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October 28, 2020

By Email Only

Honorable Elizabeth Barnes
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street, 2nd Floor West
Harrisburg, PA 17120

Re: Meghan Flynn, et al., Docket Nos. C-2018-3006116 & P-2018-3006117 (consolidated)
Melissa DiBernardino, Docket No. C-2018-3005025 (consolidated)
Rebecca Britton, Docket No. C-2019-3006898 (consolidated)
Laura Obenski, Docket No. C-2019-3006905 (consolidated)
Andover Homeowner's Association, Inc.; Docket No. C-2018-3003605 (consolidated)
v. Sunoco Pipeline L.P.

**SPLP Letter Identifying and Requesting Admission Into Record Evidence in
Response to DEP Marsh Creek Administrative Order**

Dear Judge Barnes:

On September 29, 2020, Your Honor held oral argument regarding the Flynn Complainants' September 22, 2020 Motion to Admit Additional Evidence. Over Sunoco Pipeline L.P.'s (SPLP) numerous objections, Your Honor admitted into the record two Department of Environmental Protection Administrative Orders, one of which concerned Marsh Creek dated September 11, 2020 (Marsh Creek DEP Administrative Order). N.T. 1792:19-1802:13. SPLP's counsel requested the opportunity to respond with written evidence given the last-minute identification and admission of the Marsh Creek DEP Administrative Order which injected new issues into this proceeding. Your Honor ruled that SPLP had until October 28, 2020 to provide its responsive evidence and that Flynn Complainants would have one day to respond. N.T. 1802:5-13.

Via this letter, SPLP is now providing its responsive evidence for identification and entry into the record. At hearing, SPLP's counsel advised that SPLP was appealing the Marsh Creek DEP Administrative Order to the Environmental Hearing Board (EHB). SPLP is providing here for identification and admission SPLP Exhibit No. 53, which is SPLP's Amended Petition for Review to the EHB of the Marsh Creek DEP Administrative Order, Petition for Supersedeas to the

Honorable Elizabeth Barnes
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EHB of the Marsh Creek DEP Administrative Order as well as its Affidavits and Exhibits in support. These materials are attached hereto. All of these materials were submitted to the EHB and are publicly available here:

https://ehb.courtapps.com/public/document_shower_pub.php?csNameID=5923

SPLP respectfully requests these materials be made part of the record consistent with Your Honor's September 29, 2020 rulings. Thank you for your consideration.

Respectfully,

/s/Whitney E. Snyder

Thomas J. Sniscak
Whitney E. Snyder

Counsel for Sunoco Pipeline L.P.

cc: Per Certificate of Service
Secretary Rosemary Chiavetta (e-filing)

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the forgoing document upon the persons listed below in accordance with the requirements of § 1.54 (relating to service by a party).

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/s/ Whitney E. Snyder
Thomas J. Sniscak, Esquire
Whitney E. Snyder, Esquire

Dated: October 28, 2020



**ENVIRONMENTAL HEARING BOARD
SECOND FLOOR
RACHEL CARSON STATE OFFICE BUILDING
400 MARKET STREET
P.O. BOX 8457
HARRISBURG, PA 17105-8457**

SUNOCO PIPELINE L.P. :
 :
 : **EHB Docket No. 2020-085-L**
 :
 v. :
 :
 :
 COMMONWEALTH OF PENNSYLVANIA, :
 DEPARTMENT OF ENVIRONMENTAL :
 PROTECTION :

AMENDED NOTICE OF APPEAL

1. Appellant in this matter is Sunoco Pipeline L.P. (“Sunoco Pipeline”). Sunoco Pipeline’s address and telephone number are as follows:

Sunoco Pipeline L.P.
525 Fritztown Road
Sinking Spring, PA 19608
(610) 670-3200

2. Sunoco Pipeline hereby appeals from the final action taken by the Pennsylvania Department of Environmental Protection (the “Department”) in issuing to Sunoco Pipeline an Administrative Order dated September 11, 2020 (the “Administrative Order”).

3. The final action by the Department being appealed herein was taken by John Hohenstein, Environmental Program Manager in the Department’s Southeast Regional Office.

4. The Administrative Order was issued in connection with the installation of a 20-inch diameter pipeline that traverses under Little Conestoga Road in Upper Uwchlan Township, Chester County, Pennsylvania.



5. Sunoco Pipeline received a copy of the Administrative Order by electronic mail on September 11, 2020. A copy of the Administrative Order is attached as Exhibit A.

6. In 2017, Sunoco Pipeline experienced two inadvertent returns (“IRs”) while installing a 16-inch pipeline using a horizontal direction drill (“HDD”) traversing under Little Conestoga Road. Following the IRs, the Department approved the continued use of HDD to install the 16-inch pipeline, which is now complete.

7. On August 10, 2017, the Board entered a Corrected Stipulated Order, docketed at EHB Docket No. 2017-009-L, which set forth an extensive and detailed process, agreed upon by the parties and approved by the Board following a hearing, for reevaluating HDDs where an IR occurred during the installation of one pipeline and where a second pipeline would be installed using HDD in the same right-of-way. In accordance with the Corrected Stipulated Order, Sunoco Pipeline submitted a Reevaluation Report for the installation of a second 20-inch pipeline (“HDD 290”) in the same right-of-way as the completed 16-inch pipeline.

8. Consistent with the Corrected Stipulated Order, the Reevaluation Report stated that “HDD S3-0290 has a moderate to high risk of drilling fluid loss and IRs.” While the Reevaluation Report described a possible one-mile re-route as “technically feasible,” the Reevaluation Report rejected the re-route for a number of significant factors, including that it would cross waters of the Commonwealth, cross the Pennsylvania Turnpike twice, pass in near proximity or immediately adjacent to five residential homes, and require condemnation of properties owned by previously unaffected landowners. After a seven-month review period and considering over 250 public comments, the Department approved the Reevaluation Report without providing any additional comment or conditions.



9. In accordance with the Department's approval, drilling activities for the 20-inch pipeline at HDD 290 commenced on February 2, 2020. On August 10, 2020, after more than six months since drilling commenced, and with only 37 to 45 days remaining until HDD 290 was expected to be completed, an IR occurred in the same area as the IRs that occurred in 2017 during construction of the 16-inch pipeline. Sunoco Pipeline has proceeded in accordance with its permits and its approved IR Assessment Preparedness, Prevention and Contingency Plan, and is assessing and fully restoring any impacts to waters of the Commonwealth as a result of the IR.

10. Notwithstanding that the Department approved the Reevaluation Report for HDD 290 knowing that there was a moderate to high risk of another IR, the Department issued the Administrative Order at issue in this appeal, which effectively revokes its prior approval of the Reevaluation Report, and orders Sunoco to implement the proposed re-route, even though the re-route is expected to take up to two years or more to complete and is expected to cause more local disruption and environmental impacts than would occur if Sunoco Pipeline simply utilized techniques and structures that have been demonstrated to effectively contain and recirculate drilling fluid released during an IR and allow the completion of HDD 290, which is expected to take between 37 and 45 days.

11. Sunoco Pipeline appeals the Department's Administrative Order because it improperly revokes an approval previously granted in accordance with the Corrected Stipulated Order, suspends and revokes Sunoco Pipeline's Chapter 102 and 105 permits, unlawfully orders Sunoco Pipeline to implement a re-route of HDD 290, and is otherwise arbitrary; capricious; unreasonable; constitutes an abuse of the Department's discretion; is contrary to fact; is not supported by substantial evidence; is not in accordance with applicable law; and is contrary to the Department's authority under the Clean Streams Law, 35 P.S. §§ 691.1 – 691.1001, and the



rules and regulations promulgated thereunder, the Dam Safety and Encroachments Act, 32 P.S. §§ 693.1 – 693.27, and the rules and regulations promulgated thereunder, and Section 1917-A of the Administrative Code, 71 P.S. § 510-17, including, in addition to the bases set forth in Sunoco Pipeline’s Petition for Supersedeas, as follows:

a. The Department’s decision to suspend Sunoco Pipeline’s Chapter 102 and 105 Permits, revoke approval of the Reevaluation Report, and order the re-route of HDD 290, instead of allowing Sunoco Pipeline to complete HDD 290 with reasonable mitigation measures, is arbitrary, capricious, and an abuse of discretion and will cause greater impacts to the environment than allowing Sunoco Pipeline to complete construction of HDD 290;

b. The Department’s decision to revoke its approval of the Reevaluation Report and to order Sunoco Pipeline to implement the re-route of HDD 290 violates the Corrected Stipulated Order and is otherwise arbitrary, capricious, and an abuse of discretion; and

c. The Department’s decision to revoke its approval of the Reevaluation Report and to order Sunoco Pipeline to implement the re-route of HDD 290 violates 25 Pa. Code § 105.18a(b) and is otherwise arbitrary, capricious, and an abuse of discretion.

12. Appellant reserves the right to assert additional grounds for appeal and the right to amend its Amended Notice of Appeal (1) after an opportunity for discovery, (2) following any clarification or amendment of the Administrative Order, (3) following any action by the Department under the Administrative Order, (4) following any change in circumstances, or (5) as otherwise provided by the Board’s rules.



13. Appellant has authorized the following attorneys to represent it in these proceedings before the Board:

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14. We hereby certify that we are serving true and correct copies of this Amended Notice of Appeal this day via the Board's electronic filing system upon:

Commonwealth of Pennsylvania
Department of Environmental Protection
Office of Chief Counsel
Attn: Administrative Officer
16th Floor, Rachel Carson State Office Building
400 Market Street, P.O. Box 8464
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15. The information contained in this Amended Notice of Appeal is true and correct to the best of Sunoco Pipeline's information and belief.

Respectfully Submitted,

/s/ Robert D. Fox
Robert D. Fox, Esquire
Thomas M. Duncan, Esquire
Attorneys for Appellant
Sunoco Pipeline L.P.

Dated: October 8, 2020

OF COUNSEL:

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EXHIBIT A



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the matter of:

Sunoco Pipeline, L.P. 535 Fritztown Road Sinking Springs, PA 19608	: Violations of The Clean Streams Law : and DEP Chapters 93, 102, and 105 of : Title 25 of the Pennsylvania Code. : : PA Pipeline Project—Mariner East II : E&S Permit No. ESG0100015001 : : WO&E Permit No. E15-862
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ADMINISTRATIVE ORDER

Now this 11th day of September, 2020, the Commonwealth of Pennsylvania, Department of Environmental Protection (“Department”), has found and determined the following facts and findings and by this Administrative Order imposes the specified performance obligations upon Sunoco Pipeline, L.P. (“Sunoco”).

Findings

Parties

A. The Department is the agency with the duty and authority to administer and enforce The Clean Streams Law, Act of June 22, 1937, P.L. 1987, *as amended*, 35 P.S. §§ 691.1-691.1001 (“Clean Streams Law”); the Dam Safety and Encroachment Act, the Act of November 26, 1978 P.L. 1375, as amended, 32 P.S. §§ 693.1 et seq. (“Dam Safety and Encroachment Act”); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, *as amended*, 71 P.S. § 510-17 (“Administrative Code”); and the rules and regulations promulgated thereunder (“rules and regulations”).

B. Sunoco Pipeline, L.P. (“Sunoco”) is a foreign limited partnership doing business in Pennsylvania and maintains a mailing address of 535 Fritztown Road, Sinking Springs, PA 19608.



Sunoco Logistics Partners Operations GP LLC is the general partner of Sunoco Pipeline, L.P. Joseph Colella is Executive Vice President for Sunoco Logistics Partners Operations GP LLC. Mr. Colella has been granted authority by Sunoco Logistics Partners Operations GP LLC to sign documents for Sunoco on behalf of the General Partner.

C. Sunoco owns and operates numerous pipelines in Pennsylvania used to transport petroleum and natural gas products. Sunoco has undertaken an effort to expand existing transportation systems for natural gas liquids in Pennsylvania, which is collectively referred to as the Pennsylvania Pipeline Project – Mariner East II (“PPP-ME2”). As part of PPP-ME2, Sunoco is conducting pipeline installation activities in seventeen counties in Pennsylvania, including Chester County.

Permits

- D. To construct PPP-ME2 through Chester County, Sunoco obtained:
- a. An Erosion and Sediment Control Permit under 25 Pa. Code Chapter 102, Permit Number ESG0100015001 (“Chapter 102 Permit”) and;
 - b. A Water Obstructions and Encroachment (“WOE”) Permit under 25 Pa. Code Chapter 105, Permit Number E15-862 (“Chapter 105 Permit”).
- E. For purposes of this Administrative Order, Horizontal Directional Drilling (“HDD”) is defined to include any steerable trenchless technology that controls the direction and deviation to a predetermined underground target or location.

Site

F. The work area for PPP-ME2 in Chester County, Pennsylvania includes the horizontal directional drill (“HDD”) installation of a 16-inch diameter pipeline and a 20-inch diameter pipeline that traverses Little Conestoga Road in Upper Uwchlan Township, Chester



County, Pennsylvania (“HDD S-3-0290”). The alignment of HDD S-3-0290 passes from the northwest to the southeast in the Marsh Creek Watershed with groundwater flow in the HDD bore alignment being towards Marsh Creek/Marsh Lake to the south and southwest.

G. The 16-inch pipeline was installed in 2017. During that installation, the HDD had an inadvertent return (“IR”) of approximately 100 gallons of drilling fluids to wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11, to Marsh Creek Lake on June 24, 2017. S-H 10 and S-H 11 are listed as High Quality-Trout Stocked Fisheries. On August 29, 2017, another IR of approximately 40 to 50 gallons occurred in wetland WL-17 along Stream S-H 11 approximately 40 feet from the original IR location during drill ream operations on HDD S-3-0290.

H. In accordance with the Corrected Stipulated Order entered by the Environmental Hearing Board on August 10, 2017 at Docket No. 2017-009-L, Sunoco conducted a re-evaluation of HDD S-3-0290 for installation of the 20-inch pipeline. The HDD S-3-290 re-evaluation report was submitted to the Department on May 28, 2019 and approved by the Department on January 23, 2020 (“Re-evaluation Report”).

I. As part of that re-evaluation, Sunoco reported that:

A 1.01 mile reroute to the north of the HDD is technically feasible. This would entail adjusting the project route prior to this HDD’s northwest entry/exit point to proceed north, cross under the Pennsylvania Turnpike, then proceed east for 0.7 miles parallel to the turnpike, cross Little Conestoga Road, then turn south, cross under the turnpike, and then re-intersect the existing project route just east of this HDDs southeast entry/exit point. There is no existing utility corridor here, however; therefore, this route would create a Greenfield utility corridor and would result in encumbering previously unaffected properties. The route would still cross two Waters of the Commonwealth and possible forested wetlands, and would pass in near proximity or immediately adjacent to five residential home sites. Both crossings of the turnpike would require “mini” HDD’s or direct pipe bores to achieve the required depth of cover under the highway. Considered against the possibility of additional IR’s occurring on the proposed HDD, **which are readily contained and cleaned up with minimal affect to natural resources,** the permanent taking of the new



easement and likely need to use condemnation against previously unaffected landowners results in SPLP's opinion that managing the proposed HDD is the preferred option. (emphasis added). Re-evaluation Report at p. 6 "Re-Route Analysis".

J. The Re-evaluation Report also included an "HDD Hydrogeologic Reevaluation Report – HDD S3-0290 dated May 2019 ("Hydro Report"). It was noted as a conclusion in that report that "[t]he synthesis of regional and local geologic data together with past drilling performance during drilling for the 16-inch pipeline indicate that **installation of the 20-inch line at HDD S3-0290 has a moderate to high risk of drilling fluid loss and IRs.**" (emphasis added) Hydro Report at p. 15.

K. In February 2020, Sunoco commenced drilling the pilot hole for the 20-inch pipeline at HDD S-3-0290.

L. In spite of Sunoco's assurances that it could readily contain and clean up any IRs that might occur on HDD S-3-0290 with minimal affect to natural resources, on August 10, 2020, the Department received notice from Sunoco of an IR at HDD Site S-3-0290, PA-CH-0100.0000-RD, in the vicinity of Green Valley Road in Upper Uwchlan Township, Chester County. Sunoco ultimately reported that approximately 8163 gallons of drilling fluids had surfaced in wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11, the same aquatic resources impacted by the 2017 IRs.

M. At the time of the Department's inspection on August 10, 2020, Sunoco had attempted to contain the IR by deploying various silt fences in wetland WL-17 and unnamed tributaries S-H 10 and S-H 11 and two sets of instream silt containment booms (weighted silt curtains) to reduce the amount of bentonite entering Marsh Creek Lake. There was no sandbag containment in wetland WL-17 to capture drilling fluids. An effort was being made to pump some of the drilling fluids from wetland WL-17. Representatives from Sunoco indicated that they were



still attempting to obtain landowner permission in order to gain access to areas to fully address the IR. Despite Sunoco's efforts to contain and clean up the IR, the IR discharged to wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11 and then flowed and discharged into Marsh Creek Lake, a water of the Commonwealth. Wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11 were coated with a thick layer of drilling mud. A plume of drilling mud filled a cove of Marsh Creek Lake.

N. Marsh Creek Lake is in Marsh Creek State Park, one of the most visited state parks in Pennsylvania. Marsh Creek State Park receives more than 1,000,000 visitors each year. Marsh Creek Lake is one of the primary recreational resources in the park. The 535-acre lake is used year-round for fishing and boating. It also provides important habitat for migrating waterfowl. Following the inadvertent return, 33 acres of Marsh Creek Lake had to be closed to the public.

O. On August 11, 2020, the Department received notice of a subsidence event in wetland WL-17 measuring 15 foot in diameter and 8 foot deep. The subsidence event allowed drilling fluids into the underground horizon and the wetland, adversely impacting the functions and values of the wetland, and constituting a discharge of industrial waste to groundwater, a water of the Commonwealth and wetlands, a water of the Commonwealth.

P. Immediately after the inadvertent return the Department conducted inspections of this area on August 10, 2020, August 11, 2020, August 12, 2020, and August 13, 2020.

Q. On August 17, 2020, Sunoco submitted a Restart Report for HDD S-3-290. In that report, Sunoco proposes to construct "unconventional pressure relief points" ("UPRPs"), which consist of sand-bag dams constructed at the location of the two IRs that occurred in 2017 and in wetland WL-17. Sunoco asserts, once again, that if a future IR were to occur at any of those locations, this time the drilling fluids will be collected and transported to either the entry or exit



pits for HDD S-3-0290 and recycled at the mud plant. Sunoco did recognize that placement of the sandbag dam within wetland WL-17 would require additional permitting. The Department has not approved the Restart Report for HDD S-3-0290.

R. On August 20, 2020, the Department issued a Notice of Violation to Sunoco, requesting that Sunoco provide plans to address the impacts of the inadvertent return and subsidence events to waters of the Commonwealth and information regarding various aspects of the HDD. To date the Department has not received all information requested by that Notice of Violation.

S. Sunoco's efforts to clean up the inadvertent return and assess its impacts to waters of the Commonwealth continues as of the date of this order. The Department continues to monitor conditions and cleanup efforts at this site. The 33-acre portion of Marsh Creek Lake referenced in Paragraph M, above, remains closed to recreational boating and fishing and all other public use due to the presence of drilling fluids on the lake bottom.

Violations

T. The drilling fluids described in Paragraphs L, M and O, above, constitute Industrial Waste. Sunoco's discharge of Industrial Waste to waters of the Commonwealth without a permit is a violation of 25 Pa. Code § 92a.1(b) and Section 301 of the Clean Streams Law, 35 P.S. § 691.301 and Section 18 of the Dam Safety and Encroachments Act, 32 P.S. § 693.18.

U. The violations described in Paragraphs L, M and O, above, constitute unlawful conduct under Sections 401 and 611 of the Clean Streams Law, 35 P.S. §§ 691.401 and 691.611; and a statutory nuisance under Sections 401 and 601 of the Clean Streams Law, 35 P.S. §§ 691.401 and 691.601. The violation in Paragraph L constitutes unlawful conduct under Section 18 of the



Dam Safety and Encroachments Act, 32 P.S. § 693.18; and a statutory nuisance under Section 19 of the Dam Safety and Encroachments Act, 32 P.S. § 693.19.

NOW, THEREFORE, pursuant to Section 20 of the Dam Safety and Encroachments Act, 32 P.S. § 693.20; Sections 5, 402, and 610 of The Clean Streams Law, 35 P.S. § 691.5, 691.402, and 691.610; and Section 1917-A of the Administrative Code, 71 P.S. § 510-17, the Department hereby ORDERS the following:

1. Except as specified herein, Sunoco shall immediately suspend all work authorized by the permits described in Paragraph D, above, for HDD S-3-0290 until the Department provides written authorization to resume work, except as is necessary to stabilize the site to prevent erosion and sedimentation in accordance with Paragraph 6, and to prevent additional pollutants from entering waters of the Commonwealth, including wetland WL-17, unnamed tributaries S-H 10 and S-H 11 of Marsh Creek Reservoir, and the Marsh Creek Reservoir, which is located in Marsh Creek State Park. In no event shall Sunoco undertake any pipeline installation activities at the site of HDD S-3-0290, including drilling or drilling-related preparation and drilling support activities, or the installation of casing, unless expressly authorized by the Department in writing.

2. Sunoco shall take all steps necessary, including the submission of appropriate applications and supporting materials for permit amendments, to implement the reroute of HDD S-3-290 that Sunoco previously found to be technically feasible in the Re-evaluation Report.

3. Within 30 days of the effective date of this Administrative Order, Sunoco shall submit a report to the Department that fully explains how the August 10, 2020 inadvertent return described in Paragraph L above, occurred and how the August 11, 2020 subsidence event described in Paragraph N above, occurred. Such report shall also detail the results of all geophysical testing



conducted by or on behalf of Sunoco from January 1, 2010 to the date of this Order for the 2000-foot-long by 50-foot-wide section of the HDD profile centered on the August 10, 2020 IR location areas of the HDD profile, as well as the results of all geophysical testing conducted on behalf of Sunoco from January 1, 2010 to the date of this Order in any other areas or resources that were impacted by the August 10, 2020 IR and subsidence event. The geophysical testing data shall include all results of microgravity, electrical resistivity, seismic refraction and any other geophysical testing. The report shall include analyses of each of the tests, verified by a qualified professional,

4. Sunoco shall address, to the Department's satisfaction, all impacts to waters of the Commonwealth that occurred as a result of the August 10, 2020 inadvertent return and the August 11, 2020 subsidence event by restoring and remediating impacted aquatic life, biota, and habitat, including the functions and values of the impacted wetlands resources, and all impacted recreational uses, to a condition equal to or better than that in place before the incidents occurred.

a. On or before October 1, 2020, unless the Department approves a later date in writing, Sunoco shall submit an impact assessment ("Impact Assessment") and a cleanup and restoration plan for HDD S-3-0290 Drill Site ("Restoration Plan") to the Department for review and approval to address all temporary and/or permanent impacts to waters of the Commonwealth that occurred as a result of the August 10, 2020 inadvertent return and August 11, 2020 subsidence event. The Impact Assessment and the Restoration Plan shall include a detailed resource delineation and function assessment for the wetland, stream, and reservoir in the areas impacted by the IR and subsidence event, as well as reference areas. The Restoration Plan shall provide for at least five (5) years of monitoring after the restoration activities are completed. For the first two (2) years, Sunoco shall submit



monitoring reports under the Restoration Plan to the Department on a quarterly basis with monitoring reports due on January 30th, April 30th, July 30th, and October 30th of each year for the preceding calendar quarter. After the initial two (2) year monitoring period, monitoring reports shall be submitted on an annual basis, with the first annual report due on January 30th following year three (3).

b. If the Department finds that Sunoco's implementation of the Restoration Plan has failed to eliminate impacts to waters of the Commonwealth, then Sunoco shall submit a mitigation plan for the HDD S-3-0290 Drill Site ("Mitigation Plan") to the Department for review and approval to address impacts to waters of the Commonwealth that occurred as a result of the August 10, 2020 inadvertent return and the August 11, 2020 subsidence event. The Mitigation Plan shall provide for replacement of the functions and values of all impacted wetlands at a minimum area of 0.25 acre or at a ratio of 2:1, whichever is greater, within the Marsh Creek watershed. In accordance with Permit No. E15-862, special condition EE, the Mitigation Plan shall provide for at least five (5) years of monitoring after the restoration activities are completed.

c. Sunoco shall conduct the Impact Assessment and implement the Restoration Plan at Paragraph 4.a., above, immediately upon receipt of written approval from the Department unless the Department extends that timeframe in writing. If the Department determines that a Mitigation Plan is needed pursuant to Paragraph 4.b., then Sunoco shall implement the Mitigation Plan at Paragraph 4.b., above, within 90 days of receiving written approval from the Department, unless the Department extends that timeframe in writing.



5. In the event the Department determines that additional information, revisions, modifications or amendments are necessary to any permit, plan, any other submission, or restoration and remediation work required by this Order, then within ten (10) days after receipt of written notice from the Department, Sunoco shall submit to the Department such information, revisions, amendments or modifications, and/or complete the modified work, unless an alternative timeframe is approved by the Department in writing.

6. Effective immediately, Sunoco shall secure the partially constructed borehole with grouting or an equivalent method and stabilize all disturbed areas at HDD S-3-0290 in accordance with the approved E&S Plans and in compliance with 25 Pa. Code § 102.22(a) and/or (b), as appropriate. Sunoco shall continue routine monitoring of the installed BMPs and shall perform all necessary ongoing operation and maintenance activities to ensure the BMPs continue to perform as designed, in accordance with the approved E&S Plan and permit until the disturbed areas along the current alignment for HDD S-3-0290 are permanently stabilized.

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa.C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, P.O. Box 8457, Harrisburg, PA 17105-8457, 717-787-3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800-654-5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's rules of practice and procedure may be obtained from the Board. The appeal form and the Board's rules of practice and procedure are also available in braille or on audiotape from the Secretary to the Board at 717-787-3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.



IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST REACH THE BOARD WITHIN 30 DAYS. YOU DO NOT NEED A LAWYER TO FILE AN APPEAL WITH THE BOARD.

IMPORTANT LEGAL RIGHTS ARE AT STAKE, HOWEVER, SO YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD (717-787-3483) FOR MORE INFORMATION.

FOR THE COMMONWEALTH OF
PENNSYLVANIA, DEPARTMENT OF
ENVIRONMENTAL PROTECTION:

A handwritten signature in cursive script, appearing to read "John Hohenstein".

John Hohenstein, P.E.
Environmental Program Manager



MANKO | GOLD | KATCHER | FOX LLP

AN ENVIRONMENTAL AND ENERGY LAW PRACTICE

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A LIMITED LIABILITY PARTNERSHIP
FORMED IN PENNSYLVANIA

Partner responsible:
John F. Gullace (NJ)
Brenda H. Gotanda (HI)



October 26, 2020

Via EHB's Electronic Filing System
Secretary Christine A. Walker
Commonwealth of Pennsylvania
Environmental Hearing Board
Second Floor, Rachel Carson State Office Building
400 Market Street
Harrisburg, PA 17105

Re: *Sunoco Pipeline L.P. v. DEP*, EHB Docket No. 2020-085-L

Dear Secretary Walker:

Enclosed please find a Petition for Supersedeas and two affidavits, originally filed on October 8, 2020, which un-redact certain information at the locations identified below.

1. Petition for Supersedeas – paragraphs 55-57 and 82
2. Affidavit of David Runte – paragraphs 6-8 and 10
3. Affidavit of Stephen A. Compton – paragraph 8

Respectfully submitted,

/s/ Robert D. Fox

Robert D. Fox

For MANKO, GOLD, KATCHER & FOX, LLP

Enclosures

cc: Nels Taber, Esq.
William Gerlach, Esq.
Melanie Seigel, Esq.





**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.,	:	
	:	
Petitioner	:	
	:	
v.	:	EHB Docket No. 2020-085-L
	:	
COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION,	:	
	:	
Respondent	:	

PETITION FOR SUPERSEDEAS

Appellant Sunoco Pipeline L.P. (“Sunoco Pipeline”), pursuant to 25 Pa. Code § 1021.61, petitions for supersedeas, and avers in support thereof as follows:

I. INTRODUCTION

1. Consistent with agreed protocols that the Environmental Hearing Board (the “Board”) previously approved, the Pennsylvania Department of Environmental Protection (the “Department”) approved a reevaluation report that Sunoco Pipeline submitted for the use of a horizontal directional drill (“HDD”) to install a second pipeline after an inadvertent return (“IR”) of drilling fluid occurred during the HDD to install the first pipeline. The report that the Department approved identified the fact that there was a “moderate to high risk” of an IR occurring during the HDD to install the second pipeline.

2. As anticipated in the reevaluation report that the Department approved, during the final stages of HDD construction, an IR occurred during the installation of the second pipeline. Consistent with the conditions set forth in Sunoco Pipeline’s permit that identify the actions to be taken in response to an IR, Sunoco Pipeline removed all drilling fluid that had impacted a



wetland and two streams and is remediating a small impacted area of a lake. After the IR occurred, Sunoco Pipeline installed a containment system, which is the same type that the Department has approved in numerous other locations following an IR and is designed to contain drilling fluid that may result from another IR and prevent any further impacts to waters of the Commonwealth.

3. Yet, with only a month left before installation of the pipeline through the approved HDD was expected to be completed, the Department issued an Administrative Order suspending Sunoco Pipeline's permits, revoking the Department's approval of the reevaluation report issued after a seven-month review and receipt of over 250 public comments, and ordering Sunoco Pipeline to implement a re-route of the pipeline that is expected to take two years or more to complete. In addition to the irreparable harm that re-routing the pipeline will cause to Sunoco Pipeline and the significant injury that the re-route will cause to the public and the environment, the Department's decision to issue the Administrative Order was arbitrary and capricious and constitutes an abuse of discretion, and therefore issuance of a supersedeas is necessary and appropriate.

II. BACKGROUND

A. HDD 290

4. On June 24, 2017 and August 29, 2017, IRs occurred while Sunoco Pipeline was installing a 16-inch pipeline by HDD in Upper Uwchlan Township, Chester County, at a location referred to as HDD 290. *See* Affidavit of Nicholas J. Bryan ("Bryan Aff."), at ¶¶ 3-4, attached as Ex. 1.



5. An IR that occurs as a result of underground drilling operations involves the release of drilling fluid to the ground surface, by way of naturally occurring fractures, fissures, or shallow/weak soil overburden. Drilling fluid primarily consists of fresh water, bentonite clay, and fine soil or drill cutting particles representing the native material (i.e., rock or soil) being drilled through. *See* Affidavit of Paul Martin (“Martin Aff.”), at ¶ 3, attached as Ex. 2; Affidavit of William Ettinger (“Ettinger Aff.”), at ¶ 3, attached as Ex. 3.

6. The first IR, which occurred on June 24, 2017, occurred during the “pilot” phase of the HDD within wetland W-H17, with an emergence in unnamed tributaries to Marsh Creek Reservoir (S-H10 and S-H11). Drilling stopped, and following notice to the Department, a sandbag dam and pump-around was set up in the stream and wetland to contain the IR. The drilling fluid was removed using hydraulic pumps and vacuum trucks. In accordance with the approved HDD Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan (“IR Plan”) in effect at that time, the Department inspected the site, allowed the sandbags to remain, and approved the resumption of drilling. Bryan Aff., at ¶ 6.

7. The second IR, which occurred on August 29, 2017, occurred during the “ream” phase of the HDD at approximately the same location as the IR that occurred on June 24, 2017. Once again, drilling stopped and Sunoco Pipeline notified the Department of the IR. Sunoco Pipeline added sandbags to contain the IR and removed the drilling fluid using hydraulic pumps and vacuum trucks. In accordance with the approved IR Plan in effect at that time, the Department inspected the site, allowed the sandbags to remain, and approved the resumption of drilling. Bryan Aff., at ¶ 7.



8. No additional IRs occurred at this location during installation of the 16-inch pipeline, and the sandbags were removed after construction of the 16-inch pipeline was completed on November 27, 2017. Bryan Aff., at ¶ 8.

