- to coarse-grained quartzose sandstone, siltstone, and mudstone	Lowland, wetlands area	Hammer Creek Fm	sandstone with quartz pebble conglomerate	9,360	50-70	

Note : Source of well log data - http://www.dcnr.state.pa.us/topogeo/groundwater/pagwis/records/index.htm. All other sources as referenced in comments section.

ROCK CORE DESCRIPTION SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0160

Location	Boring No.	Core Run	Core Depth (ft)		TCR (%)	SCR (%)	RQD (%)	Depth (ft)		Weathering	Classification	Bedding Thickness (ft)	Color	Discontinuity Data
			From	To				From	To					
S3-0160	SB-2	1	45	48	55	0	0	45	48	Heavily	Siltstone	Massive	Red	Heavily fractured, ranging from 0° to 45°
		2	48	53	100	12	9	48	53	Heavily	Siltstone with interbedded Sandstone	Massive, bedding is gradational	Red	Heavily fractured, ranging from 0° to 65°

FIELD DESCRIPTION AND LOGGING SYSTEM FOR SOIL EXPLORATION

GRANULAR SOILS

(Sand, Gravel & Combinations)

Density	***N (blows)****
Very Loose	5 or less
Loose	6 to 10
Medium Dense	11 to 30
Dense	31to 50
Very Dense	51 or more

Relative Proportions

Description Term	*Percent*
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Identification

Boulders	8 in. diameter or more	
Cobbles	3 to 8 in. diameter	
Gravel	Coarse (C)	3 in. to ¾ in. sieve
	Fine (F)	¾ in. to No. 4 sieve
Sand	Coarse (C)	No. 4 to No. 10 sieve (4.75mm-2.00mm)
	Medium (M)	No. 10 to No. 40 sieve (2.00mm – 0.425mm)
	Fine (F)	No. 40 to No. 200 sieve (0.425 – 0.074mm)
Silt/Clay	Less Than a No. 200 sieve (<0.074mm)	

COHESIVE SOILS

(Silt, Clay & Combinations)

Consistency	***N (blows)****
Very Soft	3 or less
Soft	4 to 5
Medium Stiff	6 to 10
Stiff	11 to 15
Very Stiff	16 to 30
Hard	31 or more

Plasticity

Degree of Plasticity	*Plasticity Index*
None to Slight	0 - 4
Slight	5 - 7
Medium	8- 22
High to Very High	> 22

ROCK

(Rock Cores)

Rock Quality Designation (RQD), %	***Rock Quality Description***
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

N - Standard Penetration Resistance. Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. The number of hammer blows to drive the sampler through each 6 inch interval is recorded; the number of blows required to drive the sampler through the final 12 inch interval is termed the Standard Penetration Resistance (SPR) N-value. For example, blow counts of 6/8/9 (through three 6-inch intervals) results in an SPR N-value of 17 (8+9).

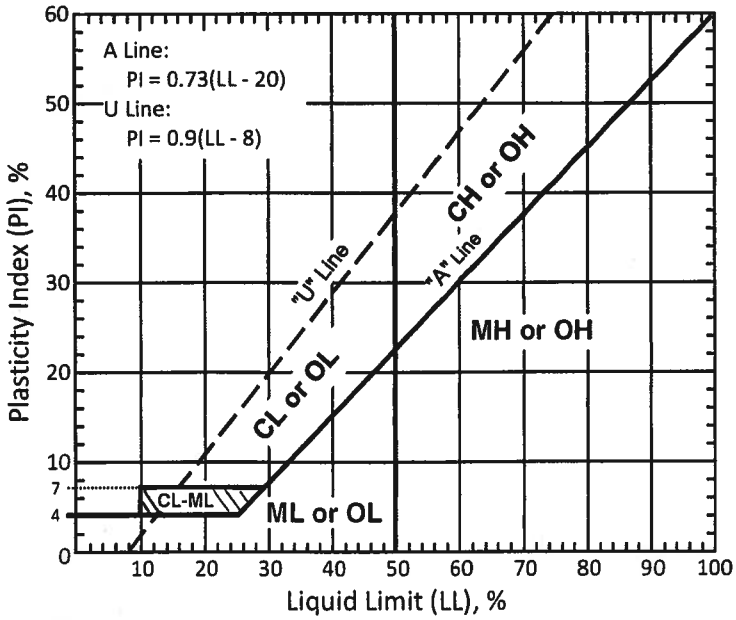
Groundwater observations were made at the times indicated. Groundwater elevations fluctuate throughout a given year, depending on actual field porosity and variations in seasonal and annual precipitation.

UNIFIED SOIL CLASSIFICATION SYSTEM [Casagrande (1948)]

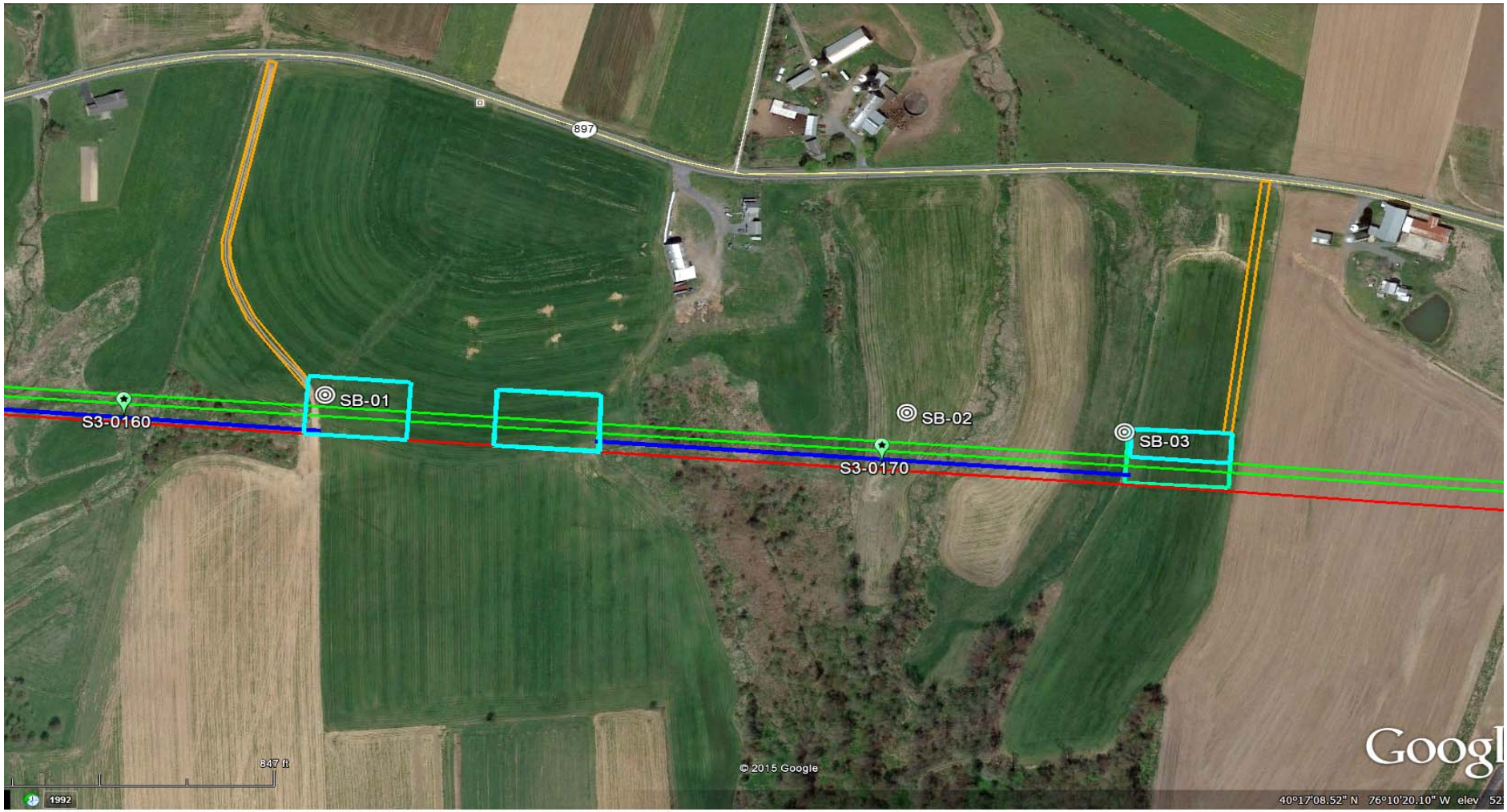
Major Divisions			Group Symbols	Typical Descriptions	Laboratory Classifications		
Coarse Grained Soils (More than half of material is larger than No. 200 sieve)	Gravels More than half of coarse fraction is larger than No. 4 sieve	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine Percentage of sand and gravel from grain size curve. Depending on Percentage of fines (fraction smaller than No. 200 sieve), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent Borderline cases requiring dual symbols[1]	$C_u=\frac{D_{60}}{D_{10}}$ greater than 4: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting C_u or C_c requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 Sieve)	Clean sands (Little or no fines)	SW	Well graded sands, gravely sands, little or no fines		$C_u=\frac{D_{60}}{D_{10}}$ greater than 6: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting C_u or C_c requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits Plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	

Major Divisions		Group Symbols	Typical Descriptions
Fine–grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays , sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
	Highly organic soils	Pt	Peat and other highly organic soils

For soils plotting nearly on A line use dual symbols i.e ., I_p = 29.5, w_L=60 gives CH-MH. When w_L is near 50 use CL-CH or ML-MH. Take near as ± 2 percent.



(1) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC. well-graded gravel-sand mixture with clay binder.



LEGEND:

◎ Geotechnical Soil Boring (SB) Locations

TETRA TECH

GEOTECHNICAL BORING LOCATIONS
HDD S3-0170
LANCASTER COUNTY, WEST COCALICO TOWNSHIP, PA
SUNOCO PENNSYLVANIA PIPELINE PROJECT

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	RT 897, DENVER, PA		Page 1 of 1
HDD No.:	S3-0170	Dates(s) Drilled: 11-20-14	Inspector: E. WATT
Boring No.:	SB-01	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 17.0	Total Depth (ft): 53.0
Boring Location Coordinates:		40° 17' 2.346" N	76° 10' 23.538" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.7			TOPSOIL (8")					
1	3.0	5.0	0.7		24		MAROON SILTY CLAY AND FINE SAND, TRACE QUARTZ FINE	3	10	11	10	**21**
						CL	GRAVEL.					
2	8.0	10.0			8		MAROON MICACEOUS SILTY CLAY WITH SOME FINE SAND.	3	4	3	3	**7**
				13.5			(USCS: CL).					
3	13.0	13.9	13.5		11		MAROON FINE TO MEDIUM SAND WITH A LITTLE CLAYEY SILT, TRACE	28	50/5"			**>50**
							FINE GRAVEL.					
4	18.0	18.9			12		MAROON FINE TO MEDIUM SAND WITH A LITTLE CLAYEY SILT, TRACE	14	50/5"			**>50**
							FINE GRAVEL.					
5	23.0	25.0			16		MARRON FINE SAND WITH SOME CLAYEY SILT, TRACE	3	11	28	50	**39**
							CONGLOMERATE.					
6	28.0	29.0			11		MAROON FINE TO MEDIUM SAND WITH SOME CLAYEY SILT, TRACE	9	50/6"			**>50**
						SM	CONGLOMERATE.					
7	33.0	34.0			12		MAROON FINE SAND AND CLAYEY SILT, TRACE CONGLOMERATE.	28	50/6"			**>50**
8	38.0	38.9			8		MAROON FINE SAND AND CLAYEY SILT, TRACE CONGLOMERATE.	8	50/5"			**>50**
							(USCS: SM)					
9	43.0	43.9			10		MAROON MEDIUM TO COARSE SAND WITH SOME CLAYEY SILT,	12	50/5"			**>50**
				44.0			TRACE FINE QUARTZ GRAVEL.					
10	44.6	45.0	44.0	45.0	4		PARTIALLY WEATHERED SILTSTONE/SANDSTONE.	50/5"				**>50**
							AUGER REFUSAL AT 44.6'.					
							ROCK CORING					
RUN 1	45.0	48.0	45.0		20		HIGHLY FRACTURED AND WEATHERED REDDISH BROWN	TCR: 55%, SCR: 0%, RQD: 0%				
				49.3			SILTSTONE.					
RUN 2	48.0	53.0	49.3		60		HIGHLY FRACTURED AND WEATHERED MAROON SILTSTONE AND	TCR: 100%, SCR: 12%, RQD: 9%				
				51.3			MEDIUM TO COARSE GRAINED SANDSTONE INTERBEDS.					
			51.3				MODERATELY TO HIGHLY FRACTURED, MODERATELY WEATHERED					
				53.0		FRACTURED ROCK	MARRON SILTSTONE AND QUARTZ PEBBLE CONGLOMERATE.					

Notes/Comments:

Pocket Pentrometer Testing
S2: 0.5 TSF

WET ON SPOON AT 17'
WATER LEVEL THROUGH AUGERS AT 18'
CAVED AT 37'.

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

TETRA TECH
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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	RT 897, DENVER, PA		Page 1 of 1
HDD No.:	S3-0170	Dates(s) Drilled: 02-06-15	Inspector: E. WATT
Boring No.:	SB-02	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 13.0	Total Depth (ft): 44.0
Boring Location Coordinates:		40° 17' 1.883" N	76° 10' 5.380" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.7			TOPSOIL (8")					
1	3.0	5.0	0.7		22		MOTTLED (REDDISH BROWN, GRAY AND ORANGE BROWN) FINE TO	3	7	11	14	**18**
							MEDIUM SAND, WITH SOME SILTY CLAY, TRACE FINE GRAVEL.					
2	8.0	10.0			18		REDDISH BROWN FINE TO MEDIUM SAND WITH SOME SILTY CLAY,	3	2	4	5	**6**
						SC	TRACE FINE GRAVEL.					
3	13.0	14.9			17		REDDISH BROWN FINE TO MEDIUM SAND AND SILTY CLAY, WITH A	13	27	44	50/5"	**>50**
							LITTLE UNWEATHERED ROCK FRAGMENTS. (USCS: SC)					
4	18.0	19.0			12		REDDISH BROWN FINE TO MEDIUM SAND AND SILTY CLAY, WITH A	11	50/6"			**>50**
				21.0			LITTLE UNWEATHERED ROCK FRAGMENTS. (USCS: SC)					
5	23.0	25.0	21.0		24		REDDISH BRWON SILTY CLAY, TRACE FINE SAND, WITH TRACE	15	27	25	35	**52**
							UNWEATHERED ROCK FRAGMENTS. (USCS: CL).					
6	28.0	28.8			10	CL	REDDISH BRWON SILTY CLAY, TRACE FINE SAND, WITH TRACE	20	50/4"			**>50**
							UNWEATHERED ROCK FRAGMENTS.					
7	33.0	33.6			8		REDDISH BROWN SILTY CLAY AND FINE SAND, WITH A LITTLE	30	50/2"			**>50**
				35.0			UNWEATHERED ROCK FRAGMENTS. (USCS: CL).					
8	38.0	38.7	35.0		8	WEATHERED SILTSTONE	REDDISH BROWN HIGHLY WEATHERED SILTSTONE.	38	50/3"			**>50**
9	43.0	43.7		44.0	7		REDDISH BROWN HIGHLY WEATHERED SILTSTONE.	25	50/3"			**>50**
							AUGER REFUSAL AT 44'.					

Notes/Comments:

Pocket Pentrometer Testing

S4 to S7: > 4 TSF

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	RT 897, DENVER, PA		Page 1 of 1
HDD No.:	S3-0170	Dates(s) Drilled: 12-13-14	Inspector: E. WATT
Boring No.:	SB-03	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 6.0	Total Depth (ft): 30.0
Boring Location Coordinates:		40° 17' 1.365" N	76° 9' 58.579" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.3			TOPSOIL (3")					
1	3.0	5.0	0.3		11	SM	VARYING SHADES OF BROWN (TRACE WHITE) FINE TO COARSE	2	6	15	21	**21**
							SAND WITH A LITTLE SILT, TRACE FINE QUARTZ GRAVEL.					
2	8.0	10.0			22		REDDISH BROWN FINE TO COARSE SAND WITH A LITTLE SILT, TRACE	4	12	13	18	**25**
				11.5			FINE GRAVEL.					
3	13.0	15.0	11.5		17	SC	REDDISH BROWN FINE TO MEDIUM SAND WITH SOME SILTY CLAY,	16	26	25	35	**51**
							WITH A LITTLE FINE TO COARSE GRAVEL.					
4	18.0	18.8			9		REDDISH BROWN FINE TO MEDIUM SAND WITH SOME SILTY CLAY,	10	50/3"			**>50**
							WITH A LITTLE FINE TO COARSE GRAVEL.					
5	23.0	23.7			5		REDDISH BROWN FINE TO MEDIUM SAND WITH SOME SILTY CLAY,	8	50/3"			**>50**
							WITH A LITTLE FINE TO COARSE GRAVEL.					
6	28.0	29.3		30.0	0		NO RECOVERY	11	20	50/3"		**>50**
							AUGERED TO 30'.					
							WET ON SPOON AT 13'.					
							WATER LEVEL THROUGH AUGERS AT 6'.					
							CAVED AT 27'.					

Notes/Comments:
Pocket Pentrometer Testing

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0170

HDD No.	Test Boring No.	Sample No.	Depth of Sample (ft.) From	Depth of Sample (ft.) To	Water Content, % (ASTM D2216)	Percent Silts/Clays, % (ASTM D1140)	Atterburg Limits (ASTM D4318) Liquid Limit, %	Atterburg Limits (ASTM D4318) Plastic Limit, %	Atterburg Limits (ASTM D4318) Plasticity Index, %	USCS Classif. (ASTM D2487)
S3-0170	SB-01	2	8.0	10.0	16.7	78.1	27	16	11	CL
		4	18.0	18.9	11.3	19.7	-	-	-	-
		6	28.0	29.0	8.6	27.9	-	-	-	-
		8	38.0	38.9	10.7	44.4	18	18	NP	SM
		9	43.0	43.9	10.6	25.1	-	-	-	-
	SB-02	2	8.0	10.0	17.0	28.6	-	-	-	-
		3	13.0	14.9	9.6	41.2	28	20	8	SC
		5	23.0	25.0	17.7	92.5	27	16	11	CL
		6	28.0	28.8	10.9	98.7	-	-	-	-
		7	33.0	33.6	10.0	53.6	28	16	12	CL
	SB-03	1	3.0	5.0	12.5	18.3	-	-	-	-
		2	8.0	10.0	13.6	17.1	-	-	-	-
		3	13.0	15.0	9.8	23.4	-	-	-	-
		4	18.0	18.8	9.3	19.8	-	-	-	-
		5	23.0	23.7	10.5	24.6	-	-	-	-

Notes:

1) Sample depths based on feet below grade at time of exploration.

REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0170

HDD No.	NAME	BORING NO.	REGIONAL GEOLOGY DESCRIPTION	GENERAL TOPOGRAPHIC SETTING	BEDROCK FORMATION	GENERAL ROCK TYPE	APPROX MAX FM THICKNESS (FT)	DEPTH TO ROCK (Ft bgs) based on nearby well drilling logs	NOTES / COMMENTS
S3-0170	Wetland A54	SB-01	**Hammer Creek Formation** - Gray and pale red, fine- to coarse-grained quartzose sandstone, siltstone, and mudstone	Lowland, wetlands area	Hammer Creek Fm	sandstone with quartz pebble conglomerate	9,360	50-70	
		SB-02						50-75	
		SB-03						50-70	

Note : Source of well log data - http://www.dcnr.state.pa.us/topogeo/groundwater/pagwis/records/index.htm. All other sources as referenced in comments section.

ROCK CORE DESCRIPTION SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0170

Location	Boring No.	Core Run	Core Depth (ft)		TCR (%)	SCR (%)	RQD (%)	Depth (ft)		Weathering	Classification	Bedding Thickness (ft)	Color	Discontinuity Data
			From	To				From	To					
S3-0170	SB-01	1	45	48	55	0	0	45	48	Heavily	Siltstone	Massive	Red	Heavily fractured, ranging from 0° to 45°
		2	48	53	100	12	9	48	53	Heavily	Siltstone with interbedded Sandstone	Massive, bedding is gradational	Red	Heavily fractured, ranging from 0° to 65°

FIELD DESCRIPTION AND LOGGING SYSTEM FOR SOIL EXPLORATION

GRANULAR SOILS

(Sand, Gravel & Combinations)

Density	***N (blows)****
Very Loose	5 or less
Loose	6 to 10
Medium Dense	11 to 30
Dense	31to 50
Very Dense	51 or more

Relative Proportions

Description Term	*Percent*
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Identification

Boulders	8 in. diameter or more	
Cobbles	3 to 8 in. diameter	
Gravel	Coarse (C)	3 in. to ¾ in. sieve
	Fine (F)	¾ in. to No. 4 sieve
Sand	Coarse (C)	No. 4 to No. 10 sieve (4.75mm-2.00mm)
	Medium (M)	No. 10 to No. 40 sieve (2.00mm – 0.425mm)
	Fine (F)	No. 40 to No. 200 sieve (0.425 – 0.074mm)
Silt/Clay	Less Than a No. 200 sieve (<0.074mm)	

COHESIVE SOILS

(Silt, Clay & Combinations)

Consistency	***N (blows)****
Very Soft	3 or less
Soft	4 to 5
Medium Stiff	6 to 10
Stiff	11 to 15
Very Stiff	16 to 30
Hard	31 or more

Plasticity

Degree of Plasticity	*Plasticity Index*
None to Slight	0 - 4
Slight	5 - 7
Medium	8- 22
High to Very High	> 22

ROCK

(Rock Cores)

Rock Quality Designation (RQD), %	***Rock Quality Description***
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

N - Standard Penetration Resistance. Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. The number of hammer blows to drive the sampler through each 6 inch interval is recorded; the number of blows required to drive the sampler through the final 12 inch interval is termed the Standard Penetration Resistance (SPR) N-value. For example, blow counts of 6/8/9 (through three 6-inch intervals) results in an SPR N-value of 17 (8+9).

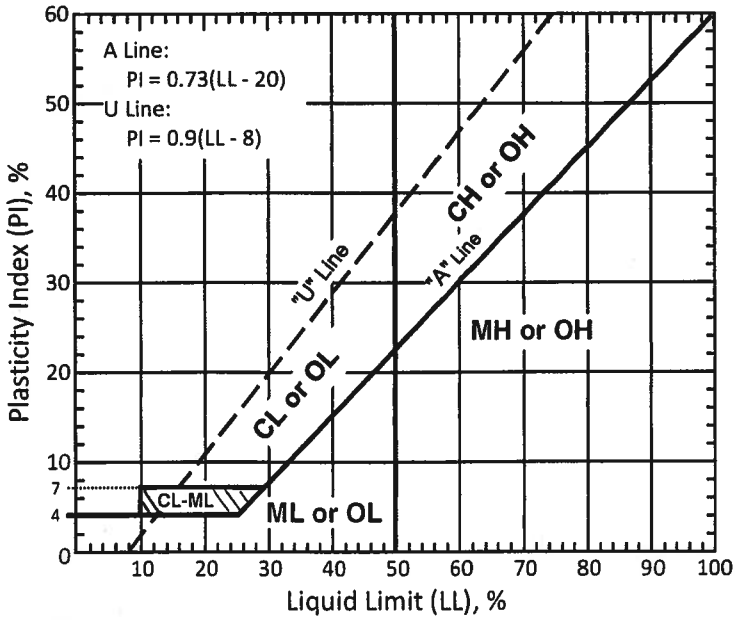
Groundwater observations were made at the times indicated. Groundwater elevations fluctuate throughout a given year, depending on actual field porosity and variations in seasonal and annual precipitation.

UNIFIED SOIL CLASSIFICATION SYSTEM [Casagrande (1948)]

Major Divisions			Group Symbols	Typical Descriptions	Laboratory Classifications		
Coarse Grained Soils (More than half of material is larger than No. 200 sieve)	Gravels More than half of coarse fraction is larger than No. 4 sieve	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine Percentage of sand and gravel from grain size curve. Depending on Percentage of fines (fraction smaller than No. 200 sieve), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent Borderline cases requiring dual symbols[1]	$C_u=\frac{D_{60}}{D_{10}}$ greater than 4: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting C_u or C_c requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 Sieve)	Clean sands (Little or no fines)	SW	Well graded sands, gravely sands, little or no fines		$C_u=\frac{D_{60}}{D_{10}}$ greater than 6: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting C_u or C_c requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits Plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	

Major Divisions		Group Symbols	Typical Descriptions
Fine–grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays , sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
	Highly organic soils	Pt	Peat and other highly organic soils

For soils plotting nearly on A line use dual symbols i.e ., I_p = 29.5, w_L=60 gives CH-MH. When w_L is near 50 use CL-CH or ML-MH. Take near as ± 2 percent.



(1) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC. well-graded gravel-sand mixture with clay binder.

LEGEND:

◎ Geotechnical Soil Boring (SB) Locations

TETRA TECH

GEOTECHNICAL BORING LOCATIONS
HDD S3-0300
CHESTER COUNTY, UPPER UWCHLAN TOWNSHIP, PA
SUNOCO PENNSYLVANIA PIPELINE PROJECT

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	CH-0111, EXTON, PA		Page 1 of 1
HDD No.:	S3-0300	Dates(s) Drilled: 05-27-15	Inspector: J. COSTELLO
Boring No.:	SB-01	Drilling Method: SPT - ASTM D1586	Driller: GREG
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 16.0	Total Depth (ft): 30.0
Boring Location Coordinates:		40° 4' 27.416" N	75° 42' 1.033" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.5			TOPSOIL (6)					
1	3.0	5.0	0.5		9	SM	BROWN FINE TO MEDIUM SAND WITH SOME SILT, TRACE FINE	8	11	7	6	**18**
				6.5			GRAVEL.					
2	8.0	10.0	6.5		16		DR WEATHERED TO A YELLOWISH BROWN AND WHITE SILT AND	2	5	15	14	**20**
							FINE TO COARSE SAND, WITH A LITTLE UNWEATH. F-GRAVEL.					
3	13.0	15.0			24		DR WEATHERED TO A REDDISH BROWN WITH WHITE VEINS, SILT AND	3	5	10	19	**15**
						ML/ SM	FINE TO COARSE SAND, WITH TRACE UNWEATH. F-GRAVEL.					
4	18.0	20.0			19		DR WEATHERED TO A BRWN AND REDDISH BROWN SILT AND FINE	1	2	4	5	**6**
							SAND. (USCS: ML/SM).					
5	23.0	25.0			24		DR WEATHERED TO A BRWN AND REDDISH BROWN SILT AND FINE	1	1	2	6	**3**
				29.0			SAND.					
6	28.0	30.0	29.0		24	SM	DR WEATHERED TO A WHITE, TAN, GRAY FINE TO COARSE SAND WITH	1	13	26	28	**39**
				30.0			SOME SILT, TRACE FINE UNWEATHERED GRAVEL.					
							WET ON SPOON AT 16'.					
							WATER LEVEL THROUGH AUGERS AT 16'.					
							CAVED AT 26'.					

Notes/Comments:
Pocket Pentrometer Testing

DR: DECOMPOSED ROCK

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	730 STOCKTON DRIVE, DOWNINGTOWN, PA		Page 1 of 1
HDD No.:	S3-0300	Dates(s) Drilled: 07-28-15	Inspector: J. COSTELLO
Boring No.:	SB-02	Drilling Method: SPT - ASTM D1586	Driller: E. OGDEN
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 18.0	Total Depth (ft): 30.0
Boring Location Coordinates:		40° 4' 13.433" N	75° 41' 36.139" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.5			TOPSOIL (6)					
1	3.0	5.0	0.5		24	CL	MOTTLED REDDISH BROWN AND GRAY SILTY CLAY WITH A LITTLE	1	4	6	10	**10**
				9.0			FINE SAND.					
2	8.0	10.0	9.0		24	SM	DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	2	2	5	6	**7**
							WITH SOME SILT.					
3	13.0	15.0			22		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	1	1	2	4	**3**
							WITH SOME SILT. (USCS: SM)					
4	18.0	20.0			15		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	1	2	3	6	**5**
							WITH SOME SILT.					
5	23.0	25.0			14		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	1	4	6	9	**10**
							WITH SOME SILT, TRACE FINE GNEISS FRAGMENTS.					
6	28.0	30.0			14		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	5	7	21	31	**28**
				30.0			WITH SOME SILT, TRACE FINE GNEISS FRAGMENTS.					
							WET ON SPOON AT 18'.					
							WATER LEVEL THROUGH AUGERS AT 18'.					
							CAVED AT 17.3'.					

Notes/Comments:

Pocket Pentrometer Testing
S1: 2.75 TSF

DR: DECOMPOSED ROCK

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0300

HDD No.	Test Boring No.	Sample No.	Depth of Sample (ft.) From	Depth of Sample (ft.) To	Water Content, % (ASTM D2216)	Percent Silts/Clays, % (ASTM D1140)	Atterburg Limits (ASTM D4318) Liquid Limit, %	Atterburg Limits (ASTM D4318) Plastic Limit, %	Atterburg Limits (ASTM D4318) Plasticity Index, %	USCS Classif. (ASTM D2487)
S3-0300	SB-01	2	8.0	10.0	12.9	21.6	-	-	-	-
		3	13.0	15.0	25.0	50.8	-	-	-	-
		4	18.0	20.0	34.7	51.9	43	33	10	ML/SM
		5	23.0	25.0	38.7	50.0	-	-	-	-
		6	28.0	30.0	13.5	24.6	NV	NP	NP	SM
	SB-02	2	8.0	10.0	23.5	20.5	-	-	-	-
		3	13.0	15.0	31.7	22.6	-	-	-	-
		4	18.0	20.0	41.7	33.1	30	25	5	SM
		5	23.0	25.0	32.2	28.7	-	-	-	-
		6	28.0	30.0	23.4	24.2	-	-	-	-

Notes:

1) Sample depths based on feet below grade at time of exploration.

REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0300

HDD No.	BORING NO.	REGIONAL GEOLOGY DESCRIPTION	GENERAL TOPOGRAPHIC SETTING	BEDROCK FORMATION	GENERAL ROCK TYPE	APPROX MAX FM THICKNESS (FT)	DEPTH TO ROCK (Ft bgs) based on nearby well drilling logs	NOTES / COMMENTS
S3-0300	SB-01	Graphitic felsic gneiss - Includes Pickering Gneiss and small areas of marble; dominantly quartz and feldspar with varying amounts of graphite and various metamorphic minerals; medium grained, light to dark gray and greenish gray; sedimentary origin.	Gently sloping to the north	Graphitic felsic gneiss (PreCambrian)	Graphitic gneiss	Unknown	Approximately 25 ft bgs, see notes	Of the 14 well records within 0.25 miles of the site, only one had a recorded bedrock depth. Given the similar geology, bedrock depth is likely to be similar to other locations in this formation
	SB-02		Generally level, slightly sloping to the west					Of the 23 well records within 0.5 miles of the site, only one had a recorded bedrock depth. Given the similar geology, bedrock depth is likely to be similar to other locations in this formation

Note : Source of well log data - http://www.dcnr.state.pa.us/topogeo/groundwater/pagwis/records/index.htm. All other sources as referenced in comments section.

FIELD DESCRIPTION AND LOGGING SYSTEM FOR SOIL EXPLORATION

GRANULAR SOILS

(Sand, Gravel & Combinations)

Density	***N (blows)****
Very Loose	5 or less
Loose	6 to 10
Medium Dense	11 to 30
Dense	31to 50
Very Dense	51 or more

Relative Proportions

Description Term	*Percent*
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Identification

Boulders	8 in. diameter or more	
Cobbles	3 to 8 in. diameter	
Gravel	Coarse (C)	3 in. to ¾ in. sieve
	Fine (F)	¾ in. to No. 4 sieve
Sand	Coarse (C)	No. 4 to No. 10 sieve (4.75mm-2.00mm)
	Medium (M)	No. 10 to No. 40 sieve (2.00mm – 0.425mm)
	Fine (F)	No. 40 to No. 200 sieve (0.425 – 0.074mm)
Silt/Clay	Less Than a No. 200 sieve (<0.074mm)	

COHESIVE SOILS

(Silt, Clay & Combinations)

Consistency	***N (blows)****
Very Soft	3 or less
Soft	4 to 5
Medium Stiff	6 to 10
Stiff	11 to 15
Very Stiff	16 to 30
Hard	31 or more

Plasticity

Degree of Plasticity	*Plasticity Index*
None to Slight	0 - 4
Slight	5 - 7
Medium	8- 22
High to Very High	> 22

ROCK

(Rock Cores)

Rock Quality Designation (RQD), %	***Rock Quality Description***
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

N - Standard Penetration Resistance. Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. The number of hammer blows to drive the sampler through each 6 inch interval is recorded; the number of blows required to drive the sampler through the final 12 inch interval is termed the Standard Penetration Resistance (SPR) N-value. For example, blow counts of 6/8/9 (through three 6-inch intervals) results in an SPR N-value of 17 (8+9).

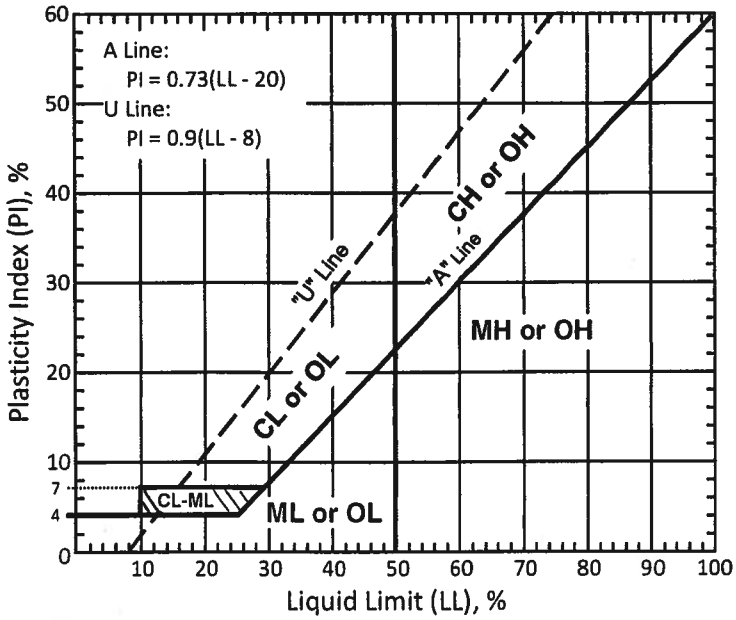
Groundwater observations were made at the times indicated. Groundwater elevations fluctuate throughout a given year, depending on actual field porosity and variations in seasonal and annual precipitation.

UNIFIED SOIL CLASSIFICATION SYSTEM [Casagrande (1948)]

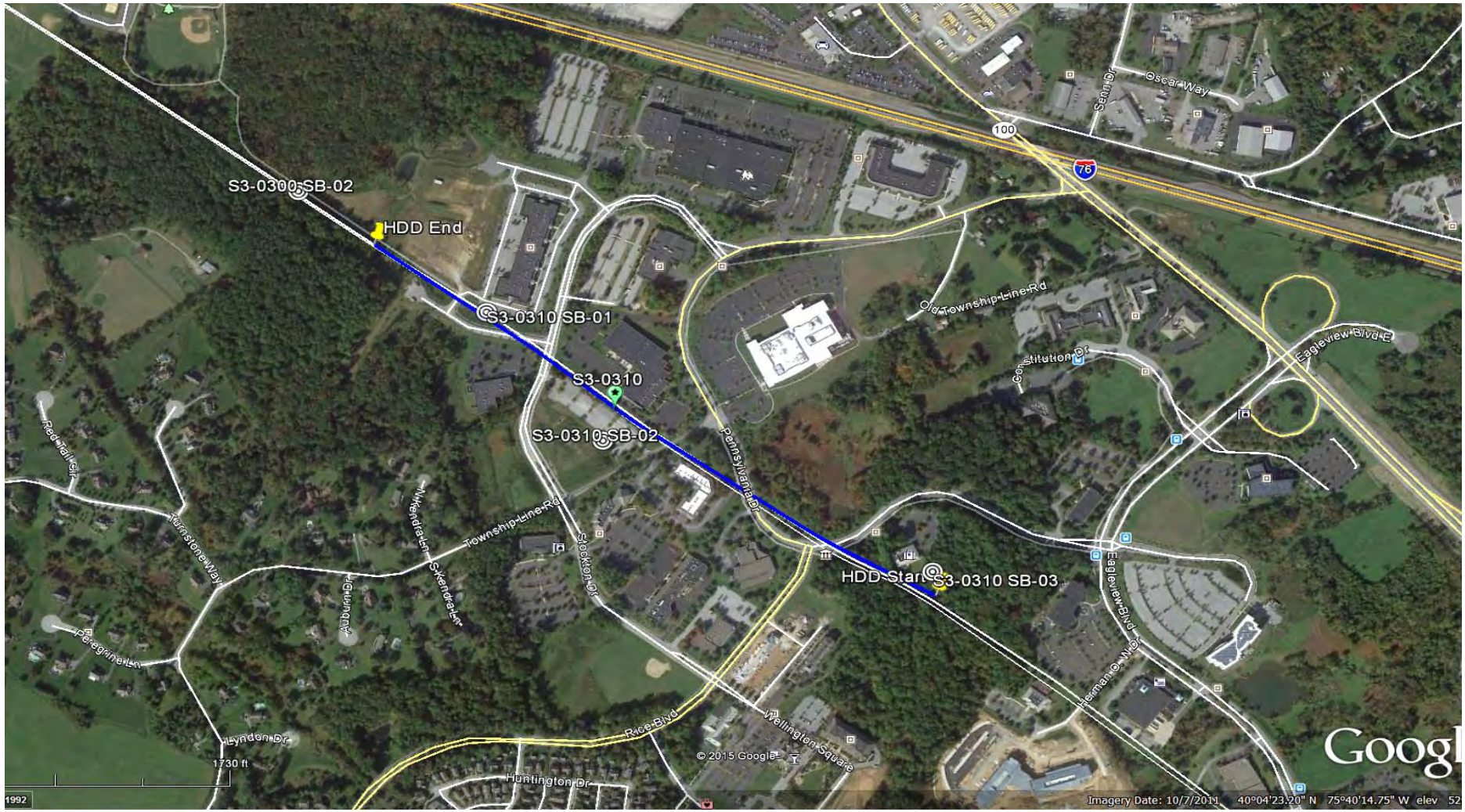
Major Divisions			Group Symbols	Typical Descriptions	Laboratory Classifications		
Coarse Grained Soils (More than half of material is larger than No. 200 sieve)	Gravels More than half of coarse fraction is larger than No. 4 sieve	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine Percentage of sand and gravel from grain size curve. Depending on Percentage of fines (fraction smaller than No. 200 sieve), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent Borderline cases requiring dual symbols[1]	$C_u=\frac{D_{60}}{D_{10}}$ greater than 4: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting C_u or C_c requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 Sieve)	Clean sands (Little or no fines)	SW	Well graded sands, gravely sands, little or no fines		$C_u=\frac{D_{60}}{D_{10}}$ greater than 6: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting C_u or C_c requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits Plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	

Major Divisions		Group Symbols	Typical Descriptions
Fine–grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays , sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
	Highly organic soils	Pt	Peat and other highly organic soils

For soils plotting nearly on A line use dual symbols i.e ., I_p = 29.5, w_L=60 gives CH-MH. When w_L is near 50 use CL-CH or ML-MH. Take near as ± 2 percent.



(1) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC. well-graded gravel-sand mixture with clay binder.



LEGEND:

Geotechnical Soil Boring (SB) Locations

TETRA TECH

GEOTECHNICAL BORING LOCATIONS
HDD S3-0310
CHESTER COUNTY, UPPER UWCHLAN/UWCHLAN TWP, PA
SUNOCO PENNSYLVANIA PIPELINE PROJECT

TETRA TECH
240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	730 STOCKTON DRIVE, DOWNINGTOWN, PA		Page 1 of 1
HDD No.:	S3-0300	Dates(s) Drilled: 07-28-15	Inspector: J. COSTELLO
Boring No.:	SB-02	Drilling Method: SPT - ASTM D1586	Driller: E. OGDEN
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 18.0	Total Depth (ft): 30.0
Boring Location Coordinates:		40° 4' 13.433" N	75° 41' 36.139" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.5			TOPSOIL (6)					
1	3.0	5.0	0.5		24	CL	MOTTLED REDDISH BROWN AND GRAY SILTY CLAY WITH A LITTLE	1	4	6	10	**10**
				9.0			FINE SAND.					
2	8.0	10.0	9.0		24	SM	DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	2	2	5	6	**7**
							WITH SOME SILT.					
3	13.0	15.0			22		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	1	1	2	4	**3**
							WITH SOME SILT. (USCS: SM)					
4	18.0	20.0			15		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	1	2	3	6	**5**
							WITH SOME SILT.					
5	23.0	25.0			14		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	1	4	6	9	**10**
							WITH SOME SILT, TRACE FINE GNEISS FRAGMENTS.					
6	28.0	30.0			14		DR, VARIEGATED (GRAY, WHITE, BROWN, RED) FINE TO MEDIUM SAND	5	7	21	31	**28**
				30.0			WITH SOME SILT, TRACE FINE GNEISS FRAGMENTS.					
							WET ON SPOON AT 18'.					
							WATER LEVEL THROUGH AUGERS AT 18'.					
							CAVED AT 17.3'.					

Notes/Comments:

Pocket Pentrometer Testing
S1: 2.75 TSF

DR: DECOMPOSED ROCK

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	730 STOCKTON, DOWNINGTOWN, PA		Page 1 of 1
HDD No.:	S3-0310	Dates(s) Drilled: 07-28/29-15	Inspector: E. WATT
Boring No.:	SB-01	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 30.5	Total Depth (ft): 73.8
Boring Location Coordinates:		40° 4' 6.762" N	75° 41' 23.914" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.1			TOPSOIL (1")					
1	3.0	5.0	0.1		12		DARK BROWN FINE TO MEDIUM SAND WITH SOME SILT, TRACE FINE	1	3	4	5	**7**
							ROCK FRAGMENTS.					
2	8.0	10.0			16		DR, YELLOWISH BROWN FINE TO MEDIUM SAND WITH SOME SILT,	1	5	12	15	**17**
							TRACE FINE GNEISS FRAGMENTS.					
3	13.0	14.2			20		DR, YELLOWISH BROWN AND WHITE FINE TO MEDIUM SAND WITH	21	50	50/2"		**>50**
							SOME SILT, TRACE FINE GNEISS FRAGMENTS.					
4	18.0	19.9			19		DR, YELLOWISH BROWN AND WHITE FINE TO MEDIUM SAND WITH	5	21	41	50/5"	**>50**
							SOME SILT, TRACE FINE GNEISS FRAGMENTS.					
5	23.0	24.5			12		DR, YELLOWISH BROWN AND DARK BROWN FINE TO MEDIUM SAND	1	23	50/5"		**>50**
							WITH SOME SILT, WITH A LITTLE FINE GNEISS FRAGMENTS.					
6	28.0	29.4			16		DR, YELLOWISH BROWN AND DARK BROWN FINE TO MEDIUM SAND	7	41	50/5"		**>50**
							WITH A LITTLE SILT, WITH A LITTLE FINE GNEISS FRAGMENTS.					
7	33.0	33.8			9		DR, YELLOWISH BROWN AND DARK BROWN FINE TO MEDIUM SAND	8	50/4"			**>50**
							WITH SOME SILT, WITH A LITTLE FINE GNEISS FRAGMENTS.					
8	38.0	40.0			15	SM	DR, VARIEGATED YELLOWISH BROWN TO BROWNISH YELLOW FINE	13	15	30	29	**45**
							SAND WITH SOME SILT. (WHITE AND BLACK LAYER)					
9	43.0	44.5			15		DR, VARIEGATED YELLOWISH BROWN TO BROWNISH YELLOW FINE	3	13	50		**63**
							SAND WITH SOME SILT.					
10	48.0	49.9			6		DR, VARIEGATED YELLOWISH BROWN TO BROWNISH YELLOW FINE	2	15	23	50/5"	**38**
							SAND WITH SOME SILT.					
11	53.0	54.4			8		DR, VARIEGATED (BROWN, BLACK, WHITE, YELLOW) CEMENTED FINE	25	18	50/5"		**>50**
							TO MEDIUM SAND, SOME SILT, TRACE F-C GNEISS FRAGMENTS.					
12	58.0	59.0			6		DR, VARIEGATED (BROWN, BLACK, WHITE, YELLOW) FINE TO MED.	15	50/6"			**>50**
							SAND, SOME SILT, A LITTLE F-C GNEISS FRAGMENTS. (USCS: SM).					
13	63.0	63.8			10		DR, VARIEGATED (BROWN, BLACK, WHITE, YELLOW) FINE TO MED.	15	50/4"			**>50**
							SAND, SOME SILT, A LITTLE F-C GNEISS FRAGMENTS.					
14	68.0	68.9			8		DR, REDDISH BROWN AND WHITE FINE TO MEDIUM SAND WITH SOME	15	50/5"			**>50**
							SILT, WITH A LITTLE F-C GNEISS FRAGMENTS.					
15	73.0	73.8			10		DR, REDDISH BROWN AND WHITE FINE TO MEDIUM SAND WITH SOME	25	50/4"			**>50**
				73.8			SAND, SOME SILT, A LITTLE F-C GNEISS FRAGMENTS. (USCS: SM).					