9. On August 10, 2017, the Board entered a Corrected Stipulated Order, docketed at EHB Docket No. 2017-009-L, which sets forth an extensive and detailed process, agreed upon by the parties and approved by the Board following a hearing, for reevaluating HDDs when an IR occurred during the installation of one pipeline and a second pipeline will be installed using HDD in the same right-of-way. Bryan Aff., at ¶¶ 11-12. A copy of the Corrected Stipulated Order is attached as Ex. 4.

10. Paragraph 3 of the Corrected Stipulated Order required Sunoco Pipeline to complete a reevaluation of HDD 290 for the Department's review and approval, following public notice and the opportunity for public comments, before using HDD to install the 20-inch pipeline in the same right-of-way. Ex. 4, at ¶ 3; Bryan Aff., at ¶ 13.

11. The Corrected Stipulated Order required, as part of the reevaluation, that Sunoco Pipeline, among other things, consider data specific to the needs of the HDD, including geologic strength at profile depth, overburden strength, HDD depth, entry angle, pipe stress radius, open cut alternatives, a re-route analysis, and well production zones. Ex. 4, at ¶ 4; Bryan Aff., at ¶ 14. In addition, upon completion of the reevaluation, the Corrected Stipulated Order required Sunoco Pipeline to submit to the Department for review and approval a report signed and sealed by a professional geologist ("PG") that specified the actions to be taken by Sunoco Pipeline to eliminate, reduce, or control the release of drilling fluid from an IR to the ground surface or water supplies. Ex. 4, at ¶ 5; Bryan Aff., at ¶ 14.



12. Sunoco Pipeline submitted to the Department its reevaluation for HDD 290 on May 28, 2019 (“Reevaluation Report”). Bryan Aff., at ¶ 15. A copy of the Reevaluation Report is attached as Ex. 5.

13. In accordance with the Corrected Stipulated Order, the Reevaluation Report submitted to the Department included a report signed and sealed by Richard T. Wardrop, a PG licensed to practice in Pennsylvania. The PG report explicitly stated that “regional and local geologic data together with past drilling performance during drilling for the 16-inch pipeline indicate that installation of the 20-inch line at HDD S3-0290 has a *moderate to high risk* of drilling fluid loss and IRs.” Ex. 5, at 30 (emphasis added); Bryan Aff., at ¶ 16.

14. In accordance with the Corrected Stipulated Order, the Reevaluation Report included a re-route analysis as an alternative to using HDD in the same right-of-way. The re-route analysis identified a 1.01-mile re-route to the north of HDD 290 as “technically feasible,” but rejected the re-route as not practicable for a number of reasons, including: (a) due to the absence of a utility corridor, the re-route would create a greenfield utility corridor and result in encumbering previously unaffected properties; (b) the re-route would cross two waters of the Commonwealth and possible forested wetlands, and would pass in near proximity or immediately adjacent to five home sites; and (c) the re-route would cross the Pennsylvania Turnpike twice and therefore would require two “mini HDDs” (or direct pipe bores) to achieve the required depth of cover under the Turnpike. Balancing these considerations against the moderate to high risk of additional IRs and the ability to contain and remediate such IRs if they were to occur, the re-route analysis rejected the 1.01 mile re-route. Ex. 5, at 6; Bryan Aff., at ¶ 17.



15. In accordance with the Corrected Stipulated Order, the Department posted the Reevaluation Report on the Pennsylvania Pipeline Portal website and provided a 14-day public comment period. The Department received over 250 public comments on the Reevaluation Report. Bryan Aff., at ¶ 18.

16. After a seven-month review, on January 23, 2020, the Department approved the Reevaluation Report without providing any additional comment or conditions and without requiring any containment measures to address the “moderate to high risk” of future IRs at HDD 290. Bryan Aff., at ¶ 19. A copy of the Department’s Approval of the Reevaluation Report is attached as Ex. 6.

B. Inadvertent Return and Immediate Response

17. In accordance with the Department’s approval, drilling activities for the 20-inch pipeline at HDD 290 commenced on February 2, 2020. Pilot hole drilling was completed by June 27, 2020. A pilot hole is the first hole drilled for the entire length of the HDD, and then additional runs of the HDD with larger drill bits increase the diameter of the pilot hole so that the pipeline can be pulled through and connected to other sections of the installed pipeline. Between June 29, 2020 and August 10, 2020, the pilot hole was reamed using a 30-inch reamer to increase the diameter of the hole. On August 10, 2020, after more than six months since drilling commenced, and with only 37 to 45 days remaining until HDD 290 was expected to be completed, an IR occurred in the same area as the IRs that occurred in 2017 during construction of the 16-inch pipeline. At the time of the IR, the reamer had advanced approximately 1,574 feet along the HDD 290 drill profile, and the 30-inch reamed hole was approximately 60 percent complete. Bryan Aff., at ¶ 20.



18. The IR first emerged into wetland W-H17, which is partially a palustrine emergent wetland and partially a palustrine forested wetland. Within wetland W-H17 are two unnamed tributaries to Marsh Creek Reservoir (the “lake”), streams S-H10 and S-H11, which lead to and discharge to the lake (identified as Pond H3). After the IR emerged in wetland W-H17, it then entered streams S-H10 and S-H11 and flowed down the streams ultimately into the lake. *See* Affidavit of Joshua A. Prosceno (“Prosceno Aff.”), at ¶ 7, attached as Ex. 7.

19. Consistent with established practices and the applicable requirements of Sunoco Pipeline’s permits, a system of sandbags and silt fence dams were constructed within stream S-H10 to contain the IR. Two turbidity curtains were installed at the confluence of stream S-H10 and the lake. Field response crew members began immediate cleanup of the IR and recovery of the drilling fluid starting at the IR release point and working their way toward the lake. Cleanup efforts were accomplished using pumps and hand tools to recover the drilling fluid from the wetland and streams into storage tanks on-site. *Prosceno Aff.*, at ¶ 8.

20. Turbidity curtains were placed as the discharge was reaching the cove of the lake prohibiting further discharge of the IR sediments, and therefore only a small amount of drilling fluids from the IR reached the lake. *Prosceno Aff.*, at ¶ 9.

21. Upon discovery of the IR, HDD activity stopped and the IR was immediately reported to the proper authorities, including the Department, and written notices were sent to the local public water supplier, Aqua America, and to two landowners with private water supplies located within 450 feet of the HDD profile. *Prosceno Aff.*, at ¶¶ 10-11.

22. A written Initial IR Report was submitted to the Department on August 11, 2020. Written Interim IR Reports have been submitted to the Department every five business days after



the initial report and will be submitted until completion of construction at the HDD 290 location. Prosceno Aff., at ¶ 12. Daily Current Condition Reports are included in the Interim IR Reports that are sent to the Department. Prosceno Aff., at ¶ 14.

23. On September 11, 2020, the Department, without understanding the underlying cause of the IR, issued to Sunoco Pipeline the Administrative Order at issue in this appeal, which: (1) suspended all work on HDD 290 permitted under Sunoco Pipeline's Chapter 102 and Chapter 105 permits; (2) ordered Sunoco Pipeline to begin to implement the re-route of HDD 290 identified in the Reevaluation Report; (3) ordered Sunoco Pipeline to submit a report describing the underlying cause of the IR; (4) ordered Sunoco Pipeline to submit an Impact Assessment and Restoration Plan regarding impacts to waters of the Commonwealth; and (5) ordered Sunoco Pipeline to secure the borehole with grout. A copy of the Administrative Order is attached as Ex. 8.

C. **Impacts from the IR have been, and are being, fully remediated.**

24. Within eleven days of the IR, and prior to issuance of the Administrative Order, all drilling fluid was removed from wetland W-H17 and streams S-H10 and S-H11. Martin Aff., at ¶¶ 4-5; Ettinger Aff., at ¶¶ 4-5.

25. Any physical impacts that occurred to the streams S-H10 and S-H11 as a result of the IR were minor and temporary, as the streams have already been restored to their original condition. The IR and associated remediation and restoration activities did not involve any permanent changes to flow patterns, bed and bank grades, bed substrate or any channel deepening/dredging activities, addition of structures or impervious surfaces in the stream



floodways, or loss of riparian forested vegetation. *See* Affidavit of Brad Schaeffer (“Schaeffer Aff.”), at ¶ 13, attached as Ex. 9.

26. Disturbed vegetation in wetland W-H17 is already re-growing, and wetlands similar to wetland W-H17, located in other areas that have been impacted by IRs have similarly fully recovered and thrived. Martin Aff., ¶¶ 5-8. In fact, wetland W-H17 and stream S-H10, which were impacted by the IRs that occurred at HDD 290 in 2017, have fully recovered. Martin Aff., ¶ 6; Ettinger Aff., at ¶ 5.

27. Based on investigations conducted after the IR, it was discovered that approximately 7.3 acres of 535 acres, or approximately 1%, of the lake, were impacted by newly deposited sediments from a range of potential sources which may include stormwater runoff and the IR. *See* Affidavit of Joshua Collins (“Collins Aff.”), at ¶ 4, attached as Ex. 10. Four samples of the newly deposited sediments collected within the 7.3-acre impacted area contained trace amounts (less than 5%) of bentonite. Collins Aff., at ¶ 5.

28. The IR discharge, containing primarily water, fine soil, or drill cutting particles representing the native material, and a trace amount of bentonite, was a single short-term event, and estimated to have discharged a small amount of drilling fluid into the cove of the lake. Martin Aff., at ¶ 11.

29. Nevertheless, the Restoration Plan submitted to the Department recommends hydraulic dredging within a portion of the impacted area of the lake to remove newly-deposited sediments where estimated thicknesses were greater than 1 inch. The Restoration Plan also includes a two-year monitoring period with reports to be sent to the Department to demonstrate the effectiveness of the Restoration Plan. Collins Aff., at ¶ 6.



30. In addition, the implementation of the Restoration Plan will provide a temporary net benefit to the lake by the removal of noxious aquatic plants associated with the hydraulic dredging, improving current habitat and recreational conditions. Collins Aff., at ¶ 7.

31. By comparison to the limited impacts caused by the IR, sedimentation of the lake occurring from precipitation events (rainfall, snow melt, etc.) occurs multiple times each year, year in and year out, as a result of natural cycles unrelated to the construction of HDD 290. Martin Aff., at ¶ 12. In addition, unrelated real estate development, construction, and agricultural activities present in the watershed that drains into streams S-H10 and S-H11 and ultimately to the lake may serve as sources of increased sediment transport and deposition within the impacted area of the lake, particularly following large storm events. Collins Aff., at ¶ 8.

32. In fact, evidence of sedimentation and associated excessive aquatic vegetation growth in the cove going back to at least 2008 resulted in the Department's decision to list the lake as impaired for recreation due to noxious aquatic plants and aquatic life due to nutrients from urban runoff and storm sewers, agriculture, and municipal point source discharges, and fish consumption due to mercury. Martin Aff., at ¶ 14; Collins Aff., at ¶ 9.

33. In terms of impacts to human health, the products contained in the drilling fluid released by the IR at HDD 290 on August 10, 2020 (i.e., bentonite, sodium bicarbonate, and citric acid) are non-toxic and do not present concern for human health in the concentrations found in, around, and downstream from the IR. See Affidavit of Brian Magee ("Magee Aff."), at ¶¶ 3-15, attached as Ex. 11.



D. Containment Structure

34. The location where the drilling fluid emerged on August 10, 2020 is expected to be the path of least resistance for any future IR that may develop during the completion of HDD 290. Schaeffer Aff., at ¶ 3.

35. To prevent and mitigate impacts associated with any IR that may develop at this location during the completion of HDD 290, a containment structure surrounding the location of the IR will be used as an unconventional pressure relief point. Schaeffer Aff., at ¶ 4.

36. Sunoco Pipeline has submitted an Emergency Permit application to the Department to permit the IR containment structure located in wetland W-H17 to remain in place and be used as an unconventional pressure relief point for a borehole grout operation to contain the discharge of grout that may occur as Sunoco Pipeline grouts the borehole as ordered by the Department. Although the Emergency Permit application was submitted to permit the containment structure for the grouting of the borehole, the exact same containment structure would be used during the completion of HDD 290 to contain any drilling fluid discharged if an IR were to occur. Schaeffer Aff., at ¶ 5.

37. The containment structure is designed to include a stacked sandbag wall approximately six feet high at its maximum and 30 feet long. The convex-shaped wall is positioned upslope and immediately downslope from the IR location. For added protection against impacts to wetland W-H17 and streams S-H10 and S-H11, this wall is supported on the downslope side with a belted reinforced silt fence secured with steel and wooden stakes. An additional stacked sandbag wall approximately three feet downslope from this structure is designed to be three feet maximum in height. A containment structure of this size is designed to



contain approximately 14,000 gallons of drilling fluid, which is approximately double the amount of drilling fluid that resulted from the IR that occurred on August 10, 2020. Schaeffer Aff., at ¶ 6.

38. Within the containment structure is a 4-inch self-contained hydraulic pump, which will pump any water and other material from the IR through hoses to storage tanks located nearby in an adjacent upland area. Although there currently is constant groundwater input into the containment structure as evidenced by ponding of water upslope of the structure, this 4-inch pump will be used to dewater the relief point to maintain a constant capacity to receive any water and other material from an IR that may occur during completion of HDD 290. Any water or other material, or combination thereof, emerging as a result of the completion of the HDD will be pumped to storage tanks using vacuum trucks or pumps. The storage tanks will be periodically emptied by additional vacuum trucks to assure that they always have enough capacity. Schaeffer Aff., at ¶ 7.

39. At least one backup vacuum truck will always be staged on composite matting in the adjacent uplands to mitigate a release rate that may threaten to overwhelm the containment or in case of equipment failure. Additionally, extra pumps, hoses, silt fence, compost filter sock, and sandbags will be staged within the adjacent uplands in case they are needed. Schaeffer Aff., at ¶ 8.

40. In addition to the structural and hydraulic means to control any discharge resulting from the IR, an environmental inspector and professional geologist will be on-site at all times during HDD drilling operations to review the efficacy of the containment structure. The



adjacent areas, drill alignment, and downslope areas of the IR location including streams S-H10 and S-H11 will be visually inspected at least twice a day. Schaeffer Aff., at ¶ 9.

41. The IR containment structure and related measures described above can successfully manage and contain any new discharges that may result from an IR occurring during the completion of drilling of HDD 290. Schaeffer Aff., at ¶ 10. The drilling fluid from an IR will not enter streams S-H10 or S-H11. Ettinger Aff., at ¶ 6. Therefore, ecological impacts will not occur to stream S-H10, stream S-H11, or the lake as a result of the completion of HDD 290. Ettinger Aff., at ¶ 6.

42. Upon the resumption of construction of HDD 290, under a worst-case scenario that the IR will continue, the existence of the containment structure will result in several weeks or less disturbance of one wetland area to allow for its use as an unconventional pressure relief point. As set forth in the Emergency Permit application submitted to the Department for the containment structure, it is estimated that roughly 0.161 acres of temporary disturbance will occur within palustrine emergent wetlands within the Limits of Disturbance. The area of the containment structure occupies only 0.02 acres. Martin Aff., at ¶ 9.

43. Once HDD 290 is completed, the IR containment structure and its apparatus will be removed and the area of wetland W-H17 will be restored in accordance with the permit issued by the Department. Schaeffer Aff., at ¶ 12. Once the containment structure is removed from the wetland and the small depression area is filled with soil and seeded as set forth in the restoration plan, the wetland will fully recover and fulfill the same wetland functions and values as it did prior to the IR. Martin Aff., at ¶ 9. A five-year monitoring program will begin to ensure



successful restoration of this area, with periodic reports prepared and submitted to the Department. Schaeffer Aff., at ¶ 12.

44. Following IRs resulting from HDD activities, the Department has routinely approved containment structures around an IR location by a redline permit modification approval for sandbags and silt fence in both uplands and waters of the Commonwealth, which has allowed construction of the HDD to be completed. In those instances, the containment structures were built surrounding the IR and were used as a relief point for the drilling fluid to allow the HDD to complete construction while minimizing further releases of the drilling fluid from the discrete confined area. Prosceno Aff., at ¶ 15.

45. Sandbag and silt fence containment structures that have been approved by the Department have successfully minimized further releases of drilling fluid from the discrete confined area of the containment and have allowed the HDD to be completed at a number of locations both in Chester County and Spread 6, as well as other areas. Prosceno Aff., at ¶ 17.

46. In fact, the Department has approved the use of containment structures in wetlands and waterbodies to contain IRs at over a dozen other locations along the Project. Bryan Aff., at ¶ 9. For example, the design of the HDD 290 IR containment structure has previously been permitted by the Department and successfully used to complete other HDDs for the Project, including but not limited to the following HDDs: S2-0121, S2-0142, S2-0210, S2-0220, S2-0247, and S3-0081. Schaeffer Aff., at ¶ 11.

47. At two of those other locations, the Department approved the use of containment structures in waterbodies or wetlands classified as “High Quality” or “Exceptional Value” resources under the Department’s Chapter 93 regulations, after the Department had approved a



re-evaluation for the corresponding HDD: Piney Creek (HDD S2-0142) and I-81 (HDD S2-0220). In each case, the containment structure effectively contained water and other materials from IRs that occurred during the remainder of the HDD activities and prevented any further impacts to aquatic resources while Sunoco Pipeline completed construction of the pipeline at those locations. At Piney Creek (HDD S2-0142), over 1.4 million gallons of drilling fluid were recirculated, and at I-81 (HDD S2-0220) almost 160,000 gallons of drilling fluid were recirculated. Bryan Aff., at ¶ 10.

48. As discussed above, during the construction of the 16-inch pipeline at the HDD 290 location, on June 24, 2017 an IR occurred in wetland W-H17 and streams S-10 and S-H11 (which is the same area as the IR that occurred on August 10, 2020), and a sandbag dam and pump were also set up in the wetland and stream to contain the IR. The Department allowed construction of the HDD for the 16-inch pipeline to continue with the sandbag containment structure in place for the remainder of the HDD construction, with additional sandbags being added when a second IR occurred at the same location on August 29, 2017. After the construction of the first 16-inch pipeline at this location was successfully completed and the pipeline was installed, the sandbag containment structure was then removed and the wetland and streams were restored. Prosceno Aff., at ¶ 16; Bryan Aff., at ¶¶ 3-8.

III. Supersedeas of Administrative Order

49. By this Petition, Sunoco Pipeline seeks a supersedeas of Paragraphs 1, 2, and 6 of the Administrative Order and an order directing the Department to immediately allow Sunoco Pipeline to recommence construction of HDD 290 in accordance with its Chapter 102 and 105



permits and its approved Reevaluation Report, along with the containment structure described above.

50. For the reasons set forth below, supersedeas of the Administrative Order is necessary and appropriate. When determining whether to grant a petition for supersedeas, the Board assesses the following factors: (i) irreparable harm to the petitioner, (ii) the likelihood of the petitioner prevailing on the merits, and (iii) the likelihood of injury to the public or other parties. 25 Pa. Code § 1021.63.

51. First, the Administrative Order is causing and will continue to cause irreparable harm to Sunoco Pipeline, by causing Sunoco Pipeline to incur substantial costs to construct the re-route of HDD 290 and lose revenue caused by the delayed completion of the Mariner East 2 pipeline project (“ME2 Project”).

52. Second, Sunoco Pipeline has a likelihood of prevailing on the merits of this appeal considering that the Department has abused its discretion by suspending Sunoco Pipeline’s permits and revoking its approval of the Reevaluation Report, violating the procedures set forth in the Corrected Stipulated Order, and ordering Sunoco Pipeline to implement a re-route based on an improper standard in violation of the Department’s regulations, notwithstanding that the Department knew in approving the Reevaluation Report that the likelihood of an IR occurring while constructing HDD 290 was “moderate to high,” and that Sunoco Pipeline has installed a containment structure, which the Department has approved in many other instances and which has been demonstrated to function effectively here and elsewhere.

53. Finally, superseding the Administrative Order will not cause or threaten pollution or injury to the public health, safety, or welfare. Any impacts from the IR have been or will be



remediated, and the containment structure will prevent harm to the environment from a potential future IR. To the contrary, the Administrative Order's requirement to implement the re-route of HDD 290 will cause substantial injury to the public and the environment.

A. **Sunoco Pipeline is suffering and will continue to suffer irreparable harm as a result of the Administrative Order.**

54. Irreparable harm exists when an ongoing business is shuttered, ongoing production or sales have been stopped, employees have been laid off, significant mobilization costs have been incurred, or contractual commitments are threatened. *See, e.g. Beardslee v. DEP*, 2016 EHB 198; *Empire Sanitary Landfill, Inc. v. DER*, 1991 EHB 102; *Mundis, Inc. v. DEP*, 1998 EHB 766. Similarly, irreparable harm exists when the Department's actions result in significant reductions in operating capacity and resulting financial losses. *A&M Composting, Inc. v. DEP*, 1997 EHB 1093. Economic harm in a matter before the Board is irreparable because a petitioner is unable to recover economic damages from the Department.

55. Sunoco Pipeline has already incurred approximately \$16,916,423 in costs to install the 20-inch pipeline at HDD 290. *See* Affidavit of David Runte, at ¶ 6, attached as Ex. 12. If required to re-route, Sunoco Pipeline would be unable to recover these costs.

56. The estimated time remaining to complete construction of HDD 290 is approximately 37 to 45 days, and the anticipated total cost to complete construction of HDD 290 is between approximately \$4,585,900 and \$5,632,300. Runte Aff., at ¶¶ 8-9.

57. By contrast, completion of the re-route of HDD 290 is expected to take twenty-four to twenty-nine months, and the anticipated total cost to construct the re-route is between approximately \$18,073,700 and \$23,590,000. Runte Aff., at ¶¶ 10-13; Affidavit of Mark McConnell ("McConnell Aff."), at ¶ 12, attached as Ex. 13; Schaeffer Aff., at ¶ 15.



58. Construction of the re-route cannot begin until Sunoco Pipeline acquires the necessary property rights to allow Sunoco Pipeline to construct the re-route of HDD 290, which is expected to take five to seven months. McConnell Aff., at ¶ 12; Runte Aff., at ¶ 11. Likewise, construction of the re-route cannot begin until Sunoco Pipeline obtains all Department permits and approvals necessary to allow Sunoco Pipeline to commence construction of the re-route, which is expected to take between approximately twenty and twenty-four months. Schaeffer Aff., at ¶ 15; Runte Aff., at ¶ 12. Construction of the re-route is expected to take between approximately four and five months. Runte Aff., at ¶ 13.

59. If Sunoco Pipeline cannot complete construction of HDD 290 and prepare the 20-inch pipeline at that location for service by March 31, 2021, every day that completion of construction of the ME2 Project is delayed after March 31, 2021, Sunoco Pipeline will lose approximately [CONFIDENTIAL] in revenue every day for the first four months after March 31, 2021 due to the lower capacity of the Mariner East 2 pipeline (“ME2”), and thereafter will lose between approximately [CONFIDENTIAL] in revenue every day due to the lower capacity of ME2 and the inability to use the converted ME1 8-inch pipeline to transport refined petroleum products between Montello, Pennsylvania and Marcus Hook, until construction of the ME2 Project is completed. See Affidavit of Richard Billman (“Billman Aff.”), at ¶ 17, attached as Ex. 14.

60. If completion of the ME2 Project is delayed by eighteen to twenty-three months after March 31, 2020, Sunoco Pipeline would expect to lose a total of between approximately [CONFIDENTIAL] in profits as a result of the Administrative Order. Billman Aff., at ¶ 25.



61. If the Petition for Supersedeas is denied, Sunoco Pipeline will not receive a ruling on the merits in this appeal in time to allow Sunoco Pipeline to complete construction of HDD 290 and prepare it for service by March 31, 2021, the date currently projected. If and when Sunoco Pipeline would prevail on the merits, Sunoco Pipeline would have already incurred significant financial costs and losses that Sunoco Pipeline would not be able to recover from the Department. This harm is precisely the type of irreparable harm that a supersedeas is intended to address.

B. Sunoco Pipeline is likely to succeed on the merits of this appeal.

62. The Department bears the burden of proving that it did not abuse its discretion in issuing an order or revoking or suspending a permit or approval. 25 Pa. Code 1021.122(b).

63. In a supersedeas proceeding, Sunoco Pipeline bears the burden of proving that the Department is ultimately unlikely to be able to show by a preponderance of the evidence that it acted properly. *See Global Eco-Logical Servs., Inc. v. DEP*, 1999 EHB 649.

64. The “Board is not called upon to decide the case on the merits in the context of a petition for a supersedeas. Rather, the Board is required to make a prediction based upon a limited record prepared under rushed circumstances of how an appeal might be decided at some indeterminate point in the future.” *Global Eco-Logical Servs.*, 1999 EHB at 652.

65. “To be successful, the petitioner’s chance of success on the merits must be more than speculative; however, it need not establish the claim absolutely.” *Erie Coke Corp. v. DEP*, 2019 EHB 481, 485.

66. Fittingly in this case, “where the magnitude of irreparable harm is great, the Board may relax the required showing on the merits that the petitioner must make” and require



the petitioner demonstrate that there is a “reasonable possibility that it will succeed in its challenge to the Department’s action.” *Erie Coke Corp.*, 2019 EHB at 496, 501 (citing *Global Eco-Logical Servs.*, 1999 EHB 649; *Gary L. Reinhart, Sr. v. DEP*, 1997 EHB 401, 419; and *Keystone Cement Co. v. DER*, 1992 EHB 590, 599).

67. When exercising its discretion to suspend or revoke a permit or approval, the decision must be a “reasonable and appropriate” remedy “necessary to aid” in the Department’s statutory enforcement. *Com., Dep’t of Env’tl. Res. v. Mill Serv., Inc.*, 347 A.2d 503, 505 (Pa. Cmwlth. 1975).

68. Supersedeas of the revocation or suspension of a permit or approval is appropriate where, as here, “any potential harm to the environment presented by the continued operation . . . can be reduced to a tolerable risk level if a supersedeas is conditioned upon full compliance with the Department-issued permit[s]” and other reasonable conditions imposed by the Board, and “it is unlikely that the public or the environment will suffer any harm if a supersedeas is issued.” *See Global Eco-Logical Servs.*, 1999 EHB 649; *see also Power Operating Co. v. DEP*, 1997 EHB 1186.

1. **The Department’s decision to suspend Sunoco Pipeline’s Chapter 102 and 105 Permits, revoke approval of the Reevaluation Report, and order the re-route of HDD 290 is arbitrary, capricious, and an abuse of discretion.**

69. As described above, Sunoco Pipeline removed all drilling fluid that had impacted wetland W-H17 and streams S-H10 and S-H11 within eleven days of the IR and is remediating a small impacted area of the lake. *See supra* Section II.C. Furthermore, the containment system that Sunoco Pipeline has installed is the same type that the Department has approved in numerous other locations following an IR and is designed to successfully manage and contain



any new discharges that may result from an IR occurring when completing construction of HDD 290. *See supra* Section II.D. Drilling fluid from an IR will therefore not enter streams S-H10 or S-H11, and ecological impacts will not occur to stream S-H10, stream S-H11, or the lake, were an IR to occur during the completion of HDD 290. Ettinger Aff., at ¶ 6.

70. Yet, with only 37 to 45 days left to complete construction of HDD 290, the Department ordered Sunoco Pipeline to implement a two-year re-route that will cause significantly more harm to the public and the environment than any limited impact that may occur from completing construction of HDD 290. *See* Affidavit of Stephen A. Compton (“Compton Aff.”), at ¶¶ 12, 14-20, attached as Ex. 15; Martin Aff., at ¶¶ 16-23; Ettinger Aff., at ¶ 7-11.

71. In this case, the Department is unlikely to show by a preponderance of the evidence that it acted “reasonably and appropriately” and did not abuse its discretion in suspending Sunoco Pipeline’s permits, which effectively operates as a revocation of the permits, and ordering Sunoco Pipeline to implement an expensive and lengthy re-route instead of allowing Sunoco Pipeline to continue with HDD 290 and minimize any impacts to the environment by maintaining the containment structure already installed, as the Department has approved at numerous other locations. *See Global Eco-Logical Servs.*, 1999 EHB 649. In particular, given the magnitude of irreparable harm set forth in Section III.A above, Sunoco Pipeline has shown a “reasonable possibility that it will succeed in its challenge to the Department’s action.” *Erie Coke Corp.*, 2019 EHB at 496, 501 (citing *Global Eco-Logical Servs.*, 1999 EHB 649; *Gary L. Reinhart*, 1997 EHB 401, 419; and *Keystone Cement Co.*, 1992 EHB 590, 599).



72. Here, supersedeas is appropriate because any potential harm to the environment presented by the continued construction of HDD 290 can be reduced to a tolerable risk level if a supersedeas is conditioned upon full compliance with all Department-issued permits and the additional condition of maintaining a containment structure. *See Global Eco-Logical Servs.*, 1999 EHB 649; *see also Power Operating Co.*, 1997 EHB 1186.

73. In addition, the Board has held that orders are intended to attain compliance and alleviate adverse environmental impacts, not to punish. *See Schaffer v. DEP*, 2006 EHB 1013, 1028 (Adjudication by J. Labuskes) (“[T]he purpose of orders is to attain compliance, not to punish.”); *Strubinger v. DEP*, 2003 EHB 247, 252 (Adjudication by J. Labuskes) (“[T]he purpose of [an] Order is to alleviate an adverse environmental impact, not to punish. It is remedial, not punitive.”)

74. To the extent that the Department’s issuance of the Administrative Order operates to punish Sunoco Pipeline for events that have occurred at other locations and was not focused solely on attaining compliance at the location of HDD 290, the Department’s issuance of the Administrative Order was arbitrary, capricious, and an abuse of discretion.

2. **The Department’s revocation of its approval of the Reevaluation Report violates the Corrected Stipulated Order and is not a practicable alternative under the Department’s regulations.**

75. The Corrected Stipulated Order sets forth a process by which Sunoco Pipeline was required to submit, and the Department was required to review and approve, a Reevaluation Report for HDD 290. Ex. 5.

76. After a seven-month review period and receiving over 250 public comments, the Department approved the Reevaluation Report for HDD 290 without providing any additional



comment or conditions and without requiring any containment measures to address the “moderate to high risk” of future IRs at HDD 290 that Sunoco Pipeline identified in the Reevaluation Report for HDD 290. Ex. 5; Ex. 6; Bryan Aff., at ¶¶ 18-19.

77. The Corrected Stipulated Order does not permit the Department to revoke its approval of a Reevaluation Report, unilaterally revise the Reevaluation Report, and order implementation of an alternate route that was specifically rejected as not practicable, which determination the Department agreed with when it approved the Reevaluation Report for HDD 290.

78. Even if the Corrected Stipulated Order allows the Department to unilaterally revise a Reevaluation Report to require Sunoco Pipeline to implement an alternate route, that alternate route must still constitute a practicable alternative that is acceptable under 25 Pa. Code § 105.18a(b).

79. Under Section 105.18a(b), the Department may not grant a Chapter 105 permit for an encroachment into a wetland that is not an exceptional value wetland, or otherwise affecting the wetland, unless there is no practicable alternative to the proposed project that would not involve a wetland or that would have less adverse impact on the wetland, and that would not have other significant adverse impacts on the environment. An alternative is practicable if it is available and capable of being carried out after taking into consideration construction cost, existing technology, and logistics. 25 Pa. Code § 105.18a(b).

80. As explained above, the Reevaluation Report for HDD 290 provided a re-route analysis, as required by the Corrected Stipulated Order. The re-route analysis noted that a re-route to the north was *technically feasible* but rejected the re-route due in part to its expected



impacts to possible forested wetlands and other significant adverse impacts on the environment, including waters of the Commonwealth. The Department's approval of the Reevaluation Report constituted the Department's agreement that the re-route was not a practicable alternative that was acceptable under 25 Pa. Code § 105.18a(b).

81. Notwithstanding that Sunoco Pipeline identified the re-route as "technically feasible" in the Reevaluation Report, which is not the standard for determining whether an alternative is practicable under the Department's regulations, the re-route is not a practicable alternative under 25 Pa. Code § 105.18a(b) due to the significant construction costs and the host of logistical issues it would pose. Compton Aff., at ¶¶ 6-11.

82. As discussed above, the cost to construct the re-route would be between approximately \$12,000,000 and \$19,000,000 more than the cost to complete construction of HDD 290. Runte Aff. at ¶¶ 8, 10.

83. The re-route would take approximately twenty-four to twenty-nine *months* to complete, as compared to the 37 to 45 *days* to complete construction of HDD 290. Schaeffer Aff., at ¶ 15; Runte Aff., at ¶¶ 9, 13. Constructing the re-route would also require Sunoco Pipeline to address a number of other complex logistical problems, including but not limited to: landowner easement restrictions and requirements; potential inconsistency with current and future residential and commercial development plans and associated land uses; restrictions or unavailability of practicable road, infrastructure, and resource crossing alignments and construction methods; possibly unallowable, un-permittable, or un-constructible road and infrastructure crossings and construction methods; and the resultant significant delays and costs



in completing project development, design, survey, approvals, permitting, construction, in-service commissioning, and operation. Compton Aff., at ¶ 7.

84. And even if the re-route were considered a practicable alternative under the Department's regulations (and it is not), the Department would be required to reject it because of its anticipated impacts on wetlands and other significant adverse impacts on the environment. Martin Aff., at ¶¶ 16-23; Ettinger Aff., at ¶ 7-11; Compton Aff., at ¶¶ 18-20.

85. The Department's order that Sunoco Pipeline implement the re-route described in the Reevaluation Report violates the Corrected Stipulated Order and 25 Pa. Code § 105.18a(b), applies an improper standard in evaluating the re-route, and is arbitrary and capricious and constitutes an abuse of discretion.

C. **The re-route of HDD 290 will cause significantly greater injury to the public and the environment than any minimal harm that may result from completing construction of HDD 290.**

86. For the reasons set forth above, a grant of supersedeas is not expected to cause or threaten pollution or injury to the public. Following the IR, Sunoco Pipeline removed all drilling fluid that had impacted a wetland and two streams and is remediating a small impacted area of the lake. *See supra* Section II.C. Sunoco Pipeline subsequently installed a containment system, which is of the same type that the Department has approved in numerous other locations following an IR and is designed to contain drilling fluid that may result from another IR and prevent any further impacts to waters of the Commonwealth. *See supra* Section II.D.

87. In stark contrast, the approximately two-year implementation and construction of the re-route of HDD 290 would cause significantly greater environmental harm and public disruption than any minimal harm that may result from completing HDD 290 in 37 to 45 days.



Compton Aff., at ¶ 12; Martin Aff., at ¶¶ 16-23; Ettinger Aff., at ¶¶ 7-11. Specifically, as compared to completing HDD 290, the re-route would cause greater direct and indirect impacts to wetlands and waterbodies, as well as other environmental (land uses, protected species) and human environment (landowners, residences, roadways) resources, including as follows:

a. The re-route would result in greater temporary construction impacts to wetlands (+0.15 acre) and PFO permanent cover type conversion (+0.03 acre). Compton Aff., at ¶ 18.

b. The re-route would result in substantively greater impacts to waterbodies. Compton Aff., at ¶ 19.

c. The re-route likely would require Phase I Bog Turtle Survey and have the potential of being determined positive for the presence of bog turtle through Phase II surveys. Compton Aff., at ¶ 20.

d. The re-route would result in almost entirely new and substantively greater (+9.28 acres) land disturbance, including new forested and residential land uses. Compton Aff., at ¶ 14.

e. The re-route would result in substantively greater open cut construction method and surface travel lane disturbance, including but not limited to potential road closures, traffic interruptions, traffic control, and associated public safety hazards. Compton Aff., at ¶ 15.

f. The re-route would result in a substantively increased amount of impacts on new landowners both during and after construction. Compton Aff., at ¶ 16.



g. The re-route would result in a substantively increased amount of impacts on residences. Compton Aff., at ¶ 17.

88. For these reasons, a grant of supersedeas is not expected to cause or threaten pollution or injury to the public. Rather, the Administrative Order, if not superseded, would cause significantly greater environmental harm and public disruption than any minimal harm that may result from completing HDD 290 in 37 to 45 days utilizing the containment structure described herein.

WHEREFORE, Appellant Sunoco Pipeline L.P. respectfully requests the Board to, following a hearing hereon, enter an Order superseding the Administrative Order issued to Sunoco Pipeline L.P. for the reasons set forth above and directing the Department to immediately allow Sunoco Pipeline L.P. to recommence construction of HDD 290 in accordance with its Chapter 102 and 105 permits and its approved Reevaluation Report, along with the containment structure that Sunoco Pipeline L.P. has installed subject to its Emergency Permit application.

Respectfully submitted,

Dated: October 8, 2020

/s/ Robert D. Fox
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Attorneys for Appellant,
Sunoco Pipeline L.P.



EXHIBIT 1



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.	:	
	:	
v.	:	EHB Docket No. 2020-085-L
	:	
COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION	:	
	:	

AFFIDAVIT OF NICHOLAS J. BRYAN, P.L.S.

Nicholas J. Bryan, P.L.S. states as follows:

1. My name is Nicholas J. Bryan, and I am Senior Director – E&C Environmental for Energy Transfer, which is the parent of Sunoco Pipeline L.P. (“Sunoco Pipeline”).
2. I am a professional licensed surveyor registered in Pennsylvania and have a bachelor’s degree in land surveying from Penn State University.
3. I am part of a team of environmental professionals for Sunoco Pipeline that manages the environmental permitting and compliance for a project known as the Mariner East 2 Pipeline project (the “Project”). Part of the Project involves installing a 20-inch pipeline by horizontal directional drill (“HDD”) in Upper Uwchlan Township, Chester County, referred to as HDD 290.
4. On June 24, 2017 and August 29, 2017, inadvertent returns (“IRs”) of drilling fluid occurred while Sunoco Pipeline was installing a 16-inch pipeline by HDD in the same right-of-way in which Sunoco Pipeline would later begin installing a 20-inch pipeline by HDD 290.
5. IR reports associated with these two IRs, which I have reviewed, were submitted to the Pennsylvania Department of Environmental Protection (the “Department”).



6. The first IR, which occurred on June 24, 2017, occurred during the “pilot” phase of the HDD within wetland W-H17, with an emergence in unnamed tributaries to Marsh Creek (S-H10 and S-H11). Drilling stopped, and following notice to the Department, a sandbag dam and pump-around was set up in the stream and wetland to contain the IR. The drilling fluid was removed using hydraulic pumps and vacuum trucks. In accordance with the approved HDD Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan (“IR Plan”) in effect at that time, the Department inspected the site, allowed the sandbags to remain, and approved the resumption of drilling.

7. The second IR, on August 29, 2017, occurred during the “ream” phase of the HDD at approximately the same location as the IR that occurred on June 24, 2017. Once again, drilling stopped and Sunoco Pipeline notified the Department of the IR. Sunoco Pipeline added sandbags to contain the IR and removed the drilling fluid using hydraulic pumps and vacuum trucks. In accordance with the approved IR Plan in effect at that time, the Department inspected the site, allowed the sandbags to remain, and approved the resumption of drilling.

8. No additional IRs occurred at this location during installation of the 16-inch pipeline, and the sandbags were removed after construction of the 16-inch pipeline was completed on November 27, 2017.

9. In addition to the sandbag containments used at HDD 290 in 2017, the Department has approved the use of containment structures in wetlands and waterbodies to contain IRs at over a dozen other locations along the Project.

10. At two of those other locations, the Department approved the use of containment structures in waterbodies or wetlands classified as “High Quality” or “Exceptional Value” resources under the Department’s Chapter 93 regulations, after the Department had approved a



re-evaluation for the corresponding HDD: Piney Creek (HDD S2-0142) and I-81 (HDD S2-0220). I have reviewed the IR reports associated with the IRs at these locations. In each case, the containment structure effectively contained IRs that occurred during the remainder of the HDD activities and prevented any further impacts to aquatic resources while Sunoco Pipeline completed construction of the pipeline at those locations. At these locations, Sunoco Pipeline has tracked the volume of drilling fluid recirculated through approved containment structures and I have reviewed those figures. At Piney Creek (HDD S2-0142), over 1.4 million gallons of drilling fluid were recirculated, and at I-81 (HDD S2-0220) almost 160,000 gallons of drilling fluid were recirculated.

11. I understand that on August 10, 2017, the Environmental Hearing Board (“EHB”) entered a Corrected Stipulated Order to resolve an Application for Temporary Partial Supersedeas and a Petition for Partial Supersedeas filed by the Clean Air Council, Delaware Riverkeeper Network, and the Mountain Watershed Association, Inc. at EHB Docket No. 2017-009-L.

12. The Corrected Stipulated Order requires Sunoco Pipeline to perform a re-evaluation of the design of the HDD techniques for certain HDDs for the Project when an IR occurred during installation of one pipeline and when a second pipeline was to be installed in the same right-of-way.

13. Paragraph 3 of the Corrected Stipulated Order thus required Sunoco Pipeline to complete a re-evaluation of HDD 290 before installation of the 20-inch pipeline.

14. The Corrected Stipulated Order required, as part of the re-evaluation, that Sunoco Pipeline, among other things, consider data specific to the needs of the HDD, including geologic strength at profile depth, overburden strength, HDD depth, entry angle, pipe stress radius, open



cut alternatives, a re-route analysis, and well production zones. In addition, upon completion of the re-evaluation, the Corrected Stipulated Order required Sunoco Pipeline to submit to the Department for review and approval a report signed and sealed by a professional geologist (“PG”) that specified the actions to be taken by Sunoco Pipeline to eliminate, reduce, or control the release of drilling fluid from an IR to the ground surface or water supplies.

15. Sunoco Pipeline submitted to the Department its re-evaluation for HDD 290 on May 28, 2019 (“Reevaluation Report”).

16. In accordance with the Corrected Stipulated Order, the Reevaluation Report submitted to the Department included a report signed and sealed by Richard T. Wardrop, a PG licensed to practice in Pennsylvania. The PG report explicitly stated that “regional and local geologic data together with past drilling performance during drilling for the 16-inch pipeline indicate that installation of the 20-inch line at HDD S3-0290 has a *moderate to high risk* of drilling fluid loss and IRs.” (Emphasis added.)

17. In accordance with the Corrected Stipulated Order, the Reevaluation Report included a re-route analysis. The re-route analysis identified a 1.01-mile re-route to the north of HDD 290 as “technically feasible,” but rejected the re-route as not practicable for a number of reasons, including: (a) due to the absence of a utility corridor, the re-route would create a greenfield utility corridor and result in encumbering previously unaffected properties; (b) the re-route would cross two waters of the Commonwealth and possible forested wetlands, and would pass in near proximity or immediately adjacent to five home sites; and (c) the re-route would cross the Pennsylvania Turnpike twice and therefore would require two “mini HDDs” or direct pipe bores to achieve the required depth of cover under the Turnpike. Balancing these



considerations against the moderate to high risk of additional IRs and the ability to contain and remediate such IRs if they were to occur, the re-route analysis rejected the 1.01 mile re-route.

18. In accordance with the Corrected Stipulated Order, the Department posted the Reevaluation Report on the Pennsylvania Pipeline Portal website and provided a 14-day public comment period. The Department received over 250 public comments on the Reevaluation Report.

19. After a seven-month review period, the Department approved the Reevaluation Report without providing any additional comment or conditions and without requiring any containment measures to address the “moderate to high risk” of future IRs at HDD 290.

20. In accordance with the Department’s approval, drilling activities for the 20-inch pipeline at HDD 290 commenced on February 2, 2020. Pilot hole drilling was completed by June 27, 2020. A pilot hole is the first hole drilled for the entire length of the HDD, and then additional runs of the HDD with larger drill bits increase the diameter of the pilot hole so that the pipeline can be pulled through and connected to other sections of the installed pipeline. Between June 29, 2020, and August 10, 2020, the pilot hole was reamed using a 30-inch reamer. On August 10, 2020, after more than six months since drilling commenced, and with only 37 to 45 days remaining until HDD S3-0290 was expected to be completed, an IR occurred in the same area as the IRs that occurred in 2017 during construction of the 16-inch pipeline. At the time of the IR, the reamer had advanced approximately 1,574 feet along the HDD 290 drill profile, and the 30-inch reamed hole was approximately 60 percent complete.

21. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.



Dated: October 7, 2020

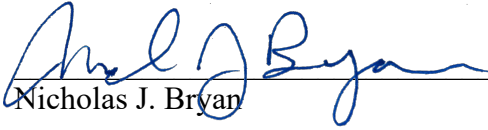

Nicholas J. Bryan



EXHIBIT 2



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.	:	
	:	
v.	:	EHB Docket No. 2020-085-L
	:	
COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION	:	

AFFIDAVIT OF PAUL MARTIN

Paul Martin states as follows:

1. My name is Paul Martin and I am a Senior Project Manager at the BSC Group. I have 33 years experience as an Ecologist with a master’s degree in Zoology from the University of New Hampshire. My CV is attached at Exhibit A.

2. I have personally visited the site of the inadvertent return (“IR”) associated with the HDD 290 occurring on August 10, 2020 in wetland W-H17 in Upper Uwchlan Township, Chester County, PA. While there, I viewed streams S-H10 and S-H11, wetland W-H17, the IR containment structure that was previously constructed in wetland W-H17 as an emergency response measure following the discovery of the IR, Marsh Creek Reservoir (the “lake”), and the location of the 1.01-mile-long re-route alternative set forth in the Reevaluation Report for HDD 290 approved by the Pennsylvania Department of Environmental Protection (the “Department”).

3. An IR that occurs as a result of underground drilling operations involves the release of drilling fluid to the ground surface, by way of naturally occurring fractures, fissures, or shallow/weak soil overburden. Drilling fluid primarily consists of fresh water, bentonite clay, and fine soil or drill cutting particles representing the native material (i.e. rock or soil) that is being drilled through.



4. The August 10, 2020 IR resulted in drilling fluid with trace amounts of bentonite covering the ground surface of Wetland H17 in a 10 to 30-foot wide area for a distance of approximately 900 feet downstream in a PEM/PSS wetland associated with stream S-H10. After this distance, the drilling fluid was primarily contained within the stream channel, which has limited bordering wetlands. The drilling fluid was removed from wetland W-H17 and streams S-H10 and S-H11 within eleven days.

5. During a site visit on September 23, 2020, there was no evidence of drilling fluid in the wetland downstream of the containment area and the vegetation recovery was well on its way, including some areas where temporary vegetation loss resulted in nearly bare soil immediately after the IR cleanup. About 7 weeks later, vegetation is re-growing through much of the temporarily disturbed wetland area.

6. IRs that occurred at this same location in 2017 were not evident after the first growing season, and photos from July 2020 prior to the recent IR reveal a thriving wetland community indistinguishable from adjacent areas that had not been impacted by the 2017 IRs.

7. Studies by Schmidt et al. (1999) and Tammi and Cameron (2002) conclude that “when drill muds are properly removed from the surface of vegetated wetlands, the floral community generally rebounds fully within one to two growing seasons” and that “wetlands that had been subjected to disturbance from cleanup machinery showed no discernable, long-term impacts.” These conclusions are demonstrated at the location of the IR on HDD 290.

8. An excellent example of the recovery of a wetland is shown by an earlier IR on the Mariner East pipeline project located in W-K68 near Blacklog Creek in central PA. The IR at this location was similarly sized of approximately 7,500 gallons of drilling fluid. Photo 1 shows trampled vegetation and associated soil disturbance associated with drilling fluid removal

efforts. Photo 2 shows 100 percent revegetation with no bare soil areas nor patches of distressed vegetation less than two years later.

Photo 1. Date: 11/20/2017, shortly after drilling fluid removal in W-K68. The black arrow provides view reference point to the 5/1/19 photo, below.



Photo 2. Date: 5/1/2019, 18 months after drilling fluid removal. The black arrow provides view reference point to the 11/20/17 photo, above.





9. Upon the resumption of construction of HDD 290, under a worst-case scenario that the IR will continue, the existence of the containment area will result in several weeks or less disturbance of one wetland area to allow for its use as an unconventional pressure relief point. As set forth in the Emergency Permit application submitted to the Department for the containment area, it is estimated that roughly 0.161 acres of temporary disturbance will occur within PEM wetlands within the Limits of Disturbance. However, the area of the containment structure is only 0.02 acres.

10. Once the containment structure is removed from the wetland, and the small depression area is filled with soil and seeded as set forth in the restoration plan, the wetland will fully recover and fulfill the same wetland functions and values as it did prior to the IR.

11. The IR discharge, containing primarily water, fine soil or drill cutting particles representing the native material, and a trace amount of bentonite, was a single short-term event, and estimated to have discharged a small amount of drilling fluid into the cove of the lake. As sediment deposits get thinner, they become less and less impactful, and begin to mimic naturally occurring sedimentation events that happen with a weekly or monthly periodicity, to which the biota of the cove have become accustomed.

12. Sedimentation of the lake occurring from precipitation events (rainfall, snow melt, etc.) occurs multiple times each year, year in and year out, as a result of natural cycles unrelated to the construction of HDD 290. For example, the following photograph shows sedimentation not associated with HDD 290 or the IR discharge, flowing from stream S-H10 into the same cove of the lake on September 29, 2020, following a 1.5-inch rain event. In August 2020 alone, there were 5 storms with rainfall events of approximately 1 inch or more in a 24-hour period, as recorded at the closest NOAA weather station in Chester County.

Photo 3. Date 9/29/20 Sedimentation into the lake following a 1.5-inch rain event not associated with HDD 290 or the IR event that occurred on August 10, 2020



13. For comparison, sediment loading found acceptable by the Department for a subbasin (B01) of the Brandywine Creek watershed located about 10 miles northwest of the IR site, and roughly the same watershed size as the lake, as part of the Christina River Basin High Flow TMDL, identified a sediment TMDL allocation of 556.61 tons/year (equal to 1,223,220 lbs per year). This allocation represents a 31% reduction of the baseline load of 806 tons/year. (EPA, 2006).

14. There is evidence of sedimentation and associated excessive aquatic vegetation growth going back to at least 2008 in the cove, that has resulted in the Department's impairment designation of the lake.

15. Therefore, the small discharge from the IR into the cove of the lake constitutes a one-time de minimis release of sediments into the lake.



16. The 1.01-mile-long re-route alternative set forth in the Reevaluation Plan approved by the Department would involve a new green field alignment which would disturb two wetland systems. The first wetland system consists of forested and riverine wetlands associated with the unnamed tributaries north of Little Conestoga Road. The second wetland system is located south of the eastern Turnpike bore and consists of emergent marsh and riverine wetland types. Based on GIS mapping analysis, it is estimated that 0.06 acres of forested wetland would be temporarily impacted during construction and 0.03 acres would remain affected during operation of the pipeline. For the riverine wetland, 0.13 acres would be temporarily impacted during construction and 0.04 acres would remain affected during operation of the pipeline. For the emergent marsh wetland 0.01 acres would be temporarily disturbed during construction and none would remain impacted during operation of the pipeline. Work or construction materials within the two wetland systems would last four to five months.

17. Open cut trenching associated with the construction of the re-route alternative results in the removal and side casting of soil and the use of heavy construction machinery in these wetlands, and then backfilling the trench after the pipe is installed. The trenching results in a more severe disturbance of the soil and its associated seed stock and the root stock, that can result in a longer timeframe for recovery of the wetland vegetation to pre-construction conditions.

18. Continued construction of HDD 290 does not result in the conversion of wetland types, since the PEM/PSS/PFO wetland that existed before the IR will continue to exist after the HDD is completed and the containment site is cleaned up and restored. In contrast, along the re-route alternative, woody vegetation will be cut at the ground surface and the stump and roots will be left in place in temporary workspaces. In the permanent ROW, woody vegetation will be cut,



and stumps and roots removed along the trenchline, resulting in a permanent conversion of PFO wetland to PEM/PSS along a strip of land over the pipeline. Vegetation management requirements will result in periodic mowing and cutting of woody vegetation in the wetland within the permanent right-of-way for the entire lifespan of the pipeline.

19. Mature woody vegetation recovery in the temporary workspace across the wetland will take decades to occur.

20. For construction of the pipeline along the re-route, additional temporary workspace ("ATWS") is required adjacent to wetland and stream crossings. In the ATWS areas, woody vegetation would be cut at the ground surface, but stumps and roots left in place. These areas will be allowed to revegetate naturally, so that over the years and decades following construction, ATWS in forested areas will become reestablished with shrubs, saplings, and mature trees. However, until these areas become restored, there will be a temporary loss of habitat function.

21. Because construction of HDD 290 is occurring within the right-of-way that is co-located with the existing 16-inch pipeline, no new right-of-way is being created within wetland W-H17. In contrast, the re-route alternative will result in the creation of a new 50-foot wide permanent right-of-way through the wetlands and adjacent uplands that could result in secondary impacts to the wetland resulting from forest fragmentation, potential introduction of invasive plant species, alteration of sunlight conditions related to greater solar penetration with tree removal (which can result in lower soil moisture levels or creation of a changed vegetation community), alteration of hydrology if surface water runoff conditions change along the new right-of-way. These impacts are avoided by continuing construction of HDD 290.



22. Conversion of the wetland types located along the re-route alternative can result in a permanent shift in the types of wildlife and birds that inhabit or use the wetlands. For instance, some wildlife species travel through wetlands that border streams, using this linear feature across the landscape as a safe corridor to travel, since in many instances streams and bordering wetlands have been protected from development and a more mature shrub and tree community exists, that simultaneously provides refuge for prey or foraging areas for predators. A break in this corridor, caused by pipeline construction through the wetlands along the greenfield re-route alternative where trees and shrubs are removed and trees are prevented from re-growth, can result in behavioral shifts in habitat use, or outright avoidance of the pipeline corridor, when compared to a wetland that is crossed under by a pipeline HDD or only temporarily affected by the temporary occurrence of drilling fluid on the wetland surface in the event of an IR.

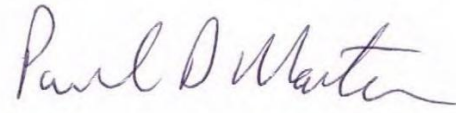
23. In some instances, open cut construction of a pipeline through a forested or shrub wetland results in subsequent increased access (trespassing) through the wetland by ATVs or dirt bikes, since travel is easier once the woody species have been removed. This unauthorized vehicular use can result in long term rutting, prevention of vegetation re-growth, and harm to wetland species such as turtles, frogs, salamanders, etc. This impact is avoided when a wetland crossed by pipeline HDD, since tree and shrub removal is a not a component of the HDD construction method, even in the event of an IR in the wetland.

24. All of the conclusions and opinions set forth in this Affidavit are provided to a reasonable degree of scientific certainty.

25. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.



Dated: October 7, 2020

A handwritten signature in cursive script that reads "Paul D. Martin".

Paul D. Martin



EXHIBIT A



Education

M.S. Zoology

University of New Hampshire

B.A. Biology

Carleton College

BACKGROUND

Mr. Martin is a Senior Project Manager with BSC Group. With a valuable background as an ecologist as well as a permitting consultant, he provides extensive experience in managing effective teams for a variety of complex projects. Mr. Martin has previously served in several senior positions at consulting firms, providing technical skills in areas ranging from ecological consulting, energy generation and transmission siting and licensing, and major transportation infrastructure permitting.

In addition to Mr. Martin's technical expertise in ecology, impact assessment, and permitting, he also has led extensive successful business development, marketing and client relationship management. He expertly represents clients during public, agency, and stakeholder group meetings and hearings where his scientific credibility and persuasive arguments lead to respectful and successful outcomes.

PROJECT EXPERIENCE

OIL & GAS

Mariner East 2 Pipeline, Energy Transfer Corporation, PA

Expert Witness, as an expert in aquatic habitat and fisheries, Mr. Martin was contracted to provide expert review and testimony of 180 HDD sites that had been shut down by an Administrative Law Judge in response to a lawsuit by a citizens group, due to potential violation of Pennsylvania permit conditions associated with inadvertent returns into wetlands and waterways. Mr. Martin visited the sites, analyzed potential impacts, and prepared a report and testimony to be used in legal proceedings to get the stay lifted, and to ultimately allow the pipeline construction to be completed.

Mariner East 2 Pipeline, Energy Transfer Corporation, PA

Expert Witness, tasked to be an expert witness in a federal lawsuit under the Clean Water Act, brought by the Delaware Riverkeeper Network, associated with nearly 300 alleged violations resulting from HDD inadvertent returns and stormwater discharges into wetlands and streams across the Commonwealth of Pennsylvania. In addition to performing site visits, preparing reports and written testimony, Mr. Martin provided deposition.

Pilgrim Pipeline, Pilgrim Pipeline Holdings LLC, NY and NJ

Senior Project Manager, provided insight for this dual pipeline project involving the installation of 197 miles of crude oil and refined product pipelines between the port of Albany and refineries and terminal facilities in NJ. The crude pipeline moves



oil south, while the refined products pipeline moves product north, with five laterals to existing tank storage facilities. The project involved biological and cultural field work, hazardous waste assessments, evaluation of project impacts on a wide range of resources, alternatives analyses, routing studies, development of a SEQRA EIS, and environmental permitting in both NY and NJ. The primary distinguishing aspect of the project called for the pipelines to be buried in the same trench, and for 120 miles to be located within the NY Thruway right-of-way, requiring an occupancy permit, with the potential to trigger an NEPA EIS by the Federal Highway Administration.

Pipeline Permitting at BEC, Bayonne Energy Center, Bayonne, NJ

Senior Project Manager, managed the permitting of a short pipeline lateral and appurtenant facilities to allow interconnection of the gas fired power plant to an additional interstate natural gas pipeline. The project was determined to require preparation and submittal of a Major Modification Application under the Flood Hazard Area regulations. An environmental assessment was prepared as part of the application, that required characterization of resources, analysis of impacts, and evaluation of alternatives.

Salem Harbor Lateral, Spectra Energy, MA

Senior Technical Advisor, provided input into the permitting of this 1.79-mile-long natural gas pipeline proposed to deliver natural gas to a new gas fired power plant. The project involved construction within Beverly Harbor, with the potential to impact a range of marine and coastal resources. Mr. Martin provided QA on permit applications, FERC resource reports, EFH Assessment, various field survey reports, and development of mitigation plans. The Project taps into the HubLine Pipeline project in a subsea connection, and since Mr. Martin was the lead marine biologist on the permitting and construction of the HubLine Pipeline, he offered an intimate understanding of the resource characteristics, agency and stakeholder concerns, and potential construction methods and equipment and the resulting potential environmental impacts.

NY-NJ Expansion Project, Spectra Energy, NJ and NY

Senior Technical Advisor, responsible for leading the development of a water quality monitoring plan to be employed during construction, to assess the potential for suspended sediment concentrations to exceed permit limits. The plan covered dredging and other in water work within the Hudson River, to be carried out during the construction of a 27-mile long natural gas pipeline project, designed to increase the delivery of natural gas into Manhattan. The plan was developed in consultation with NYS DEC staff and was well received and rapidly approved.

NEXT Pipeline Project Feasibility Study, Spectra Energy, OH and MI

Senior Technical Advisor, worked to provide senior input and review for this feasibility study of a potential 240-mile long natural gas pipeline to carry Utica Shale gas to Canada. One of the alternatives evaluated included a crossing of Lake Erie versus going around Detroit. Mr. Martin directed the collection of existing resource information on Lake Erie, as well as the selection and evaluation of criteria beneficial to assessing the feasibility of the project. Permitting processes, future data collection efforts, and likely stakeholder involvement were incorporated into the analysis.

Northeast Gateway Lateral, Algonquin Gas Transmission Company, Boston, MA

Senior Project Biologist, responsible for the biological resources, water quality, and field sampling program for this 16.5-mile long offshore pipeline, located in water 120 to 270 feet deep about 12 miles offshore of Boston. Significant issues include location near the Stellwagen Bank Sanctuary, two Massachusetts Ocean

Sanctuaries, and protected marine mammals. He is also responsible for three years of post-construction monitoring to assess recovery of the seafloor following pipeline installation.

Quoddy Bay LNG Terminal, Quoddy Bay LLC, Eastport, ME

Senior Principal Scientist, responsible for biological resource characterization and biological sections of the FERC Resource Report associated with the marine portions of the project. The project consisted of a proposed 2 BCF LNG import and storage facility, and a 40-mile long interconnection pipeline. Sited in a highly productive and historically significant shoreline location near Eastport Maine, studies and surveys focused on fisheries, benthos, water quality, marine birds, and marine mammals. Given the 14 foot tides and 4 to 6 knot tidal currents, potential impacts from construction and operation of the facility had the potential to be far reaching, and require use of specialized construction methods, and implementation of a variety of mitigation measures.

Everett Lateral Pipeline Permitting, Algonquin Gas Transmission Company, Boston, MA

Senior Project Biologist, provided senior expertise on fisheries and marine biology issues in the preparation of the FERC resource reports. The project involves the crossing of nearshore marine habitats in the Boston Harbor area, including crossing under Logan airport. A number of horizontal directional drills were considered for shoreline crossings and installing the pipeline under the airport. Sensitive shellfish habitats, intertidal zones, eelgrass, lobster and winter flounder, and EFH assessment were major project issues.

Islander East Pipeline Siting and Licensing, Duke Energy, Branford, CT

Project Manager responsible for resource characterization and permitting this 59-mile long natural gas pipeline located in the suburban areas of Connecticut and Long Island, including a 23-mile crossing of Long Island Sound. Mr. Martin was responsible for and participated in preparation of FERC resource reports, oversight of field surveys including biological characterization of the route as well as Federal and state permitting in both states.

HubLine Siting and Licensing, Algonquin Gas Transmission Company, Boston, MA

Senior Project Biologist, responsible for resource characterization and permitting of this 30-mile long natural gas pipeline located off the coast of Massachusetts. Mr. Martin was responsible for preparation of FERC resource reports, oversight of field surveys including geophysical, bathymetric, and biological characterization of the marine environment. he was also responsible for marine monitoring during a yearlong construction process, including mobilization for nearly 100 water quality monitoring events in coastal waters of Massachusetts as well as for the three-year, post-construction habitat restoration monitoring program.

M&N Connector Project Siting and Licensing, Algonquin Gas Transmission Company, Boston, MA

Senior Project Biologist, responsible for preparation of FERC Water and Biological Resource Reports for the 7C filing, including surface and ground water, fisheries, wildlife, wetlands, vegetation, and threatened and endangered species. Mr. Martin prepared impact analyses as well as mitigation planning relative to these resources.

Phase I, Joint Pipeline, Haverhill Spur Licensing, Maritimes & Northeast, Haverhill, MA

Senior Project Biologist, responsible for preparation of FERC Environmental Resource Reports for the 7C filing. Performed field survey to identify land use, wildlife and wetland habitat, soils, vegetation, surface water, and construction feasibility information for the filing.

**Phase I Pipeline Assessment, Joint Pipeline, Maritimes & Northeast and Portland Natural Gas Transmission, Portsmouth, NH**

Project Biologist responsible for setting up studies, contracting staff, and overseeing work in relation to the Piscataqua River Crossing Contingency Plan. As a result of the permitting of this 290-mile long pipeline, the clients were required to assess the impacts of an open cut crossing of this important estuarine resource, part of the Great Bay Estuary on the Maine/New Hampshire border. Resource issues focused on eelgrass, shellfish, lobster, and fisheries.

Phase II Pipeline Siting and Permitting, Maritimes & Northeast, Augusta, ME

Project Biologist, participated in the assessment of stream crossings for a portion of this pipeline during site visits with representatives of Maine DEP and DIFW. He assisted in the determination of suitable crossing locations and methods, along with mitigation for agency concerns over water quality impacts, fisheries impacts, and sediment and erosion control. Mr. Martin was responsible for endangered Tomah mayfly surveys at 13 sites in Maine. Assisted in other RTE survey efforts. He provided expertise on fisheries and surface water issues as the project went to construction.