Notes/Comments:

Pocket Pentrometer Testing

DR: DECOMPOSED ROCK

WET ON SPPON AT 30.5' CAVED AT 72'.
WATER LEVEL THROUGH AUGERS AT 30.5'.

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	630 STOCKTON, DOWNINGTOWN, PA		Page 1 of 1
HDD No.:	S3-0310	Dates(s) Drilled: 07-30-15	Inspector: E. WATT
Boring No.:	SB-02	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 38.0	Total Depth (ft): 51.5
Boring Location Coordinates:		40° 3' 59.736" N	75° 41' 16.420" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.3			TOPSOIL (3")					
1	3.0	5.0	0.3		18	CL	BROWN WITH RED NODULES SILTY CLAY AND FINE SAND, TRACE	3	3	5	9	**8**
				6.5			FINE GRAVEL. (USCS: CL).					
2	8.0	10.0	6.5		14	SM	DR, VARIEGATED (BROWN, RED, WHITE) FINE TO MEDIUM SAND WITH A	5	15	31		**46**
							LITTLE SILT.					
3	13.0	13.8			13		DR, VARIEGATED (BROWN, RED, WHITE) FINE TO MEDIUM SAND WITH A	12	50/4"			**>50**
							LITTLE SILT, TRACE F-C ROCK FRAGMENTS.					
4	18.0	20.0			18		DR, VARIEGATED (BROWN, RED, WHITE) FINE TO MEDIUM SAND WITH A	3	13	22	31	**35**
							LITTLE SILT, TRACE F-C ROCK FRAGMENTS.					
5	23.0	25.0			21		DR, VARIEGATED (BROWN, RED, WHITE) FINE TO MEDIUM SAND WITH A	3	13	22	24	**35**
							LITTLE SILT, TRACE F-C ROCK FRAGMENTS.					
6	28.0	30.0			24		DR, VARIEGATED (DARK BROWN, WHITE, REDDISH BROWN) FINE TO	2	10	12	21	**22**
							MEDIUM SAND WITH A LITTLE SILT, TRACE MICA.					
7	33.0	34.5			13		DR, VARIEGATED (DARK BROWN, WHITE, REDDISH BROWN) FINE TO	1	15	50		**65**
							MEDIUM SAND WITH A LITTLE SILT, TRACE MICA.					
8	38.0	38.6			4		DR, REDDISH BROWN FINE TO MEDIUM SAND WITH SOME SILT, TRACE	12	50/2"			**>50**
							FINE GEISS ROCK FRAGS.					
9	43.0	43.5		45.0	0		NO RECOVERY (AUGER CUTTINGS - SIMILAR TO S8).	50/6"				**>50**
							AUGER REFUSAL AT 45'.					
							ROCK CORING					
RUN 1	45.0	50.0	45.0		42	DECOMPOSED TO WEATH. ROCK	INTENSELY FRACTURED GRAY, WHITE AND RED GNEISS.	TCR: 70%, SCR: 32%, RQD: 13%				
RUN 2	50.0	51.0			12		INTENSELY FRACTURED DARK GRAY AND WHITE GNEISS (GRAVEL)	TCR: 100%, SCR: 25%, RQD: 0%				
RUN 3	51.0	51.5		51.5	5		INTENSELY FRACTURED DARK GRAY GNEISS (GRAVEL)	TCR: 83%, SCR: 67%, RQD: 0%				
							DIFFICULTY WITH CORE BARRELL JAMBING WITH ROCK GRAVEL.					
							OUT OF WATER AT 51.5', LARGE WATER LOSS.					
							CORE TESTING RESULTS (RUN 1, DEPTH 47-47.5'):					
							COMPRESSIVE STRENGTH: 5,390 PSI					
							UNIT WEIGHT: 159.5 PCF					

Notes/Comments:

Pocket Pentrometer Testing
S1: 3.25 TSF

DR: DECOMPOSED ROCK

WET ON SPOON AT 38'.
WATER LEVEL THROUGH AUGERS AT 38'. CAVED AT 42'.

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

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TEST BORING LOG

Project Name:	SUNOCO PENNSYLVANIA PIPELINE PROJECT		Project No.: 103IP3406
Project Location:	WORLED TRAVEL, Inc., 620 PENNSYLVANIA DRIVE, EXTON, PA		Page 1 of 1
HDD No.:	S3-0310	Dates(s) Drilled: 06-14-15	Inspector: E. WATT
Boring No.:	SB-03	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): NOT ENCOUNTERED	Total Depth (ft): 30.0
Boring Location Coordinates:		40° 3' 52.538" N	75° 40' 55.207" W

Sample No.	Sample Depth (ft) From	Sample Depth (ft) To	Strata Depth (ft) From	Strata Depth (ft) To	Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
			0.0	0.3			TOPSOIL (4")					
1	3.0	4.0	0.3		10	SM	BROWN AND LIGHT BROWN FINE TO MEDIUM SAND AND SILT, WITH	11	50/6"			**>50**
							A LITTLE FINE GRAVEL.					
2	8.0	9.9			23		DR WEATHERED TO A BROWN, LIGHT BROWN, WHITE F-M SAND, SOME	25	14	21	50/5"	**35**
				12.0			SILT, TRACE UNWEATHERED F-GRAVEL (GNEISS). (USCS: SM)					
3	13.0	13.4	12.0		5	SM/ GM	DR WEATHERED TO A LIGHT BROWN F-M SAND WITH SOME SILT, AND	50/5"				**>50**
				14.0			FINE TO COARSE UNWEATHERED GNEISS GRAVEL.					
4	18.0	18.5	14.0		5	SM	DR WEATHERED TO A WHITE AND LIGHT BROWN FINE SAND, A LITTLE	50/5"				**>50**
							SILT, WITH A LITTLE FINE UNWEATHERED GNEISS GRAVEL.					
5	23.0	23.2			2		DR WEATHERED TO A WHITE AND LIGHT BROWN FINE SAND, SOME	50/2"				**>50**
							SILT, WITH A LITTLE FINE UNWEATHERED GNEISS GRAVEL.					
6	28.0	28.0		30.0	0		NO RECOVERY.	50/0"				**>50**
							AUGERED TO 30'.					
							CAVED AND DRY AT 26'.					

Notes/Comments:
Pocket Pentrometer Testing

DR: DECOMPOSED ROCK

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
N: Number of blows to drive spoon from 6" to 18" interval.

GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0310

	Test				Water	Percent	Atterburg Limits (ASTM D4318)			USCS
HDD	Boring	Sample	Depth of Sample (ft.)		Content, %	Silts/Clays, %	Liquid	Plastic	Plasticity	Classif.
No.	No.	No.	From	To	(ASTM D2216)	(ASTM D1140)	Limit, %	Limit, %	Index, %	(ASTM D2487)
S3-0300	SB-02	2	8.0	10.0	23.5	20.5	-	-	-	-
		3	13.0	15.0	31.7	22.6	-	-	-	-
		4	18.0	20.0	41.7	33.1	30	25	5	SM
		5	23.0	25.0	32.2	28.7	-	-	-	-
		6	28.0	30.0	23.4	24.2	-	-	-	-
S3-0310	SB-01	2	8.0	10.0	15.3	20.7	-	-	-	-
		4	18.0	19.9	10.2	24.7	-	-	-	-
		6	28.0	29.4	7.8	15.9	-	-	-	-
		9	43.0	44.5	14.8	25.1	-	-	-	-
		10	48.0	49.9	12.6	33.1	-	-	-	-
		12	58.0	59.0	8.5	36.6	31	25	6	SM
		14	68.0	68.9	13.1	32.3	-	-	-	-
	SB-02	1	3.0	5.0	20.5	67.1	39	22	17	CL
		2	8.0	10.0	8.7	17.3	-	-	-	-
		4	18.0	20.0	6.2	14.8	-	-	-	-
		7	33.0	34.5	13.7	11.9	-	-	-	-
		8	38.0	38.6	10.3	22.7	-	-	-	-
	SB-03	1	3.0	4.0	10.6	44.7	-	-	-	-
		2	8.0	9.9	10.8	28.3	NV	NP	NP	SM
		4	18.0	18.5	4.9	20.1	-	-	-	-
		5	23.0	23.2	4.6	22.8	-	-	-	-

Rock Core Testing Results				
Boring No.	Core Run	Approximate Depth (ft)	Compressive Strength (psi)	Unit Weight (pcf)
S3-0310 SB-02	1	47.0-47.5	5,390	159.5

Notes:

1) Sample depths based on feet below grade at time of exploration.

ROCK CORE DESCRIPTION SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0310

Location	Boring No.	Core Run	Core Depth (ft)		TCR (%)	SCR (%)	RQD (%)	Depth (ft)		Weathering	Classification	Bedding Thickness (ft)	Color	Discontinuity Data
			From	To				From	To					
S3-0310	SB-2	1	45	50	70	32	13	45	49	Moderate	Gneiss	4	White/Lt. gray	Fractures ranging from 2° to 42°, Avg. 27°
		2	50	51	100	25	0	49	51.5	Heavily	Gneiss	Massive	White/Lt. gray/black	Rubble, two pieces over 3"
		3	51	51.5	83	67	0							

REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0310

HDD No.	BORING NO.	REGIONAL GEOLOGY DESCRIPTION	GENERAL TOPOGRAPHIC SETTING	BEDROCK FORMATION	GENERAL ROCK TYPE	APPROX MAX FM THICKNESS (FT)	DEPTH TO ROCK (Ft bgs) based on nearby well drilling logs	NOTES / COMMENTS
S3-0300	SB-02	Graphitic felsic gneiss - Includes Pickering Gneiss and small areas of marble; dominantly quartz and feldspar with varying amounts of graphite and various metamorphic minerals; medium grained, light to dark gray and greenish gray; sedimentary origin.	Generally level, slightly sloping to the west	Graphitic felsic gneiss (PreCambrian)	Graphitic gneiss	Unknown	See Notes.	Of the 23 well records within 0.5 miles of the site, only one had a recorded bedrock depth. Given the similar geology, bedrock depth is likely to be similar to other locations in this formation
S3-0310	SB-01		Gently sloping to the west				Ranges from 30 to 95 ft bgs, Avg. 75 ft bgs (.5 mile radius)	
	SB-02		Generally level				Ranges from 30 to 95 ft bgs, Avg. 72 ft bgs (.5 mile radius)	
	SB-03		Gently sloping to the South	Felsic and intermediate gneiss (PreCambrian)	Felsic gneiss		Ranges from 30 to 95 ft bgs, Avg. 52 ft bgs (.5 mile radius)	

Note : Source of well log data - http://www.dcnr.state.pa.us/topogeo/groundwater/pagwis/records/index.htm. All other sources as referenced in comments section.

FIELD DESCRIPTION AND LOGGING SYSTEM FOR SOIL EXPLORATION

GRANULAR SOILS

(Sand, Gravel & Combinations)

Density	***N (blows)****
Very Loose	5 or less
Loose	6 to 10
Medium Dense	11 to 30
Dense	31to 50
Very Dense	51 or more

Relative Proportions

Description Term	*Percent*
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Identification

Boulders	8 in. diameter or more	
Cobbles	3 to 8 in. diameter	
Gravel	Coarse (C)	3 in. to ¾ in. sieve
	Fine (F)	¾ in. to No. 4 sieve
Sand	Coarse (C)	No. 4 to No. 10 sieve (4.75mm-2.00mm)
	Medium (M)	No. 10 to No. 40 sieve (2.00mm – 0.425mm)
	Fine (F)	No. 40 to No. 200 sieve (0.425 – 0.074mm)
Silt/Clay	Less Than a No. 200 sieve (<0.074mm)	

COHESIVE SOILS

(Silt, Clay & Combinations)

Consistency	***N (blows)****
Very Soft	3 or less
Soft	4 to 5
Medium Stiff	6 to 10
Stiff	11 to 15
Very Stiff	16 to 30
Hard	31 or more

Plasticity

Degree of Plasticity	*Plasticity Index*
None to Slight	0 - 4
Slight	5 - 7
Medium	8- 22
High to Very High	> 22

ROCK

(Rock Cores)

Rock Quality Designation (RQD), %	***Rock Quality Description***
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

N - Standard Penetration Resistance. Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. The number of hammer blows to drive the sampler through each 6 inch interval is recorded; the number of blows required to drive the sampler through the final 12 inch interval is termed the Standard Penetration Resistance (SPR) N-value. For example, blow counts of 6/8/9 (through three 6-inch intervals) results in an SPR N-value of 17 (8+9).

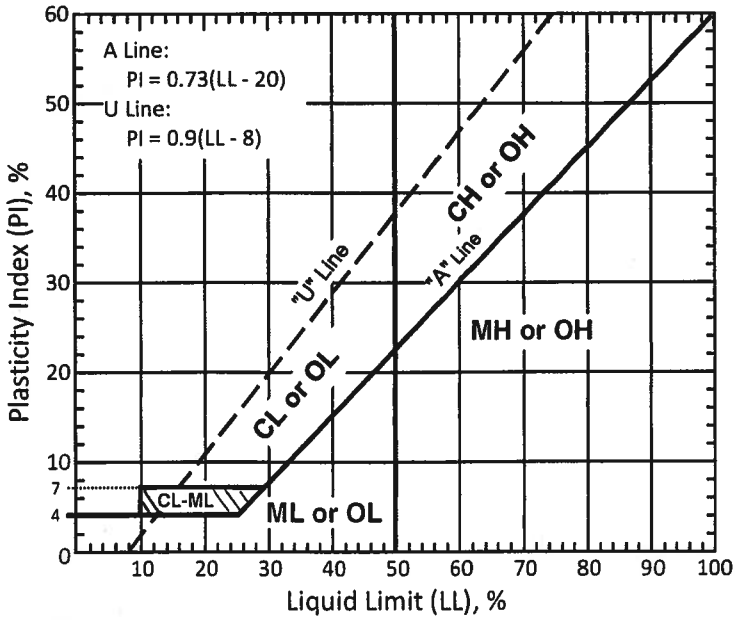
Groundwater observations were made at the times indicated. Groundwater elevations fluctuate throughout a given year, depending on actual field porosity and variations in seasonal and annual precipitation.

UNIFIED SOIL CLASSIFICATION SYSTEM [Casagrande (1948)]

Major Divisions			Group Symbols	Typical Descriptions	Laboratory Classifications		
Coarse Grained Soils (More than half of material is larger than No. 200 sieve)	Gravels More than half of coarse fraction is larger than No. 4 sieve	Clean gravel (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine Percentage of sand and gravel from grain size curve. Depending on Percentage of fines (fraction smaller than No. 200 sieve), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent Borderline cases requiring dual symbols[1]	$C_u=\frac{D_{60}}{D_{10}}$ greater than 4: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting C_u or C_c requirements for GW	
		Gravel with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 Sieve)	Clean sands (Little or no fines)	SW	Well graded sands, gravely sands, little or no fines		$C_u=\frac{D_{60}}{D_{10}}$ greater than 6: $C_c=\frac{(D_{30})2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting C_u or C_c requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits Plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above A line with I_p greater than 7	

Major Divisions		Group Symbols	Typical Descriptions
Fine–grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays , sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
	Highly organic soils	Pt	Peat and other highly organic soils

For soils plotting nearly on A line use dual symbols i.e ., I_p = 29.5, w_L=60 gives CH-MH. When w_L is near 50 use CL-CH or ML-MH. Take near as ± 2 percent.

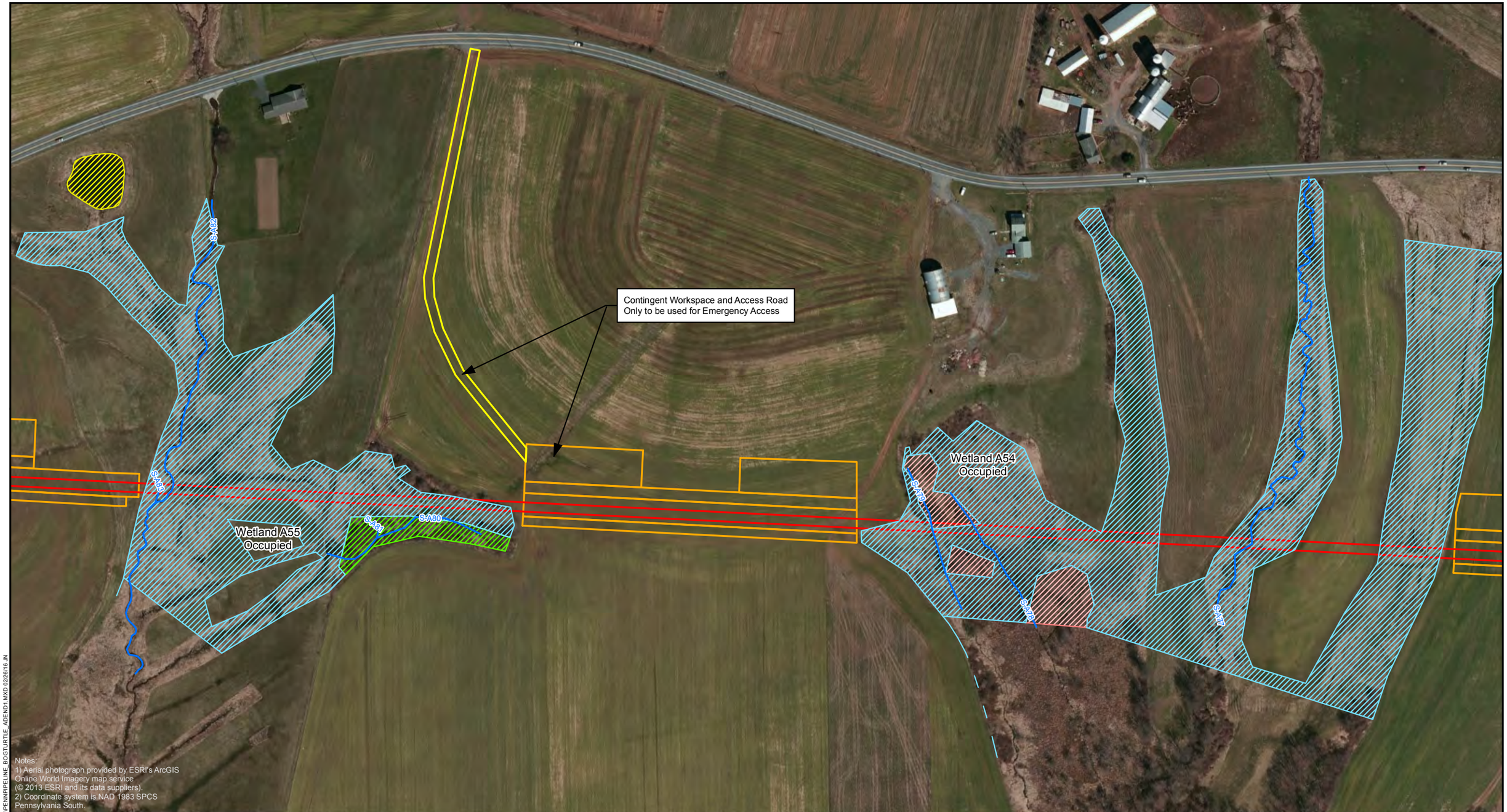


(1) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC. well-graded gravel-sand mixture with clay binder.

APPENDIX C

Bog Turtle Occupied and Assumed Presence

Wetlands Figure Series



Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
- PuB
- Access Road
- New Proposed Alignment Centerline
- New Proposed Limit of Disturbance

N

0 100 200 Feet

0 25 50 Meters

BOG TURTLE OCCUPIED AND ASSUMED PRESENCE WETLANDS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
LANCASTER COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/26/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 1A

REVISION 0

PGH P:\GIS\SUNOCO\MARINER EAST 2MX\DPENNPIPELINE_BOGTURTLE_ADEND1.MXD 02/26/16 JN

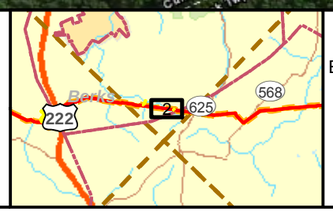
Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).
2) Coordinate system is NAD 1983 SPCS Pennsylvania South.

Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
  - PuB
- Access Road
- New Proposed Alignment Centerline
- New Proposed Limit of Disturbance

Feet: 0 100 200

Meters: 0 25 50



BOG TURTLE OCCUPIED AND ASSUMED PRESENCE WETLANDS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
BERKS COUNTY, PENNSYLVANIA

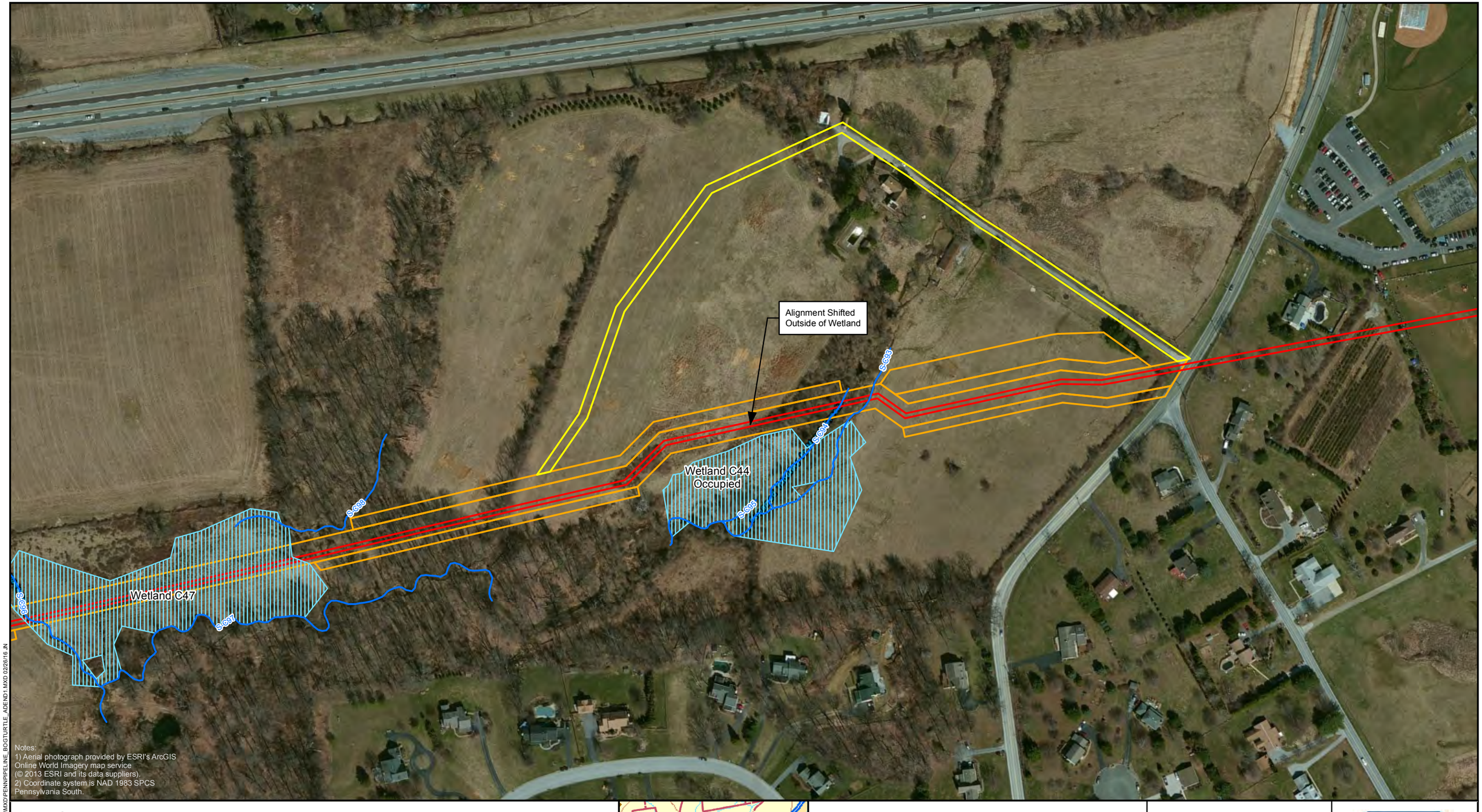
DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/26/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 1B

REVISION 0

PGH P:\GIS\SUNOCO\MARNER EAST 2MX\DPENNPIPELINE_BOGTURTLE_ADEND1.MXD 02/26/16 JN



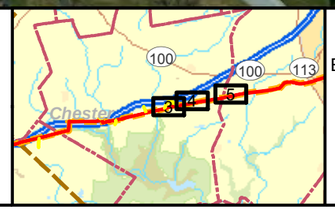
Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).
2) Coordinate system is NAD 1983 SPCS Pennsylvania South.

Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
  - PuB
- Access Road
- New Proposed Alignment Centerline
- New Proposed Limit of Disturbance

0 100 200 Feet

0 25 50 Meters



BOG TURTLE OCCUPIED AND ASSUMED PRESENCE WETLANDS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
CHESTER COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/26/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 1C

REVISION 0

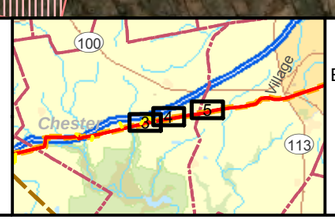
PGH P:\GIS\SUNOCO\MARINER EAST 2MX\D\PENN\PIPELINE_BOGTURTLE_ADEND1.MXD 02/26/16 JN

Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
- PuB
- Access Road
- New Proposed Alignment Centerline
- New Proposed Limit of Disturbance

0 100 200 Feet

0 25 50 Meters



BOG TURTLE OCCUPIED AND ASSUMED PRESENCE WETLANDS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
CHESTER COUNTY, PENNSYLVANIA

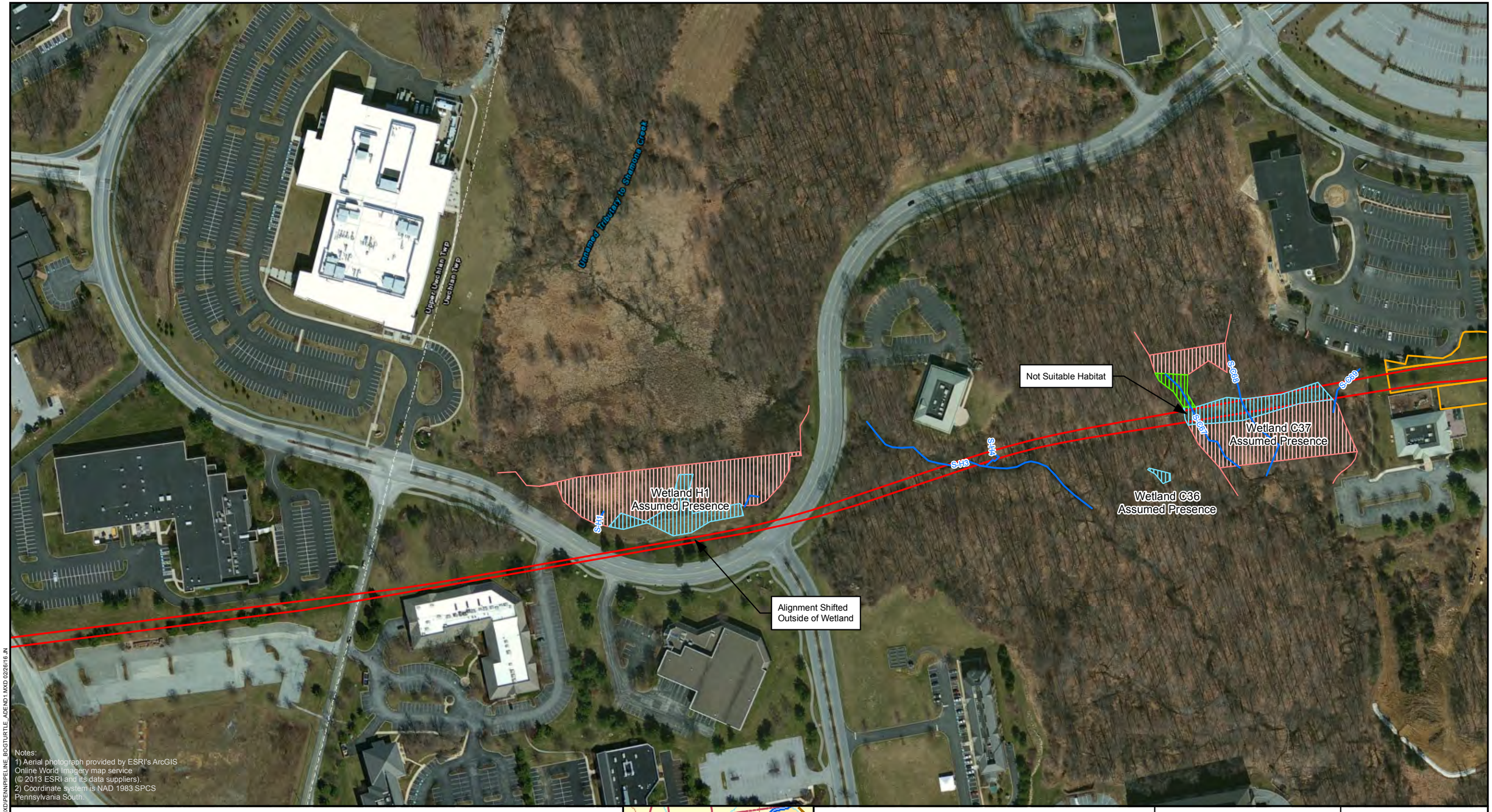
DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/26/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 1D

REVISION 0

PGH P:\GIS\SUNOCO\MARNER EAST 2MX\DPENN\PIPELINE_BOGTURTLE_ADEND1.MXD 02/26/16 JN

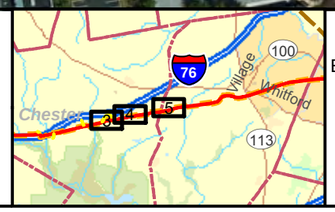


Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
- PuB
- Access Road
- New Proposed Alignment Centerline
- New Proposed Limit of Disturbance

0 100 200 Feet

0 25 50 Meters



BOG TURTLE OCCUPIED AND ASSUMED PRESENCE WETLANDS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
CHESTER COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/26/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 1E

REVISION 0

PGH P:\GIS\SUNOCO\MARINER EAST 2MX\D\PENNPIPELINE_BOGTURTLE_ADEND1.MXD 02/26/16 JN

APPENDIX D

Bog Turtle Phase II Negative Wetland with Potential Hydrological Connections Figure Series

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).
2) Coordinate system is NAD 1983 SPCS Pennsylvania South.

Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
  - PuB
- Access Road
- Alignment Centerline
- Limit of Disturbance

Feet: 0 100 200

Meters: 0 25 50

BOG TURTLE PHASE II NEGATIVE WETLAND WITH POTENTIAL HYDROLOGICAL CONNECTIONS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
LEBANON COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/25/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 2A

REVISION 0

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PENNPIPELINE_BOGTURTLE_ADEND2.MXD 02/25/16 JN

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).
2) Coordinate system is NAD 1983 SPCS Pennsylvania South.

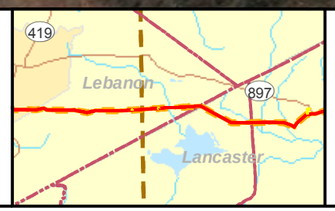
Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
  - PuB
- Access Road
- Alignment Centerline
- Limit of Disturbance

N

0 100 200 Feet

0 25 50 Meters



BOG TURTLE PHASE II NEGATIVE WETLAND WITH POTENTIAL HYDROLOGICAL CONNECTIONS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
LEBANON COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/25/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 2B

REVISION 0

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PENNPIPELINE_BOGTURTLE_ADEND2.MXD 02/25/16 JN

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).
2) Coordinate system is NAD 1983 SPCS Pennsylvania South.

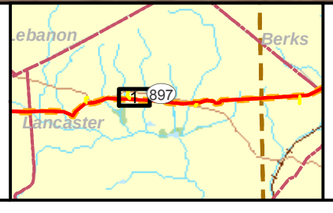
Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
- PuB
- Access Road
- Alignment Centerline
- Limit of Disturbance

N

0 100 200 Feet

0 25 50 Meters



BOG TURTLE PHASE II NEGATIVE WETLAND WITH POTENTIAL HYDROLOGICAL CONNECTIONS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
LANCASTER COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/25/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 2C

REVISION 0

PGH P:\GIS\SUNOCO\MARINER EAST 2MX\DPENNPIPELINE_BOGTURTLE_ADEND2.MXD 02/25/16 JN

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).
2) Coordinate system is NAD 1983 SPCS Pennsylvania South.

Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
- PuB
- Access Road
- Alignment Centerline
- Limit of Disturbance

0 100 200 Feet

0 25 50 Meters

BOG TURTLE PHASE II NEGATIVE WETLAND WITH POTENTIAL HYDROLOGICAL CONNECTIONS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
CHESTER COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/25/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

FIGURE 2D

REVISION 0

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PENNPIPELINE_BOGTURTLE_ADEND2.MXD 02/25/16 JN

Notes:
1) Aerial photograph provided by ESRI's ArcGIS Online World Imagery map service (© 2013 ESRI and its data suppliers).
2) Coordinate system is NAD 1983 SPCS Pennsylvania South.

Legend

- Stream
- **Wetland**
  - PEM
  - PFO
  - PSS
- PuB
- Access Road
- Alignment Centerline
- Limit of Disturbance

0 100 200 Feet

0 25 50 Meters

BOG TURTLE PHASE II NEGATIVE WETLAND WITH POTENTIAL HYDROLOGICAL CONNECTIONS
PENNSYLVANIA PIPELINE PROJECT
SUNOCO LOGISTICS, L.P.
CHESTER COUNTY, PENNSYLVANIA

DRAWN BY: K. MOORE 2/6/14
CHECKED BY: P. SMITH 02/25/16
APPROVED BY:

CONTRACT NUMBER: 112IC05958

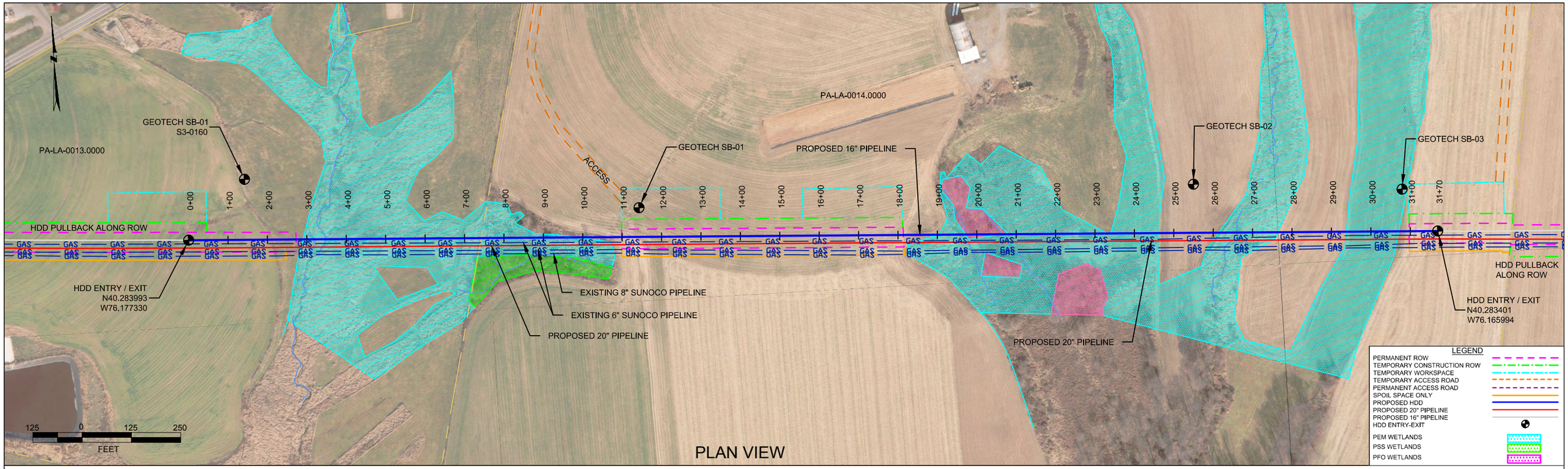
FIGURE 2E

REVISION 0

PGH P:\GIS\SUNOCO\MARINER EAST 2\MXD\PENNPIPELINE_BOGTURTLE_ADEND2.MXD 02/25/16 JN

APPENDIX D

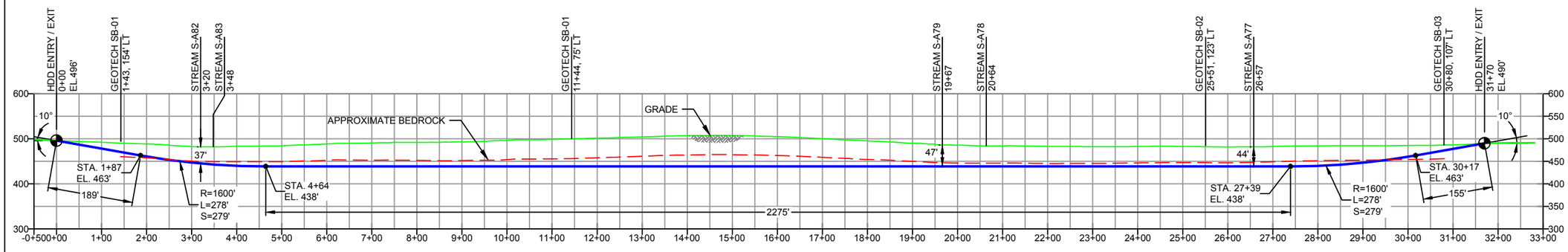
HDD and Bore Drawings



PLAN VIEW

PROFILE VIEW

LANCASTER COUNTY, PENNSYLVANIA - WEST COCALICO TOWNSHIP
S3-0161-16



GEOTECH SB-01
-NG EL. 500'
-TOPSOIL (0' - 0.7')
-CL (0.7' - 13.5')
-GROUNDWATER (17.0')
-SM (13.5' - 44.0')
-WEATHERED SILTSTONE/SANDSTONE (44.0' - 45.0')
-COMPLETION DEPTH EL. 441'

GEOTECH SB-02
-NG EL. 485'
-TOPSOIL (0' - 0.7')
-GROUNDWATER (13.0')
-SC (0.7' - 21.0')
-CL (21.0' - 35.0')
-WEATHERED SILT STONE (35.0' - 44.0')
-COMPLETION DEPTH EL. 441'

GEOTECH SB-03
-NG EL. 487'
-TOPSOIL (0' - 0.3')
-SM (0.3' - 11.5')
-GROUNDWATER (6.0')
-SC (11.5' - 30.0')
-COMPLETION DEPTH EL. 457'

NOTE: REFER TO TEST BORING LOG S3-0170 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH SB-01
-NG EL. 494'
-TOPSOIL (0' - 0.1')
-SM (0.1' - 21.5')
-GROUNDWATER (15.0')
-SC (21.5' - 26.0')
-CL (26.0' - 30.0')
-COMPLETION DEPTH EL. 464'

NOTE: REFER TO TEST BORING LOG S3-0160 FOR COMPLETE SOIL MATERIAL DESCRIPTION

DESIGN AND CONSTRUCTION:
1. CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXITING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
2. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HORZ. LENGTH (L=):3170'
   HDD PIPE LENGTH (S=):3177'
   16" x 0.438" W.T., X-70, APISL, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
12. SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
13. SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

NOTES
1. ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
2. STATIONING IS BASED ON HORIZONTAL DISTANCES.
3. ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP ARE NOT RESPONSIBLE FOR LOCATION OF FOREIGN UTILITIES SHOWN IN PLOT PLAN OR PROFILE. THE INFORMATION SHOWN HEREON IS FURNISHED WITHOUT LIABILITY ON THE PART OF ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP, FOR ANY DAMAGES RESULTING FROM ERRORS OR OMISSIONS THEREIN.
4. CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
5. SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
1	DESIGN CHANGE	MRS	02/24/16	RMB	02/24/16	AAW	02/24/16
0	ISSUED FOR CONSTRUCTION	MRS	01/21/16	RMB	01/21/16	AAW	01/21/16

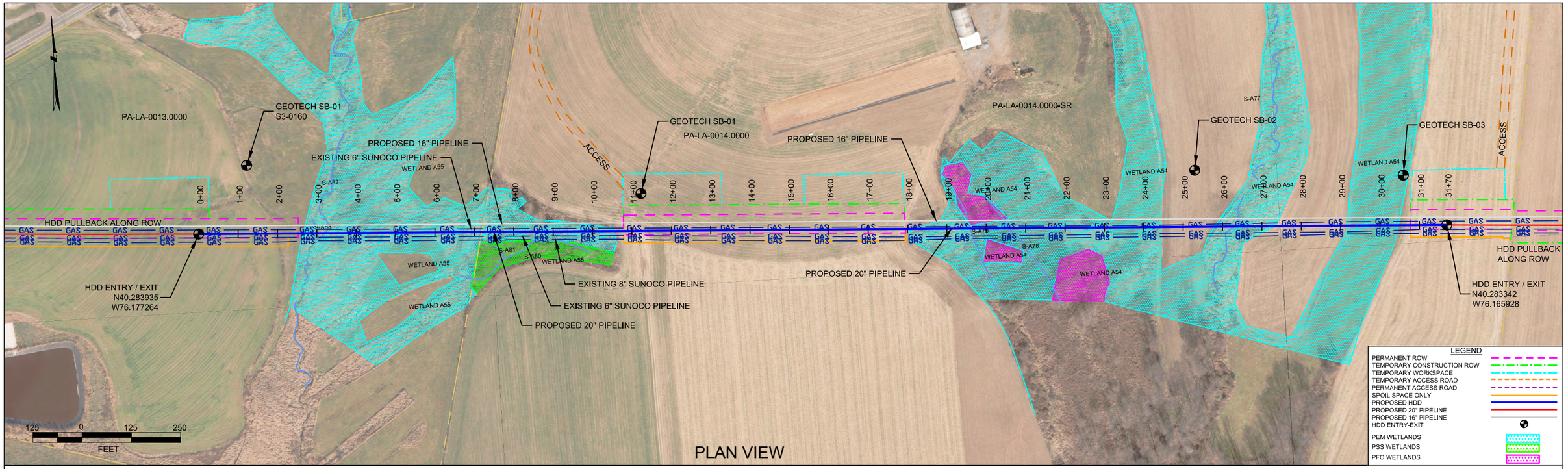
Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
WETLAND A54 & A55
PENNSYLVANIA PIPELINE PROJECT