Great Lakes Expansion Project Assessment, Great Lakes Gas Transmission Company, Detroit, MI

Project Biologist, responsible for getting wetland delineations completed along a 1,000-mile long pipeline corridor in Minnesota, Wisconsin, and Michigan. He prepared scopes of work, training manual, and contracted eight firms to provide over 70 wetland delineators, supervisors, and QA/QC personnel. Mr. Martin completed delineations on about half the route in six weeks before the client cancelled the project.

Environmental Inspector, Tennessee Gas Pipeline Company, Enfield, CT

Environmental Inspector, acted as environmental inspector on the construction and rehabilitation of 12 miles of natural gas pipeline in western Massachusetts, 8.5 miles in Burlington and Arlington, Massachusetts as well as the construction of a sales meter station. Responsible for compliance with permit requirements, Order of Condition requirements, attending public hearings, and interacting with regulatory agency staff and conservation commissioners. Mr. Martin performed three years of post-construction monitoring for wetland restoration.

Northeast Settlement Siting and Licensing, Tennessee Gas Pipeline Company, Enfield, CT

Project Biologist, participated in preparation of an Environmental Report for a FERC license application and State of New York PSC license application for the construction of new natural gas pipeline segments. Mr. Martin was responsible for report preparation, agency correspondence, and fieldwork investigating the environmental impacts of pipeline construction. He performed wetland delineations to identify wetland boundaries as well as surveys of wildlife and fishery habitats in New York and Massachusetts.

Niagara Settlement Siting and Licensing, Tennessee Gas Pipeline Company, Enfield, CT

Project Biologist, participated in preparation of an Environmental Report for a FERC license application and State of New York PSC license application for the construction of new natural gas pipeline segments. He was responsible for report preparation, agency correspondence, and fieldwork investigating the environmental impacts of pipeline construction. Mr. Martin performed wetland delineations to identify wetland boundaries as well as surveys of wildlife and fishery habitats in New York and Massachusetts.

NOREX Siting and Licensing, Tennessee Gas Pipeline Company, Enfield, CT



Project Biologist responsible for wetlands delineations, permitting, construction inspection, and representation at hearings associated with a variety of maintenance, rehabilitation, and new construction of natural gas pipeline and related facilities.

Granite State Pipeline Expansion Siting and Permitting, Granite State Pipeline Company, Portsmouth, NH

Project Biologist, performed wetland delineations, wildlife habitat surveys, and fisheries habitat surveys in southern Maine for a proposed 75-mile-long natural gas pipeline from Haverhill, Massachusetts to Portland, Maine.

Boston Expansion Project Siting and Permitting, Tennessee Gas Pipeline Company, Enfield, CT

Ecologist, assisted in the assessment of the proposed project construction of 63 miles of new gas pipeline in three states. As part of the licensing, the project required preparation of an Environmental Impact Report (EIR) under Massachusetts Environmental Policy Act and an Environmental Report as a part of the Federal Energy Regulatory Commission License Application. As ecologist, Mr. Martin assisted in the assessment of wetland and wildlife habitat impacts from construction and operation of the pipeline.

Environmental Inspector, Tennessee Gas Pipeline Company – Enfield, CT Mr. Martin acted as environmental inspector on the construction and rehabilitation of 12 miles of natural gas pipeline in western Massachusetts, 8.5 miles in Burlington and Arlington, Massachusetts as well as the construction of a sales meter station. Responsible for compliance with permit requirements, Order of Condition requirements, attending public hearings, and interacting with regulatory agency staff and conservation commissioners. Mr. Martin performed three years of post-construction monitoring for wetland restoration.

22-Inch Northern State Pipeline, Falcon Seaboard Pipeline Company, Plattsburgh, NY

Project Biologist, participated in preparation of an Environmental Report for a FERC license and State of New York PSC Article VII license applications for the construction of a new natural gas pipeline near Plattsburgh New York. Mr. Martin was responsible for report preparation, agency correspondence, literature review and data collection investigating the environmental impacts of pipeline construction. He performed wetland delineation, stream crossing surveys, and fish and wildlife habitat surveys along the 22-mile-long virgin right-of-way.

Twenty-Four-Inch Malden-Everett Pipeline Siting and Licensing, Distrigas, Inc. Boston, MA

Project Biologist responsible for the preliminary activities in support of preparing an Environmental Report for a FERC license application for the construction of a new natural gas pipeline. Mr. Martin performed wetland surveys, data collection, literature review, agency consultation, and document preparation.

UTILITY/TRANSMISSION LINE

B154/C155 Asset Condition Refurbishment Project. National Grid, MA

Senior Project Manager for this maintenance project on a 26-mile long transmission right-of-way that will involve wooden pole replacement with steel, access road improvements, and installation of OPGW and new grounding. The project extends from a substation in Salem to North Andover and involves both coastal and inland resources and habitats.

A179/Q169 Asset Condition Refurbishment Project. National Grid, Saugus, MA



Senior Project Manager for this maintenance project on a transmission right-of-way that will involve wooden pole replacement with steel, access road improvements, installation of OPGW and new grounding, and re-insulating both lines. The project extends from a substation in Wakefield to Lynn and involves both coastal and inland resources and habitats. Of particular concern is work within Rumney Marsh, an ACEC that is of high value for salt marsh and estuarine species.

X176 Asset Condition Refurbishment Project. National Grid, Belchertown and Palmer, MA

Senior Project Manager for this maintenance project on a 9.2-mile long transmission line that will involve wooden pole replacement with steel poles, shieldwire and OPGW replacement, and access road construction. A portion of the ROW is in designated habitat for rare insect species requiring additional measures to address concern over loss of host plants.

M139/N140 Skywrap and Structure Replacement Project. National Grid, MA

Senior Project Manager for this project to include installation of SkyWrap Fiber Optic Cable over the shield wire along a 6.3-mile long section of transmission line in Tewksbury and Billerica. In addition, a section of shield wire will be installed on a shorter segment of line in association with relocation of a Jitney Bus.

M139 Flyover Switch Project. National Grid, Billerica, MA

Senior Project Manager for this project that involves construction of three flyover switches in the Town of Billerica. Work will occur within the buffer zone of BVW at two of the three switch locations. Permanent access roads to the switches will also be constructed.

SeaLink HVDC Cable Project, NextEra, Boston, MA

Senior Principal Scientist for NextEra's response to a New England ISO RFP for transmission solutions to address grid reliability and energy supply concerns arisen from the future closing of Mystic Generating Station in Boston. Provided senior technical input into permitting feasibility assessment, development of a permitting plan, and preparation of a permitting cost estimate.

Granite State Power Link, GridAmerica LLC, VT, NH

Senior Project Manager for the Presidential Permit application for this 59-mile long overhead HVDC cable designed to import Canadian wind and solar generated electricity into the U.S. market. Mr. Martin was responsible for assembling the team and driving a very accelerated schedule, resulting in a successful filing with the Department of Energy in just two months.

Fulkerson Street Substation, Eversource, Cambridge, MA

Principal-in-Charge, provided expertise for the project involving siting and permitting of a new substation along with up to 1.25 miles of underground 115 kV and 345 kV electric cable in congested city streets. Responsible for providing periodic QA/QC on project deliverables, offering strategic advice on permitting activities, and helping to manage client relationships and interactions.

Plumtree to Brookfield Junction Independent Environmental Inspector, Eversource, CT

Principal-in-Charge, associated with the CT Siting Council approval of the project, involving construction of a new 3.4-mile 115-kilovolt (kV) overhead transmission line and modifications at the Stony Hill substation, Eversource was obligated to obtain the services of an independent party to oversee construction, functioning as the eyes and ears of the agencies. Provided periodic QA/QC of the effort and interacted with the client in an oversight role.

Frost Bridge to Campville Independent Environmental Inspector, Eversource, CT

Principal-in-Charge, provided inspections associated with the CT Siting Council approval of the project, involving construction of a new 10.4-mile 115-kilovolt (kV) predominantly overhead transmission line and modifications at two substations. Eversource was obligated to obtain the services of an independent party to oversee construction, essentially functioning as the eyes and ears of the agencies. Responsible for overseeing environmental inspections as well as providing periodic QA/QC of the effort, and interacting with the client in an oversight role.

Vermont Green Line, National Grid, NY, VT

Senior Technical Advisor, provided review and input into Lake Champlain studies for this HVDC cable project designed to transmit renewable energy from upstate New York into Vermont. The project included a 47-mile long underwater installation of cable, with two HDDs at the shoreline crossings. Reviewed fisheries and aquatic resources sections of permit applications.

Master Services Agreement, National Grid, New England, NY

Principal-in-Charge on multiple assignments over nine years under multiple MSAs with National Grid. Projects have ranged from small O&M activities such as pole replacement and reconductoring to capital improvement projects along transmission lines, as well as work at substations. Scopes of work involved environmental support, permitting, and construction oversight on multiple dozens of National Grid projects. Provided pricing, permit strategy development, staffing and scheduling support, and quality assurance reviews.

Multiple Projects, VELCO, VT

Principal-in-Charge for over a dozen projects over a seven-year period. Projects ranged from small O&M activities such as pole replacement and reconductoring to capital improvement projects involving 30- to 50-mile-long ROWs, involving upgrades and full replacement of transmission lines as well as work at substations. Provided pricing, permit strategy development, staffing and schedule support, and quality assurance reviews.

Eversource Environmental Permitting MSA, Eversource, MA, CT, NH

Principal-in-Charge for multiple assignments over the course of four years. Projects ranged from small O&M activities such as pole replacement and reconductoring to capital improvement projects, involving both transmission lines as well as work at substations. Provided pricing, permit strategy development, staffing and scheduling support, and quality assurance reviews.

Hampden County Reliability Project, National Grid, Western MA

Principal-in-Charge, for a 17-mile-long capital improvement project that involved the evaluation of multiple alternative routes, construction of a new substation, and modifications at several other substations. The project involved a filing with the Massachusetts Energy Facility Siting Board, an EIR under MEPA, ACOE and conservation commission filings on wetlands, as well as field studies for several state threatened and endangered species and cultural resource and wetland surveys and consultation.

Champlain Hudson Power Express, Transmission Developers Inc, NY and CT

Technical Advisor for this unique project that involved the siting, permitting and installation of nearly 350 miles of HVDC cable system from the Canadian border to New York City via a route down Lake Champlain and the Hudson River. Provided senior level guidance on aquatic resource characterization, impact assessment methodology, construction procedures, and permitting strategy.

Lake Erie Link Project Siting and Licensing, TransEnergie U.S., Erie, PA

Senior Project Biologist for a Presidential Permit application that was prepared for submittal to the U.S. Department of Energy along with other federal and state permit applications. The Presidential Permit Application allowed the DOE to meet its obligations under NEPA for issuing a permit. With the potential for over one hundred miles of cable to be installed in the bed of Lake Erie between Nanticoke Ontario and Erie Pennsylvania and Ashtabula Ohio and 10 miles of cable on land, a wide variety of resources are being studied and impact assessments performed as part of the permitting efforts. Due to market conditions the project was canceled. Responsible for oversight of Lake Erie studies and permitting the Ohio portion of the proposed electric cable.

Transmission Line Wildlife Habitat Study, New England Power, Westborough, MA

Project Manager, for a report New England Power used to create a brochure for distribution to interested parties. Literature searches were performed and the findings synthesized into a short document reporting the potential benefits of rights-of-way for wildlife species. Responsible for oversight of preparation of a report on wildlife habitat values of transmission line rights-of-ways.

INFRASTRUCTURE**Long Island Bridge Demolition and Replacement, Boston Department of Public Works, Boston, MA**

Senior Principal Scientist, provided input for the project which involved the blast demolition of a 3,300-foot bridge between Moon and Long Island within Boston Harbor. The bridge deck and superstructure were removed by blasting from 12 piers, with all material ending up in the ocean. In addition, water, electric and phone utilities removed from the bridge prior to blasting were then installed through HDD and open trenching between the two islands. The granite block piers remained in the water, pending design of the replacement bridge. Provided senior marine biology input into the design of baseline and post-construction monitoring efforts, environmental permitting, and agency consultations.

Belden Bly Bridge Replacement, MA Department of Transportation, Lynn and Saugus, MA

Senior Principal Scientist, provided input for the replacement of a moveable bridge over the Saugus River. New structures in the river, dredging for widening of a federal navigation channel, and submarine electric cable installation are components of the project. Has provided senior estuarine biology input into the studies, design, and permitting as well as assisted in impact characterization, review of environmental permit applications, and consultations with agencies.

NYS DOT Kosciuszko Bridge Construction Permit Support, Skanska, New York City, NY

Senior Principal Scientist, for permit compliance for work in Newtown Creek, which forms part of the border between Brooklyn and Queens in New York City. The contractor had determined a more cost-effective approach for dealing with the old bridge abutments on the shoreline of the creek, but this required consultation and approval from the various permitting authorities. Provided review and input into construction timeframe modifications to means and methods relative to permit compliance. Also provided input into NPDES permit modifications related to the addition of a 100,000 GPD water withdrawal and discharge to the creek as part of construction method changes related to concrete curing temperature control.

Southport Reef Mitigation Site, Philadelphia Regional Port Authority, PA



Senior Principal Scientist, for part of the mitigation committed to and associated with the Army Corps permitting of the expansion of the Port Facilities. The designated mitigation area occurred along a half-mile section of shoreline, and in-water depths ranging from nine to 30 feet. In consultation with the agencies, there was a strong interest in considering this as a demonstration project for the placement of pre-fabricated reef structures, which has seldom been done in a large freshwater river. Responsible for overseeing the development of an artificial reef in the Delaware River. In order to support efforts to enhance habitat for shortnose sturgeon, a linear ridge of stone was also included in the design to mimic a more natural rocky reef. The design was approved by the agencies, and then bid spec documents were prepared for the Port Authority for inclusion in their solicitation of bids.

Washington Ave Green, Delaware River Basin Commission, PA

Senior Principal Scientist, provided insight for plans submitted by design build firms in response to an RFP for creation of habitat enhancements, and public open space at one of the unused and dilapidated shipping piers along the Philadelphia water front on the Delaware River. The DRBC had funding to create fishery and wildlife habitat, including waterfowl and wading bird foraging areas, as well as create appealing, safe, and long term public open space adjacent to and out onto the pier. The designs of three firms were evaluated, one of which was selected to implement their design. Worked as part of a team responsible for evaluating design plans.

Durante Mitigation Site, Massachusetts Bay Transit Authority, MA

Senior Principal Scientist, provided mitigation efforts for the redevelopment of the MBTA's Greenbush commuter rail line. Impacts to salt marsh required salt marsh mitigation efforts as a result of state and federal wetlands permitting. Environmental site assessment work was undertaken to support re-design of a conceptual salt marsh creation plan to accommodate identified areas of contamination on the Durante property, which had already been purchased by the MBTA for the mitigation effort. It was also determined that more detailed contaminated soil investigations were needed in order to pinpoint discrete areas of soil that would need to be removed, in order to keep remediation costs to a minimum. Contamination consists of some heavy metals and PCBs, at the property, which operated for decades as a wool carding mill.

Hingham Intermodal Facility, Massachusetts Bay Transit Authority, MA

Senior Technical Advisor, for an intermodal facility that was being redeveloped to incorporate better traffic flow, passenger handling, and docking facilities for a commuter ferry terminal in Hingham. The MBTA operates a bus system that would drop off and pick up ferry passengers, a parking lot for driving commuters, and a ticket sales office with waiting room, and handicap accessible docking facilities for ferries moving commuters into and out of Boston. Coastal resource concerns, sea level rise, and storm surge redesignation by FEMA complicated the permitting process and led to several design revisions in order to create an acceptable project. Provided advice on the permitting strategy.

Greenbush Rail Corridor Improvement Project, Independent Observer, Massachusetts Bay Transportation Authority, Braintree to Scituate, MA

Project Manager for four years of inspection oversight of the reconstruction efforts for a 17-mile long commuter rail project. Responsible for coordination with federal, state, and local regulators to provide monitoring of the construction contractor's efforts for complying with wetland and waterway permits. Performance included weekly inspection of the construction corridor to document dewatering activities, sedimentation and erosion controls, and implementation of BMPs to minimize impacts to wetlands, streams, and rare species habitats. Involved in negotiations over potential non-compliance events, some of which we reported, and others observed.

**Fore River Bridge Replacement Project, MassDOT, Weymouth, MA**

Principal-in-Charge for the largest movable bridge project being undertaken by MassDOT at the time, involving a heavily-travelled state roadway that is vital for commuter travel in and out of Boston from several south shore communities. Coastal resources of the Fore River include shellfish, anadromous fish, commercial vessel traffic associated with an oil terminal and an auto import terminal, and substantial recreational boat traffic. Mr. Martin was involved in the permitting of the project, completed in coordination with an engineering firm that advanced the 25% design.

New Bedford/Fall River Strategic Environmental Permitting Plan, Massachusetts Bay Transportation Authority, MA

Project Manager for the development of a strategic plan that looked at streamlining the permitting for the proposed redevelopment of commuter rail service on 54 miles of abandoned rail as well as freight rail. The project included the construction of seven commuter stations and associated parking, several of which were proposed for congested urban areas. The effort required management of legal, engineering, and cultural resources subcontractors. The project schedule was reduced from nine months to five months when the Governor requested the information as part of his overall transportation improvement agenda for the state.

MBTA 12 Bridges Program, MBTA, Boston, Dedham, Gloucester, MA

Principal-in-Charge, for the project involving both movable and fixed bridges for the Boston area commuter rail system, with three of the bridges involving work in and over coastal rivers with important fish and recreational use. Mr. Martin served as a subcontractor to an engineering firm that provided preliminary engineering design.

I-90 Logistics Center/Trucking Distribution Center, Bay Colony Properties, Charlton, MA

Senior Principal Scientist responsible for wetland delineations and associated environmental permitting efforts. Permitting involves wetlands at the state and federal levels.

Shaft 7 to WASM 3 Connecting Mains Project, MWRA, Waltham/Watertown, MA

Project Manager for work in support of the MWRA's primary contractor for this project. He provided natural resource characterization and regulatory/permitting support of this project, which involved a crossing of the Charles River.

Quabbin Reservoir Watershed Change Study, Metropolitan District Commission, Boston, MA

Project Biologist, responsible for data collection and literature review regarding the effects of changes in the watershed on the quality of water in a drinking water supply reservoir. Emphasis was placed on land use changes, logging, and vegetation removal due to over-browsing by deer. Mr. Martin developed recommendations for the protection of the watershed of the largest drinking water supply reservoir in Massachusetts.

Belle Isle Marsh Water Main Construction Permitting, MWRA, Winthrop, MA

Project Biologist responsible for developing a salt marsh impact-monitoring plan and collecting baseline data. He prepared the baseline monitoring report. Mr. Martin reviewed MWRA RFP document for five-year monitoring contract.

Section 22 Water Main Repair Permitting, MWRA, Milton, MA

Project Biologist responsible for wetland delineation in coastal resource areas, preparation and presentation of NOI including a salt marsh restoration plan, and consideration of Neponset River ACEC concerns.

RENEWABLES

Bay State Wind Offshore Wind Project, Orsted, Somerset, MA

Senior Principal Scientist, worked as task manager for the state environmental permitting and the submittals of applications to both the Massachusetts and Rhode Island Energy Facility Siting Boards. Particularly challenging was converting the project characterization and assessment under the Project Design Envelope of the COP to the more traditional approach of proposing a preferred project and project alternatives. In addition, state applications only focused on project facilities within state jurisdictional waters and on land, so many of the resource characterizations and impact assessments required a more focused and detailed emphasis than the COP. Mr. Martin provided senior review of sections of the Construction and Operation Plan (COP), prior to submittal to BOEM.

Equinor Offshore Wind Project, Equinor, New York City, NY

Senior Principal Scientist, worked as task manager for the state environmental permitting and the submittal of the Article VII application to the NY PSC for the first phase project, the Empire Wind Gowanus Project. A particular challenge was converting the project characterization and assessment under the Project Design Envelope of the COP to the more traditional approach of proposing a preferred project and project alternatives. In addition, state applications only focused on project facilities within state jurisdictional waters and on land, so many of the resource characterizations and impact assessments required a more focused and detailed emphasis than the COP. USACE permitting efforts were also commenced, whereby Section 404, 408 and 10 application requirements were triggered. Mr. Martin provided senior review of sections of the Construction and Operation Plan (COP), prior to submittal to BOEM and was also responsible for finalization of a sediment chemistry report and development of a second phase sediment sampling and analysis plan.

Green County Solar Project, Hecate Solar, Coeymans, NY

Senior Principal Scientist, provided technical input into issues around stormwater runoff, erosion, water quality impairment, and aquatic habitat impacts associated with the development of a 50 MW solar project. Of particular concern was that downstream of the project site, a private residential water supply reservoir received input from a perennial stream that runs through the solar project site. The lake homeowners associated intervened in the Article 10 process, requiring the preparation of modeling reports, memos, and responses to interrogatories.

Sunrise Wind Offshore Wind Project, Orsted, Brookhaven, NY

Senior Principal Scientist responsible for development of a sediment sampling and analysis plan to assess sediments along the marine export cable route for the presence of potential contaminants.

Battery Storage Feasibility Study, Bayonne Energy Center, Bayonne, NJ

Senior Project Manager, managed the feasibility assessment of a 25- to 50-MW battery storage project on property at the existing Bayonne Energy Center. Four alternatives were evaluated, one of which include a barge mounted facility in the Kill van Kull. Resource characteristics were assessed, permitting requirements were evaluated, and preliminary designs were considered for each alternative.

Massachusetts Solar Projects, Eversource, Multiple locations throughout MA



Principal-in-Charge, providing help to over 12 solar sites, ranging from 1 to 4.9 MW, requiring biological, cultural civil, geotechnical and survey services, as well as environmental and zoning permitting efforts. Mr. Martin provides periodic QA/QC on project deliverables, offers strategic advice on permitting activities, and helps to manage client relationships and interactions.

Laurel Mountain Wind, NPDES renewal AES Wind, WV

Principal-in-Charge for the project's NPDES permit for construction stormwater required amendment and extension. The original permit supported the construction of 61 turbines, but only 57 were constructed. After six years of operation, the client wanted to construct the other four turbines but was unclear about the process for obtaining NPDES stormwater coverage. Mr. Martin worked with water resource engineers to develop the necessary application materials for submittal to the WV Department of Environmental Protection.

Delaware Offshore Wind Critical Flaw Analysis, EDF Renewables, DE

Project Manager, managed the critical flaw analysis for EDF, who was assessing their interest in responding to the BOEM leasing of an offshore area for the development of a wind project. The analysis included a broad range of factors from technical design aspects, constructability, cable installation to shore, environmental conditions and concerns during construction, and future operational concerns for potentially objectionable environmental impacts, such as aesthetics, navigation, fisheries, wildlife and birds, noise, etc.

NC Offshore Wind Demonstration Project Feasibility Study, Duke Energy, NC

Project Manager, managed the feasibility assessment for the installation of an offshore wind demonstration project, with two turbines proposed to be located in Pimlico Sound. The feasibility study investigated a broad range of factors from technical design aspects, constructability, cable installation to shore, environmental conditions and concerns during construction, and future operational concerns for potentially objectionable environmental impacts, such as aesthetics, navigation, fisheries, wildlife and birds, noise, etc. A report was prepared, and incorporated into Duke Energy's decision-making process, which ultimately resulted in a decision not to pursue the project.

New Creek Wind Project, AES Wind LLC, WV

Principal-in-Charge, responsible for overseeing staff and subcontractors that provided full environmental permitting services for a 65-turbine wind project located on a ridge in northeastern West Virginia. Biological, cultural, noise, traffic, visual, socioeconomic, and telecommunication resources were all characterized and assessed as part of the filing with the WV PSC. In addition, stormwater permitting, preliminary electric system design, and preliminary roadway design were completed by the engineers.

South Coast Wind Project, Patriots Renewable Energy, Buzzards Bay, MA

Project Manager, provided professional insight for siting constraints and critical flaw evaluation of a potential commercial scale offshore wind energy project being proposed for Buzzards Bay. The effort involved evaluation of the natural and human resources and regulatory, and permitting issues and constraints for a wind project potentially consisting of between 50 and 150 turbines to be located in the waters of Buzzards Bay.

Massachusetts Coastal Zone Management (MCZM), Offshore Energy Facility Siting Study, MA

Principal-in-Charge, worked to assess the locations of reasonably foreseeable offshore energy facilities off the coast of Massachusetts out to 200 miles. The project assessed the economic viability and technological feasibility of new offshore energy technologies including offshore wind turbines, wave energy, tidal in-stream energy conversion (TIEC) devices, offshore liquefied natural gas facilities, and interconnecting undersea gas and electric transmission lines. Coordinated research among team members and directed the preparation of

GIS maps to show the feasible and macro-economically viable locations where offshore wind and other renewable energy facilities may be constructed within the next ten years. The resulting maps were prepared for use by CZM to initiate their ocean planning efforts.

RIWINDS Feasibility Study, Rhode Island Economic Development Corporation, RI

Principal-in-Charge, responsible for leading his team's effort to evaluate the entire state of Rhode Island, including offshore waters for potential wind energy development sites. The scope of work included natural resource, regulatory, and permitting characterization of potential sites, evaluation and screening of potential sites, evaluation of electrical interconnection issues, and reporting. A multi-level screening process was developed that involved a broad range of natural resource, economic, engineering, public perception, and regulatory criteria that were used to develop potential locations for two different scale projects, those involving one to a few turbines (<5 MW) and those involving 12 turbines or more.

NEPA

Cape Wind Third Party EIS Preparation, New England Division, Army Corps of Engineers and the Mineral Management Service, Cape Cod, MA

Project Manager, proposed first in the nation 430 MW, 130-turbine, offshore wind energy project, Mr. Martin was responsible for the overall content and quality of the DEIS and FEIS, developing responses to over 5,000 comment letters, and presenting draft versions to a group of cooperating agencies and stakeholders. With the proposed location in Nantucket Sound, this project was very controversial for a wide variety of reasons, with a key consideration being the alteration of the viewshed in this historic and heavily-visited recreational area. While the DEIS was prepared under USACE jurisdiction, Federal legislation mandated the FEIS preparation under MMS jurisdiction.

ELBA III, 3rd Party EIS Preparation, FERC – Savannah, GA

Senior Project Biologist, responsible for preparing the EFH Assessment component for the EIS as well as the overall aquatic resources existing conditions presentation and the impact and mitigation analyses.

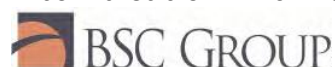
Golden Pass LNG Terminal and Pipeline Projects, 3rd Party EIS Preparation, FERC – Jefferson County, TX

Senior Project Biologist responsible for preparing the aquatic resource characterization and impact and mitigation assessment for the marine and estuarine environments associated with the preparation of an EIS under the FERC process. The project is located on the Port Arthur Channel of the Sabine-Neches Waterway. Mr. Martin was responsible for review of the FERC application, preparation of AIRs, and Draft and Final EIS sections. Alternative analyses were performed addressing the LNG Terminal, Storage, and send-out pipeline facility components. He was responsible for preparation of the Essential Fish Habitat Assessment.

Cheniere-Sabine LNG Terminal and Pipeline Project, 3rd Party EIS Preparation, FERC – Cameron Parish, LA

Senior Project Biologist responsible for preparing the aquatic resource characterization and impact and mitigation assessment for the marine and estuarine environments associated with the preparation of an EIS under the FERC process. The project is located on the Louisiana shoreline of Sabine Pass. Mr. Martin was responsible for review of the FERC application, preparation of AIRs, and Draft and Final EIS sections. Alternative analyses were performed addressing the LNG Terminal, Storage, and send-out pipeline facility components. He was also responsible for preparation of the Essential Fish Habitat Assessment.

Hibernia Cable Environmental Assessment, Worldwide Fiber, Lynn, MA





Senior Project Biologist responsible for preparation of components of a federal EA under NEPA requirements. NOAA requested the EA because the Hibernia under-sea cable crossing passed through a portion of the Stellwagen Bank Marine Sanctuary off the coast of Massachusetts. Characterization of all aspects of the marine environment for the cable route within U.S. waters was performed and impacts analyzed for both preferred and alternative routes and construction methods.

Licensing and Compliance Support, Federal Energy Regulatory Commission, Office of Hydro Licensing, Washington, D.C.

Project Biologist, prepared over 28 Environmental Assessments and Environmental Impact Statements under NEPA requirements for relicensing of hydroelectric plants in 14 states around the United States. Mr. Martin was responsible for all aspects of terrestrial resource sections including vegetation, wetlands, wildlife habitat, and threatened and endangered species, including cumulative impacts. He developed mitigation requirements for unavoidable adverse impacts. He prepared biological assessments under Section 7 requirements of the Endangered Species Act. Wrote license article conditions prior to issuance of new licenses. As part of the relicensing of the Edwards Project on the Kennebec River in Maine, performed an extensive dam removal analysis that involved wetlands, wildlife, and fisheries habitat assessments as well as sediment and water contaminant sampling.

Millennium Third Party EIS, FERC Office of Pipeline Regulation, Washington, D.C.

Deputy Project Manager, responsible for overseeing Earth Tech staff preparing sections involving soils, wetlands, threatened and endangered species, surface water resources, and fisheries. The project involved construction of 420-mile natural gas pipeline across New York State and included a 90-mile crossing of Lake Erie and 25 major river crossings. Teamed with Foster Wheeler Environmental Corporation to perform this work.

FOSSIL/NUCLEAR GENERATION

Entergy Indian Point Nuclear Station SEQRA EIS for Cooling Water System, Entergy, NY

Senior Principal Scientist, provided fisheries information for the EIS associated with the evaluation of a large cylindrical wedgewire screen cooling water intake system within the Hudson River. As part of a decades-long legal battle over the impacts associated with the 2 billion gallon-per-day cooling water withdrawal and discharges, two alternatives were evaluated, the screens, and wet cooling towers. The intent of the evaluations was to assess the efficacy of the alternatives in reducing impacts on fishery resources from entrainment and impingement. The screen alternative design included placement of 144 cylindrical screens in the river. In addition, the evaluation also considered construction impacts, long term impacts to the river in addition to the fisheries concerns, such as navigation, currents, sediment transport and deposition, and water quality. Mr. Martin assisted in the preparation of expert witness testimony to be presented by others.

Salem Harbor Station, NPDES Permitting Support, Dominion Energy, Salem, MA

Senior Project Biologist, provided NPDES relicensing support for a 700 MW once-through cooled power plant located in the estuarine portion of Salem Harbor. He completed evaluation of entrainment and impingement impacts, alternative cooling water intake technologies, and regulatory liabilities.

Kendall Generating Station Assessment and Permitting, Mirant, Cambridge, MA

Task Manager, served in preparation of the NPDES renewal application for this repowered facility located in Cambridge Massachusetts. Extensive BTA and anti-degradation issues were involved in the preparation of the application and coordination with agencies and interested parties.

Canal Generating Station Assessment and Permitting, Mirant, Sandwich, MA

Task Manager, worked in preparation of the NPDES renewal application for this repowered facility located in Sandwich Massachusetts on the Cape Cod Canal. Extensive BTA and anti-degradation issues were involved in the preparation of the application and coordination with agencies and interested parties.

Manchester Street Station, NPDES Permitting Support, Dominion Energy, Providence, RI

Senior Project Biologist, provided NPDES relicensing support for a 480 MW once-through cooled power plant located in the estuarine portion of the Providence River. Mr. Martin completed evaluation of entrainment and impingement impacts, alternative cooling water intake technologies, and regulatory liabilities.

Taunton Municipal Light NPDES Permit Renewal Support, City of Taunton, Taunton, MA

Senior Project Biologist, responsible for review of past 316 (a) & (b) data, evaluation of cooling water intake system and thermal discharge characteristics of the plant, located in a tidally influence reach of the Taunton River. Mr. Martin provided renewal strategy and consultation with the EPA and Massachusetts DEP. Of particular concern was zone of passage blockage for fish migrations and exceedances of thermal discharge limits adversely affecting the local estuarine habitat and species.

Heritage Station Permitting, Sithe Energy, Oswego, NY

Senior Project Biologist, responsible for the water resources portion of the Article X application for a proposed 800-MW natural gas-fired generating station in Oswego, New York. Prepared the water withdrawal and discharge, surface water, aquatic resource and stormwater sections of the application. Mr. Martin provided characterization of existing resources as well as detailed impact analyses, including CORMIX modeling, adult-equivalent estimation, and scaling factor comparisons. He provided senior review of groundwater and wetland resource sections along with responsibility for preparing the SPDES permit application.

Meriden Power Plant Permitting, Power Development Corporation, Meriden, CT

Senior Project Biologist responsible for preliminary analysis of surface water intake versus a Raney well for supplying cooling water to this power plant in Meriden Connecticut. He assessed potential impacts to riparian wetlands and fisheries of the Connecticut River. Mr. Martin also evaluated site feasibility based on likely intake design.

Summit Power Plant Siting and Licensing, Power Development Corporation, Westfield, MA

Senior Project Biologist, assisted in the preparation of filing information for the Massachusetts Energy Facility Siting Board and the Massachusetts Executive Office of Environmental Affairs for this combustion turbine combined cycle plant located in Westfield, Massachusetts. Responsibilities included development of a Wetland Creation Conceptual Plan as mitigation for wetland impacts, review of the project for wetland concerns and site layout, and writing the EFSB application section and DEIR section on wetlands.

AQUATIC AND FISHERIES**Newburyport WWTP NPDES Renewal, Weston & Sampson Engineers, Peabody, MA**

Project Manager responsible for review of draft permit conditions, development of comments on the draft permit, meetings with the agencies and client, and input into the assessment of alternative conditions. Mr.



Martin supported the lead engineering firm in dealing with lawyers relative to the current EPA Region 1 NPDES program and the best strategy for supporting the Town Managers agenda.

New London Water Diversion Assessment, City of New London, New London, CT

Senior Project Biologist, responsible for the fisheries habitat, recreation, and water quality components of the diversion permit application. Designed and performed field studies, prepared sections of the application, and coordinated the work of other biologists. The project involved an impact assessment of the interbasin transfer of water and included a detailed study of altered hydrology effects on the donor watershed.

Dam Removal Assessment, Rising Paper Company, Stockbridge, MA

Project Biologist responsible for determining the environmental impacts and permitting effort associated with the removal of a dam from the Housatonic River. Mr. Martin reviewed available information, determined scope of work and cost estimates for further environmental assessment and remediation. PCB contaminated sediments behind the dam and shoreline wetlands were major issues of concern.

Salem Harbor Station, NPDES Permitting Support, Dominion Energy – Salem MA Mr. Martin provided NPDES relicensing support for a 700 MW once-through cooled power plant located in the estuarine portion of Salem Harbor. He completed evaluation of entrainment and impingement impacts, alternative cooling water intake technologies, and regulatory liabilities.

Manchester Street Station, NPDES permitting support, Dominion Energy – Providence, RI Mr. Martin provided NPDES relicensing support for a 480 MW once-through cooled power plant located in the estuarine portion of the Providence River. He completed evaluation of entrainment and impingement impacts, alternative cooling water intake technologies, and regulatory liabilities.

Assessment, Design and Post Construction Monitoring of Salt Marsh and Salt Pond Creation at the Bush Pier Landfill, NYCEDC – New York City, NY Mr. Martin served as Lead ecologist assessing the feasibility of creating salt marsh habitat and salt ponds in an area of metals contamination of soil and sediments associated with the Bush Pier Landfill in Brooklyn New York. He developed a plan that allowed for capping of certain areas of the landfill to reduce soil removal costs while creating beneficial wildlife and fishery habitat in an urban setting. Mr. Martin also developed and participated in benthos and water quality sampling plan. Participated in meetings with the client and resource agency personnel. Mr. Martin reviewed construction contractor changes in means and methods, and subsequent to construction, has participated in ongoing monitoring efforts, including input on remedial efforts to ensure success.

Aquatic Resource Characterization, Phelps Dodge Manufacturing Facility – Norwalk, CT Mr. Martin served as aquatic ecologist responsible for designing benthic sampling and analysis plan to address contaminated sediments in the Yantic River. Atmospheric deposition and stormwater runoff from this wire and cable manufacturing facility has resulted in the detection of elevated levels of several metals in soils and sediments in the local area. Sampling plan was designed to assess the potential for contaminants affecting the benthic macroinvertebrate community in the river and for refinement of areas of concern identification.

Aquatic and Surface Water Resource Characterization, Confidential Client – Wareham, MA Mr. Martin was Manager of surface water sampling and aquatic habitat evaluation of the 9,500-acre landholdings of this company in southeastern Massachusetts. Work is being performed in support of future land development activities including the potential development of several golf courses, residential housing, wastewater treatment and water supply facilities and light commercial development. Land development is being balanced against the existing cranberry

growing operations on 2500 acres of bogs.

Massachusetts Military Reservation, FS-1 Plume, Quashnet River, Bog Separation Project, Fish Habitat Monitoring Study, Jacobs Engineering, Cape Cod, MA Mr. Martin prepared scope of work and performed fieldwork designed to monitor changes to rare native brook trout spawning habitat. A groundwater extraction and treatment system were installed and concerns over changes in discharging groundwater and alteration of surface water flows resulted in the need to monitoring a one-year pilot test. Monthly substrate mapping, fish counts, cross-sectional profiles, DO and temperature monitoring, and photographic documentation were performed.

Millennium Power Plant Aquatic Impact Assessment, USGEN, Charlton, MA

Senior Project Biologist responsible for the evaluation of water withdrawal impacts to the Quinebaug River in south central Massachusetts. Mr. Martin prepared a white paper discussing the Instream Flow Incremental Methodology (IFIM), including its features, its application, and its relevance for this particular project. This paper successfully convinced Massachusetts regulators that an IFIM study or some derivation of IFIM was not an appropriate tool for assessing impacts or setting operating conditions in the permit for the one to three million gallons per day (mgd) withdrawal, particularly during low flow conditions.

Post-Construction Macroinvertebrate and Fish Survey, Tennessee Gas Pipeline Company, Lee, MA

Project Manager, served on the assessment of pipeline construction impacts on several trout streams in western Massachusetts. Mr. Martin prepared sampling plan, performed field sampling including Hester-Dendy sampling, kick-net sampling, and electrofishing. Managed subcontractors and prepared final report.

ECOLOGICAL RISK AND NATURAL RESOURCE INJURY ASSESSMENT

Preliminary Natural Resource Impact Assessment, Massachusetts Military Reservation, FS-1 and SWOU Plumes, AFCEE, Cape Cod, MA

Senior Project Biologist, participated in the development of a Preliminary Impact Assessment document that looked at the past, present, and future adverse impacts to natural resources from contaminants in these plumes. EDB, CCl₄, TCE, and PCE were contaminants of concern. Mr. Martin addressed potential affects from the construction and operation of remedial treatment systems.

Westover ARB Integrated Natural Resource Management Plan, U.S. Air Force Reserve, Westover, MA

Project Manager responsible for the preparation of an INRMP following Air Force guidance. Expanded activity and assignments at this airfield in Chicopee, Massachusetts dictated the need for more thorough planning. Mr. Martin performed review of all operation plans, identified conflicts, and developed planning requirements for protection of the base natural resources, including two state-listed birds.

Natural Resource Injury Assessment, Massachusetts Military Reservation, LF-1 Plume, AFCEE, Cape Code, MA

Senior Project Biologist, participated in the development of a Preliminary Assessment Screening Document under Dept. of Interior NRDA regulations. As part of the Decision Document for the remediation of the LF-1 plume, the potential for adverse impacts to natural resources was assessed.

Devils Foot Road Dump Ecological Risk Assessment, New England ACOE, Quonset Point, RI

Project Manager and Senior Project Biologist, served for this Stage II eco-risk assessment on land formerly part of the Quonset Point Naval Station. Responsible for developing SAP, BRA workplan, fisheries,



sediment, and habitat assessment surveys, and risk analyses. Metals, pesticides, and PCBs were contaminants of concern. He performed macroinvertebrate, fish, and sediment sampling in a stream and small pond.

Spot Pond Brook Ecological Risk Assessment, MWRA, Stoneham, MA

Project Manager, responsible for developing scope of work, performing field sampling, and completion of risk assessment report. Petroleum hydrocarbon and metals contamination of a small stream and wetlands were investigated under Massachusetts MCP guidelines for a Phase II Stage 3 eco-risk assessment.

Evaluation of PCB Contamination at the Birch Hill Dam, New England Division, Corps of Engineers, Athol, MA

Project Biologist, performed a Phase 1 Site reconnaissance of this flood control project located in north central Massachusetts. Previously collected sediment samples located along four miles of the Miller and Otter Rivers revealed a number of sample locations with elevated levels of PCB's. Mr. Martin performed assessment of wetlands, wildlife, and fisheries habitats in order to preliminarily determine the potential severity of the risk to the environment and the reporting responsibilities of the COE under Massachusetts' regulations.

Fort Devens, Sudbury Training Annex, Source Control Remedial Design, ACOE New England Division, Shirley, MA

Project Biologist, performed wetland delineations of Study Area A-7. Fieldwork required Level 1 exposure protection and decontamination of sampling equipment. Contamination stems from former use of the site as an uncontrolled dump and items of concern included volatile organics, pesticides, and arsenic. Items of low concern included unexploded ordinance, other metals, and research wastes.

Publications and Presentations:

Martin, Paul, Joe Rossignoli, Bryan Sanderson. 2017. Moving Wind Energy Through an HVDC Cable Sited Within Lake Champlain: Why This Makes Sense. Poster presented at the 2017 AWEA annual convention, Anaheim CA. May 19-22, 2017.

Martin, Paul, Pat Fleischauer, Dave Clevenger. 2008. It's not Just About the Turbines. Poster presented at the 2008 AWEA annual convention, Houston TX. June 1-4, 2008.

Monitoring Results for the HubLine Pipeline Project in Massachusetts Bay. Presentation at NEERS Spring 2008 meeting, Portsmouth NH, May 2, 2008.

Martin, Paul, Charlie Cooper, Dave Schafer. 2004. NPDES Power Plant Relicensing in New England, 3 Case Studies.

Presentation at American Fisheries Society Annual Meeting, Madison Wisconsin, August 2004.

Martin, Paul and Mike Tyrrell. 2003. Marine Resource and Impact Characterization Associated with the Permitting of Two Offshore Natural Gas Pipelines in New England. Presentation at the 2003 Joint NEERS/SNECAFS Meeting in Fairhaven, MA., May 8-10, 2003.

Martin, Paul, Denis Blais, Mike Lychwala, Colin Duncan, Mike Tyrrell, Gus McLachlan. 2002. Restoration Success of Newly Constructed Natural Gas Pipeline Rights-of-Way: Upland, Wetland, and Riverine Habitats. Poster presented at the SWS 23rd Annual Meeting in Lake Placid, NY June 3-7, 2002



Martin, Paul, Denis Blais, Mike Lychwala, Mike Tyrrell, Gus McLachlan. 2002. Restoration Success of Newly Constructed Natural Gas Pipeline Rights-of-Way: Upland, Wetland, and Riverine Habitats. Poster presented at the 58th Northeast Fish & Wildlife Conference, Portland, Maine. April 22-24, 2002.

Paul Martin –Organizer and Moderator- Symposium on Revised Clean Water Act 316a&b Regulations. Held at the 57th Northeast Fish & Wildlife Conference, Saratoga Springs, New York. April 2001.

Martin, Paul and Mike Tyrrell. 2000. Natural Resources That May Be Impacted If Your Horizontal Directional Drill Fails: Open Cut Analysis of a Coastal Maine River. Poster presented at the 12th International Right-of-Way Conference, Calgary, Canada. Sept 10-13, 2000.

Martin, Paul, Mike Tyrrell, and Fred Short. 1999. Piscataqua River Open Cut Contingency Impact Assessment, Joint Pipeline Facilities. Presented at: the 55th Northeast Fish & Wildlife Conference, Manchester, New Hampshire. April 12-14, 1999.

Martin, Paul, Mike Tyrrell, Mike Lychwala, and George McLachlan. 1998. The Wetlands of Maine: Results of 350 Miles of Natural Gas Pipeline Corridor Siting Studies. Poster Presentation at the 54th Northeast Fish & Wildlife Conference, Camp Hill, Pennsylvania. May 3-6, 1998.

Martin, Paul. 1997. Wetland Functional Value Assessment: All Linear Projects Should Not Be Considered Equal. 53rd Northeast Fish & Wildlife Conference, Framingham, Massachusetts. April 27-30, 1997.

Martin, Paul, Kathy Creighton, and Ron Richards. 1996. Stage II Ecological Risk Characterization under the Massachusetts Contingency Plan: A Case Study. Presented at the 11th Annual Conference on Contaminated Soils, UMass Amherst. October 21-24, 1996.

Tsou, John, Jeffrey Coyle, Steve Pallo, Yusuf Mussalli, and Paul Martin. 1995. Evaluation of the Use of Chlorine Dioxide to Control Zebra Mussels. Presented At: The Fifth International Zebra Mussel and Other Aquatic Nuisance Organisms Conference. Toronto, Canada. February 21-24, 1995.

Martin, Paul D. and Steve Dolat. 1994. Underwater Strobe Lights and Sound Successfully Bypass Shad Past York Haven Hydro Turbines. Presented At: American Fisheries Society Annual Meeting. Halifax, Nova Scotia. August 20-25, 1994.

Martin, Paul D. 1994. A Low Impact Way of Repairing Pipelines in Very Wet Places: A Southern Solution to a Northern Problem. In: Proceedings of the Wetlands Restoration and Creation Conference. Tampa. Florida. May 19-20, 1994 (Peer Reviewed).

Martin, Paul D., E. Taft, and C. Sullivan. 1993. Reducing Entrainment of Juvenile American Shad (*Alosa sapidissima*) Using a Strobe Light Diversion System. In: Proceedings of the Anadromous Alosa Symposium. Virginia Beach, Virginia. January 14-15, 1993 (Peer Reviewed).

Martin, Paul D. and Charles W. Sullivan. 1992. Guiding American Shad with Strobe Lights. Hydro- Review Vol. XI, No. 4. July 1992 (Peer Reviewed).



Martin, P., J. Winchell, and D. Michaud. 1992. Evaluation of a Barrier Net for Reducing Fish Entrainment at the Pine Hydroelectric Project. Presented At: Northeast Fish and Wildlife Conference. Norfolk, Virginia. May 3-6, 1992.

Martin, P., J. Downing, N. Taft, C. Sullivan. 1991. A Demonstration of Strobe Lights to Repel Fish. In: Proceedings, Waterpower '91 Conference. Denver, Colorado. July 24-26, 1991.

Taft, E.P., J.K. Downing, P.D. Martin, C. Sullivan. 1990. Evaluation of Behavioral Devices for Fish Protection. Poster Presented At: Northeast Fish and Wildlife Conference. Nashua, New Hampshire. April 9-11, 1990.

Martin, Paul D. 1989. The Ecology of Caprellid Amphipods: Population Patterns and the Role of Algal Complexity in Mediating Predation by Wrasse. Poster Presented At: American Society of Zoologists 1989 Annual Meeting. Boston, Massachusetts.

Martin, Paul D. 1988. The Ecology of Caprellid Amphipods: Population Patterns and the Role of Algal Complexity in Mediating Predation by Wrasse. M.S. Thesis, Zoology Department, University of New Hampshire.

Martin, Paul D., Stephen P. Truchon, and Larry G. Harris. 1988. *Strongylocentrotus droebachiensis* Populations and Community Dynamics at Two Depth-Related Zones Over an 11-Year Period. In: Proceedings of the 6th International Echinoderm Conference. Victoria, British Columbia. 1987. A.A. Balkema Publishers (Peer Reviewed).



EXHIBIT 3



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.	:	
	:	
v.	:	EHB Docket No. 2020-085-L
	:	
COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION	:	
	:	

AFFIDAVIT OF WILLIAM ETTINGER

William Ettinger states as follows:

1. My name is William Ettinger and I am a Principal Aquatic Biologist at Normandeau Associates. I am an aquatic biologist and have 46 years of experience. I have a Master of Science in Entomology. My CV is attached as Exhibit A.

2. I have personally visited the site of the inadvertent return (“IR”) associated with HDD 290 of the Mariner East pipeline project in Upper Uwchlan Township, Chester County, PA. While there, I viewed streams S-H10 and S-H11, as well as the Marsh Creek Reservoir (the “lake”) and the 1.01 mile re-route set forth in the Reevaluation Report for HDD 290 approved by the Pennsylvania Department of Environmental Protection. (the “Department”).

3. Drilling fluid primarily consists of fresh water, bentonite clay, and fine soil or drill cutting particles representing the native material (i.e., rock or soil) that is being drilled through.

4. The August 10, 2020 IR resulted in the discharge of drilling fluid with trace amounts of bentonite clay within the channel for streams S-H10 and S-H11. The drilling fluid then entered a cove of the lake, where it settled out on the lakebed in a linear plume. The drilling fluid was removed from streams S-H10 and S-H11 within eleven days. During a site visit on



September 25, 2020, there was no evidence of drilling fluid in these streams downstream of the location of the IR. The location of the IR was surrounded by a sandbag containment structure.

5. IRs that occurred at this same location in 2017 temporarily affected a shorter length of stream S-H10 and did not affect the lake. Drilling fluid cleanup activities in the stream at that time were minimal and conditions typical of such small streams in southeastern Pennsylvania were restored.

6. Assuming that the IR will continue during the completion of HDD 290, drilling fluid will be discharged into a containment structure designed to contain any release of drilling fluid from an IR. The drilling fluid from an IR will not enter streams S-H10 or S-H11. Therefore, ecological impacts will not occur to stream S-H10, stream S-H11, or the lake as a result of the completion of HDD 290.

7. The re-route alternative set forth in the Reevaluation Report would involve a new greenfield pipeline location, crossing two streams located north of Little Conestoga Road and improvements to an access road crossing over one of these streams at a location south of Little Conestoga Road. It is anticipated that the pipeline crossings at the two locations will be constructed using a dam and pump-type open cut methodology where approximately 100 linear feet of stream channel has flow re-directed through the dam and pump, so that the trench through the stream can be excavated in the dry. Each stream will be directly affected for 48 to 72 hours.

8. Approximately 100 linear feet of each of the two streams crossed by the pipeline re-route alternative will be dewatered and physically impacted by the dam construction and trenching, and subsequent trench backfilling and dam removal required to install the pipeline. Stream hydraulics will be altered, downstream siltation will increase, and stream bottom macroinvertebrate communities will be temporarily impacted during the installation of the



pipeline. Upstream/downstream movement of any fish will be also temporarily prevented during this period. After the pipeline installation is completed, the above impacts will be addressed through restoration of the stream channel. However, streamside trees removed during pipeline construction will not be replaced or allowed to re-grow for the remaining lifespan of the pipeline, resulting in less shading of the stream, which may alter water temperature slightly. Trees in the temporary workspace will naturally reseed and grow larger as years pass, whereas the reseeded pipeline right-of-way will be mowed every year, preventing tree growth. Therefore, shading impacts at the stream crossings will be reduced, but not ended, as years pass.

9. The stream crossing carrying the existing access road will use an existing structure which will require some improvement so that it can support the load of construction equipment and materials. Improvements to the service road will cause temporary siltation impact to the stream.

10. If HDD 290 is completed, no new right-of-way will be created in the land adjacent to HDD 290 because HDD 290 is located on an existing pipeline right-of-way and the work will continue within this space. In contrast, the re-route would create a new 1.01-mile long permanent right-of-way through adjacent uplands, any streamside wetlands that may be present, and the above-mentioned streams.

11. The permanent right-of-way for the re-route alternative will be 50 feet wide. This new right-of-way could be used by off-road motor vehicles, including trail bikes and ATVs, for entry into and passage through the streams. Such vehicle entry will damage the stream banks, causing erosion and associated streambed sedimentation. Vehicle travel through the streams will disturb the streambed, impacting the macroinvertebrates present and increasing downstream movement of streambed material.



12. All of the conclusions and opinions set forth in this Affidavit are provided to a reasonable degree of scientific certainty.

13. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020

A handwritten signature in cursive script that reads "William F. Ettinger".

William Ettinger



EXHIBIT A

WILLIAM S. ETTINGER Principal Aquatic Ecologist

Mr. Ettinger's education and expertise are in aquatic, estuarine, and marine ecology, specializing in macroinvertebrates, fish, physical habitat, hydrology, and water quality. He has wide experience in diverse areas of natural resource impact assessments, including evaluation of impacts of coal mining, dredging, industrial and municipal wastewater, water diversion, and power plant operations on aquatic biota. His experience includes surveys of benthic macroinvertebrates, freshwater mussels, fish, and submerged aquatic vegetation in streams, rivers, and lakes throughout the northeastern United States. In addition to his technical role in conducting these assessments, Mr. Ettinger often is the project manager.

EDUCATION

M.S., Entomology, Pennsylvania State University

B.S., Fundamental Sciences, Lehigh University

PROFESSIONAL EXPERIENCE

1983-Present Normandeau Associates

1979-1983 Skelly and Loy

1974-1979 Ichthyological Associates, Inc.

PROFESSIONAL AFFILIATIONS

- American Entomological Society
- American Fisheries Society
- Society for Freshwater Science

REPRESENTATIVE PROJECT EXPERIENCE

Expert Witness Services, Manko, Gold, Katcher & Fox, LLP., PA (2019-2020). Review of PADEP Notices of Violation and other documentation related to ecological impact of pipeline construction in Pennsylvania. In support of legal action, Mr. Ettinger prepared an expert's report and was deposed by opposing counsel. The case was settled before going to trial. Expert Witness.

Freshwater Mussel and Macroinvertebrate Survey, Allegheny County Sanitary Authority (ALCOSAN) Outfall and Riverwall Project, Allegheny County, PA (2017-Present). Freshwater mussel survey, macroinvertebrate survey, and fish evaluation study in support of Environmental Assessments associated with a Joint Permit Application submission for outfall and riverwall construction in the Ohio River. Mr. Ettinger assisted in preparation of reports.

AECOM – Pennzoil Quaker State Refinery, Plant II Mussel Survey, Oil Creek, Venango County, PA (2017-Present). Freshwater mussel survey targeting the Federally Endangered northern riffleshell (*Epioblasma torulosa rangiana*) in support of shoreline improvements at a hazardous waste site. Mr. Ettinger assisted in preparation of reports.

Wetland Restoration Plan Review, Black & Veatch Special Projects Corporation, Wilmington, DE (2016-Present). Review of a wetland restoration plan designed to enhance fish habitat along the shoreline of the Delaware River at Fox Point State Park. Mr. Ettinger is responsible for oversight of the project, including preparation of deliverables, and adherence to budget. Project Manager.

Ashokan Reservoir Discharge Impact Assessment in Lower Esopus Creek, New York City Department of Environmental Protection, Kingston, NY (2009-Present). Characterization of fish and macroinvertebrates in Lower Esopus Creek in relation to discharge of water from Ashokan Reservoir. Yearly sampling data are used to assess the impacts of turbid water discharged from the reservoir to the stream. These data also are used in preparation of section of an Environmental Impact Statement. Mr. Ettinger is responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Schoharie Creek Ecological Study at the Gilboa Hydroelectric Dam, New York City Department of Environmental Protection, Gilboa, NY (2005-2006 and 2014 and 2015). Assessment of fish and benthic macroinvertebrate communities present in Schoharie Creek immediately downstream of Gilboa Dam. In addition, PHABSIM modeling of stream habitat in relation to proposed conservation discharge from Gilboa Dam.

Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

East Branch Perkiomen Creek Aquatic Biology Assessment, Exelon Energy, Inc., Bucks and Montgomery Counties, PA (1983-Present). Assessment of fish and macroinvertebrates in multidisciplinary monitoring of effects of an interbasin water transfer on a stream in eastern Pennsylvania. Studies include annual fish and macroinvertebrate sampling and data analysis for detection of impacts and subsequent reporting. Mr. Ettinger is responsible for all aspects of the project, including sampling, reporting, and adherence to budget. Principal Investigator/Project Manager.

Biofouling Organism Assistance, Exelon Energy, Inc., Pottstown, PA (1987-Present). Consulting services relative to the introduced biofouling bivalves Asiatic clam (*Corbicula fluminea*), zebra mussel (*Dreissena polymorpha*), and Quagga mussel (*Dreissena rostriformis bugensis*). These services include surveys, monitoring, and provision of life history/ecological information. Mr. Ettinger is responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Regulatory Agency Document Review, Manko Gold Katcher Fox, LLP, Bala Cynwyd, PA (2018). Review of Pennsylvania Department of Environmental Protection reports on redesignation of Devil's Hole Creek and Paradise Creek from High Quality to Exceptional Value stream status. In addition, macroinvertebrate sampling to confirm if biological conditions support the current designation. Mr. Ettinger was responsible for all aspects of the project, including report review, macroinvertebrate sampling design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Investigation of Chromium Impacts to Wetlands and Stream Resources, WSP, Inc., York County, PA (2017-2018). Assessment of chromium in groundwater impacts to wetlands vegetation and stream benthic macroinvertebrates at a contaminated industrial site. In addition, wetlands soil and stream sediment and water were sampled for determination of chromium levels. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Freshwater Mussel Survey and Impact Avoidance Plan Preparation, Matrix Development Group, Inc., Delaware River, Burlington, NJ (2016-2018). Survey of freshwater mussels in the Delaware River where shoreline industrial redevelopment is proposed. SCUBA was required and two New Jersey-listed species were observed - eastern pondmussel (*Ligumia nasuta*) and tidewater mucket (*Leptodea ochracea*). Normandeau prepared an Impact Avoidance Plan to minimize project impacts to mussels as per state agency requirements. Normandeau also placed a construction monitor on-site to ensure that mussel resources were not affected by stormwater outfall placement. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Freshwater Mussel Survey, NP Renewal, LLP, Woodbury Creek/Hessian Run, National Park, NJ (2017). Survey of freshwater mussels in tidal Woodbury Creek and Hessian Run where landfill closure/land redevelopment and shoreline stabilization are planned. SCUBA was required and two New Jersey-listed species were observed - eastern pondmussel (*Ligumia nasuta*) and tidewater mucket (*Leptodea ochracea*). Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Project Manager.

Regulatory Agency Document Review, Manko Gold Katcher Fox, LLP, Bala Cynwyd, PA (2017). Review of Pennsylvania Department of Environmental Protection reports on redesignation of Swiftwater Creek from High Quality to Exceptional Value stream status. In addition, macroinvertebrate sampling to confirm if biological conditions support the redesignation. Mr. Ettinger was responsible for all aspects of the project, including

report review, macroinvertebrate sampling design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Regulatory Agency Document Review, Manko Gold, Katcher, & Fox, LLP, Bala Cynwyd, PA (2017). Review of Pennsylvania Department of Environmental Protection reports on redesignation of Tunkhannock Creek from High Quality to Exceptional Value stream status. In addition, macroinvertebrate sampling to confirm if biological conditions support the redesignation. Mr. Ettinger was responsible for all aspects of the project, including report review, macroinvertebrate sampling design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Festival Pier Biological Assessment Preparation, Urban Engineers, Inc., Philadelphia, PA (2017). Preparation of a Biological Assessment concerning pier redevelopment effects to the Federally-Endangered Atlantic Sturgeon and Shortnose Sturgeon. Mr. Ettinger was responsible for all aspects of the project, including primary authorship of the Biological Assessment and adherence to budget. Principal Investigator/Project Manager.

Regulatory Agency Document Review, Confidential Law Firm, Pittsburgh, PA (2016-2017). Review of Pennsylvania Department of Environmental Protection reports on receiving waters impacts from an NPDES-permitted wastewater discharge. Mr. Ettinger was responsible for all aspects of the project, including report review, reporting, and adherence to budget. Principal Investigator/Project Manager.

Regulatory Agency Document Review, Manko, Gold, Katcher & Fox LLP, East Stroudsburg, PA (2016). Review of Pennsylvania Department of Environmental Protection and Monroe County Planning Commission reports on aquatic ecology and water quality in Brodhead Creek and Sambo Creek as they relate to East Stroudsburg Borough's Municipal Separate Storm Sewer System (MS4). Mr. Ettinger was responsible for all aspects of the project, including report review, reporting, and adherence to budget. Principal Investigator/Project Manager.

Borehole Blow-out Ecological Impact Assessment, Confidential Client, Western PA (2017). Assessment of wetland and stream impacts from a borehole blowout that released abandoned mine drainage from a flooded underground coal mine. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Quagga/Zebra Mussel Survey Conducted in the Lower Susquehanna River, Susquehanna River Basin Commission, PA (2016). Search for the biofouling invasive species quagga mussel and zebra mussel in the lower Susquehanna River from Harrisburg to Conowingo Dam. This effort included in-river search employing mask and snorkel and viewing buckets at 10 locations, based on habitat and locations of possible introduction (boat ramps, etc.). Live zebra mussels were confirmed in Conowingo Pond. Mr. Ettinger was responsible for the survey design and review of the report. Principal Investigator.

Fish Passage Feasibility Study, D & B Engineers and Architects, Woodbury, NY (2016). Study of the feasibility of restoring alewife passage into Sunken Meadow Creek, a tidal stream located on Long Island, NY, in order to allow alewife reproduction in the headwaters. Mr. Ettinger is responsible for oversight of the project, including preparation of deliverables, and adherence to budget. Project Manager.

Expert Witness Services, Babst/Calland, Pittsburgh, PA (2015-2016). Assessment of ecological impacts and subsequent recovery from a natural gas industry water release on a Class A Wild Trout Stream. In support of legal action before Pennsylvania's Environmental Hearing Board, Mr. Ettinger prepared an expert's report and provided testimony. Expert Witness.

Festival Pier Ecological Support Services, Urban Engineers, Inc., Philadelphia, PA (2015-2016).

Characterization of the fish community and submerged aquatic vegetation in the Delaware River at Festival Pier. Also, determination of the jurisdictional limits of waters of the United States/Commonwealth of Pennsylvania. Both efforts in support of permitting necessary for redevelopment of the pier. Mr. Ettinger was responsible for all aspects of the project, including report preparation and adherence to budget. Principal Investigator/Project Manager.

Mussel Habitat Survey in Swedes Lake, Delran Township, NJ (2015). Survey conducted to determine if habitat suitable to support tidewater mucket (*Leptodea ochracea*) is present where a lake discharge pipe is to be replaced. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Mussel and Mussel Habitat Surveys, Confidential Client, NY and NH (2015). Surveys conducted to determine (1) if habitat suitable to support a Federally-listed mussel species is present in a stream in New York state and (2) if state-listed mussel species are present in two streams in New Hampshire. All locations are associated with proposed gas pipeline stream crossings. Mr. Ettinger assisted in the field surveys and in preparation of the reports. Project Biologist.

Review of Third Party Documentation in regard to Potential Upgrade in Regulatory Status – Hosensack Creek, ERG, Inc., Berks County, PA (2015). Several parties, including a township and an NGO, are contesting issue of a non-coal mining permit for a proposed quarry, using potential Hosensack Creek redesignation in the process. Mr. Ettinger was responsible for all documentation review and adherence to the budget. Principal Investigator/Project Manager.

Scudder Falls Bridge Replacement - Monitoring Plan Preparation, Delaware River Joint Toll Bridge Commission, Delaware River, PA and NJ (2015). Preparation of Water Temperature, Water Quality, and Cofferdam Monitoring Plans to support the Commission's Scudder Falls Bridge (I-95) Replacement Project. Mr. Ettinger was responsible for all aspects of the project, including monitoring plan development and adherence to budget. Principal Investigator/Project Manager.

Environmental Sampling in New York Harbor, Confidential Client, NJ and NY (2014-Present). Collection of fish, blue crab, and softshell clam tissue and associated sediment to support development of a risk assessment pursuant to an Administrative Order on Consent with the United States Environmental Protection Agency (USEPA). All sampling and tissue sample preparation followed methodology contained in two USEPA Quality Assurance Project Plans. Mr. Ettinger is responsible for all aspects of the project, including sampling and adherence to budget. Principal Investigator/Project Manager.