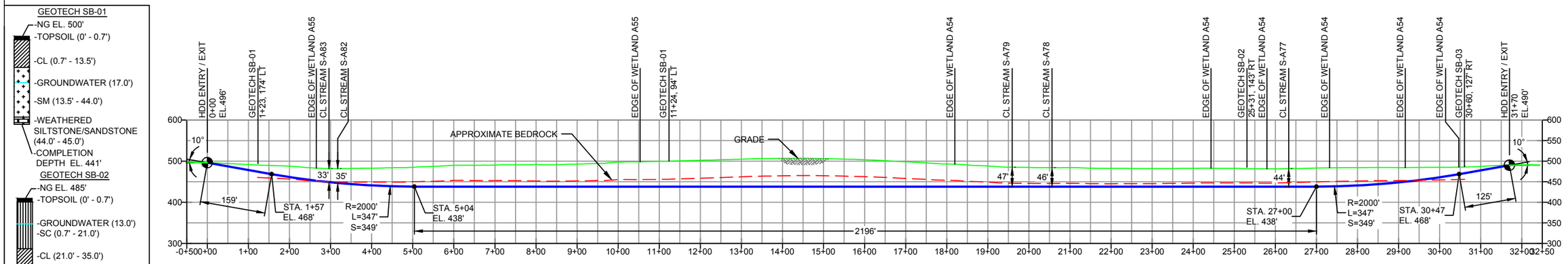
SCALE: 1"=250' | DWG. NO: PA-LA-0014.0000-SR-16



PLAN VIEW

PROFILE VIEW

LANCASTER COUNTY, PENNSYLVANIA - WEST COCALICO TOWNSHIP
S3-0161



DESIGN AND CONSTRUCTION:

1. CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXITING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
2. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HORZ. LENGTH (L=):3170'
   HDD PIPE LENGTH (S=):3178'
   20" x 0.456" W.T., X-65, APISL, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
12. SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
13. SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

NOT FOR CONSTRUCTION, ISSUED FOR PERMIT ONLY

NOTES

1. ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
2. STATIONING IS BASED ON HORIZONTAL DISTANCES.
3. ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP ARE NOT RESPONSIBLE FOR LOCATION OF FOREIGN UTILITIES SHOWN IN PLOT PLAN OR PROFILE. THE INFORMATION SHOWN HEREON IS FURNISHED WITHOUT LIABILITY ON THE PART OF ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP, FOR ANY DAMAGES RESULTING FROM ERRORS OR OMISSIONS THEREIN.
4. CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
5. SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
EP	NOT FOR CONSTRUCTION, ISSUED FOR PERMIT	MRS	02/26/16	RMB	02/26/16	AAW	02/26/16
1	DESIGN CHANGE	MRS	02/24/16	RMB	02/24/16	AAW	02/24/16
0	ISSUED FOR CONSTRUCTION	MRS	01/21/16	RMB	01/21/16	AAW	01/21/16

Sunoco Logistics Partners L.P.

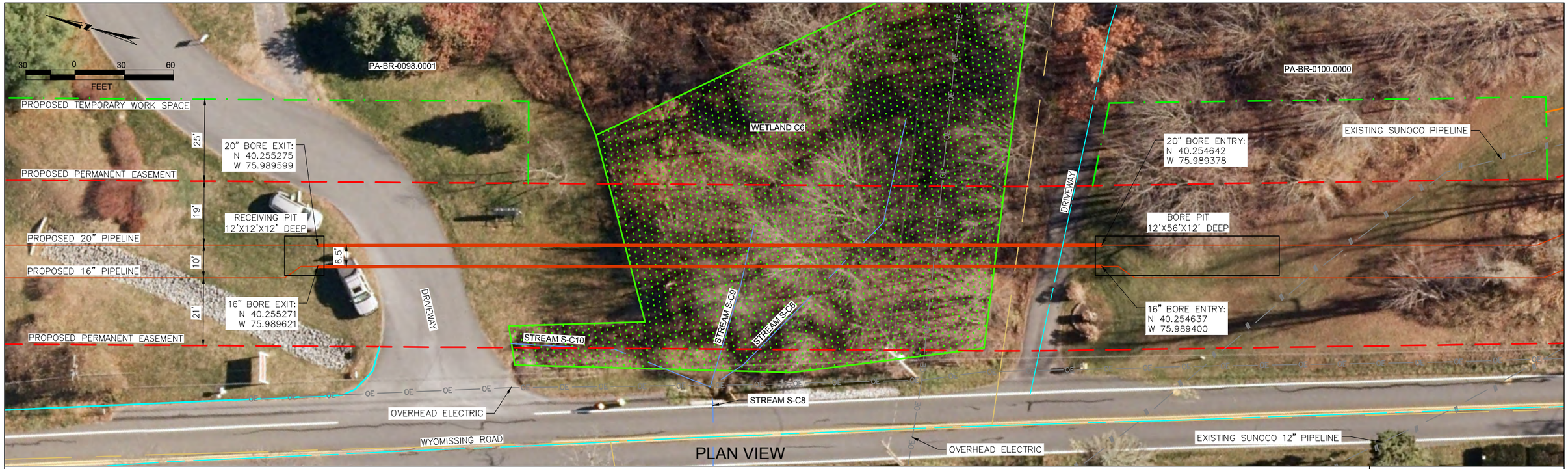
TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
WETLAND A54 & A55
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=250'

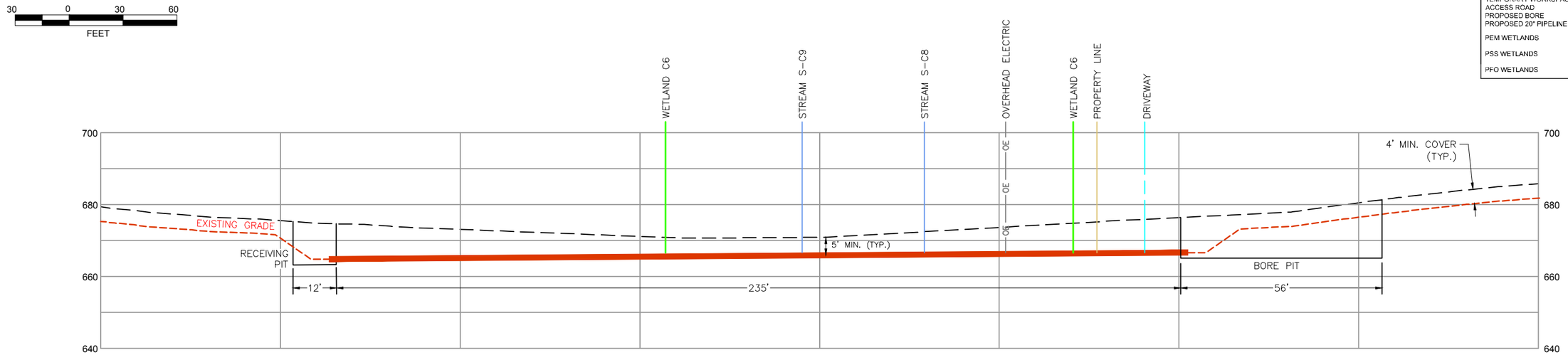
DWG. NUMBER: PA-LA-0014.0000-SR



PLAN VIEW

BERKS COUNTY, PENNSYLVANIA - CUMRU TOWNSHIP

PROFILE VIEW



LEGEND

- PERMANENT ROW
- TEMPORARY CONSTRUCTION ROW
- TEMPORARY WORKSPACE
- ACCESS ROAD
- PROPOSED BORE
- PROPOSED 20" PIPELINE
- PEM WETLANDS
- PSS WETLANDS
- PFO WETLANDS

CONSTRUCTION NOTES

1. STEEL PIPE: 20" OD x 0.456" WT, X-65, API-5L, PSL2, ERW, BFW, DRL
2. STEEL PIPE: 16" OD x 0.438 WT, X-70, API-5L, PSL2, ERW, BFW
3. COATING: 14 TO 16 MILS OF 3M SCOTCHKOTE TM 6233 FBE WITH 40 MILS MIN. DFT POWERCRETE R95.
4. DESIGN FACTOR: 0.50 (HOOP STRESS)
5. DESIGN PRESSURE: 1480 PSIG
   TEST PRESSURE: 1850 PSIG
6. WELDING PROCESSES: SUBMERGED ARC WELDING PROCESS OR SEMI-AUTOMATIC PROCESSES APPROVED BY THE CERTIFIED PIPELINE VENDER.
7. THE COATING ON THE CARRIER PIPE SHALL BE INSPECTED IMMEDIATELY PRIOR TO ITS INSTALLATION AND ALL DAMAGED COATING SHALL BE REPAIRED IN ACCORDANCE WITH SUNOCO'S PIPELINE COATING SPECIFICATIONS.
8. IN ADDITION TO THE SITE-SPECIFIC INFORMATION PROVIDED IN THIS DRAWING, GENERAL REQUIREMENTS INCLUDED IN PERMITS AND APPROVAL FROM FEDERAL, STATE AND LOCAL AGENCIES ALSO APPLY.

FOR PRELIMINARY USE ONLY

THIS DRAWING HAS BEEN DESIGNED FOR PRELIMINARY USE ONLY.
ONCE FIELD SURVEY IS OBTAINED, DESIGN WILL BE REVISED.

NOTES

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REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
A	ISSUED FOR REVIEW	JTW	02/25/16	CAG	02/25/16	AAW	02/25/16

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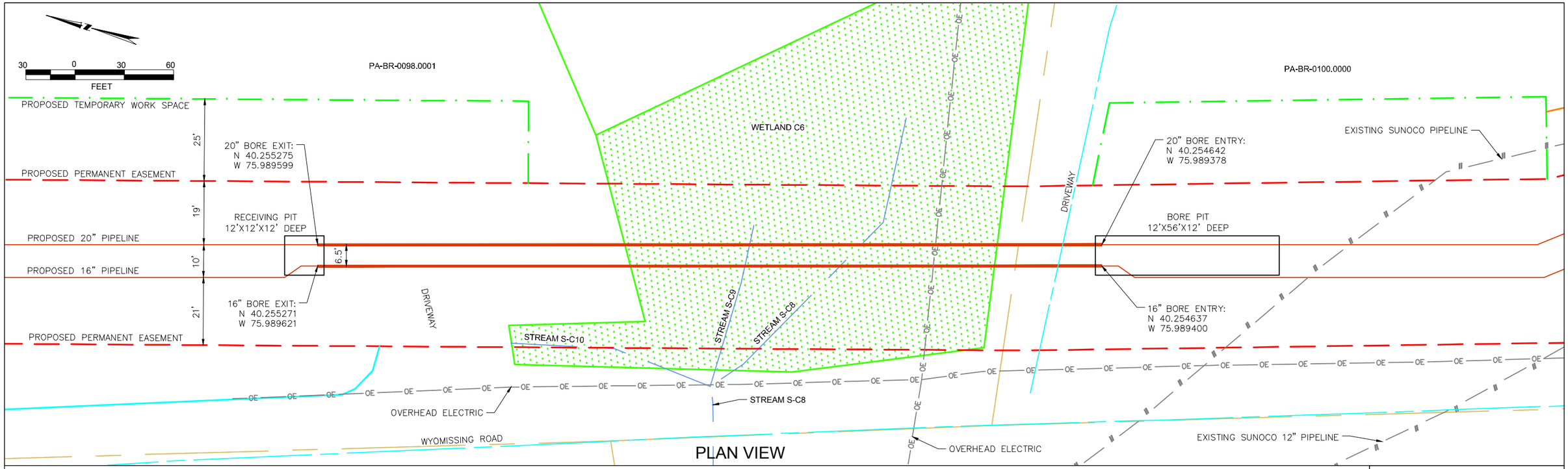
(303) 792-5911

SUNOCO PIPELINE, L.P.

AUGER BORE
WETLAND
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=30'

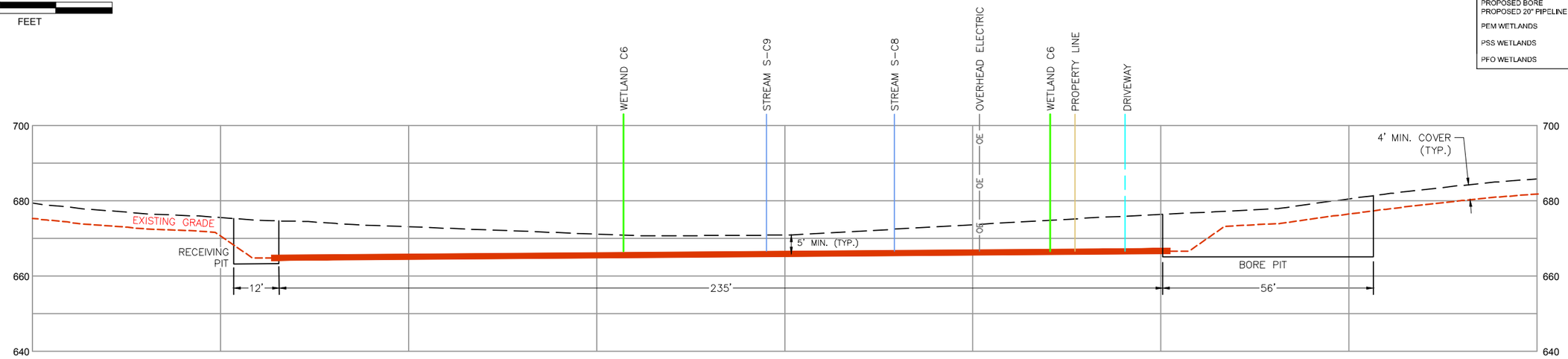
DWG. NUMBER: PA-BR-0098.0001



PLAN VIEW

PROFILE VIEW

BERKS COUNTY, PENNSYLVANIA - CUMRU TOWNSHIP



LEGEND

- PERMANENT ROW
- TEMPORARY CONSTRUCTION ROW
- TEMPORARY WORKSPACE
- ACCESS ROAD
- PROPOSED BORE
- PROPOSED 20" PIPELINE
- PEM WETLANDS
- PSS WETLANDS
- PFO WETLANDS

CONSTRUCTION NOTES

1. STEEL PIPE: 20" OD x 0.456" WT, X-65, API-5L, PSL2, ERW, BFW, DRL
2. STEEL PIPE: 16" OD x 0.438 WT, X-70, API-5L, PSL2, ERW, BFW
3. COATING: 14 TO 16 MILS OF 3M SCOTCHKOTE TM 6233 FBE WITH 40 MILS MIN. DFT POWERCRETE R95.
4. DESIGN FACTOR: 0.50 (HOOP STRESS)
5. DESIGN PRESSURE: 1480 PSIG
   TEST PRESSURE: 1850 PSIG
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REVISIONS

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A	ISSUED FOR REVIEW	JTW	02/25/16	CAG	02/25/16	AAW	02/25/16

Sunoco Logistics Partners L.P.

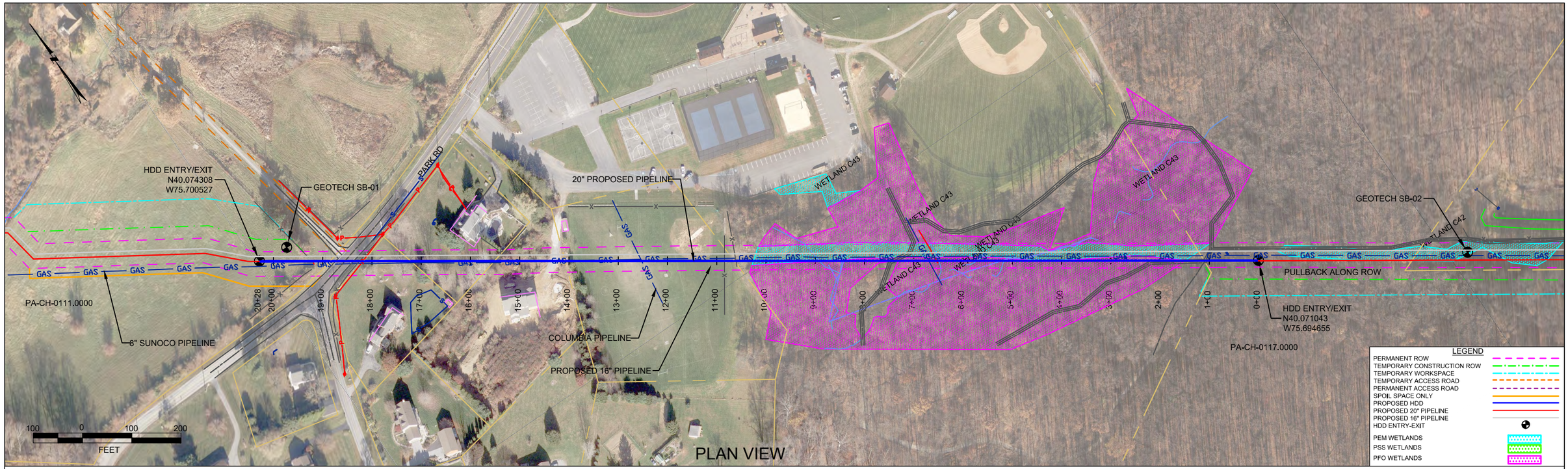
TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

AUGER BORE
WETLAND
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=30'

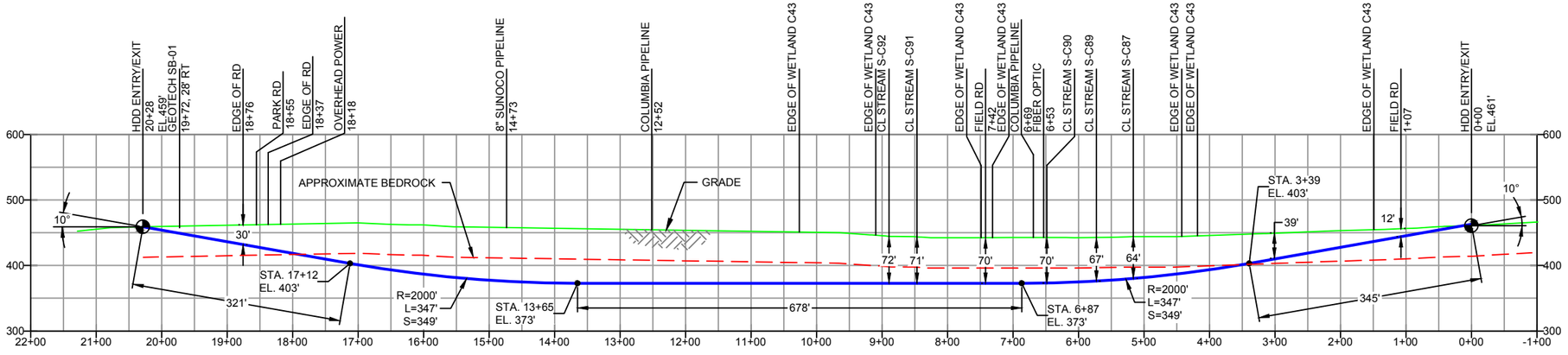
DWG. NUMBER: PA-BR-0098.0001



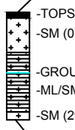
PLAN VIEW

PROFILE VIEW

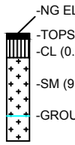
CHESTER COUNTY, PENNSYLVANIA - UWCHLAN TOWNSHIP
S3-0300



GEOTECH SB-01



GEOTECH SB-02



NOTE:
1.REFER TO TEST BORING LOG S3-0210 FOR COMPLETE SOIL MATERIAL DESCRIPTION
2. PDOT RECORD INDICATED GRAPHITIC FELSIC GNEISS AT 25'-35' DEPTH, REFER TO PaGWIS PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

DESIGN AND CONSTRUCTION:
1. CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXITING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
2. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HORZ. LENGTH (L=):2028'
   HDD PIPE LENGTH (S=):2042'
   20" x 0.456" W.T., X-65, API5L, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.

NOT FOR CONSTRUCTION, ISSUED FOR PERMIT ONLY

NOTES
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REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
EP	NOT FOR CONSTRUCTION, ISSUED FOR PERMIT	MRS	12/07/15	RMB	12/07/15	AAW	12/07/15
D	ADDED GEOTECH INFO	MRS	09/25/15	RMB	09/25/15	AAW	09/25/15
C	ISSUED FOR BID	DLM	08/21/15	RMB	08/21/15	AAW	08/21/15
B	ISSUED FOR BID	DLM	07/31/15	RMB	07/31/15	AAW	07/31/15
A	ISSUED FOR REVIEW	KB	03/26/15	RMB	03/26/15	AAW	03/26/15

Sunoco Logistics Partners L.P.

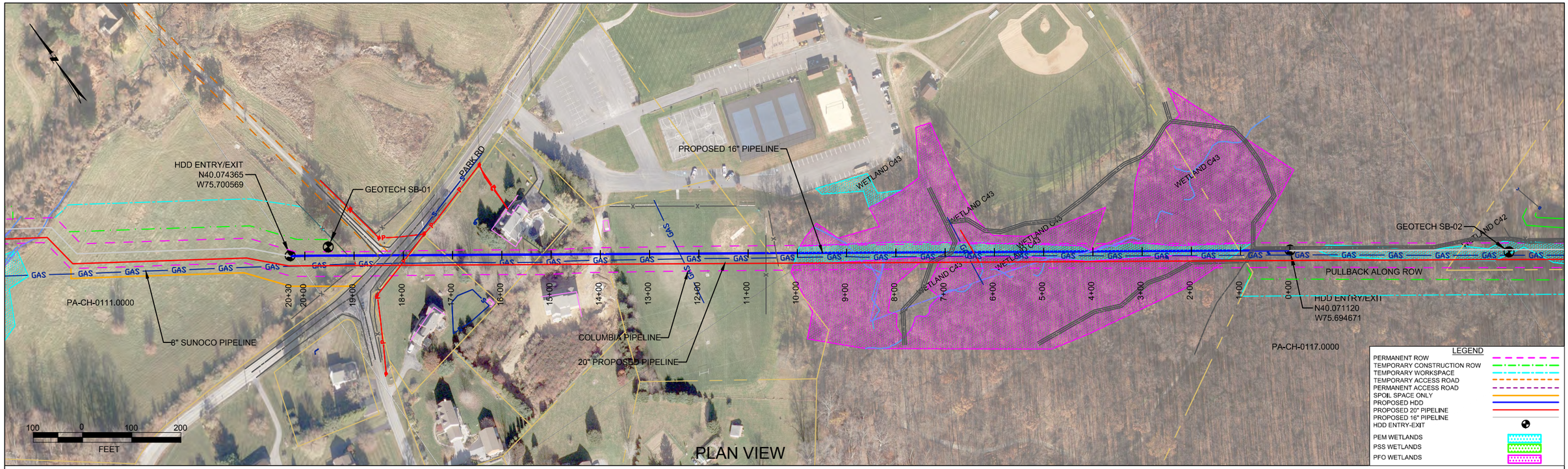
TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
PARK ROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200'

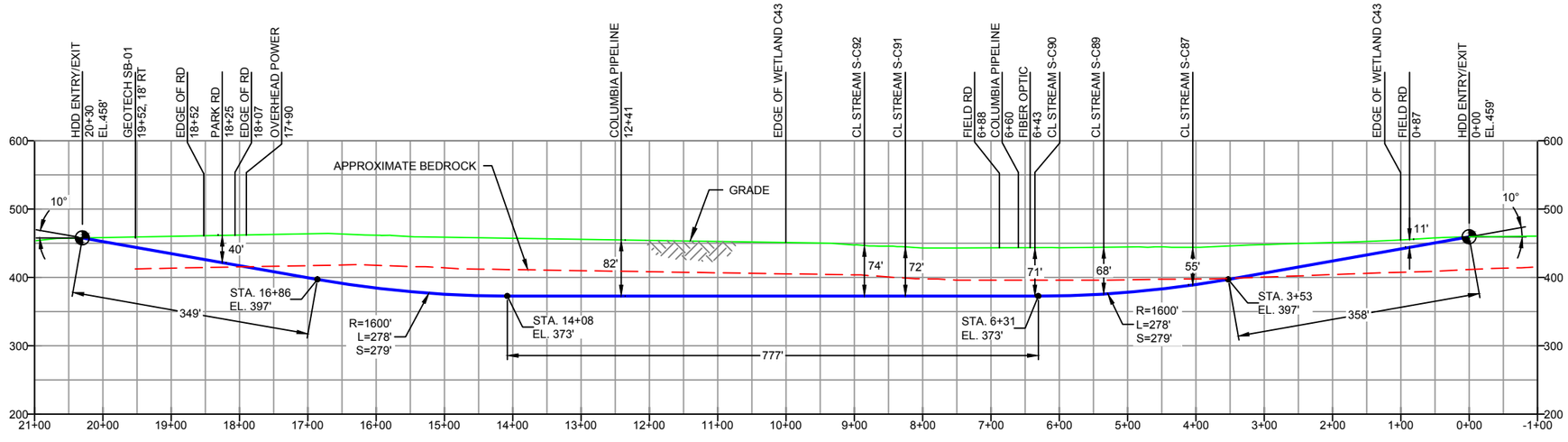
DWG. NUMBER: PA-CH-0111.0000-RD



PLAN VIEW

CHESTER COUNTY, PENNSYLVANIA - UWCHLAN TOWNSHIP
S3-0300-16

PROFILE VIEW



GEOTECH SB-01

GEOTECH SB-02

NOTE:
1.REFER TO TEST BORING LOG S3-0210 FOR COMPLETE SOIL MATERIAL DESCRIPTION
2. PDOT RECORD INDICATED GRAPHITIC FELSIC GNEISS AT 25'-35' DEPTH, REFER TO PaGWIS PENNSYLVANIA DEPARTMENT OF TRANSPORTATION

DESIGN AND CONSTRUCTION:
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2. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HOR2. LENGTH (L=):2030'
   HDD PIPE LENGTH (S=):2043'
   16" x 0.438" W.T., X-70, API5L, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.

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NOTES
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REVISIONS

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EP	NOT FOR CONSTRUCTION, ISSUED FOR PERMIT	MRS	12/07/15	RMB	12/07/15	AAW	12/07/15
A	ISSUED FOR BID	MRS	08/31/15	RMB	08/31/15	AAW	08/31/15

Sunoco Logistics Partners L.P.

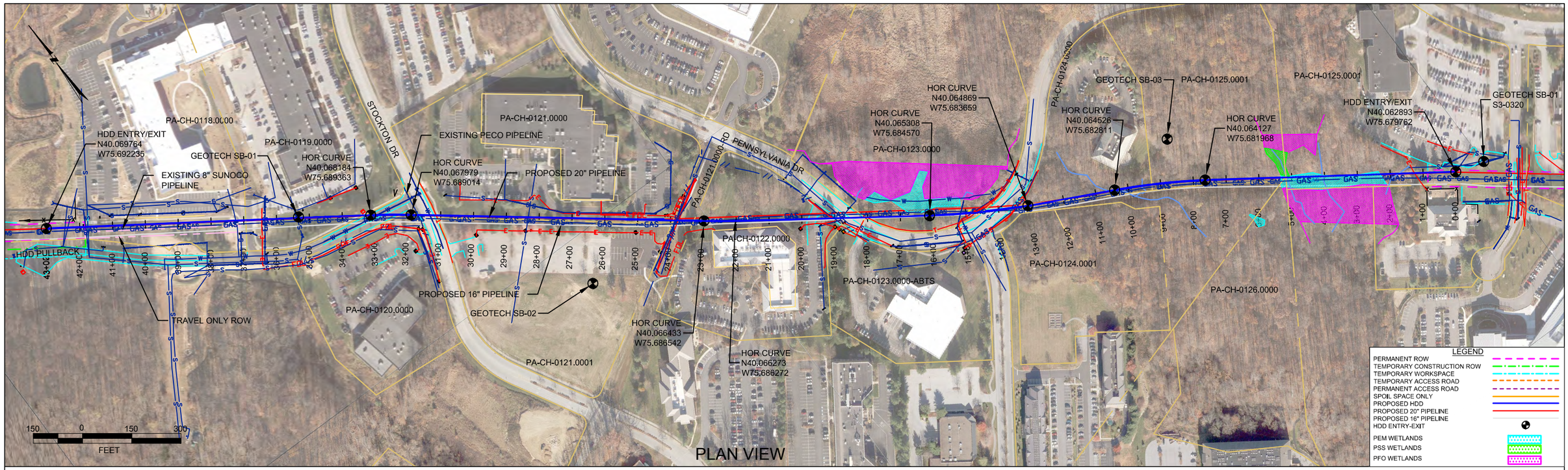
TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
PARK RD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200'

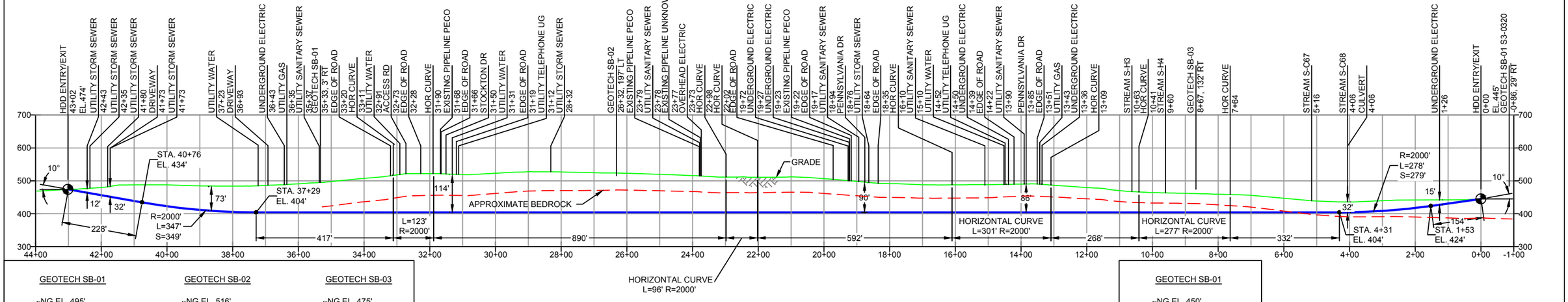
DWG. NO: PA-CH-0111.0000-RD-16



PLAN VIEW

PROFILE VIEW

CHESTER COUNTY, PENNSYLVANIA - UWCHLAN TOWNSHIP
S3-0310



GEOTECH SB-01
- NG EL. 495'
- -TOPSOIL (0' - 0.1')
- -GROUNDWATER (30.5')
- -SM (0.1' - 73.8')
- -COMPLETION DEPTH EL. 421'

GEOTECH SB-02
- NG EL. 516'
- -TOPSOIL (0' - 0.3')
- -CL (0.3' - 6.5')
- -GROUNDWATER (38.0')
- -SM (6.5' - 45.0')
- -FRACTURED GNEISS (45.0' - 51.5')
- -COMPLETION DEPTH EL. 471'

GEOTECH SB-03
- NG EL. 475'
- -TOPSOIL (0' - 0.3')
- -SM (0.3' - 12.0')
- -SM/GM (12.0' - 14.0')
- -SM (14.0' - 30.0')
- -COMPLETION DEPTH EL. 435'

NOTE: REFER TO TEST BORING LOG S3-0310 FOR COMPLETE SOIL MATERIAL DESCRIPTION

DESIGN AND CONSTRUCTION:
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3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HORZ. LENGTH (L=):4302'
   HDD PIPE LENGTH (S=):4306'
   20" x 0.456" W.T., X-65, API5L, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.

GEOTECH SB-01
- NG EL. 450'
- -TOPSOIL (0' - 0.2')
- -ML (0.2' - 9.0')
- -GROUNDWATER (25.0')
- -SM (9.0' - 53.0')
- -WEATHERED GNEISS (53.0' - 61.3')
- -COMPLETION DEPTH EL. 389'

NOTE: REFER TO TEST BORING LOG S3-0320 FOR COMPLETE SOIL MATERIAL DESCRIPTION

NOTES

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REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
0	ISSUED FOR CONSTRUCTION	MRS	02/19/16	RMB	02/19/16	AAW	02/19/16

Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
PENNSYLVANIA DRIVE
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=300'

DWG. NUMBER: PA-CH-0124.0000-RD

APPENDIX F

HDD Inadvertent Return Contingency Plan with Special Bog Turtle Area Procedures

HDD Inadvertent Return Contingency Plan with Special Bog Turtle Area Procedures

Pennsylvania Pipeline Project

February 29, 2016

Prepared for:
Sunoco Pipeline, L.P.
535 Friztown Road
Sinking Spring, PA 19608

Prepared by:
Tetra Tech, Inc.
661 Anderson Drive
Pittsburgh, Pennsylvania 15220
(412) 921-7090
Fax (412) 921-4040

Sunoco Pipeline, L.P. HDD Inadvertent Return Contingency Plan with Special Bog Turtle Area Procedures -Pennsylvania Pipeline Project-

Revision – Feburary 29, 2016

Introduction

This document has been prepared to minimize potential for impacts to sensitive environmental resources from inadvertent releases associated with the horizontal directional drill (HDD) method. This plan will be followed during construction of Sunoco Pipeline, L.P.'s (SPLP's) Pennsylvania Pipeline Project where the HDD construction method is planned under streams, rivers, wetlands, special areas, and transportation features. This plan also contains a specific section outlining the procedures to be implemented to avoid potential impacts to the bog turtle (*Glyptemys muhlenbergii*), a federally threatened species, at some of the HDD locations. A listing of HDD sites is provided in Attachment A with the special bog turtle HDDs highlighted. Construction personnel will be provided detailed constructions plans for each HDD, and will be required to implement all erosion and sedimentation control and this contingency plan.

Horizontal directional drilling is used to install pipeline crossings on construction projects, depending on site-specific conditions. HDD is a widely used trenchless construction method which accomplishes the installation of pipelines and buried utilities with minimal disturbance to the ground surface, including streams and wetlands. The primary potential environmental impact associated with HDD revolves around the use of drilling fluids. An inadvertent return of drilling lubricant is a potential concern when the HDD method is used. The purpose of this document is to present SPLP's plan for minimizing the risk for inadvertent returns and potential environmental impacts associated with drilling fluids that do inadvertently escape to the ground surface.

The purpose of this contingency plan is to:

- Provide an overview of the HDD process;
- Minimize the potential for inadvertent returns associated with horizontal drilling activities;
- Provide for the timely detection of inadvertent returns;
- Protect areas that are considered environmentally sensitive (streams, wetlands, other biological resources, cultural resources);
- Ensure an organized and timely response in the unlikely event an inadvertent release of drilling mud would occur; and,
- Ensure that all appropriate notifications are made to SPLP's Environmental Compliance Coordinator, the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), Pennsylvania Department of Environmental Protection (PADEP), and other applicable regulatory agencies in a timely manner, and that all required documentation is completed as identified in this document.

Background

An awareness of the function and composition of HDD drilling fluids (also referred to as drilling mud) is imperative in producing a permittable and constructable HDD crossing design. The principal functions of drilling fluid in HDD pipeline installation are listed below.

- **Transportation of Spoil.** Drilled spoil, consisting of excavated soil or rock cuttings, is suspended in the fluid and carried to the surface by the fluid stream flowing in the annulus between the bore hole and the pipe.

- **Cooling and Cleaning of Cutters.** Build-up of drilled spoils on bit or reamer cutters is removed by high velocity fluid streams directed at the cutters. Cutters are also cooled by the fluid.

- **Reduction of Friction.** Friction between the pipe and the hole wall is reduced by the lubricating properties of the drilling fluid.

- **Hole Stabilization.** Stabilization of the drilled hole is accomplished by the drilling fluid building up a "wall cake" which seals pores and holds soil particles in place. This is critical in HDD pipeline installation as holes are often in soft soil formations and are uncased.

- **Transmission of Hydraulic Power.** Power required to turn a bit and mechanically drill a hole is transmitted to a downhole motor by the drilling fluid.

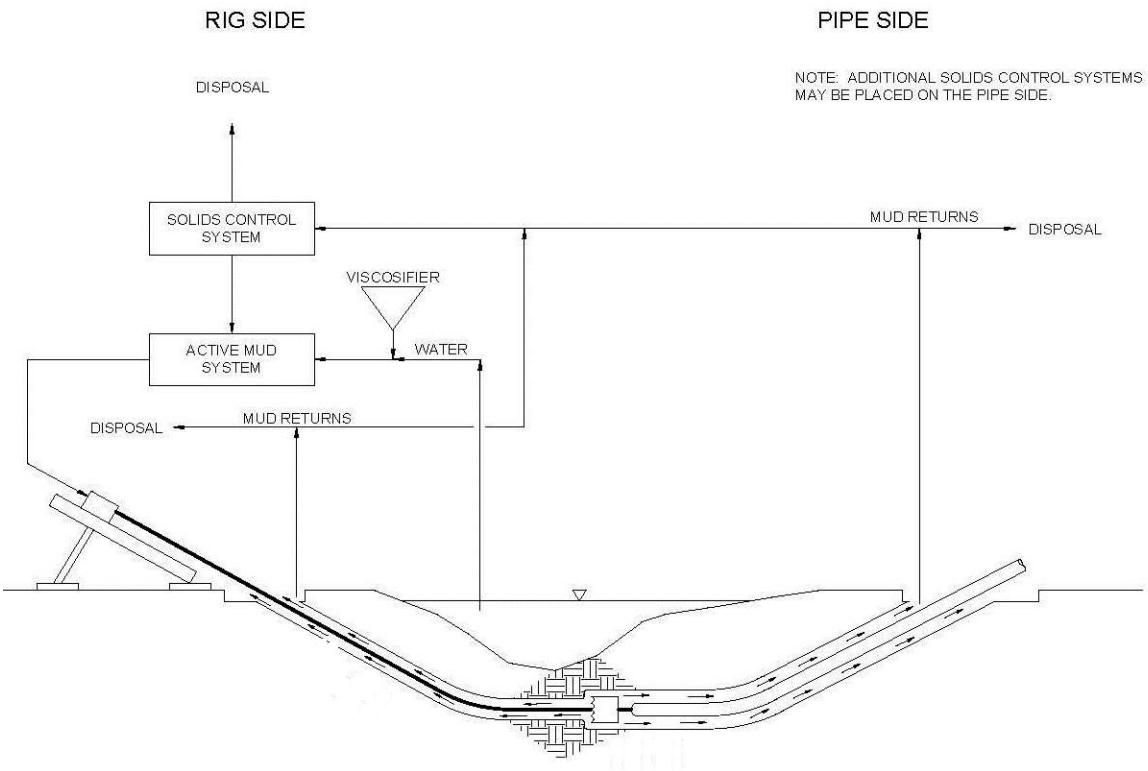
- **Hydraulic Excavation.** Soil is excavated by erosion from high velocity fluid streams directed from jet nozzles on bits or reaming tools.

- **Soil Modification.** Mixing of the drilling fluid with the soil along the drilled path facilitates installation of a pipeline by reducing the shear strength of the soil to a near fluid condition. The resulting soil mixture can then be displaced as a pipeline is pulled into this formation.

The major component of drilling fluid used in HDD pipeline installation is fresh water, typically obtained at the crossing location. To increase the hydraulic properties of the water, it is generally necessary to modify it by adding a viscosifier. The viscosifier used almost exclusively in HDD drilling fluids is naturally occurring bentonite clay, which is principally sodium montmorillonite. It is not a listed hazardous material/substance as defined by the U.S. Environmental Protection Agency's (USEPA) Emergency Planning and Community Right-to-know Act (EPCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulatory criteria. If the product becomes a waste, it does not meet the criteria of a hazardous waste, as defined by the USEPA. Bentonite is non-toxic and commonly used in farming practices, but has the potential to impact plants, fish and their eggs if discharged to waterways in significant quantities.

All stages of HDD involve circulating drilling fluid from equipment on the surface, through a drill pipe, and back to the surface through a drilled annulus. Drilling fluid returns collected at the entry and exit points are stored in a steel tank and processed through a solids control system which removes spoil from the drilling fluid, allowing the fluid to be recycled. The cleaned fluid is trucked back to the entrance point for reuse. The basic method used by the solids control system is mechanical separation using shakers, desanders, and desilters. The excess spoil and drilling fluid

are transported to, and disposed of, at an approved and permitted solid waste landfill. A typical HDD drilling fluid flow circuit is illustrated schematically below.



Drilling fluid expended downhole will flow in the path of least resistance. In the drilled annulus, the path of least resistance may be an existing fracture or fissure in the soil or rock substrate. When this happens, circulation can be lost or reduced. This is a common occurrence in the HDD process, but does not prevent completion. However, the environment may be impacted if the fluid inadvertently returns to the surface at a location on a waterway's banks or within a waterway or wetland.

Inadvertent Return Minimization Practices

The risk of an inadvertent return can be mitigated through profile design and implementation of specific measures throughout the installation process.

The HDD profile is designed to minimize the potential for the release of drilling fluid in sensitive areas. Cohesive soils, such as clays, dense sands, and competent rock are considered ideal materials for containment of drilling fluids. Case by case analysis of the overburden will be conducted to determine the depth of the bore necessary to provide a margin of safety against returns in a sensitive area. In non-cohesive soils, such as gravel, a greater depth of cover will be used. If substrate test bores are required during the design phase, they should be a minimum of 20 feet from the HDD centerline where practical. The bore holes should be properly sealed by filling with concrete prior to the HDD process.

Key preventive measures implemented during installation are geared toward keeping the drill fluid contained in the borehole and preventing its escape to the surface. This is accomplished through monitoring and management of drill fluid pressures and drill fluid volumes. The most effective ways of containing and controlling an inadvertent return are early detection and quick response by the HDD crew.

Minimization of Environmental Impact

The major key to minimize environmental impacts associated with HDD drilling fluids is to maintain fluid circulation to the extent practical. Maintenance of fluid circulation is the responsibility of the HDD contractor. Monitoring of drilling mud volumes, pressures, and pump rates/returns will be monitored to assist in determining if significant drill mud loss occurs signaling a possible inadvertent return.

It should be recognized that restoration of circulation may not be practical or possible, and that environmental impact will be minimized by completing construction as soon as possible.

Drilling fluid is easily contained by standard erosion and sedimentation control measures. Drilling fluid is controlled within the boundaries of the worksite through the use of pits at the crossing entry and exit points and typical fluid handling equipment such as vac trucks.

The environmental impacts of a release of drilling fluid into a water body include a temporary increase in local turbidity until drilling fluid dissipates with the current and/or settles to the bottom. In the immediate vicinity of a release, benthic organisms may be impacted if sufficient quantities of bentonite settle upon them.

SPLP will ensure that the HDD contractor will closely monitor fluid circulation to detect potential inadvertent returns at the earliest possible time.

SPLP does not expect that HDD will alter, disturb, or otherwise impact subsurface hydrology of associated streams and wetlands, including subsurface pressurized waters. As such, the surfacing of groundwater is not expected. The HDD engineer is able to monitor pressure releases which would signify a potential return or the surfacing of ground water. Such pressure releases would result in the inspection of the HDD alignment and adjacent areas for releases. If a groundwater discharge is identified, it will be photographed, characterized (i.e., location, size, limits, flow rate, flow direction, clarity, etc.) and reported to the chain of command which will follow the proper agency notification procedures. The inspection and early detection of any discharge will allow the HDD engineer to stop or adjust the HDD to reduce the potential for secondary impacts.