Alum Impact and Remediation Studies in a Water Supply Reservoir, Confidential Client, northeastern United States (2010-Present). Investigations concerning a deposit of alum residuals from water treatment in a water supply reservoir located in the northeastern United States. Normandeau prepared a state-approved study plan and conducted an ecological risk assessment and evaluation of engineering remedy alternatives. Supporting studies included bathymetric survey, fish and benthic macroinvertebrate studies, sediment and water quality studies, and laboratory bioassays. Mr. Ettinger is responsible for all aspects of the project, including study plan preparation, sampling, reporting, and adherence to budget. Principal Investigator/Project Manager.

Dyke Marsh Bathymetry and Erosion/Deposition Since 1992, National Park Service, Potomac River, Alexandria, VA (2008-2009). The survey was conducted preliminary to preparation of a restoration plan for the largest tidal freshwater marsh on the Potomac River. The effort included use of the bathymetric data in comparison with similar data acquired in 1992 for determination of erosion/deposition through the 17-year

period. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Fish and Macroinvertebrate Survey in Rock Run, Confidential Client, Tioga County, PA (2013-2014).

Assessment of impacts and subsequent recovery from a natural gas industry water release on a Class A Wild Brook Trout Stream. Fish and macroinvertebrates were sampled and the resultant data were used in the assessment. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Fish and Macroinvertebrate Survey in an Unnamed Tributary to Coal Run, Confidential Client, Butler County, PA (2013). Assessment of impacts from a natural gas industry process water release on a stream. Fish and macroinvertebrates were sampled and the resultant data were used in the assessment. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Benthic Macroinvertebrate Monitoring in Otter Run, Fisher Mining Company, Tioga County, PA (1998-Present). Assessment of coal mine drainage impacts to a trout stream in northcentral Pennsylvania. This quarterly impact assessment focuses on effectiveness of a treated surface coal mine discharge in enhancing stream ecology within a watershed containing other untreated mine drainage sources. Mr. Ettinger is responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Expert Witness Services, Burack Environmental Law Firm, Chester County, PA (2011-2012). Assessment of ecological impacts to a residential pond due to sediment deposition from an offsite source. A deposition was given, but the case was settled before it went to Chester County Court. Mr. Ettinger reviewed all pertinent documents, prepared an expert's report, and was deposed. Expert Witness.

Cedar Hill Quarry Discharge Impact Assessment in Octoraro Creek, Independence Construction Materials, Inc., Lancaster County, PA (2007-2014). Assessment of quarry discharge impacts on fish and macroinvertebrates in Octoraro Creek, Lancaster County, PA. This work is a PA Department of Environmental Protection NPDES permitting requirement. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Mussel Habitat Assessment in Blue Stone Creek, Hatch Mott MacDonald, Inc., Doddridge County, WV (2012). This survey was conducted to determine if habitat suitable to support mussels is present at a proposed gas pipeline crossing. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Golf Course Community Development Impact Assessment in Beaver Creek, Pulte Homes of PA, LLC, Chester County, PA (2007-2011). Assessment of construction activities' impacts on a stream macroinvertebrate community near a large golf course/housing development. This work is a PA Department of Environmental Protection permitting requirement. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Potential Upgrade in Regulatory Status – Fishing Creek, Drumore Crossing, LP, Lancaster County, PA (2009-2010). Assessment of macroinvertebrate community structure in Fishing Creek. This effort was conducted to determine if an upgrade to Exceptional Value stream status is warranted. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Submerged Aquatic Vegetation Monitoring, PBF Refining Company, Delaware River, Paulsboro, NJ (2010-Present). PBF Refining Company planted a restoration site with several aquatic species as mitigation in regard to a construction project. Normandeau was contracted to assess the success of the restoration effort through annual surveys. Mr. Ettinger is responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Dwarf Wedgemussel Survey at the Station Road Bridge, Warren County, NJ Engineer's Office, Hainesburg, NJ (2012). Survey for dwarf wedgemussel (*Alasmidonta heterodon*) in the Paulins Kill River at the Station Road Bridge. This survey was conducted as a permitting requirement in support of a county bridge replacement project. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Rare Mussel Survey at the Bell Bend Site, PPL Resources, Inc., Susquehanna River, Berwick, PA (2011-2012). Survey for two rare mussel species (green floater – *Lasnigona subviridis* and brook floater – *Alasmidonta varicosa*). The objective was to determine if populations of these species are at risk of dewatering at low river flow due to power plant water consumptive use. Mr. Ettinger was responsible for the technical aspects of the project, including study design and reporting. Principal Investigator.

Southport Terminal Environmental Permitting Services, Philadelphia Regional Port Authority, Delaware River, Philadelphia, PA (2010-2012). Essential Fish Habitat Assessment and preparation of responses to comments by the National Marine Fisheries Service concerning the Philadelphia Regional Port Authority's proposed Southport Terminal on the Philadelphia waterfront of the tidal Delaware River. Also, characterization of fish and macroinvertebrate communities in lower tidal Neshaminy Creek, the likely compensation site for habitat loss from the proposed Southport Terminal. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Southport Terminal Environmental Permitting Services, Philadelphia Regional Port Authority, Delaware River, Philadelphia, PA (2003-2004). Characterization of fish and benthic macroinvertebrate communities in the tidal Delaware River in support of environmental permitting for the Authority's proposal Southport Terminal on the Philadelphia waterfront. The effort included macroinvertebrate sampling by Ponar grab and fish sampling using several gear types, including electrofishing and gillnetting. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Hydroelectric Relicensing Services – Mussel Survey at Conowingo Dam, Exelon Energy, Inc., Susquehanna River, MD, (2010-2012). The 4.5 mile reach encompassed rugged free-flowing habitat as well as tidally influenced soft-bottom habitat contiguous with upper Chesapeake Bay. SCUBA as well as snorkel survey was conducted. This effort included semi-quantitative survey throughout the reach, followed by quantitative sampling in five selected areas within that reach. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Side-Scan and Bathymetric Surveys in the Greenup Pool, Ohio River, U.S. Army Corps of Engineers (2010-2011). Acoustic riverbed classification and bathymetry surveys for a mussel habitat assessment. Acoustic surveys were conducted in order to identify mussel habitat and populations at risk to dewatering due to potential lock failure. Mr. Ettinger was responsible for the financial aspects of the project, including adherence to budget. Project Manager.

Bathymetric Surveys in the Byrd, Racine, and Willow Island Pools, Ohio River, U.S. Army Corps of Engineers, Huntington District (2001). Acquisition of bathymetric data in the Byrd, Racine, and Willow Island Pools of the Ohio River. The work involved collection of georeferenced data in 111 river miles in a short period

of time. Mr. Ettinger was responsible for the financial aspects of the project, including adherence to budget. Project Manager.

Rare Mussel Survey at the Madison Avenue Bridge, Hunt Engineers, Architects & Land Surveyors, Inc., Chemung River, Elmira, NY (2010). Survey of freshwater mussels in the Chemung River at the Madison Avenue Bridge in Elmira, NY. The bridge project involves placement of scour protection around the piers. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Leachate Treatment Plant Impact Assessment, Waste Management, Inc., Delaware River, Morrisville, PA (2009-2010). This effort included Ponar grab sampling in soft-bottom habitat and use of artificial substrates (Hester-Dendy Multiplate Samplers) to simulate woody debris habitat. The assessment was a Delaware River Basin Commission permitting requirement. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Dwarf Wedgemussel Habitat Assessment, Matrix New World Engineering, Inc., Paulins Kill River, Sparta, NJ (2009). Survey for dwarf wedgemussel (*Alasmidonta heterodon*) habitat in an unnamed tributary to the Paulins Kill, near Sparta, NJ. Dwarf wedgemussel is a Federal-listed Endangered Species. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Rare Mussel and Submerged Aquatic Vegetation Survey at the Big Slackwater Historic Stonewall and Towpath, National Park Service, Potomac River (2009). Survey of freshwater mussels and submerged aquatic vegetation at the Chesapeake and Ohio Canal National Historical Park in Pool 4 of the Potomac River. The results were incorporated into an Environmental Assessment for the project. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Potential Upgrade in Regulatory Status – Hosensack Creek, ERG, Inc., Berks County, PA (2006-2007). Assessment of macroinvertebrate community structure in Hosensack Creek. This effort was conducted to determine if an upgrade to Exceptional Value stream status is warranted. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Fly Ash Impact Assessment in the Delaware River, PPL Resources, Inc., Martins Creek, PA (2006-2009). Assessment of fly ash spill impacts to the mussel and periphyton communities in the Delaware River at Martins Creek Generating Station. The results were incorporated into a Natural Resource Damage Assessment. Mr. Ettinger was responsible for the technical aspects of the project, including study design and reporting. Principal Investigator.

Sugarhouse Casino Site Environmental Permitting Services, Sugarhouse HSP Gaming, LLC, Delaware River, Philadelphia, PA (2006-2008). Characterization of fish and benthic macroinvertebrate communities and submerged aquatic vegetation in the tidal Delaware River in support of waterfront renewal permitting at the proposed Sugarhouse Casino site at Philadelphia. The effort included macroinvertebrate sampling by Ponar grab and fish sampling using several gear types, including electrofishing and gillnetting. In addition, a habitat enhancement plan was prepared in compensation for shallow water habitat loss. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Scudder Falls Bridge Replacement – Environmental Permitting Services, Delaware River Joint Toll Bridge Commission, Delaware River, PA and NJ (2004-2010). Survey of freshwater mussels and characterization of the

fish community present in the Delaware River at the I-95 Bridge, West Trenton, NJ. In addition, Section 7 consultation on the Federally-listed shortnose sturgeon, including preparation of a biological assessment. The effort supported preparation of an Environmental Assessment for demolition of the existing bridge and construction of a much larger bridge at the site by the Delaware River Joint Toll Bridge Commission. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, and adherence to budget. Principal Investigator/Project Manager.

Pond Sediment Impact Assessment, Ober and Associates and Wilson, Elser, Moskowitz, Edelman, and Dicker, LLP, Chester County, PA (2004-2009). Investigations of ecological impacts related to sediment deposition from an offsite source in two private ponds in Chester County, PA. These investigations include surveys of fish, benthic macroinvertebrates, water quality, and submerged aquatic vegetation. In addition, expert testimony was provided in court. Mr. Ettinger was responsible for all aspects of the project, including study design, reporting, providing testimony, and adherence to budget. Principal Investigator/Project Manager.

REPRESENTATIVE PEER-REVIEWED ARTICLES AND PUBLICATIONS

Ettinger, W.S. 1995. Oligohaline/freshwater macroinvertebrate community, soft (mud/sand) bottom. Pages 99-103 in L.E. Dove and R.M. Nyman, eds. Living Resources of the Delaware Estuary. The Delaware Estuary Program.

Ettinger, W. S. 1991. Keystone crabbing. Pennsylvania Angler (July).

Ettinger, W.S. 1987. Impacts of a chemical dust suppressant/soil stabilizer on the physical and biological characteristics of a stream. J. Soil and Water Conservation. 42(2):111-114.

Ettinger, W.S. 1984. Variation between technicians sorting benthic macroinvertebrate samples. Freshwater Invertebrate Biology. 3(3):147-149.

Ettinger, W.S. and C. Yuill. 1982. Sand and gravel pit reclamation in Louisiana: Creation of wetlands habitat and its integration into adjacent undisturbed bayou. pp.109-114 in W.D. Svedarsky and R.D. Crawford, eds., Wildlife Values of Gravel Pits, Proceedings of a symposium held June 24-26, 1982, University of Minnesota Agri. Exp. Sta. Misc. Publ. 17.

Ettinger, W.S. 1982. Macrobenthos of the freshwater tidal Schuylkill River at Philadelphia, Pennsylvania. J. Freshwater Ecology. 1(6):599-606.

Ettinger, W.S. 1981. The macroinvertebrate community of the Schuylkill River at Philadelphia, pp. 80-84 in L.F. Berseth, ed., Proceedings of the Schuylkill River Symposium, held September 24-25, 1980, The Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania.

Ettinger, W.S. and R.W. Blye. 1981. Occurrence of the blue crab, *Callinectes sapidus*, in the tidal freshwater reaches of the Delaware and Schuylkill in 1976. J. Crustacean Biology 1(2):177-182

SPECIAL TRAINING

Attended 2016 workshop entitled Identification and Ecology of Freshwater Mussels, presented by Janet Clayton at the 2016 Association of Mid-Atlantic Aquatic Biologists meeting at Cacapon State Park, Berkeley Spring, WV, 31 March and 1 April 2016.

Attended 2013 workshop entitled Freshwater Mussels of West Virginia: Life History and Identification, presented by Janet Clayton, West Virginia State Malacologist at Windwood Fly-In Resort, Davis, WV, 13-17 May 2013.

Attended 2013 workshop entitled Identification and Taxonomy of Mussels, presented by Dr. Arthur E. Bogan and Richard Spear at the 2013 Association of Mid-Atlantic Aquatic Biologists meeting at Cacapon State Park, Berkeley Springs, WV, 4-5 April 2013.

Attended 2011 workshop entitled Identification and Taxonomy of Mussels, presented by Dr. Arthur E. Bogan at the 2011 Association of Mid-Atlantic Aquatic Biologists meeting at Cacapon State Park, Berkeley Springs, WV, 7-8 April 2011.

Attended 2008 workshop entitled Freshwater Mussels: Problems, Resources, and Taxonomy, presented by Dr. Arthur E. Bogan at the 2008 Association of Mid-Atlantic Aquatic Biologists meeting at Cacapon State Park, Berkeley Springs, WV, 2-3 April 2008.

Attended 1991 and 1992 Workshops on Freshwater Bivalves of Pennsylvania, presented by Dr. Arthur E. Bogan at the Carnegie Museum of Natural History, Pittsburgh, PA.



EXHIBIT 4



COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD

CLEAN AIR COUNCIL; THE DELAWARE
RIVERKEEPER NETWORK; and
MOUNTAIN WATERSHED
ASSOCIATION, INC.,

Appellants,

EHB DOCKET NO. 2017-009-L

v.

COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF ENVIRONMENTAL
PROTECTION,

Appellee,

and

SUNOCO PIPELINE L.P.,

Permittee.

CORRECTED STIPULATED ORDER

AND NOW this 10th day of August, 2017, the Clean Air Council, the Delaware Riverkeeper Network, the Mountain Watershed Association, Inc. (collectively "Appellants"), Sunoco Pipeline L.P. ("Sunoco"), and the Commonwealth of Pennsylvania, Department of Environmental Protection ("Department"), by and through their respective counsel, hereby agree to resolve the Appellants' Application for Temporary Partial Supersedeas and Petition for Partial Supersedeas, both of which were filed on July 19, 2017, through a negotiated agreement with regard to the following terms and conditions, which shall be entered by the Environmental Hearing Board ("Board") as a Stipulated Order, and which supersedes and replaces the Stipulated Order approved by the Board on August 9, 2017, as follows:



1. Appellants' Petition for Temporary Partial Supersedeas and Petition for Partial Supersedeas are hereby withdrawn without prejudice. The Board's Orders dated July 25, 2017, July 28, 2017, August 1, 2017, August 3, 2017, and August 4, 2017 (attached as Exhibit "1") are hereby vacated. Appellants reserve the right to seek a temporary or permanent supersedeas for conduct after the Board's entry of this Stipulated Order, including any activities related to horizontal directional drilling ("HDD").

2. Sunoco will perform a re-evaluation of the 41 HDDs listed on Exhibit "2" attached hereto. Exhibit "2" provides the rationale for selecting these HDDs for re-evaluation as well as the nature of the re-evaluation.

3. Sunoco will also perform a re-evaluation of the HDDs listed on Exhibit "3." These HDDs constitute drills for which an inadvertent return ("IR") occurred during the installation of one pipe (20" or 16" diameter) and where a second pipe will hereafter be installed in the same right-of-way ("ROW"). In addition, Sunoco will perform a re-evaluation of HDDs for which an IR occurs in the future during the installation of one pipe where a second pipe will thereafter be installed in the same ROW.

4. In re-evaluating the design of the HDD techniques for the sites referenced in Paragraphs 2 and 3 herein, Sunoco shall:

- i. Re-examine the geology at each site using information and data gathered during HDD operations at that and other sites during construction of the pipelines subject to the permits in the above-captioned Appeal;
- ii. Consider data that is specific to the needs of each HDD being reevaluated, including at a specific HDD: geologic strength at profile depth, overburden strength, HDD depth, entry angle, pipe stress radius, open cut alternatives, a



re-route analysis for all HDDs (including those on Exhibit "2") and analysis of well production zones;

iii. Conduct, as appropriate, additional geotechnical evaluation at each site using techniques generally recognized within the scientific community which may include:

- Additional field drilling and sampling;
- Seismic surveys;
- Ground penetrating radar; and
- Electromagnetic surveys/electrical resistivity tomography.

iv. In karst areas, Sunoco shall consider the use of seismic surveys and electromagnetic surveys/electrical resistivity tomography for the re-evaluation undertaken pursuant to this Order, and if it does not use these evaluation methodologies, it will provide the Department with an explanation for why they were not used at that site.

5. Upon completion of Sunoco's re-evaluation of each HDD site referenced in Paragraphs 2 and 3 herein, Sunoco shall provide for each such site a report signed and sealed by a Professional Geologist, describing and presenting the results of its study for that location ("Report"). The Professional Geologist shall be a person trained and experienced in geotechnical and hydrogeologic investigation. The Report shall specify all actions to be taken by Sunoco to eliminate, reduce, or control the release or IR of HDD drilling fluids to the surface of the ground or impact to water supplies at that location during HDD operations.

i. The Report shall document in detail the information considered for the re-evaluation of the design of the HDD at that site.



- ii. The Report shall contain an evaluation of the feasibility of constructing the proposed HDD crossing at that location and, as appropriate, propose modification of the design of the HDD or relocation of the pipeline based upon the results of its study for that location.
6. Sunoco will submit the Reports to the Department for review and approval.
- i. For any recommendation that requires a major permit modification, the Department's procedures for major permit modifications shall apply.
 - ii. For all recommendations for which a minor permit modification is required, including, but not limited to, certain changes from HDD to an open cut or certain changes to the Limit of Disturbance ("LOD"), the Department will have 21 days to review the submission and render a determination with respect to such minor permit modification, unless Sunoco agrees to extend the 21-day time period. Appellants and private water supply landowners, who have received notice pursuant to Paragraph 7 below, shall submit comments, if any, within 14 days of the Department's posting of Sunoco's Reports on the Department's Pennsylvania Pipeline Portal website. Comments on the Reports shall be submitted to the Department at: Karyn Yordy, Executive Assistant, Office of Programs, Department of Environmental Protection, Rachel Carson State Office Building, 400 Market Street, Harrisburg, PA 17101; Email – kyordy@pa.gov; Phone – (717) 772-5906; Fax – (717) 705-4980. Appellants will provide copies of their comments by email to Sunoco to the email address provided to Appellants'



counsel. The Department shall consider comments received and document such consideration.

- iii. For all other recommendations, including, but not limited to, recommendations of no change or of changes that do not require a minor permit modification, the Department will have 21 days to review the submission and render a determination with respect thereto, unless Sunoco agrees to extend the 21-day time period. Appellants and private water supply landowners who have received notice pursuant to Paragraph 7 below, shall submit comments, if any, within 14 days of the Department's posting of Sunoco's Reports on the Department's Pennsylvania Pipeline Portal website. Comments on the Reports shall be submitted to the Department at: Karyn Yordy, Executive Assistant, Office of Programs, Department of Environmental Protection, Rachel Carson State Office Building, 400 Market Street, Harrisburg, PA 17101; Email – kyordy@pa.gov; Phone – (717) 772-5906; Fax – (717) 705-4980. Appellants will provide copies of their comments by email to Sunoco to the email address provided to Appellants' counsel. The Department shall consider comments received and document such consideration.

7. At the same time that Sunoco provides the Report to the Department, Sunoco will also provide a copy of the Report to Appellants by email to the address provided to Sunoco's counsel. The Department shall post Sunoco's Report to the Pennsylvania Pipeline Portal website within one business day of receipt. Sunoco shall send a copy of the Report (by U.S. Postal



Service Certified Mail and First Class Mail) to all landowners who have a private water supply that is located within 450 feet of the HDD addressed by the Report.

8. Ten days before HDD operations start at an HDD location, or re-start at an HDD location at which there was an IR (as listed on Exhibit "4"), Sunoco will identify all landowners within 450 feet of HDD alignments, and notify all such landowners (by U.S. Postal Service Certified Mail and First Class Mail) and offer such landowners the opportunity to have their water supplies within 450 feet of the HDD alignment sampled before, during, and after start or re-start of such HDD in accordance with the parameters in the water supply testing plan (Appendix B of the Water Supply Assessment, Preparedness, Prevention and Contingency Plan). For any such water supplies, the drill path will be compared to the well depth and geology of the area. Those water supplies in geologies with potentially significant interconnected secondary porosity (solution openings and structural features) will be considered for monitoring during HDD installs depending on specific individual water supplier requirements.

9. At the 22 HDDs identified on Exhibit "5," water supplies within 150 feet shall receive 72 hours' notice (by U.S. Postal Service Certified Mail and First Class Mail) in advance of restarting these HDDs, and Sunoco will provide notice to landowners (by U.S. Postal Service Certified Mail and First Class Mail) between 150 feet and 450 feet of the HDD within 30 days of the HDD restarting. Such notice shall offer the landowner with the opportunity to have a water supply located within 450 feet of the HDD alignment sampled in accordance with the parameters in the water supply testing plan (Appendix B of the Water Supply Assessment, Preparedness, Prevention and Contingency Plan) within 10 days of the landowner's request.

10. Sunoco shall provide copies of the Certified Mail receipts and landowner responses to the Department, and copies of the Certified Mail receipts to Appellants.



11. Sunoco will immediately notify a landowner with a water supply within 450 feet of an HDD when Sunoco or the Department has determined that there is a substantial possibility that the operation of the HDD will impact his or her water supply.

12. Within 14 days of the Board's entry of this Stipulated Order, Sunoco will provide the Department with a complete list of drilling instructions and specifications provided to all drillers performing HDD operations associated with the permits that are subject to the above-captioned Appeal, which provide the general operational parameters and best management practices to be utilized by the drillers during the performance of HDD operations under said permits.

13. The Department may review the drilling instructions and specifications, and suggest modifications to be incorporated into the instructions and specifications. If appropriate, the Department and Sunoco will discuss the feasibility of incorporating the Department's suggested modifications into the drilling instructions and specifications.

14. Within 14 days of the Board's entry of this Stipulated Order, Sunoco will provide the Department with as-builts for six HDDs that have been completed and at which an IR occurred to assure that the HDDs are being built in accordance with approved plans. To the extent possible, the as-builts shall represent the work of at least three different drilling contractors for HDD work performed in at least three different spreads of the pipelines subject to the permits in the above-captioned Appeal.

15. The parties have agreed to revisions to: the HDD Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan; the Water Supply Assessment, Preparedness, Prevention and Contingency Plan; and, the Void Mitigation Plan for Karst Terrain and



Underground Mining (collectively, the “Plans”), as revised, such revisions dated August 8, 2017.

Sunoco agrees to abide by these Plans, as revised.

16. Sunoco shall inform, as appropriate, its officers, agents, employees, and contractors of the August 8, 2017 revisions to the Plans and ensure that the Plans as revised are present onsite during drilling operations and are made available to the Department.

SUNOCO PIPELINE L.P.:

/s/ Robert D. Fox
Robert D. Fox, Esq.

THE COMMONWEALTH OF
PENNSYLVANIA, DEPARTMENT OF
ENVIRONMENTAL PROTECTION:

/s/ Nels J. Taber
Nels J. Taber, Esq., Regional Counsel

CLEAN AIR COUNCIL:

/s/ Joseph O. Minott
Joseph O. Minott, Esquire

DELAWARE RIVERKEEPER
NETWORK:

/s/ Aaron J. Stemplewicz
Aaron J. Stemplewicz, Esquire

s/ Maya K. van Rossum
Maya K. van Rossum

MOUNTAIN WATERSHED
ASSOCIATION:

/s/ Melissa Marshall
Melissa Marshall, Esquire

APPROVED AND SO ORDERED

ENVIRONMENTAL HEARING BOARD

s/ Bernard A. Labuskes, Jr.
BERNARD A. LABUSKES, JR.
Judge

DATED: August 10, 2017



COMMONWEALTH OF PENNSYLVANIA
ENVIRONMENTAL HEARING BOARD

CLEAN AIR COUNCIL, THE DELAWARE :
RIVERKEEPER NETWORK, AND :
MOUNTAIN WATERSHED ASSOCIATION, :
INC. :

v. :

EHB Docket No. 2017-009-L

COMMONWEALTH OF PENNSYLVANIA, :
DEPARTMENT OF ENVIRONMENTAL :
PROTECTION and SUNOCO PIPELINE, L.P., :
Permittee :

ORDER

AND NOW, this 25th day of July, 2017, following two conference calls during which the parties presented extensive argument in support of their respective positions, it is hereby ordered that the Appellants' application for a temporary partial supersedeas is **granted**. The permits that are the subject of this appeal are hereby superseded effective immediately to the extent they authorize the Permittee to conduct horizontal directional drilling. However, this Order may be modified in part if the Permittee provides the Board with detailed affidavits explaining why it would cause equipment damage, a safety issue, or more environmental harm than good to stop drilling at the 55 locations where drilling is actively underway. This temporary partial supersedeas shall expire at 9:00 a.m. on August 7, 2017, unless further extended by the Board. The hearing on the Appellants' petition for a partial supersedeas shall commence in the Board's Harrisburg hearing room on the date requested by the parties; namely, **9:00 a.m. on August 7, 2017.**



ENVIRONMENTAL HEARING BOARD

s/ Bernard A. Labuskes, Jr.
BERNARD A. LABUSKES, JR.
Judge

DATED: July 25, 2017

c: For the Commonwealth of PA, DEP:

William J. Gerlach, Esquire
Gail Guenther, Esquire
Margaret O. Murphy, Esquire
Curtis C. Sullivan, Esquire
Nels J. Taber, Esquire
(*via electronic filing system*)

For Appellant, Clean Air Council:

Alexander G. Bomstein, Esquire
Kathryn L. Urbanowicz, Esquire
Joseph O. Minott, Esquire
(*via electronic filing system*)

For Appellant, Delaware Riverkeeper Network:

Aaron J. Stemplewicz, Esquire
(*via electronic filing system*)

For Appellant, Mountain Watershed Association, Inc.:

Melissa Marshall, Esquire
(*via electronic filing system*)

For Permittee:

Robert D. Fox, Esquire
Neil S. Witkes, Esquire
Diana A. Silva, Esquire
Jonathan E. Rinde, Esquire
Terry R. Bossert, Esquire
(*via electronic filing system*)

Court Reporter:

Premier Reporting, LLC
(*via electronic mail*)



COMMONWEALTH OF PENNSYLVANIA
ENVIRONMENTAL HEARING BOARD

CLEAN AIR COUNCIL, THE DELAWARE :
RIVERKEEPER NETWORK, AND :
MOUNTAIN WATERSHED ASSOCIATION, :
INC. :

v. :

EHB Docket No. 2017-009-L

COMMONWEALTH OF PENNSYLVANIA, :
DEPARTMENT OF ENVIRONMENTAL :
PROTECTION and SUNOCO PIPELINE, L.P., :
Permittee :

ORDER

AND NOW, this 28th day of July, 2017, in consideration of the Permittee’s emergency motion to modify our July 25, 2017 Order and the affidavit submitted in support thereof, and the Appellants’ response in opposition to the Permittee’s motion, which also included an affidavit, it is hereby ordered that the motion is granted in part. The temporary partial supersedeas imposed by our previous Order of July 25, 2017 is lifted with respect to the following three horizontal directional drilling locations as identified in the Permittee’s motion:

- The HDD at Harrisburg Pike in Cumberland County, where the only drilling work to be completed as of July 25, 2017 was the final cleaning ream
- The HDD at Wetland 161 in Lebanon County, where the reamed hole was 95 percent completed
- The HDD at Creek 110 in Lebanon County, where 1,500 feet of the total hole of 1,527 feet (98 percent) of the reamed hole was completed

The Board takes the Permittee’s motion with respect to the other 14 locations listed in the motion under advisement.



ENVIRONMENTAL HEARING BOARD

s/ Bernard A. Labuskes, Jr.
BERNARD A. LABUSKES, JR.
Judge

DATED: July 28, 2017

c: For the Commonwealth of PA, DEP:

William J. Gerlach, Esquire
Gail Guenther, Esquire
Margaret O. Murphy, Esquire
Curtis C. Sullivan, Esquire
Nels J. Taber, Esquire
(*via electronic filing system*)

For Appellant, Clean Air Council:

Alexander G. Bomstein, Esquire
Kathryn L. Urbanowicz, Esquire
Joseph O. Minott, Esquire
(*via electronic filing system*)

For Appellant, Delaware Riverkeeper Network:

Aaron J. Stemplewicz, Esquire
(*via electronic filing system*)

For Appellant, Mountain Watershed Association, Inc.:

Melissa Marshall, Esquire
(*via electronic filing system*)

For Permittee:

Robert D. Fox, Esquire
Neil S. Witkes, Esquire
Diana A. Silva, Esquire
Jonathan E. Rinde, Esquire
Terry R. Bossert, Esquire
(*via electronic filing system*)



COMMONWEALTH OF PENNSYLVANIA
ENVIRONMENTAL HEARING BOARD

CLEAN AIR COUNCIL, THE DELAWARE :
RIVERKEEPER NETWORK, AND :
MOUNTAIN WATERSHED ASSOCIATION, :
INC. :

v. :

EHB Docket No. 2017-009-L

COMMONWEALTH OF PENNSYLVANIA, :
DEPARTMENT OF ENVIRONMENTAL :
PROTECTION and SUNOCO PIPELINE, L.P., :
Permittee :

ORDER

AND NOW, this 1st day of August, 2017, in consideration of the Permittee's affidavit correcting certain information provided in its July 27, 2017 affidavit and seeking confirmation that it may resume drilling at the horizontal directional drilling locations subject to the Board's Order of July 28, 2017, it is hereby ordered that the temporary partial supersedeas continues to be lifted with respect to the following horizontal directional drilling locations as identified in the Permittee's affidavit:

- The HDD at Harrisburg Pike in Cumberland County, PA-CU-0136.0000-RD
- The HDD at Wetland S161 in Lancaster County, PA-LA-0014.0000-SR

ENVIRONMENTAL HEARING BOARD

s/ Bernard A. Labuskes, Jr. _____
BERNARD A. LABUSKES, JR.
Judge

DATED: August 1, 2017



c: For the Commonwealth of PA, DEP:

William J. Gerlach, Esquire
Gail Guenther, Esquire
Margaret O. Murphy, Esquire
Curtis C. Sullivan, Esquire
Nels J. Taber, Esquire
(via electronic filing system)

For Appellant, Clean Air Council:

Alexander G. Bomstein, Esquire
Kathryn L. Urbanowicz, Esquire
Joseph O. Minott, Esquire
(via electronic filing system)

For Appellant, Delaware Riverkeeper Network:

Aaron J. Stemplewicz, Esquire
(via electronic filing system)

For Appellant, Mountain Watershed Association, Inc.:

Melissa Marshall, Esquire
(via electronic filing system)

For Permittee:

Robert D. Fox, Esquire
Neil S. Witkes, Esquire
Diana A. Silva, Esquire
Jonathan E. Rinde, Esquire
Terry R. Bossert, Esquire
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COMMONWEALTH OF PENNSYLVANIA
ENVIRONMENTAL HEARING BOARD

CLEAN AIR COUNCIL, THE DELAWARE :
RIVERKEEPER NETWORK, AND :
MOUNTAIN WATERSHED ASSOCIATION, :
INC. :

v. :

EHB Docket No. 2017-009-L

COMMONWEALTH OF PENNSYLVANIA, :
DEPARTMENT OF ENVIRONMENTAL :
PROTECTION and SUNOCO PIPELINE, L.P., :
Permittee :

ORDER

AND NOW, this 3rd day of August, 2017, in further consideration of the Permittee's emergency motion to modify our July 25, 2017 Order, it is hereby ordered that the temporary partial supersedeas is lifted with respect to all horizontal directional drilling locations identified in the Permittee's motion, except for the HDD at Creek 110 in Lebanon County, PA-LE-0117.0000-WX.

ENVIRONMENTAL HEARING BOARD

s/ Bernard A. Labuskes, Jr.
BERNARD A. LABUSKES, JR.
Judge

DATED: August 3, 2017

c: For the Commonwealth of PA, DEP:
William J. Gerlach, Esquire
Gail Guenther, Esquire
Margaret O. Murphy, Esquire
Curtis C. Sullivan, Esquire
Nels J. Taber, Esquire
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EHB Docket No. 2017-009-L

Page 2

For Appellant, Clean Air Council:

Alexander G. Bomstein, Esquire

Kathryn L. Urbanowicz, Esquire

Joseph O. Minott, Esquire

(via electronic filing system)

For Appellant, Delaware Riverkeeper Network:

Aaron J. Stemplewicz, Esquire

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For Appellant, Mountain Watershed Association, Inc.:

Melissa Marshall, Esquire

(via electronic filing system)

For Permittee:

Robert D. Fox, Esquire

Neil S. Witkes, Esquire

Diana A. Silva, Esquire

Jonathan E. Rinde, Esquire

Terry R. Bossert, Esquire

(via electronic filing system)



COMMONWEALTH OF PENNSYLVANIA
ENVIRONMENTAL HEARING BOARD

CLEAN AIR COUNCIL, THE DELAWARE :
RIVERKEEPER NETWORK, AND :
MOUNTAIN WATERSHED ASSOCIATION, :
INC. :

v. :

EHB Docket No. 2017-009-L

COMMONWEALTH OF PENNSYLVANIA, :
DEPARTMENT OF ENVIRONMENTAL :
PROTECTION and SUNOCO PIPELINE, L.P., :
Permittee :

ORDER

AND NOW, this 4th day of August, 2017, except as otherwise provided in the Board's Orders of July 25, 2017, July 28, 2017, August, 1, 2017, and August 3, 2017, it is hereby ordered that the temporary partial supersedeas previously set to expire at 9:00 a.m. on August 7, 2017 shall now expire at **9:00 a.m. on August 9, 2017.**

ENVIRONMENTAL HEARING BOARD

s/ Bernard A. Labuskes, Jr.

BERNARD A. LABUSKES, JR.

Judge

DATED: August 4, 2017

c: For the Commonwealth of PA, DEP:
William J. Gerlach, Esquire
Gail Guenther, Esquire
Margaret O. Murphy, Esquire
Curtis C. Sullivan, Esquire
Nels J. Taber, Esquire
(via electronic filing system)



For Appellant, Clean Air Council:

Alexander G. Bomstein, Esquire
Kathryn L. Urbanowicz, Esquire
Joseph O. Minott, Esquire
(via electronic filing system)

For Appellant, Delaware Riverkeeper Network:

Aaron J. Stemplewicz, Esquire
(via electronic filing system)

For Appellant, Mountain Watershed Association, Inc.:

Melissa Marshall, Esquire
(via electronic filing system)

For Permittee:

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Neil S. Witkes, Esquire
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**Ex. 2 -Horizontal Directional Drills For Design Review
Sunoco Mariner 2 Project**

SPLP 53



Factors For Selecting These HDDs

Sunoco considered a variety of screening factors in identifying HDDs for reevaluation. No one factor was dispositive. These factors included proximity to public and private water supplies, proximity to natural features (e.g. streams and wetlands) and the value of those natural features, proximity to man-made features (e.g. underground utilities and pipelines, railroad crossings), known impacts to rock from historic blasting, geologic conditions, depth of cover, and occurrence of inadvertent returns. In addition to these HDDs that will undergo reevaluation, Sunoco is reevaluating every HDD for the 16 inch line where there was an IR on the HDD for the proximate 20 inch line. In three cases there was an IR on the HDD for the 16 inch line and Sunoco will reevaluate the proximate 20 inch line for that HDD.

Data Review to Perform

In re-evaluating the design of the HDD techniques for the HDDs, Sunoco shall:

- (1) Re-examine the geology at each site using information and data gathered during HDD operations at that and other sites during construction of the pipeline subject to the permits in this Appeal.
- (2) Consider data that is specific to the needs of each HDD being reevaluated, including at a specific HDD, geologic strength at profile depth, overburden strength, HDD depth, entry angle, pipe stress radius, open cut alternatives, a re-route analysis for all HDDs (including those on this Exhibit) and analysis of well production zones.
- (3) Conduct, as appropriate, additional geotechnical evaluation at each site using techniques generally recognized within the scientific community which may include: (i) Additional field drilling and sampling; (ii) Seismic surveys; (iii) Ground penetrating radar; and (iv) electromagnetic surveys/electrical resistivity tomography.
- (4) In karst areas, Sunoco shall consider the use of seismic surveys and electromagnetic surveys/electrical resistivity tomography for the re-evaluation undertaken pursuant to this Order, and if it does not use these methodologies, it will provide the Department with an explanation for why they were not used at that site.

Construction					
	Spread	HDD Name	HDD #	PADEP 105 Permit HDD #	County
1	Spread 1	Wheeling and Lake Erie RR	S1B-0120	PA-WA-0171.0000-RR (20")	Washington
2	Spread 1	Gombach Road	S1B-0260	PA-WM1-0111.0000-RD (20")	Westmoreland
3	Spread 1	Hildebrand Road	S1B-0190	PA-WM1-0023.0000-RD (20")	Westmoreland
4	Spread 1	Norfolk Southern	S1B-0250	PA-WM1-0088.0000-RR (20")	Westmoreland
5	Spread 2	Goldfinch Lane	S2-0069	PA-CA-0016.0000-RD (20" &16")	Cambria
6	Spread 2	William Penn Ave (Route 271)	S2-0070	PA-CA-0023.0000-RD (20" &16")	Cambria
7	Spread 2	Wetland C-17	S2-0075	PA-CA-0047.0000-SR (20" &16")	Cambria
8	Spread 2	Spinner Road	S2-0080	PA-CA-0069.0000-RD (20" &16")	Cambria
9	Spread 3	Piney Creek	S2-0142	PA-BL-0126.0000-RD (20")	Blair
10	Spread 3	Juniata River	S2-0140	PA-BL-0122.0000-WX (20" &16")	Blair
11	Spread 3	Aughwick Creek	S2-0153	PA-HU-0078.0000-WX (20")	Huntingdon

**Ex. 2 -Horizontal Directional Drills For Design Review
Sunoco Mariner 2 Project**

SPLP 53



Construction		HDD Name	HDD #	PADEP 105 Permit HDD #	County
Spread					
12	Spread 3	Horse Valley	S2-0157	PA-PE-0002.0000-RD (20" &16")	Perry
13	Spread 4	Creek Rd	S2-0181	PA-CU-0125.0001-WX (20" &16")	Cumberland
14	Spread 4	Yellow Breeches Creek	S2-0250	PA-CU-0203.0000-WX (20" &16")	Cumberland
15	Spread 5	Wetland J-47	S3-0090	PA-LE-0001.0000-SR (20" &16")	Lebanon
16	Spread 5	Route 897	S3-0170	PA-LA-0024.0000-RD (20" &16")	Lancaster
17	Spread 6	N. Pottstown Pike	S3-0370	PA-CH-0212.0000-RD (20" &16")	Chester
18	Spread 6	Swedesford Rd	S3-0381	PA-CH-0219.0000-RD (20" &16")	Chester
19	Spread 6	Chester Rd	S3-0541	PA-CH-0421.0000-RD (20" &16")	Chester
20	Spread 6	Gradyville Rd	S3-0580	PA-DE-0032.0000-RD (20" &16")	Delaware
21	Spread 6	Valley Rd	S3-0591	PA-DE-0046.0000-RD (20" &16")	Delaware
22	Spread 6	Devon Dr. - Shoen Rd.	S3-0360	PA-CH-0199.0000-RD (16")	Chester
23	Spread 6	Eagleview Blvd.	S3-0321	PA-CH-0135.0000-RD (16")	Chester
24	Spread 5	Joanna Road	S3-0250	PA-BR-0181.0000-RD (20" & 16")	Berks
25	Spread 6	Bow Tree Drive	S3-0520	PA-CH-0413.0000-RD (20")	Chester

Ex. 3 - HDDs for Reevaluation



	Construciton Spread	Drill Name	HDD #	PADEP 105 Permit HDD #	First HDD Pipe Diameter	Second HDD Pipe Diameter
1	2	Loyalhanna Lake	S2-0010	PA-WM2-0064.0000-WX	20	16
2	2	Livermore Rd	S2-0016	PA-WM2-0093.0000-RD	20	16
3	2	Kendall Rd/Norfolk Southern RR	S2-0040	PA-IN-0019.0000-RR	20	16
4	3	Old US 220	S2-0109	PA-BL-0001.0027-RD	20	16
5	3	Everett RR	S2-0121	PA-BL-0001.0048-RR	20	16
6	3	Piney Creek	S2-0142	PA-BL-0126.0000-RD	20	16
7	3	Aughwick Creek	S2-0153	PA-HU-0078.0000-WX	20	16
8	4	Letorte Springs Run	S2-0210	PA-CU-0136.0002-WX	20	16
9	4	I-81	S2-0220	PA-CU-0136.0003-RD	20	16
10	4	Hwy 15	S2-0247	PA-CU-0176.0019-RD	20	16
11	4	Lewisberry Road	S2-0260	PA-YO-0016.0000-RD	20	16
12	5	Laural Lane	S3-0091	PA-LE-0005.0000-RD	20	16
13	5	T307 & Creek S-C86	S3-0110	PA-LE-0117.0000-WX	20	16
14	5	Wetland K32 & S-K35	S3-0111	PA-LA-0004.0000-SR	20	16
15	5	Wetland A54 & A55	S3-0161	PA-LA-0014.0000-SR	20	16
16	5	Hwy 222	S3-0200	PA-BR-0075.0000-RD	20	16
17	6	Milford Rd. S3-0290	S3-0290	PA-CH-0100.0000-RD	20	16
18	6	Wetland C43 - Park Road S3-0300	S3-0300	PA-CH-0111.0000-RD	20	16
19	6	Bow Tree Dr. S3-0520	S3-0520	PA-CH-0413.0000-RD	20	16
20	6	Glen Riddle/SEPTA S3-0620 (16")	S3-0620	PA-DE-0100.0000-RR	16	20
21	6	Chester Creek (Gun Club) S3-0631 (16")	S3-0631	PA-DE-0104.0008-WX	16	20
22	6	Commerce Drive S3-0670 (16")	S3-0670	PA-DE-0104.0023-RR	16	20



Ex. 4					
	Spread	Drill Name	HDD #	PADEP 105 Permit HDD #	Diameter
1	Spread 1	LINDEN ROAD	S1B-0080	PA-WA-0119.0000-RD	20
2	Spread 1	WHEELING AND LAKE ERIE RR	S1B-0120	PA-WA-0171.0000-RR	20
3	Spread 3	Old US 220	S2-0109	PA-BL-0001.0027-RD	20
4	Spread 3	Everett RR	S2-0121	PA-BL-0001.0048-RR	20
5	Spread 3	Piney Creek	S2-0142	PA-BL-0126.0000-RD	20
6	Spread 3	Aughwick Creek	S2-0153	PA-HU-0078.0000-WX	20
7	Spread 4	Letorte Springs Run	S2-0210	PA-CU-0136.0002-WX	20
8	Spread 4	I-81	S2-0220	PA-CU-0136.0003-RD	20
9	Spread 4	Hwy 15	S2-0247	PA-CU-0176.0019-RD	20
10	Spread 4	Lewisberry Road	S2-0260	PA-YO-0016.0000-RD	20
11	Spread 5	Laural Lane	S3-0091	PA-LE-0005.0000-RD	20
12	Spread 5	T307 & Creek S-C86	S3-0110	PA-LE-0117.0000-WX	20
13	Spread 5	Hwy 222	S3-0200	PA-BR-0075.0000-RD	20
14	Spread 6	Milford Rd.	S3-0290	PA-CH-0100.0000-RD	20
15	Spread 6	Wetland C43 - Park Road	S3-0300	PA-CH-0111.0000-RD	20
16	Spread 6	Bow Tree Dr.	S3-0520	PA-CH-0413.0000-RD	20
17	Spread 6	Riddlewood Dr	S3-0620	PA-DE-0100.0000-RR	16



Ex. 5					
	Spread	Drill Name	HDD #	PADEP 105 Permit HDD #	Diameter
1	Spread 1	Norfolk RR	S1B-0250	PA-WM1-0088.0000-RR	20
2	Spread 1	Old William Penn	S1B-0270	PA-WM1-0144.0000-RD	20
3	Spread 2	Grange Hall Rd	S2-0064	PA-IN-0086.0000-RD	20
4	Spread 3	Raystown Lake	S2-0150	PA-HU-0020.0008-WX	20
5	Spread 4	Pipeline/Double Gap Rd	S2-0160	PA-CU-0015.0000-RD	20
6	Spread 4	Wildwood Road	S2-0180	PA-CU-0067.0000-RD	20
7	Spread 4	Appalachian Trail	S2-0230	PA-CU-0136.0012-RD	20
8	Spread 4	Arcona Rd, Lisburn Rd	S2-0249	PA-CU-0189.0000-RD	20
9	Spread 4	S Market Street	S2-0246	PA-CU-0174.0001-RD	20
10	Spread 4	Waltonville Road	S3-0080	PA-DA-0056.0000-RD	20
11	Spread 5	Peach Tree Lane	S3-0201	PA-BR-0079.0000-RD	20
12	Spread 5	Gebhart School Road	S3-0230	PA-BR-0138.0001-RD	20
13	Spread 5	Joanna Road	S3-0250	PA-BR-0181.0000-RD	20
14	Spread 6	Pennsylvania Drive	S3-0310	PA-CH-0124.0000-RD	20
15	Spread 6	Dairy Queen Parking Lot	S3-0331	PA-CH-0138.0000-RD	20
16	Spread 6	Devon Dr. - Shoem Rd.	S3-0360	PA-CH-0199.0000-RD	20
17	Spread 6	Exton Bypass	S3-0400	PA-CH-0256.0000-RR	20
18	Spread 6	Hollyview Ln.	S3-0421	PA-CH-0290.0000-RD	20
19	Spread 6	Greenhill Road	S3-0460	PA-CH-0326.0000-RD	20
20	Spread 6	Carriage Dr.	S3-0461	PA-CH-0326.0004-SR	20
21	Spread 6	Village Square Dr.	S3-0471	PA-CH-0326.0006-RD	20
22	Spread 6	Highway 23		PA-CH-0002.0000-RD	20



EXHIBIT 5



**HORIZONTAL DIRECTIONAL DRILL ANALYSIS
LITTLE CONESTOGA ROAD CROSSING
PADEP SECTION 105 PERMIT NO.: E15-862
PA-CH-0100.0000-RD
(SPLP HDD# S3-0290)**



**HORIZONTAL DIRECTIONAL DRILL ANALYSIS
LITTLE CONESTOGA ROAD CROSSING
PADEP SECTION 105 PERMIT NO.: E15-862
PA-CH-0100.0000-RD
(SPLP HDD# S3-0290)**

This reanalysis of the horizontal directional drill (HDD) installation of a 20-inch diameter pipeline that traverses Little Conestoga Road in Upper Uwchlan Township, Chester County, Pennsylvania is in accordance with the Stipulated Order issued under Environmental Hearing Board Docket No. 2017-009-L for HDDs listed on Exhibit 3 of the Stipulated Order.

The installation of the 16-inch diameter pipeline using HDD was initiated before the temporary injunction issued by the Pennsylvania Department of Environmental Protection (PADEP) Environmental Hearing Board on July 25, 2017. The 16-inch HDD had an inadvertent return (IR) on the installation of the first pipe (16-inch) and therefore, the installation of the second pipe (20-inch) requires reanalysis. The IRs associated with the HDD of the 16-inch pipe were fully remediated and the HDD of the 16-inch pipe was completed.

The 20-inch pipe HDD is referred to herein as HDD S3-0290.

PIPE INFORMATION

20-Inch: 0.456 wall thickness; X-65

Pipe stress allowances are an integral part of the design calculations performed for each HDD. Characteristics of the redesigned HDD and stress allowances are provided in Horizontal Directional Drill Redesign section at the end of this report.

ORIGINAL HORIZONTAL DIRECTIONAL DRILL DESIGN SUMMARY: 20-INCH

- Horizontal length: 2,564 feet (ft)
- Entry/Exit angle: 10 degrees and 14 degrees
- Maximum depth of cover: 170 ft
- Maximum depth of cover under wetland H17: 70 ft
- Maximum depth of cover under stream S-H11: 46 ft
- Pipe design radius: 2,200 ft

ROOT CAUSE ANALYSIS FOR THE 20-INCH PIPE INSTALLATION IR

The occurrence of the IR events during the installation of the 16-inch pipe at S3-0290 occurred near the southeast entry/exit where the overburden is thin relative to the HDD profile. The HDD was approximately 50-60 feet below ground surface at the time of the IRs. The geophysical study revealed a zone of fractured weathered bedrock in the same area as the two IRs. The increased drilling fluid pressure to maintain returns to the point of entry and shallow profile associated with HDD entry/exit, within the weathered/fractured bedrock, are the contributing factors to the occurrence of the IRs near the entry/exit of S3-0290. The IR information presented graphically on Figures 1 and 2 in Attachment 2 presents the plan and cross section views of IR events occurring during installation of the 16-inch pipe. This figure presents the dates and locations of IRs occurring during this HDD in relation to the tool location in the profile and allows for correlation to geologic monitoring data collected by the geologists during active drilling. In addition, Section 3.0 of the HDD Hydrogeologic Reevaluation Report included as Attachment 1 provides additional details concerning dates, locations, and geologic conditions associated with IRs and losses of circulation (LOCs) experienced during installation of the 16-inch pipe. SPLP utilized all the foregoing information obtained during installation of the 16-inch pipe in the assessment of construction alternatives and the proposed revisions to the 20-inch HDD profile.



**HORIZONTAL DIRECTIONAL DRILL ANALYSIS
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GEOLOGIC ANALYSIS

HDD S3-0290 is in southeastern Pennsylvania within the Piedmont Physiographic Province, Piedmont Upland Section. Broad, rounded to flat-topped hills and shallow valleys with low to moderate topographic relief, characterizes the Piedmont Uplands Section. The geology of this region is generally comprised of meta-igneous and metasedimentary rocks (gneiss and schist) of Proterozoic to Early- to Mid-Paleozoic age that have been severely folded and fractured. Rolling rounded and flat-topped hills and shallow valleys characterize the area of HDD S3-0290. Based on published mapping, the majority of the HDD bore profile passes through graphitic gneiss (referred to as the Pickering Gneiss), with the northwest end of the HDD passing through a metadiabase.

Based upon the data obtained from vertical geotech bores at both ends of the HDD, the HDD profile will pass through overburden and weathered bedrock until achieving 50 ft of depth below ground surface (bgs). From 50 to 100 ft of depth bgs, bedrock consistency improves with core recoveries generally near or at 100%, but bedrock strength is variable, with RQD values ranging from 0 to 100. The maximum profile depth is at an elevation of 278 ft; which correlates to -216 ft on the west end geotech core, and -103 ft on the east end geotech core. Based on the geotech data the horizontal run of the HDD will be a minimum of 30 ft below the top of a bedrock zone having 100% recovery values, with RQD values ranging from 20 – 100.

The geophysical survey data indicates potential fracture zones crossing the HDD alignment at a frequency of approximately one every 100 to 200 feet in the northwestern part of the alignment, with a greater density (generally one every 50 to 100 feet in the southeastern part of the alignment; however, data recovery to profile depth was limited to the eastern 300 ft of the revised HDD profile. The IRs discussed above occurred adjacent to HDD stations 22+57 and 22+90 on the revised profile. At these locations, both the seismic refraction data profile and the electrical resistivity profile indicate a fracture zone; therefore, these areas will require enhanced monitoring efforts during the second drilling effort.

Attachment 1 provides an extensive discussion on the geology and the results of the geotechnical and geophysical investigations performed at this location.

HYDROGEOLOGY, GROUND WATER, AND WELL PRODUCTION ZONES

In general, groundwater flow proximal to HDD S3-0290 moves along gradients established by a water table surface that is a subdued reflection of the local topography. The alignment of HDD S3-0290 passes from the northwest to the southeast in the Marsh Creek Watershed with groundwater flow in the HDD bore alignment being towards Marsh Creek/Marsh Lake to the south and southwest.

Based on soil borings and borings advanced into bedrock, groundwater has been encountered in both the soil/weathered bedrock zone and bedrock, under water-table conditions. Groundwater aquifer recharge occurs vertically through the unconsolidated overburden materials and downward into the more competent bedrock horizon. The storage of groundwater and direction of groundwater flow in the more competent fractured bedrock is expected to occur in discontinuities (fractures) sometimes in zones of fracture concentration as indicated by mapped fracture traces.

A PAGWIS search of wells completed in gneissic bedrock in Uwchland and Upper Uwchlan Townships in Chester County was completed. The wells listed with recorded static water levels, had water levels ranging from 4 to 170 ft bgs with an average of 36 ft-bgs. The published median well yield for the graphitic gneiss is typically 10 gallons per minute (gpm) or less; wells can have potential yields of 35 gpm from wells properly sited and developed. The PAGWIS search indicated a range in well yields from 0 to 200 gallons per minute with an average of 21 gallons per minute.



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(SPLP HDD# S3-0290)**

As discussed below in the Adjacent Features section, most residences in the area of this HDD appear to be on public water.

Attachment 1 provides a discussion on the hydrogeology and results of the geotechnical investigation performed at this location.

ADJACENT FEATURES ANALYSIS

The crossing of Little Conestoga Road is located in Uwchlan Township in Chester County, approximately 11.8 miles (mi) south of the community of Pottstown, and approximately 30.2 mi northwest of Philadelphia, Pennsylvania.

The pipeline route utilizes an existing SPLP pipeline easement from the north side of the intersection of Milford Road with Little Conestoga Road to approximately 800 ft southeast of Highview Road. This HDD is set under Little Conestoga Road, Milford Road, an existing SPLP pump station, three driveways within a residential development, various utilities (overhead electric lines and underground utilities, including water lines, telephone lines, and a storm sewer line) situated immediately adjacent and parallel to or crossing perpendicular to the easement, Highview Road, one wetland, and two streams. Wetland H17 is comprised of palustrine emergent and forested cover types. Both streams (streams S-H11 and S-H10) drain to a Chapter 93 designated high quality stream, Marsh Creek that is stocked with trout. The presence of these features necessitated the HDD to avoid effects on: public infrastructure; utilities; residences; two high quality streams and their floodways; and one wetland, including its forested components.

SPLP has identified all landowners with property located within 450 ft of the HDD alignment. SPLP sent each of these landowners a notice letter via both certified and first class mail that included an offer to sample the landowner's private water supply/well in accordance with the terms of the Order and the Water Supply Assessment, Preparedness, Prevention and Contingency Plan. The letter also requested that each landowner contact the Project Right-of-Way agent for the local area and provide SPLP with information regarding: (1) whether the landowner has a well; (2) where that well is located, and its depth and size if known; and (3) whether the landowner would like to have the well sampled. In accordance with paragraph 10 of the Order, copies of the certified mail receipts for the letters sent to landowners have been provided to Karyn Yordy, Executive Assistant, and Office of Programs at PADEP's Central Office.

SPLP's public outreach results indicated the presence of one (1) water well within 450 ft of the proposed HDD. A second well (WL-09052017-613-02) was located beyond the 450-foot search zone, at 565 feet from the alignment. A depiction of the identified private water well and those with public water service is provided in Attachment 2.

There were no water well impact complaints during the installation of the 16-inch pipeline, therefore, it is expected that neither water well will be impacted by the installation of the 20-inch pipeline.

ALTERNATIVES ANALYSIS

As required by the Order, the reanalysis of HDD S3-0300-20 includes an evaluation of open cut alternatives and a re-route analysis. As part of the Pennsylvania Department of Environmental Protection (PADEP) Chapter 105 permit process for the Mariner II East Project, SPLP developed and submitted for review a project-wide Alternatives Analysis. During the development and siting of the Project, SPLP considered several different routings, locations, and designs to determine whether there was a practicable alternative to the proposed impact. SPLP performed this determination through a sequential review of routes and design techniques, which concluded with an alternative that has the least environmental impacts, taking into consideration cost, existing technology, and logistics.



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The HDD as permitted is an alternative plan of installation to a conventional open trench construction plan to avoid direct impacts to two streams, their associated floodways and forested wetland riparian areas, wetland H17, parallel and conflicting utilities, public infrastructure (Little Conestoga Road, Milford Road, and Highview Road), and several residences.

Alteration of the current permitted route and plans for installation would require major modifications of the state Chapter 102 and Chapter 105 permits, and authorization issued by the U.S. Army Corps of Engineers.

Open-cut Analysis

During the Pennsylvania Department of Environmental Protection (PADEP) Chapter 105 permit process for the Pennsylvania Pipeline Project, SPLP created and submitted for review a project-wide alternatives analysis. The baseline route provided for the pipeline construction to cross every wetland and stream on the project by open trench construction procedures. The alternatives analysis submitted to PADEP conceptually analyzed the feasibility of any alternative to trenched resource crossings (e.g., reroute, bore, HDD). The decision making processes for switching from an open cut to HDD is discussed thoroughly in the submitted alternatives analysis and was an important part of the overall PADEP approval of HDD plans as currently permitted. Where HDDs are planned and received PADEP Chapter 105 and 102 authorizations, they have already been evaluated to be the preferred alternative based on several variables that led the SPLP and PADEP to believe there would be less impacts on the environment in general, and aquatic and upland natural resources specifically, if these resources were drilled rather than trenched.

Considering the location of adjacent features and existing utilities, an excavation of sufficient size to accommodate an open trench construction method could result in disturbances to adjacent residences and damages and disruption to service on existing utility lines and public infrastructure (e.g., Little Conestoga Road, Milford Road, and Highview Road). Additionally, use of conventional open-cut would directly affect 304.5 square feet of state water bottoms, 0.258 acre of floodway, and 0.219 acre of wetlands, including conversion of 0.040 acre of forested wetlands.

Conventional Auger Bore Analysis

Planning for a conventional bore must account for the extent or width of the feature (road, stream, etc.) being bored under, as well as the length and width of the setup-entry pit for setting the boring equipment within while operating, and the receiving pit through which the product pipeline is pulled back through after the boring machinery exits.

Based on experience gained during construction of the Mariner II Pipeline project, conventional auger bores should be limited to approximately 200 linear foot at a time, or less, varying by the underlying substrate. Conventional auger bores for the 16 and 20-inch pipelines, attempted at longer distances, have at times had alignment drift and elevation deflections which have complicated installation. Drift and deflection are safety concerns when boring adjacent to in-service pipelines and other utilities.

The western 1,900 ft of the proposed HDD crosses two public roads and avoids surface disturbance within and adjacent to six (6) residential home sites. This length exceeds the technical limits of performance by a conventional auger bore.

FlexBor Analysis

SPLP contractors attempted three (3) FlexBors and partially completed two of these to replace HDDs on the Mariner Project. One FlexBor failed in the pilot phase and was replaced with a conventional bore under a highway and open cut construction. The two partially successful FlexBors completed the pilot phases, but both had difficulties completing the reaming phase. SPLP's analysis is that this technology is not perfected for larger diameter bore attempts.



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Direct Pipe Bore Analysis

The direct pipe bore method is also known as "microtunneling". This method of pipeline installation is a remote-controlled, continuously supported pipe jacking method. During the direct pipe installation, operations are managed by an operator in an above-ground control room alongside of the installation pit. Rock and soil cutting and removal occurs by drilling fluid injection through the cutting tool during rotation at the face of the bore, and the cuttings are forced into inlet holes in the crushing cone at the tool face for circulation to a recycling plant through a closed system. The entire operating system for this method of pipeline installation, including the cutting tool drive hydraulics, fluid injection, fluid return, and operating controls are enclosed inside the outside diameter bore pipe (or casing pipe) being installed. At the launching point/entry pit, the bore pipe is attached to a "jacking block" that hammers the bore pipe while the tool is cutting through the substrate or geology. The cutting tool face is marginally larger in diameter than the pipe it is attached to. As a result, there is minimal annulus space, which minimizes the potential for drilling fluid returns or the production of groundwater returning back to the point of entry.

SPLP's construction contractors have successfully completed one (1) Direct Pipe Bore approximately 925 ft on the PPP. The western portion of the proposed HDD extends approximately 1,900 ft to cross two public roads and avoid surface disturbance within and adjacent to six (6) residential home sites. This length of crossing is longer than our contractors are willing to attempt using this construction method.

Re-Route Analysis

The general route of the Pennsylvania Pipeline Project in this area of the state generally proceeds from the northwest to the southeast. There are no nearby existing utility corridors that can be considered as possible alternative routes.

No practicable re-route option lies to the south of the proposed route. Marsh Creek Reservoir occurs south of the project route, and attempting to route around the lake would induce a reroute of the entire project many miles in extent, and would require establishing a Greenfield utility corridor. Compared to this proposed HDD which is only 2,660 ft in extent, a hypothetical Greenfield route would affect many previously unencumbered properties; would increase the number and extent of Waters of the Commonwealth to be crossed; result increased clearing of forested habitats; and would place the pipeline in near proximity to many residential home sites.

A 1.01 mile reroute to the north of the HDD is technically feasible. This would entail adjusting the project route prior to this HDD's northwest entry/exit point to proceed north, cross under the Pennsylvania Turnpike, then proceed east for 0.7 miles parallel to the turnpike, cross Little Conestoga Road, then turn south, cross under the turnpike, and then re-intersect the existing project route just east of this HDD's southeast entry/exit point. There is no existing utility corridor here, however; therefore, this route would create a Greenfield utility corridor and would result in encumbering previously unaffected properties. The route would still cross two Waters of the Commonwealth and possible forested wetlands, and would pass in near proximity or immediately adjacent to five residential home sites. Both crossings of the turnpike would require "mini" HDD's or direct pipe bores to achieve the required depth of cover under the highway. Considered against the possibility of additional IR's occurring on the proposed HDD, which are readily contained and cleaned up with minimal affect to natural resources, the permanent taking of the new easement and likely need to use condemnation against previously unaffected landowners results in SPLP's opinion that managing the proposed HDD is the preferred option.



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HORIZONTAL DIRECTIONAL DRILL REDESIGN

SPLP has considered all geologic data and the results of the installation of the 16-inch pipeline and has made further adjustments to the plan of construction for the 20-inch pipeline to include a redesign of the 20-inch HDD. A summary of the redesign factors is provided below. The original and redesigned HDD plan and profile for the 20-inch pipeline are provided in Attachment 2.

Revised Horizontal Directional Drill Design Summary: 20-inch

- Horizontal length: 2,640 (ft)
- Entry/Exit angle: 16 – 18 degrees
- Maximum Depth of cover: 200 ft
- Pipe design radius: 2,400 ft

The HDD redesign is limited by presence of wetlands and streams adjacent to the southeast entry/exit point. These resources occur before and after the entry/exit, and if the profile were extended 500 ft further to the southeast, additional wetlands occur again before and after another possible entry/exit point. As a result, the profile cannot be redesigned to be constructed on the southeast end to avoid Waters of the Commonwealth above the profile while at shallow depths. The presence of these natural resources is a limiting factor to the profile redesign.

The northwest entry/exit point could be extended further to the northwest; however, the risk of IRs would not be reduced by this change.

The entry and exit angles have been maximized to the drilling rigs maximum adjustment level, and the allowable breakover stress radius to tie-in the HDD pipeline pull segment to the conventionally laid pipe. The northwest entry/exit angle exceeds the breakover stress allowance of the pipeline, which will be managed by digging down the pipeline trench at this location and ramping it at an angle to the northwest to prevent exceeding the pipe's free stress tolerance, or a custom fabricated pipe bend will be welded at the tie-in

The entry and exit radius to the horizontal run of the profile at 2400 ft is well below the pipe stress allowance; however, adjusting either of these radii to a tighter curve; would result in increasing the entry/exit angles; which are already at or above allowable limits for equipment operations or pipe free stress curvature.

Since the root cause of the IRs as discussed above is identified as the shallow depth of cover while within overburden and weathered rock, the redesigned HDD profile has maximized the depth of cover below the prior IR locations as a preventative measure.

To correct the drilling pressures identified as contributing to the IR's on the 16-inch pipeline installation, the 20-inch pipeline will be drilled from east to west, or from low elevation to high elevation on the profile.

CONCLUSION

Based on the original and revised profile for the 20-inch HDD, the revised HDD profile increases the depth in bedrock for a majority of the HDD profile and increased the depth of profile an additional 34 ft at the location of the IRs occurring during installation of the 16-inch pipeline; therefore, adjustments to the plan of construction for the 20-inch pipeline represent a reduced risk of IRs. IRs are common on entry and exit of the drilling tool and other measures are required to minimize IR potential. Upon the start of this HDD, SPLP will employ the following HDD best management practices:



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- SPLP will mandate annular pressure monitoring during the drilling of the pilot hole, which assists in immediate identification of pressure changes indicative of loss of return flows or over pressurization of the annulus, to help manage development pressures that can induce an IR;
- SPLP inspectors will ensure that an appropriate diameter pilot tool, relative to the diameter of the drilling pipeline, is used to ensure adequate “annulus spacing” around the drilling pipeline exits to allow good return flows during the pilot drilling;
- SPLP will implement short-tripping of the reaming tools, as indicated by monitoring of return flows, to ensure an open annulus is maintained to manage the potential inducement of IRs;
- SPLP will require monitoring of the drilling fluid viscosity, such that fissures and fractures in the subsurface are sealed during the drilling process;
- During all drilling phases, the use of Loss Control Materials (LCMs) will be implemented upon detection of a LOC or indications of a potential IR are noted or an IR is observed. The use of LCMs, however, is less effective 70 ft-bgs. Accordingly, the preferred corrective action needed to address the presence of fractures or LOC at greater depths below ground will require grouting of the HDD annulus. Two types of grouting may be utilized for corrective actions to seal fractures. These are: 1) grouting using “neat cement”; and 2) grouting using a sand/cement mix. Neat cement grout is a slurry of Portland cement and water which is highly reactive to bentonite and induces solidification. The sand/cement grout mix is a slurry of mostly sand with a small percentage of Portland cement and activators that after setup results in a material having the competency of a friable sandstone or mortar. Both grouting actions require tripping out the drilling tool, and then tripping in with an open-ended drill stem to apply or inject the grout mixes. Either of these grouting actions may be implemented upon the first detection of an LOC with the selection of the treatment based upon the circumstances of the LOC, being small or large in magnitude.



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FEASIBILITY DETERMINATION

Based on the information reviewed by the Geotechnical Evaluation Leader, Professional Geologists, Professional Engineers, and HDD specialists, the HDD Reevaluation Team's opinion is that the proposed HDD design and implementation of the management measures contained within this re-evaluation report will minimize the risk of IRs.

Pertaining to Horizontal Directional Drilling Practices and Procedures; Conventional Construction Alternatives; and Environmental Effects

Larry J. Gremminger, CWB
Vice President – Environmental
Geotechnical Evaluation Leader
Mariner East 2 Pipeline Project

5/28/2019

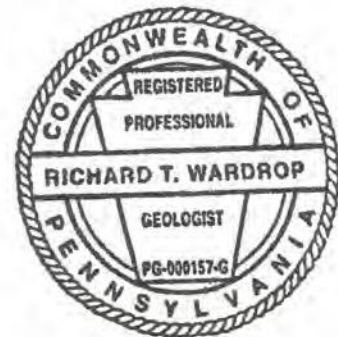
Date:

Pertaining to the practice of geology

Richard T. Wardrop, P.G.
License No. PG-000157-G
Groundwater & Environmental Services, Inc.
Lead Hydrogeologist

5/28/19

Date:



Pertaining to the pipeline stress and HDD geometry

Jeffrey A. Lowy, P.E.
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Civil Engineer

5/28/19

Date:



SPLP 53



**HORIZONTAL DIRECTIONAL DRILL ANALYSIS
LITTLE CONESTOGA ROAD CROSSING
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PA-CH-0100.0000-RD
(SPLP HDD# S3-0290)**

ATTACHMENT 1

GEOLOGY AND HYDROGEOLOGICAL EVALUATION REPORT

HDD HYDROGEOLOGIC REEVALUATION REPORT

**Mariner East II
Spread 6
HDD S3-0290-20
Milford Rd/Little Conestoga Rd
Upper Uwchlan Township, Chester County, Pennsylvania**

Prepared for:

Sunoco Pipeline, L.P.

Prepared by:

**Groundwater & Environmental Services, Inc.
440 Creamery Way, Suite 500
Exton, Pennsylvania 19341**

May 2019

HDD HYDROGEOLOGIC REEVALUTION REPORT

**Mariner East II
Spread 6
HDD S3-0290-20
Milford Rd/Little Conestoga Rd
Upper Uwchlan Township, Chester County, Pennsylvania**

May 2019

Prepared for:

**Sunoco Pipeline, L.P.
535 Fritztown Road
Sinking Spring, Pennsylvania 19608**

Prepared by:



Steven L. Tanen, P.G.
Principal Hydrogeologist

Reviewed by:



Richard T. Wardrop
Lead Hydrogeologist

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440 Creamery Way, Suite 500
Exton, Pennsylvania 19341
(610) 458-1077

By affixing my seal to this document, I am certifying that the geologic and hydrogeologic information is true and correct. I further certify I am licensed to practice in the Commonwealth of Pennsylvania and that it is within my professional expertise to verify the correctness of the information.

Richard T. Wardrop



May 27, 2019

Richard T. Wardrop, P. G.
Lic. No. PG000157G

Date

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1.0 INTRODUCTION

Sunoco Pipeline, L.P. (SPLP) retained Groundwater & Environmental Services, Inc. (GES) to prepare horizontal directional drill (HDD) Hydrogeologic Reevaluation Reports (HRRs) for certain HDDs associated with the Mariner East II pipeline project. This HRR has been prepared for HDD S3-0290 (the 20-inch HDD for this location), that is listed in Exhibit 3 of Stipulated Order EHB Docket No. 2017-009-L signed August 10, 2017.

The 16-inch pipeline at HDD-S3-0290 was pulled on November 21, 2017 without incident. It should be noted that the 16-inch line was installed along the originally planned alignment for the 20-inch line. The changeover for all active drilling locations in Spread 6, from the 20-inch line to the 16-inch line, was on November 1, 2017. The discussion presented in this report is based on a permitted plan and profile (P & P) developed by Tetra Tech/Rooney (Tetra Tech), revised on February 10, 2017 as compared to a proposed P & P revised March 14, 2019 (see **Attachment A**).

Figure 1 shows the location of the alignment for the 20-inch line at HDD S3-0290-16, with topographic information for the surrounding area.



Figure 1. Site Location Map (modified from USGS, revised 1999)

The 20-inch HDD will run from the undeveloped lot located on the west-northwest side of Milford Road to the southeast crossing the intersection of Milford Road and Little Conestoga Road, then cross under several residential properties, until exiting in cultivated fields to the southeast of Highview Road.

Drilling for the 16-inch line at HDD S3-0290 started at the northwest entry/exit on May 27, 2017, initially for the 20-inch pipeline. On November 1, 2017, a decision was made by SPLP to complete the bore for the installation of the 16-inch pipeline using the 20-inch profile. On June 24, 2017 while advancing the pilot, inadvertent returns (IRs) were observed in two general locations at P & P Station 22+57 between a pond and the wetland on a slope leading up to the pond, and a small spot in an unnamed stream within the wetlands (see **Attachment A**, proposed P & P). The IR was estimated to be 50 to 100 gallons. Drilling activity resumed on August 29, 2017 after a project-wide suspension of activity. Subsequently, a 40 to 50 gallon IR occurred in the wetlands along stream SH-11 at approximately Station 22+90 while mud was being circulated prior to enlarging the pilot hole with a reamer.

This HRR is based on geotechnical boring reports; field observations during HDD drilling for the installation of the 16-inch pipe; a geophysical survey, and the interpretation of published information. Tetra Tech in May 2015 and Terracon in September 2017 advanced geotechnical borings to facilitate HDD design. Note that GES did not oversee or direct either of the geotechnical boring programs, including but not limited to, the selection of the number and location of borings, the determination of surface elevations and target depths, observations of rock cores during drilling operations and the preparation of boring logs. In addition, GES did not provide any input to a geophysical study performed by Rettew & Associates (Rettew) in January 2019. GES relied on these reports and incorporated the information presented therein into the general geologic and hydrogeologic framework for this HRR.

As described in the Stipulated Order (pages 3 and 4), the HRRs will provide information to eliminate, reduce, or control the release or IR of HDD drilling fluids to the surface of the ground or impact to water supplies at the location during HDD operations. The HRRs are not intended to evaluate potential adverse effects on nearby man-made structures from HDD activities

This report presents the following information:

- Geologic and hydrogeologic characteristics in the area of the 20-inch line at HDD S3-0290;
- Summaries of studies performed pertinent to reevaluation, including fracture trace analysis, geotechnical borings; and the geophysical survey;
- A site conceptual model; and
- A reevaluation summary with conclusions and recommendations.

2.0 HDD GEOLOGY / HYDROGEOLOGY

2.1 Physiography

HDD S3-0290 is located in southeastern Pennsylvania within the Piedmont Physiographic Province, Piedmont Upland Section. Broad, rounded to flat-topped hills and shallow valleys with low to moderate topographic relief, characterizes the Piedmont Uplands Section. The geology of this region is generally comprised of meta-igneous and metasedimentary rocks (gneiss and schist) of Proterozoic to Early- to Mid-Paleozoic age that have been severely folded and fractured. Rolling rounded and flat-topped hills and shallow valleys characterize the area of HDD S3-0290. The area along the HDD bore alignment is comprised of a mix of residential properties and agricultural land.

2.1.1 Topography

Figure 1 shows the area around HDD S3-0290 to generally slope to the west-southwest with local lows (relatively shallow valleys) to the northwest and southeast that contain unnamed tributaries to Marsh Creek. The profile of the land surface over HDD S3-0290 slopes to the southeast with elevations decreasing from the northwest entry/exit, northwest of the intersection of Milford Road and Little Conestoga Road, to the southeast entry/exit point in cultivated land. The as-built profile for the 16-inch pipeline (provided in **Attachment A**) shows the northwest entry/exit point to be at elevation 493 feet above mean sea level (ft amsl), and the southeast entry/exit point at elevation 393 ft amsl. Therefore there is a 100 foot difference in elevation between the two entry / exit points.

2.1.2 Hydrology

HDD S3-0290 is located within the Marsh Creek Watershed that is part of the Brandywine Creek East Branch Watershed, all of which are located in the Delaware River Basin. The area defined by Marsh Creek Lake and surrounding tributaries is a regional groundwater discharge zone. The water table in the area is a subtle reflection of the surface topography and as such, groundwater flow is to the lake and south.

Starting at the southeast entry/exit the permitted P & P for S3-0290 (see **Attachment A**) shows the profile passing below a wetland (between Stations 21+95 and 23+50) and two small (less than six inches deep) branches to an unnamed tributary to Marsh Creek (Stations 22+75 and 23+20). A small pond is present approximately 50 feet northeast of the alignment in the area of HDD Station 22+00.

Similar to the permitted profile, on the proposed profile there is approximately 113 feet of surface elevation difference between the northwest entry/exit and the southeast entry/exit indicating the potential for a groundwater discharge at the southeast entry/exit when a pilot hole is drilled (see **Attachment A**).

2.2 Geology

2.2.1 Surface Soils

Surface soils along the HDD bore alignment were researched on the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey Site (USDA NRC WSS). At the northwest entry/exit, surficial soils have been mapped as the Gladstone gravelly loam on 3 to 8-percent slopes. The Gladstone-Parker gravelly loam on 15 to 25-percent slopes is mapped across the central portion of the HDD bore alignment. The surficial soils along the southeastern portion of the alignment consist of the Califon loam on 3 to 8-percent slopes and the Cokesbury silt loam on 0 to 3-percent slopes. The Califon loam and the Cokesbury silt loam are located in the area of the wetlands along the southeast part of the HDD alignment. Minor components of the Califon loam and the Cokesbury silt loam have been classified as hydric soils.

Ground surface elevations then increase after the HDD bore alignment passes through the wetlands and approach the southeast entry/exit. The entry/exit at the southeast end of the bore is located in cultivated land mapped as the Gladstone gravelly loam on 8 to 15-percent slopes and the Gladstone gravelly loam on 25 to 35-percent slopes.

Soils along HDD S3-0290 were characterized by five geotechnical borings, three drilled by Tetra Tech and two drilled by Terracon (see locations in **Attachment A**). The Tetra Tech borings were located near each entry/exit location with one additional boring was located approximately mid-way along the alignment. The Terracon borings were located at each of the entry/exit locations. Both Terracon borings were drilled well into bedrock, while one of the Tetra Tech (SB-02) was drilled five feet into bedrock.

Based on the geotechnical boring logs, topsoil thicknesses ranged from three-inches (at the northwest entry/exit) to twelve-inches (in the wetlands area approaching the southeast end of the alignment). The Tetra Tech borings were drilled to 30 feet below ground surface (ft bgs) in both the northwest and southeast borings, with soils from 8.0 ft bgs to boring completion being classified as decomposed rock. In the boring located near the center of the HDD bore alignment (SB-02), auger refusal was encountered at 7 ft bgs and then the bore was cored five additional feet into bedrock. The core consisted of decomposed rock described as a brown and gray silty, fine to medium, sand with gravel sized gneiss rock fragments.

2.2.2 Bedrock Lithology

Based on published mapping (see **Figure 2** and **Attachment A**, proposed profile), the majority of the HDD bore profile passes through graphitic gneiss (referred to as the Pickering Gneiss), with the northwest end of the HDD passing through a metadiabase (PaGEODE).

The geologic formations associated with HDD S3-0290 are described, as follow:

- **metadiabase (md):** a dark-greenish-gray to almost black diabase. Grain size is generally 0.5 to 1 mm. The rock consists of augite, feldspar, and magnetite. Much of it has been extensively altered. Feldspar is altered to sericite, and augite has been replaced by epidote and chlorite. It occurs as mostly thin dikes, but a few may be greater than 100 feet thick. It exhibits no banding (Geyer and Wilshusen, 1982).
- **graphitic gneiss (gg):** The graphitic felsic gneiss includes quartz, orthoclase, hornblende, biotite, graphite, and small areas of marble. It is light to medium gray. The graphite occurs as flakes 1 to 2 mm in diameter, somewhat larger than the usual grain size of the rock, and is disseminated throughout the gneiss. The unit is also referred to as the Pickering Gneiss (Hall, 1934). It has distinct and very common flaggy banding and is of sedimentary origin. Its thickness is unknown (Berg et al., 1980; Geyer and Wilshusen, 1982).



Figure 2. Local Bedrock Geology (from PaGEODE)

2.2.3 Structure

As a result of tectonic processes (folding with some diabase intrusions), the metamorphic rocks of Chester County are fractured and jointed, with some regional faulting. The geologic maps reviewed for this evaluation did not identify any mapped fault zones or other significant structural features along the HDD bore alignment, other than two geologic contacts; one within the alignment near the northwest entry/exit (the metadiabase / graphitic gneiss contact) and one southeast of the southeast entry/exit (the graphitic gneiss / Franklin Marble contact).

Statewide maps prepared by Berg et. al. (1980) show a northeast trending regional structural fabric across northern Chester County. Associated cross sections show the mapped formations steeply dipping to the southeast. Bedding orientations described for two historic graphite mines in the area indicate local bedrock trends N 85° E and dips 45° S (see Section 2.2.6).

Deformational fracture and jointing systems are prevalent throughout Pennsylvania. They can typically be orthogonal (90°) sets or conjugate (60°) sets which are systematic patterns usually related to folding and faulting. Commonly there are non-systematic orientations that are curvilinear and hook and fork into the systematic systems.

2.2.4 Fracture Trace Analysis

Fracture trace analysis using high altitude aerial photography was performed for the area of interest to identify potential zones of bedrock weakness along drill paths. Fracture traces (one mile in length or less) and lineaments (greater than one mile in length) are the surficial expression on natural landscapes of vertical to near vertical zones of bedrock fracture concentration. Fracture trace analysis is partly

subjective; therefore, every mapped fracture trace does not necessarily represent a zone of bedrock fracture concentration.

The baseline photography used for this Fracture Trace Analysis consisted of historic photographic stereo pairs from the US Department of Agriculture (USDA) and US Geological Survey (USGS), available through the Pennsylvania Imagery Navigator web site. The fracture trace analysis was based on a composite of interpretations for several 1937-1942 USDA (1-20,000) aerial photograph stereo pairs viewed with a Topcon MS-3 Stereo Scope and the traces observed were transferred to a single photo for further evaluation.

Figure 3 presents the fracture trace map prepared from the analysis. While the analysis identified several fracture traces in the area of the HDD, none intersected the HDD bore alignment.

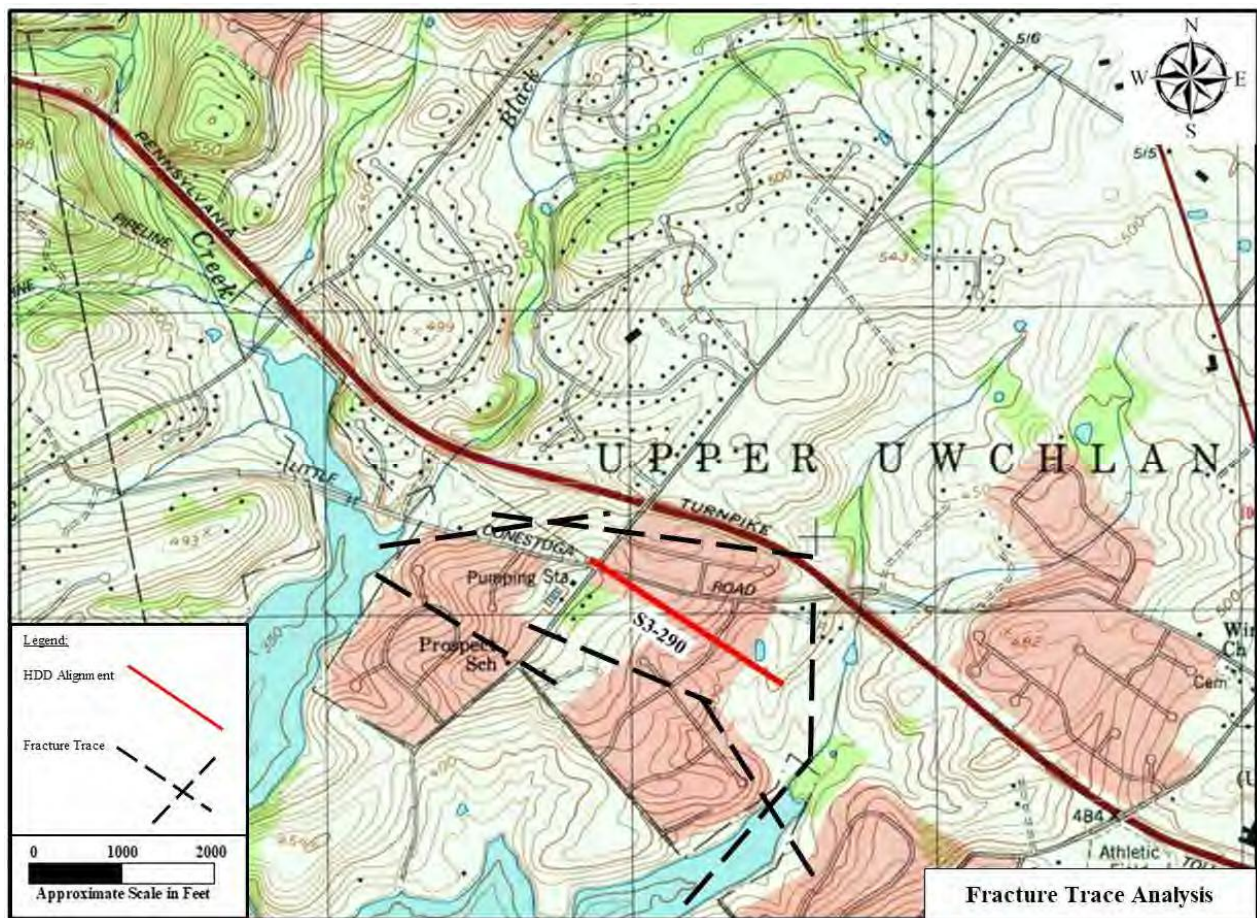


Figure 3. Fracture Trace Map (mod. USGS rev. 1999)

2.2.5 Karst

Geologic maps show the Franklin Marble to occur due southeast of the southeast entry/exit for HDD S3-0290. However, based on published geologic data, there are no known or mapped sinkholes in the area of the drill path (Kochanov, 1993; Kochanov and Reese, 2003), which is consistent with the mapped bedrock in the area directly under the alignment.

2.2.6 Mining

Based on a review of the Pennsylvania Mine Map Atlas and PADEP eMap PA web sites, there are no active subsurface mining or surface mining operations, or mining limits, at, or near, the HDD S3-0290 alignment.

Sloto (2009) discusses a series of historical graphite mines in Upper Uwchlan Township, as noted below:

- The Pettino Brothers graphite mine located approximately 1.9 miles to the east-southeast from the S3-290 southeast entry/exit. This mine operated in the 1880s until operations ceased in 1920. The mine included both open-pits and mine shafts.
- The Pennsylvania Graphite Company Mine located approximately 1.6 miles east of the S3-290 southeast entry/exit and operated from the late 1870s until circa 1920. Sloto notes that the graphite bearing beds were in a coarsely crystalline calcareous gneiss, micaceous gneiss, and marble striking N 85° E and dipping 45° SE, and the beds were reportedly cut by faults.
- The Acme Graphite Company Mine was located approximately one mile east-southeast from the S3-290 southeast entry/exit. The mine operated from the mid-1870s until 1910. The strike and dip of the beds in the mine were reported as N 85° E and 45° S. The mine included both open-pits and mine shafts.

In addition to the graphite mines, Sloto (2009) also discusses an open-pit iron mine located 200 feet west of Pennsylvania State Route 100 approximately one mile east-northeast from the S3-290 southeast entry/exit – the Beerbower Mine. The pit was filled in 2007 during local housing development activities.

The geologic map prepared by Bascom and Strose (1938) indicates that the mapped section of the Franklin Marble located southeast of the southeast entry/exit of the S3-0290 HDD bore alignment was once mined. However, additional research (review of Sloto, 2009 and historical aerial photographs), produced no information that would suggest any mining near the southeast entry/exit of the HDD bore alignment.

Since none of the mines listed above intersect or otherwise cross the S3-0290 20-inch HDD bore alignment, it is expected that historical mining features will not affect the installation of the 20-inch pipeline.

2.2.7 Rock Engineering Properties

Geyer and Wilshusen (1982) report the following with respect to the graphitic gneiss and metadiabase (diabase):

Graphitic gneiss

- Bedding: Banding is distinct and very common; bands are flaggy in thickness.
- Fracturing: Joints are the most common fractures; platy pattern; well developed; moderately to highly abundant; regular; moderately to closely spaced; open and steeply dipping to vertical.
- Weathering: Moderately resistant; deeply weathered; sometimes results in disintegration into very small rectangular fragments; overlying mantle is thick.
- Ease of excavation: Weathered portion may be excavated moderately easily; moderate drilling rate.

Diabase

- No bedding
- Joints / fractures are well developed in a blocky pattern, of moderate abundance, regularly spaced, with moderate spacing, open and steeply dipping.
- Difficult to excavate, large boulders can create difficulty, slow drilling rate.

2.2.8 Results of Geotechnical Borings

The locations of the geotechnical borings advanced for characterization of HDD S3-0290 are shown on the P & Ps in **Attachment A** and boring logs are provided in **Attachment B**.

Original Geotechnical Borings (Tetra Tech)

The Tetra Tech borings encountered a decomposed rock at depths of 8.0 ft bgs (SB-01), 7.0 ft bgs (SB-02) and 6.5 ft bgs (SB-03). The decomposed rock horizon (a completely weathered zone) consisted of a light brown, white and gray silty medium to fine sand with gravel sized gneiss rock fragments. A mottled brown and gray fine sandy silty clay was encountered between 1.0 and 6.5 ft bgs in SB-03 (located in the area of the wetlands and streams). Bedrock was cored at SB-02 from 7 to 12 ft bgs. The recovered core had an RQD of 20-percent and was described as a moderately to intensely fractured gray gneiss. The Rock Quality Designations (RQDs) indicated very poor rock quality (as defined by ASTM STP 984). Soil conditions regarding these borings was previously discussed in **Section 2.2.1**.

Recent Geotechnical Borings

Terracon drilled two (2) borings, one at each HDD S3-0290 entry/exit point in September 2017. The borings were generally located within 50 feet of the entry/exit points with B-21W located at the northwest entry/exit and B-21E located at the southeast entry/exit. Bedrock core recovery and RQD values with depth for each boring are presented on **Figure 4**.

Boring B-21W had a total depth of 237.5 feet. The bedrock cores consisted of felsic gneiss to approximately 150 ft bgs, after which it was described as being a mica gneiss. RQD and recovery values at B-21W indicated highly weathered and fractured (or poor rock quality) from approximately 15 to 35 ft bgs. The rock then became more competent with depth as recoveries were almost entirely 100 percent. However, RQD was highly variable, ranging from 20 to 100 percent, and higher RQD did not correlate with depth.

B-21E had a total depth of 145.5 feet. The bedrock cores consisted of highly fractured felsic gneiss, with a pegmatite intrusion between the depths of 75 ft bgs and 94.1 ft bgs, at which point the rock transitioned into more competent graphitic felsic gneiss. Recovery was poor until a depth of approximately 75 feet, after which the values were all 100 percent. RQD values indicated very poor rock quality to approximately 70 ft bgs, after which the rock quality was generally poor to fair, with the most competent bedrock zone (or good as described by ASTM) being from 80.5 ft bgs to 115.5 ft bgs; however, the RQD decreased again from 115.5 to the total depth of 145.5 feet.

2.3 Hydrogeology

In general, groundwater flow proximal to HDD S3-0290 moves along gradients established by a water table surface that is a subdued reflection of the local topography. The alignment of HDD S3-0290 passes from the northwest to the southeast in the Marsh Creek Watershed with groundwater flow in the area of the HDD bore alignment being towards Marsh Creek/Marsh Lake to the south and southwest.

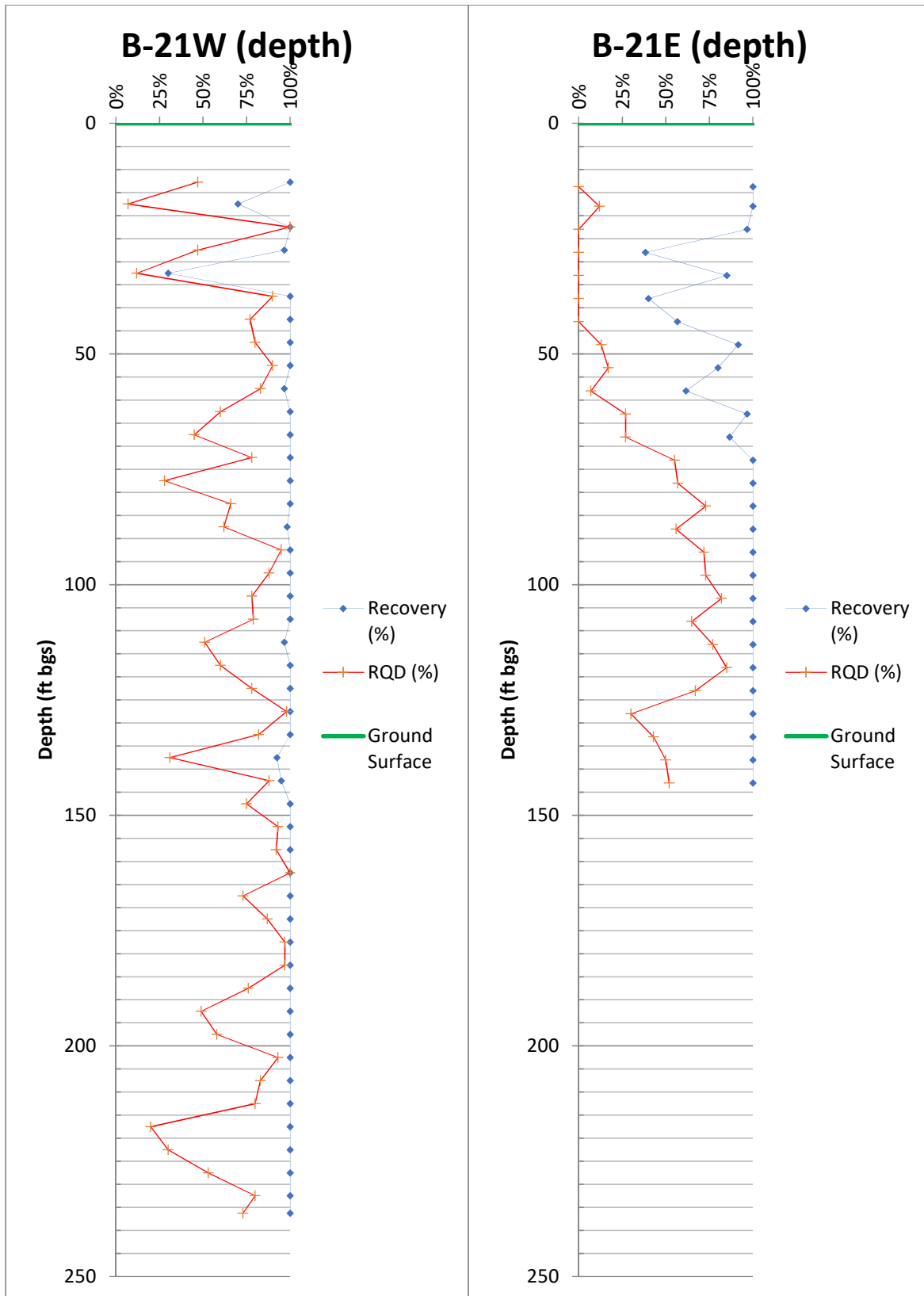


Figure 4. Recovery and RQD with Depth for Borings B-21W and B-21E

2.3.1 Occurrence of Groundwater

Based on soil borings and borings advanced into bedrock, groundwater has been encountered in both the soil/weathered bedrock zone and bedrock, under water-table conditions. Groundwater aquifer recharge occurs vertically through the unconsolidated overburden materials and downward into the more competent bedrock horizon. The storage of groundwater and direction of groundwater flow in the more competent fractured bedrock is expected to occur in discontinuities (fractures) sometimes in zones of fracture concentration as indicated by mapped fracture traces.

2.3.2 Groundwater Levels and HDD entry/exit elevations

A PAGWIS search of wells completed in gneissic bedrock in Uwchland and Upper Uwchlan Townships in Chester County. The wells listed with recorded static water levels had water levels ranging from 4 to 170 ft bgs with an average of 36 ft bgs. Groundwater level observations for the geotechnical borings are presented below:

- SB-03 (22+95 on proposed P & P): Groundwater was encountered at 16 ft bgs in a weathered silty medium to fine sand with gravel gneiss fragments classified as decomposed rock.
- B6-21W (located in the area of the northwest of northwest entry/exit): A water level measurement was recorded at 38 