Response to Inadvertent Returns

The HDD contractor shall immediately notify the lead Construction Inspector (CI) and Environmental Inspector (EI) of any sudden losses in returns or any inadvertent return to the surface. If a return is observed, the HDD contractor will take reasonable measures to eliminate, reduce, or control the release. The actions to be taken will depend on the location and time of release, site specific geologic conditions, and the volume of the release. The EI or CI will notify the SPLP's Environmental Compliance Coordinator (ECC) with the initial details of the return upon discovery.

Inadvertent Returns in Uplands

If a release is identified within or nearby the HDD alignment, but outside of wetland areas and within the adjacent uplands, notification, containment, and clean-up will be carried out as necessary. The EI will be required to be present as these activities may need to be conducted outside of pre-approved limits of disturbance. The CI and EI will work closely to determine the best course of action for inadvertent returns occurring within upland areas. The EI will be responsible for notification of the return to SPLP's ECC. The PADEP/USACE/USFWS will not be notified in these cases. The HDD contractor will take appropriate reasonable actions to reduce, eliminate, or control the release. The actions may include:

- Constructing a small pit or sandbag coffer around the release point, installing a section of silt fence and/or straw bales to trap as much drilling fluids as possible, and placing a pump hose in the pit to pump the drilling fluid back to the bore site or temporary holding area or vessels (i.e.: vac truck);
- Reducing drilling fluid pressures;
- Thickening drilling fluid mixture; and/or
- Adding pre-approved loss circulation materials to the fluid mixture, such as wood fibers or shredded paper.

Drilling fluid may be recovered, recycled, and reused to the extent practical. All waste drilling fluid will be properly managed.

Inadvertent Returns in Wetlands/Streams

If the release is identified within wetlands and/or streams, drilling operations will be temporarily suspended to allow the EI to appropriately quantify the release, document its location, photograph the release, assess the potential to impact to the resource(s), and report the incident to SPLP's ECC. Information about the return will be recorded and updated as necessary as a running report on the data form provided in Attachment B. SPLP's ECC is responsible for completion of the data form with the assistance of the EI and environmental compliance contractor. Each form will be updated as new information is learned about the return and as activities to restore the area occur. The general reporting will be "Initial", "Interim", and then "Final". The initial, interim, and final reports will comprehensively document the return from initial discovery/notification through final restoration. **ALL inadvertent returns in wetlands and streams, regardless of size, are to be reported to the appropriate agencies in accordance with the notification section below.**

Containment, clean-up, and restoration activities that would require the installation of construction matting or the entry of construction vehicles and equipment are not allowed without PADEP/USACE approval. If upon reporting the incident, and under further consultation with the agencies, the return is determined to be significant enough to warrant containment, clean-up, and restoration via mechanical methods, then the following procedures will be followed:

- Draft containment and restoration plan, outlining the limits, types, and duration of disturbances, will be submitted to the PADEP/USACE for review and approval.
- Appropriate aquatic resource encroachment permits will be applied for depending on levels and types of disturbances required to clean up the material.
- Approved activities would only be implemented under the close, full-time supervision of the assigned EI.

- Drilling operations will resume when the return is contained and successfully remediated. The return area will continue to be monitored during the daily inspection.

One exception to ceasing drilling operations would be a release of drilling fluids during the pipe pullback process. Ceasing operations would pose significant risk of causing the pulled pipe to be stuck and not able to resume.

Containment & Clean-up Material and Equipment

The HDD contractor will be required to have the necessary containment and clean-up equipment on-site and/or readily available for use. At a minimum, a combination of some or all of the following material and equipment should be on site and in ample supply depending on the extent of sensitive areas:

- Spill sorbent pads and booms
- Compost filter socks
- Straw bales (certified weed-free)
- Wood stakes
- Sand bags
- Silt fence
- Plastic sheeting
- Corrugated plastic pipe
- Shovels
- Push brooms
- Centrifugal, trash and sump pumps
- Vacuum truck
- Rubber tired or wide track back hoe
- Bobcat (if needed)
- Storage tanks (if needed)
- Floating turbidity curtain (may be considered for use on large streams)Timber (enough to cross 50% of the wetland length need to be readily available)

If necessary, a 24-hour outside emergency response company may be called in for assistance (such as Enviroserve – 1-800-642-1311).

Notifications

No agency notifications are required for returns occurring in and contained in upland areas. SPLP's ECC will be responsible for notifying the PADEP/USACE of all returns occurring in or flowing into aquatic resources. SPLP's ECCs are identified as Chris Embry (610-670-3237) and Matt Gordon (610-670-3284). The notifications will initially be via phone to the PADEP Emergency Response numbers listed below and then to the appropriate agency personnel via submittal of an initial inadvertent return data form located in Attachment B.

The Pennsylvania Clean Streams Law regulations require that when any pollutant is discharged into surface or groundwater, including sewers, drains and ditches, the person spilling the substance or the person owning the premises from which the substance is spilled must notify PADEP

immediately. Therefore all returns in aquatic resources SPLP will notify the appropriate PADEP regional emergency number within 24 hours of return discovery:

- PADEP Southwest Regional Office: 412-442-4000;
- PADEP Southcentral Regional Office: 717-705-4802
- PADEP Southeast Regional Office: 484-250-5900
- Other agencies that will be notified include;
    - U.S. Army Corps of Engineers
      Pittsburgh District: 412-395-7155
      Baltimore District: 410-962-3670
      Philadelphia District: 215-656-6728
    - Local agencies and municipalities who are downstream users of water, as applicable.

Following notification to the appropriate emergency/regulatory numbers, SPLP's ECC will notify the following individuals via e-mail submittal of the inadvertent return form located in Attachment B. This will consist of the initial reporting of the return and open consultation and further reporting to the PADEP/USACE in regards the return. The further consultations will be regards to remediation approval, restoration approval, and the need for appropriate approval/permits. The inadvertent return data form will be used to document the consultation and approvals and report final remediation/restoration.

- PADEP Southwest Regional Permit Reviewer (Michael Engelhardt)
- PADEP Southcentral Regional Permit Reviewer (Andrew McDonald)
- PADEP Southeast Regional Permit Reviewer (Donald Knorr)
- PADEP Pittsburgh District Permit Reviewer (Jared Pritts)
- USACE Baltimore District Permit Reviewer (Patricia Strong)
- USACE Philadelphia District Permit Reviewer (David Caplan)

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500 Waterfront Drive | Pittsburgh, PA 15222
Phone: 412.442.4304
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Andrew McDonald | Soil Scientist
Department of Environmental Protection | Waterways and Wetlands Program
South-central Regional Office
909 Elmerton Avenue | Harrisburg, PA 17110
Phone: 717.705.4776
anmcdonald@pa.gov

Donald F. Knorr, PWS | Water Pollution Biologist 3
Department of Environmental Protection | Waterways and Wetlands
2 East Main Street | Norristown, PA 19401
Phone: 484.250.5147
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David.J.Caplan@usace.army.mil

SPECIAL BOG TURTLE AREA PROCEDURES

All crossings occurring within known or potential bog turtle habitats, as identified and approved by the U.S Fish and Wildlife Service (USFWS) and listed in Attachment A (highlighted in yellow), will be HDD or dry-bored, rather than open trenched, to minimize impact to this species and their habitat. In addition, the HDD drilling activities will only occur at known or potential sites between the dates of April 1 and October 31 to further minimize the potential impact. This plan includes pre-construction and during construction procedures to ensure no bog turtles are negatively impacted at the HDD sites listed in Attachment A (and highlighted in yellow), and outlines a contingency plan for inadvertent releases at these special concern areas.

As discussed, the primary potential environmental impact associated with HDD revolves around the use of drilling fluids. Inadvertent return of drilling lubricant is a potential environmental concern in general and is of particular concern to the USFWS and SPLP in regards to potential impacts to bog turtles where they occur or have the potential to occur. In addition, the increased construction activity in the area of known or potential habitats has the potential for unintentional disturbance to individuals and their habitats. Although implementation of the HDD crossing method represents one of the highest levels of avoidance of impacts (by minimizing/avoiding open trench excavation and the operation of construction equipment in the wetland), the purpose of this document is to present SPLP's plan to further minimize potential impacts to bog turtles associated with all phases of the HDD process and in particular in the event of an inadvertent release.

The objectives of this section of this contingency plan are:

- Avoid impacts to the bog turtle.
- List known or potential bog turtle habitats.
- Ensure project work areas and wetlands are clearly defined on engineer approved project plans.
- Ensure all construction contractors are appropriately trained on the identification of this species and its biology, the notification procedures, and implementation of this contingency plan.
- Ensure bog turtle wetlands/areas are marked prior to construction and that all work areas are appropriately defined (e.g., staked) according to project plans.
- Ensure bog turtle wetlands/areas are sealed off/protected from construction activities.
- Provide daily inspection of contractor activities to ensure compliance with project work plans.
- Provide daily inspection of the HDD alignment and adjacent areas for timely detection of inadvertent returns.
- Ensure all appropriate notifications are made to the USFWS, United States Army Corps of Engineers (USACE) and PADEP, and all other applicable regulatory agencies in a timely manner and that all required documentation is completed as identified in this document.

Pre-construction Activities

All construction, including professional survey personnel will be trained on implementation of this plan, the identification of this species and its biology, and the location of the areas of particular concern. All construction personnel, Environmental Inspector (EI), and on-site bog turtle Specialist (BT Specialist) will be provided with the necessary project plans, mapping, permits, authorized impacts, clearance letters, conservation plans, and this contingency plan prior to the start of construction activities.

To reduce the risk of unintentional damage to bog turtles and their habitats, a BT Specialist will inspect the surveyed (e.g. staked) entrance and exit locations and access roadways associated with the HDD prior to disturbance to ensure that they are not sited in bog turtle habitat and in accordance with project plans (A BT Specialist is defined as an individual holding a Pennsylvania Fish and Boat Commission a Scientific Collector's Permit, and a Special Permit to survey for and handle bog turtles species pursuant to 58 PA Code 75.4). In addition, the boundary of the bog turtle habitat nearest the work areas will be temporarily marked to ensure no activities are unintentionally conducted within bog turtle wetlands and work is restricted to approved work-spaces. Under the direction of the BT Specialist, silt fence will be installed between wetlands and work areas to also prevent bog turtles from entering construction work spaces. Under the direction of the BT Specialist, some areas of herbaceous vegetation may require clearing so that inspection of the area for bog turtles can be made easier.

Construction Activities

No HDDs identified as bog turtle HDDs in Attachment A will occur between November 1 and March 30 to protect hibernating turtles from potential returns. Some pre-construction activities that do not include ground disturbance within the wetland areas, such as drill rig set-up and equipment staging may occur between these time frames, but under close monitoring by the bog turtle specialists.

All procedures implemented by the drilling contractor discussed previously in this contingency plan to reduce the potential for, identification, and notification of inadvertent returns will be implemented at all HDDs. At the bog turtle HDDs listed in Attachment A, inspection of the work areas and compliance with the project plans will be carried out daily by the BT Specialist. In addition, when drilling commences the BT Specialist will inspect all disturbed upland areas and silt fencing multiple times for bog turtles and inadvertent returns. In addition, each wetland will be inspected once-daily for the occurrence of inadvertent returns, including the surfacing of ground water by the BT Specialist. Multiple, daily inspections for inadvertent returns within the wetlands areas were determined unnecessary and a one-time daily inspection would reduce the direct disturbance of normal behaviors if turtles are present. These inspections will continue until drilling is completed and the inadvertent return risk in the wetlands has been removed. Only if the drilling contractor suspects an inadvertent return as determined from the drilling progress and monitoring of the drilling fluids would more than one daily inspection of the wetlands for returns be performed.

Bog Turtle Observations and Handling

Construction personnel will be trained to report all turtle observations to the EI immediately upon siting. All bog turtle observations that are not in harm's way will be documented within project

logs and reported to the USFWS/USACE/PADEP within the final report. Documentation will include dates, times, photographs, and behavior. Additional, protection measures should be considered depending on where bog turtles are observed in relation to project areas.

Bog turtles observed in harm's way shall be handled by the bog turtle Specialist assigned to the area and only if handling is determined necessary to remove the risk of injury or death. Other project personnel are allowed to move turtles small distances, but only in cases of immediate danger. Otherwise steps to passively remove the threat and allow the turtles to continue normal behavior may be determined to be the best course of action. Bog turtles will only be moved to an area within the same wetland, only to a distance necessary to remove the threat. Additional silt fence installation may be required in the area to prevent turtles from returning to areas that presented the threat. Removal or relocation of the construction activity in that particular area will also be considered if practicable to completing the drill. Any bog turtles found within harm's way will be reported to the USFWS immediately as an incident and how it was handled.

Response to Inadvertent Returns

The HDD contractor shall immediately notify the lead Construction Inspector (CI) and Environmental Inspector (EI) of any sudden losses in returns or any inadvertent return to the surface. If a return is observed, the HDD contractor will take reasonable measures to eliminate, reduce, or control the release. The actions to be taken will depend on the location and time of release, site specific geologic conditions, and the volume of the release. The EI or CI will notify the SPLP's Environmental Compliance Coordinator (ECC) with the initial details of the return upon discovery.

Inadvertent Returns in Bog Turtle Wetlands/Streams

If the release is identified within bog turtle wetlands and/or streams, drilling operations will be temporarily suspended to allow the EI and BT Specialist to appropriately quantify the release, document its location, photograph the release, assess the potential to impact to the resource(s), and report the incident to SPLP's ECC. Information about the return will be recorded and updated as necessary as a running report on the data form provided in Attachment B. SPLP's ECC is responsible for completion of the data form with the assistance of the EI, BT Specialist, and environmental compliance contractor. Each form will be updated as new information is learned about the return and as activities to restore the area occur. The general reporting will be "Initial", "Interim", and then "Final". The initial, interim, and final reports will comprehensively document the return from initial discovery/notification through final restoration.

ALL inadvertent returns in bog turtle wetlands and streams, regardless of size, are to be reported to the appropriate agencies in accordance with the notification section below.

Containment, clean-up, and restoration activities that would require the installation of construction matting or the entry of construction vehicles and equipment are not allowed without PADEP/USACE/USFWS approval. If upon reporting the incident, and under further consultation with the agencies, the return is determined to be significant enough to warrant containment, clean-up, and restoration via mechanical methods, then the following procedures will be followed:

- Draft containment and restoration plan, outlining the limits, types, and duration of disturbances, will be submitted to the PADEP/USACE/USFWS for review and approval.
- Appropriate aquatic resource encroachment permits will be applied for depending on levels and types of disturbances required to clean up the material.
- Approved activities would only be implemented under the close, full-time supervision of the assigned EI.
- Drilling operations will resume when the return is contained and successfully remediated. The return area will continue to be monitored during the daily inspection.

One exception to ceasing drilling operations would be a release of drilling fluids during the pipe pullback process. Ceasing operations would pose significant risk of causing the pulled pipe to be stuck and not able to resume.

Containment & Clean-up Material and Equipment

The HDD contractor will be required to have the necessary containment and clean-up equipment on-site and/or readily available for use. At a minimum, a combination of some or all of the following material and equipment should be on site and in ample supply depending on the extent of sensitive areas:

- Spill sorbent pads and booms
- Compost filter socks
- Straw bales (certified weed-free)
- Wood stakes
- Sand bags
- Silt fence
- Plastic sheeting
- Corrugated plastic pipe
- Shovels
- Push brooms
- Centrifugal, trash and sump pumps
- Vacuum truck
- Rubber tired or wide track back hoe
- Bobcat (if needed)
- Storage tanks (if needed)
- Floating turbidity curtain (may be considered for use on large streams)Timber (enough to cross 50% of the wetland length need to be readily available)

If necessary, a 24-hour outside emergency response company may be called in for assistance (such as Enviroserve – 1-800-642-1311).

Notifications

No agency notifications are required for returns occurring in and contained in upland areas. SPLP's ECC will be responsible for notifying the PADEP/USACE/USFWS of all returns occurring in or flowing into bog turtle resources. SPLP's ECCs are identified as Chris Embry (610-670-3237) and Matt Gordon (610-670-3284). The notifications will initially be via phone to

the PADEP Emergency Response numbers listed below and then to the appropriate agency personnel via submittal of an initial inadvertent return data form located in Attachment B.

The Pennsylvania Clean Streams Law regulations require that when any pollutant is discharged into surface or groundwater, including sewers, drains and ditches, the person spilling the substance or the person owning the premises from which the substance is spilled must notify PADEP immediately. Therefore all returns in aquatic resources SPLP will notify the appropriate PADEP regional emergency number within 24 hours of return discovery:

- PADEP Southcentral Regional Office: 717-705-4802
- PADEP Southeast Regional Office Waters and Wetlands: 484-250-5160

In addition, SPLP will notify the appropriate USACE regulatory office numbers within 24 hours of return discovery:

- U.S. Army Corps of Engineers
  Baltimore District: 410-962-3670
  Philadelphia District: 215-656-6728

Following notification to the appropriate emergency/regulatory numbers, SPLP's ECC will notify the following individuals via e-mail submittal of the inadvertent return form located in Attachment B. This will consist of the initial reporting of the return and open consultation and further reporting to the PADEP/USACE in regards the return. The further consultations will be regards to remediation approval, restoration approval, and the need for appropriate approval/permits. The inadvertent return data form will be used to document the consultation and approvals and report final remediation/restoration.

- PADEP Southcentral Regional Permit Reviewer (Andy McDonald)
- PADEP Southeaset Regional Permit Reviewer (Donald Knorr)
- USACE Baltimore District Permit Reviewer (Debby Nizer)
- USACE Philadelphia District Permit Reviewer (David Caplan)

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HDDs under bog turtle wetlands will also require additional notification to the USFWS/USACE/ PADEP personnel if different from above. The contact information for the identified points of contacts for bog turtles for these agencies is provide below (note: these may overlapped with other notifications points of contact):

Pamela Shellenberger U.S. Fish & Wildlife Service Pennsylvania Field Office 110 Radnor Rd; Suite 101 State College, PA 16801 814 234-4090 x7459 Pamela_shellenberger@fws.gov	Brian Scofield U.S. Fish & Wildlife Service Pennsylvania Field Office 110 Radnor Rd; Suite 101 State College, PA 16801 814 234-4090 Brian_scofield@fws.gov
Cumberland County Debby Nizer U. S. Army Corps of Engineers Baltimore Dist., Regulatory Branch, PA Section P. O. Box 1715 Baltimore, MD 21203-1715 Phone: 410-962-6085 DEBBY.NIZER@usace.army.mi	**Berks (Baltimore District), York Counties** Mike Danko U. S. Army Corps of Engineers Carlisle Regulatory Field Office 401 Louther Street, Suite 205 Carlisle, PA 17013 Phone: 717-249-8730
Berks (Philadelphia District), Chester (Philadelphia District), Delaware, Counties Bill Jenkins, Chief, Applications Section U. S. Army Corps of Engineers Wanamaker Building 100 Penn Square East Philadelphia, PA 19107-3390 Phone: 215-656-6726	**Chester (Baltimore District), Lancaster, Lebanon Counties** Pat Strong U. S. Army Corps of Engineers Baltimore Dist., Regulatory Branch, PA Section P. O. Box 1715 Baltimore, MD 21203-1715 Phone: 410-962-1847

Summary Report

A summary report will be prepared at the end of the project to document the implementation of the drilling method and this special section of the contingency plan. Number of drills, duration of drills, number of returns, return characteristics, inspection results and observations, lessons learned, and recommendations will all be discussed within this report.

ATTACHMENT A

HDD Table

HDD Name	Aquatic Resources Crossed	County	PADEP Region	Notes	BT HDD
PA-BL-0001.0021-RD	W- BB120	Blair	Southcentral	Drive Through - Travel Only	
PA-BL-0001.0021-RD-16	W- BB120	Blair	Southcentral	Drive Through - Travel Only	
PA-BL-0001.0027-RD	S-M69, W- M49, W- M79	Blair	Southcentral		
PA-BL-0001.0027-RD-16	S-M69, W- M49, W- M79	Blair	Southcentral		
PA-BL-0001.0032-RD	No Aquatic Resource Crossed	Blair	Southcentral	Drive Through - Clearing Only	
PA-BL-0001.0032-RD-16	No Aquatic Resource Crossed	Blair	Southcentral	Drive Through - Clearing Only	
PA-BL-0001.0048-RR	S-BB48, W- BB58	Blair	Southcentral	Drive Through - Clearing Only	
PA-BL-0001.0048-RR-16	S-BB48, W- BB58	Blair	Southcentral	Drive Through - Clearing Only	
PA-BL-0001.0094-WX	S-L76, S-L77, S-BB92, S-BB95, W- L54, W- L55, W- L56	Blair	Southcentral		
PA-BL-0001.0094-WX-16	S-L76, S-L77, S-BB92, S-BB95, W- BB125, W- L54, W- L56	Blair	Southcentral		
PA-BL-0122.0000-WX	S-M38, S-M32, S-M31, W- M24, W- M29	Blair	Southcentral	Drive Through - Clearing Only	
PA-BL-0122.0000-WX-16	S-M38, S-M32, S-M31, W- M24, W- M29	Blair	Southcentral	Drive Through - Clearing Only	
PA-BL-0126.0000-RD	S-M30, S-M33, W- M26	Blair	Southcentral		
PA-BL-0126.0000-RD-16	S-M30, S-M33	Blair	Southcentral		
PA-BR-0032.0000-RD	No Aquatic Resource Crossed	Berks	Southcentral	Drive Through - Travel Only	
PA-BR-0032.0000-RD-16	No Aquatic Resource Crossed	Berks	Southcentral	Drive Through - Travel Only	
PA-BR-0075.0000-RD	No Aquatic Resource Crossed	Berks	Southcentral		
PA-BR-0075.0000-RD-16	No Aquatic Resource Crossed	Berks	Southcentral		
PA-BR-0079.0000-RD	No Aquatic Resource Crossed	Berks	Southcentral		
PA-BR-0079.0000-RD-16	No Aquatic Resource Crossed	Berks	Southcentral		
PA-BR-0138.0001-RD	Pond-B3PuB	Berks	Southcentral	Drive Through - Clearing Only	
PA-BR-0138.0001-RD-16	Pond-B3PuB	Berks	Southcentral	Drive Through - Clearing Only	
PA-BR-0181.0000-RD	S-A57, S-A58, S-J51, W- J48	Berks	Southcentral		
PA-BR-0181.0000-RD-16	S-A57, S-A58, S-J51, W- A37, W- J48	Berks	Southcentral		
PA-CU-0015.0000-RD	S-I89, W- I63, W- J40	Cumberland	Southcentral		
PA-CU-0015.0000-RD-16	S-I89, W- I63, W- J40	Cumberland	Southcentral		
PA-CU-0053.0000-RD	S-BB120, W177	Cumberland	Southcentral		
PA-CU-0053.0000-RD-16	S-BB120, W177	Cumberland	Southcentral		
PA-CU-0062.0000-WX	S-J41, S-J37, S-J36, W- J35	Cumberland	Southcentral		
PA-CU-0062.0000-WX-16	S-J41, S-J37, S-J36, W- J35	Cumberland	Southcentral		
PA-CU-0067-0000-RD	S-J34, W- J31, W- J31	Cumberland	Southcentral		
PA-CU-0067-0000-RD-16	S-J34, W- J31-1	Cumberland	Southcentral		
PA-CU-0128.0000-WX	S-K45, S-I54, S-I53, W- J10, W- J9, W- K44	Cumberland	Southcentral		
PA-CU-0128.0000-WX-16	S-K45, S-I54, S-I53, W- I36, W- J10, W- J9, W- K44	Cumberland	Southcentral		
PA-CU-0136.0000-RD	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0136.0000-RD-16	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0136.0003-RD	S-I47, W- I30	Cumberland	Southcentral		
PA-CU-0136.0003-RD-16	S-I47, W- I30	Cumberland	Southcentral		
PA-CU-0136.0012-RD	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0136.0012-RD-16	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0136.0020-RR	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0136.0020-RR-16	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0136-0002-WX	S-I50, S-I48, W- I31, W- I32	Cumberland	Southcentral		
PA-CU-0136-0002-WX-16	S-I48, W- I31, W- I32	Cumberland	Southcentral		
PA-CU-0176.0014-RD	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0176.0014-RD-16	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0176.0019-RD	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0176.0019-RD-16	No Aquatic Resource Crossed	Cumberland	Southcentral		
PA-CU-0189.0000-RD	S-I40, S-I41, S-I43, W- I25, W- I26, W- I27	Cumberland	Southcentral		
PA-CU-0189.0000-RD-16	S-I40, S-I41, S-I43, W- I25, W- I26, W- I27	Cumberland	Southcentral		
PA-CU-0203.0000-WX	S-I34, S-I36, W- I24	Cumberland	Southcentral		
PA-CU-0203.0000-WX-16	S-I34, S-I36, W- I24	Cumberland	Southcentral		
PA-DA-0005.0000-RD	No Aquatic Resource Crossed	Dauphin	Southcentral		
PA-DA-0005.0000-RD-16	No Aquatic Resource Crossed	Dauphin	Southcentral		
PA-DA-0019.0000-RD	No Aquatic Resource Crossed	Dauphin	Southcentral		
PA-DA-0019.0000-RD-16	No Aquatic Resource Crossed	Dauphin	Southcentral		
PA-DA-0020.0000-RD	No Aquatic Resource Crossed	Dauphin	Southcentral		
PA-DA-0020.0000-RD-16	No Aquatic Resource Crossed	Dauphin	Southcentral		
PA-DA-0030.0000-RR	S-B70, S-C54	Dauphin	Southcentral		
PA-DA-0030.0000-RR-16	S-B70, S-C54	Dauphin	Southcentral		
PA-DA-0039.0000-RD	S-A75, W- CC22	Dauphin	Southcentral		
PA-DA-0039.0000-RD-16	S-A75, W- CC22	Dauphin	Southcentral		
PA-DA-0056.0000-RD	S-B60, S-B61, S-B62, S-B63, W- B57, W- B58, W- C26	Dauphin	Southcentral		
PA-DA-0056.0000-RD-16	S-B60, S-B61, S-B62, S-B63, W- B57, W- B58, W- C26	Dauphin	Southcentral		
PA-DA-0063.0000-RD	No Aquatic Resource Crossed	Dauphin	Southcentral		

HDD Name	Aquatic Resources Crossed	County	PADEP Region	Notes	BT HDD
PA-DA-0063.0000-RD-16	No Aquatic Resource Crossed	Dauphin	Southcentral		
PA-HU-0019.0002-RD	S-Y5, S-Y6, S-Y7, W- Y6, W- Y7-1	Huntingdon	Southcentral	Drive Through - Travel Only	
PA-HU-0019.0002-RD-16	S-Y5, S-Y6, W- Y6, W- Y7-1	Huntingdon	Southcentral		
PA-HU-0020.0008-SS2	S-Y1, S-Y2, S-Y3, W- Y1, W- Y2, W- Y3, W- Y4	Huntingdon	Southcentral	Drive Through - Clearing Only	
PA-HU-0020.0008-SS2-16	S-Y1, S-Y2, S-Y3, W- Y1, W- Y2, W- Y3, W- Y4	Huntingdon	Southcentral	Drive Through - Clearing Only	
PA-HU-0020.0008-WX	LK-2PuB	Huntingdon	Southcentral		
PA-HU-0020.0008-WX-16	LK-2PuB	Huntingdon	Southcentral		
PA-HU-0047.0000-RD	S-L46, W- L27-1	Huntingdon	Southcentral		
PA-HU-0047.0000-RD-16	S-L45, S-L46, Pond-I4PuB, W- L27-1	Huntingdon	Southcentral		
PA-HU-0078.0000-WX	S-L29, S-L28, W46b	Huntingdon	Southcentral		
PA-HU-0078.0000-WX-16	S-L29, S-L28, W46b	Huntingdon	Southcentral		
PA-HU-0106.0000-RD	S-K94, W- K69, W- K69, W- K70-2	Huntingdon	Southcentral		
PA-HU-0106.0000-RD-16	S-K94, W- K69, W- K69, W- K70-2	Huntingdon	Southcentral		
PA-HU-0110.0000-SR	S-K93, S-K91, W- K68	Huntingdon	Southcentral		
PA-HU-0110.0000-SR-16	S-K93, S-K91, W- K68	Huntingdon	Southcentral		
PA-JU-0004.0000-WX	S-K74, W- K59, W- K60-1	Juniata	Southcentral		
PA-JU-0004.0000-WX-16	S-K74, W- K59, W- K60-1	Juniata	Southcentral		
PA-LA-0004.0000-SR	S-K34, S-K35, W- K32	Lancaster	Southcentral		
PA-LA-0004.0000-SR-16	S-K34, S-K35, W- K32	Lancaster	Southcentral		
PA-LA-0014.0000-SR	S-A77, S-A78, S-A79, W- A54, W-A55	Lancaster	Southcentral		Yes
PA-LA-0014.0000-SR-16	S-A77, S-A78, S-A79, W- A54, W-A55	Lancaster	Southcentral		Yes
PA-LE-0001.0000-RD	S-A49, S-A51	Lebanon	Southcentral		
PA-LE-0001.0000-RD-16	S-A49	Lebanon	Southcentral		
PA-LE-0001.0000-SR	S-A47, S-K18, W- J47	Lebanon	Southcentral		
PA-LE-0001.0000-SR-16	S-A47, S-K18, W- J47	Lebanon	Southcentral		
PA-LE-0009.0000-RD	No Aquatic Resource Crossed	Lebanon	Southcentral	Drive Through - Travel Only	
PA-LE-0009.0000-RD-16	No Aquatic Resource Crossed	Lebanon	Southcentral		
PA-LE-0055.0000-RD	S-A17	Lebanon	Southcentral		
PA-LE-0055.0000-RD-16	S-A17	Lebanon	Southcentral		
PA-LE-0117.0000-WX	S-C86, W- H13, W- H14	Lebanon	Southcentral		
PA-LE-0117.0000-WX-16	S-C86, W- H13, W- H14	Lebanon	Southcentral		
PA-PE-0002.0000-RD	S-L6, W- L1-1, W- L2	Perry	Southcentral		
PA-PE-0002.0000-RD-16	S-L6, W- L1-1, W- L2	Perry	Southcentral		
PA-YO-0016.0000-RD	No Aquatic Resource Crossed	York	Southcentral	Drive Through - Travel Only	
PA-YO-0016.0000-RD-16	No Aquatic Resource Crossed	York	Southcentral	Drive Through - Travel Only	
PA-YO-0040.0002-RD	No Aquatic Resource Crossed	York	Southcentral		
PA-YO-0040.0002-RD-16	No Aquatic Resource Crossed	York	Southcentral		
PA-YO-0063.0000-RR-16	S-A22, W- A18, W- BB1	York	Southcentral	Drive Through - Clearing Only	
PA-YO-0063.0000-RRb	S-A22, W- A18, W- BB1	York	Southcentral	Drive Through - Clearing Only	
PA-CH-0088.0000-RD	S-Q83, S-Q88, W- Q76, W- Q77, W- Q79	Chester	Southeast		
PA-CH-0088.0000-RD-16	S-Q83, S-Q86, S-Q88, W- Q77, W- Q79	Chester	Southeast		
PA-CH-0100.0000-RD	S-H10, W- H17-1	Chester	Southeast	Drive Through - Travel Only	
PA-CH-0100.0000-RD-16	S-H10, S-H11, W- H17-1	Chester	Southeast	Drive Through - Travel Only	
PA-CH-0111.0000-RD	S-C92, S-C91, S-C87, S-C90, S-C89, W- C43	Chester	Southeast		Yes
PA-CH-0111.0000-RD-16	S-C92, S-C87, S-C90, S-C89, W- C43-1	Chester	Southeast		Yes
PA-CH-0124.0000-RD	S-H4, S-C67, S-C68, S-C69, S-H3, W- C37	Chester	Southeast	BT wetlands H1 and C36 in vicinity	Yes
PA-CH-0124.0000-RD-16	S-H4, S-C67, S-C68, S-C69, S-H3, W- C37	Chester	Southeast	BT wetlands H1 and C36 in vicinity	Yes
PA-CH-0127.0000-RD	S-H5	Chester	Southeast		
PA-CH-0127.0000-RD-16	S-H5	Chester	Southeast		
PA-CH-0138.0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0138.0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0167.0000-RD	S-C64, S-C63	Chester	Southeast		
PA-CH-0167.0000-RD-16	S-C64, S-C63	Chester	Southeast		
PA-CH-0199.0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0199.0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0212.0000-RD	S-C61, S-C59, S-C60	Chester	Southeast		
PA-CH-0212.0000-RD-16	S-C61, S-C61, S-C59, S-C59, S-C60, S-C60	Chester	Southeast		
PA-CH-0212.0000-RD-16	S-C61, S-C61, S-C59, S-C59, S-C60, S-C60	Chester	Southeast		
PA-CH-0219.0000-RD	S-B79, S-B81, W- B71	Chester	Southeast		
PA-CH-0219.0000-RD-16	S-B79, S-B81, W- B71	Chester	Southeast		
PA-CH-0256.0000-RR	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0256.0000-RR-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0277.0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0277.0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		

HDD Name	Aquatic Resources Crossed	County	PADEP Region	Notes	BT HDD
PA-CH-0290.0000-RD	S-H30	Chester	Southeast		
PA-CH-0290.0000-RD-16	S-H30	Chester	Southeast		
PA-CH-0326.0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0326.0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0326.0004-SR	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0326.0004-SR-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0326.0006-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0326.0006-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0355-0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0355-0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0370.0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0370.0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0383.0003-ABTE	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0383.0003-ABTE-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0413.0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0413.0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0420.0000-RD	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0420.0000-RD-16	No Aquatic Resource Crossed	Chester	Southeast		
PA-CH-0421.0000-RD	S-B35	Chester	Southeast		
PA-CH-0421.0000-RD-16	S-B35	Chester	Southeast		
PA-DE-0008.0000-RD	No Aquatic Resource Crossed	Delaware	Southeast		
PA-DE-0008.0000-RD-16	S-B36	Delaware	Southeast		
PA-DE-0016.0000-RD	S-B54, S-B52	Delaware	Southeast		
PA-DE-0016.0000-RD-16	S-B54, S-B55	Delaware	Southeast		
PA-DE-0032.0000-RD	No Aquatic Resource Crossed	Delaware	Southeast		
PA-DE-0032.0000-RD-16	No Aquatic Resource Crossed	Delaware	Southeast		
PA-DE-0046.0000-RD	S-C42, S-C40	Delaware	Southeast		
PA-DE-0046.0000-RD-16	S-C42, S-C40, W- C21	Delaware	Southeast		
PA-DE-0074.0000-RD	S-C24, S-C25, S-C23, S-C26, W- C10-1	Delaware	Southeast		
PA-DE-0074.0000-RD-16	S-C24, S-C25, S-C23, S-C26, W- C10	Delaware	Southeast		
PA-DE-0100.0000-RR-16	W- I1	Delaware	Southeast	Drive Through - Travel Only	
PA-DE-0100.0000-RRa	W- I1	Delaware	Southeast	Drive Through - Travel Only	
PA-DE-0100.0000-RRb-16	S-I2, W- I1	Delaware	Southeast	Drive Through - Travel Only	
PA-DE-0104.0008-WX	S-H39, S-H41, S-H37	Delaware	Southeast		
PA-DE-0104.0008-WX-16	S-H39, S-H41, S-H37	Delaware	Southeast		
PA-DE-0104.0008-WX-16	S-H39, S-H41, S-H37	Delaware	Southeast		
PA-DE-0104.0023-RR	S-I18, W- BA5, W- BA6, W- I16	Delaware	Southeast		
PA-DE-0104.0023-RR-16	S-I18, W- BA5, W- BA6, W- I16	Delaware	Southeast		
PA-DE-0104.0025-RD	S-H44, S-H43	Delaware	Southeast		
PA-DE-0104.0025-RD-16	S-H44, S-H43	Delaware	Southeast		
PA-AL-0001.0000-RR	No Aquatic Resource Crossed	Allegheny	Southeast		
PA-AL-0033.0000-RD	S163	Allegheny	Southwest	Drive Through - Clearing Only	
PA-CA-0016.0000-RD	S-N41, S-N42 ,W- N27 ,W- N26 , W- N25	Cambria	Southwest		
PA-CA-0016.0000-RD-16	S-N41 ,W- N27 ,W- N26 ,W- N25	Cambria	Southwest		
PA-CA-0023.0000-RD	S-N39, S-O44, S-N36, S-O43 ,W- N24 ,W- N20	Cambria	Southwest		
PA-CA-0023.0000-RD-16	S-N39, S-O44, S-N36, S-O43 ,W- O35 ,W- N24 ,W- N20	Cambria	Southwest		
PA-CA-0047.0000-SR	S-CC8 ,W- CC17 ,W- CC19 ,W- CC16	Cambria	Southwest		
PA-CA-0047.0000-SR-16	S-CC8 ,W- CC17 ,W- CC19 ,W- CC16	Cambria	Southwest	Drive Through - Travel Only	
PA-CA-0069.0000-RD	S-N34, S-N17 ,W- N18	Cambria	Southwest	Drive Through - Clearing Only	
PA-CA-0069.0000-RD-16	S-N34, S-N17 ,W- N18	Cambria	Southwest	Drive Through - Clearing Only	
PA-CA-0089.0000-RR	S-K33 ,W- K31	Cambria	Southwest		
PA-CA-0089.0000-RR-16	S-K33 ,W- K31	Cambria	Southwest		
PA-CA-0091.0016-RD	W- L62 ,W- M59 ,	Cambria	Southwest		
PA-CA-0091.0016-RD-16	W- L62 ,W- M59	Cambria	Southwest		
PA-IN-0000.0001-WX	S-J55 ,W- J52 ,W- N28	Indiana	Southwest		
PA-IN-0000.0001-WX-16	S-J56, S-J55 ,W- N28	Indiana	Southwest		
PA-IN-0002.0000-RR	S-J57	Indiana	Southwest	Drive Through - Clearing Only	
PA-IN-0002.0000-RR-16	S-J57, S-J54 ,W- P1	Indiana	Southwest	Drive Through - Clearing Only	
PA-IN-0019.0000-RR	S-J58 ,W- J53	Indiana	Southwest		
PA-IN-0019.0000-RR-16	S-J58 ,W- J53	Indiana	Southwest		
PA-IN-0022.0000-RD	S-O113 ,W- O77	Indiana	Southwest		
PA-IN-0022.0000-RD-16	S-O113 ,W- N61 ,W- O77	Indiana	Southwest		
PA-IN-0025.0000-RD	No Aquatic Resource Crossed	Indiana	Southwest		
PA-IN-0025.0000-RD-16	No Aquatic Resource Crossed	Indiana	Southwest		
PA-IN-0048.0000-RD	W- N56 ,W- N57	Indiana	Southwest		
PA-IN-0048.0000-RD-16	W- N56 ,W- N57	Indiana	Southwest		

HDD Name	Aquatic Resources Crossed	County	PADEP Region	Notes	BT HDD
PA-IN-0086.0000-RD	S-N66 ,W- N34	Indiana	Southwest	Drive Through - Clearing Only	
PA-IN-0086.0000-RD-16	S-N66, S-N65 ,W- N35 ,W- N34	Indiana	Southwest	Drive Through - Clearing Only	
PA-WA-0072.0000-SR	No Aquatic Resource Crossed	Washington	Southwest		
PA-WA-0074.0000-RR	S7	Washington	Southwest		
PA-WA-0102.0000-SR	No Aquatic Resource Crossed	Washington	Southwest		
PA-WA-0103.0000-RD	S16, S250	Washington	Southwest	Drive Through - Clearing Only	
PA-WA-0106.0000-SR	No Aquatic Resource Crossed	Washington	Southwest	Drive Through - Travel Only	
PA-WA-0111.0000-SR	No Aquatic Resource Crossed	Washington	Southwest	Drive Through - Travel Only	
PA-WA-0119.0000-RD	S129, S280	Washington	Southwest		
PA-WA-0119.0003-RD	No Aquatic Resource Crossed	Washington	Southwest		
PA-WA-0127.0000-RR	S130, S131 ,W- W43	Washington	Southwest		
PA-WA-0164.0000-RD	No Aquatic Resource Crossed	Washington	Southwest	Drive Through - Travel Only	
PA-WA-0171.0000-RR	S142, S27, S28	Washington	Southwest	Drive Through - Clearing Only	
PA-WA-0172.0000-RD	S29	Washington	Southwest		
PA-WA-0176.0000-RR	S121	Washington	Southwest		
PA-WM1-0012.0000-RR	S222, S122	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM1-0020.0000-WX	S224	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM1-0023.0000-RD	S172	Westmoreland	Southwest		
PA-WM1-0039.0000-RD	S226, S181	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM1-0042.0000-WX	S182	Westmoreland	Southwest		
PA-WM1-0044.0000-RD	S184	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM1-0054.0000-RD	S227, S228 ,W68	Westmoreland	Southwest		
PA-WM1-0072.0000-RD	S198	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM1-0088.0000-RR	S199	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM1-0111.0000-RD	S201, S202	Westmoreland	Southwest		
PA-WM1-0144.0000-RD	S215 ,W61	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM1-0157.0000-RD	No Aquatic Resource Crossed	Westmoreland	Southwest		
PA-WM2-0021.0000-RD	S-Q8, S-Q5, S-Q7 ,W- Q8 ,W- Q7 ,W- Q6	Westmoreland	Southwest		
PA-WM2-0021.0000-RD-16	S-Q8, S-Q5, S-Q7 ,W- Q4 ,W- Q8 ,W- Q7 ,W- Q6	Westmoreland	Southwest		
PA-WM2-0064.0000-WX	Pond-O4	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM2-0064.0000-WX-16	Pond-O4	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM2-0090.0000-RD	S-P20 ,W- P14 ,W- P13 ,Pond-P3	Westmoreland	Southwest		
PA-WM2-0090.0000-RD-16	S-P20 ,Pond-P3	Westmoreland	Southwest		
PA-WM2-0093.0000-RD	S-O61 ,W- O45	Westmoreland	Southwest	Drive Through - Clearing Only	
PA-WM2-0093.0000-RD-16	S-O61 ,W- O45	Westmoreland	Southwest	Drive Through - Clearing Only	

ATTACHMENT B

Inadvertent Return Data Form

SPLP PENNSYLVANIA PIPELINE PROJECT

HORIZONTAL DIRECTIONAL DRILLING – INADVERTENT RETURN REPORT FORM

IR TRACKING ID	
REPORT DATE:	
REPORT INITIAL/UPDATE/FINAL:	
PADEP PERMIT NO:	
USACE PERMIT NO:	
RESOURCE(S):	
LOCATION COORDINATES:	
LOCATION DESCRIPTION:	
MATERIAL(s) RELEASED:	
DESCRIPTION OF THE RELEASE:	
QUANTITY:	
AERIAL EXTENT:	
T&E / BOG TURTLE SUMMARY:	
TROUT STREAM / EV WATER:	
PADEP EMERGENCY NOTIFICATION:	
NUMBER:	
DATE:	
TIME:	
PERSON:	
CASE NO:	
NOTES:	
PADEP WATERWAYS NOTIFICATION:	
PHONE / EMAIL:	
DATE:	
TIME:	
PERSON:	
NOTES:	
USACE REGULATORY NOTIFICATION:	
PHONE / EMAIL:	
DATE:	
TIME:	

PERSON:	
NOTES:	
USFWS NOTIFICATION:	
PHONE / EMAIL:	
DATE:	
TIME:	
PERSON:	
NOTES:	
IMEADIATE ACTION:	
CORRECTIVE MEASURES SUMMARY:	
MONITORING PLAN:	
RESTORATION PLAN:	
MAP:	See attached
PHOTOGRAPH(S):	See attached
SPLP POC:	
RESTORATION STATUS:	
ROOT CAUSE:	
IR PLAN REVISIONS:	

MAP:

PHOTOS: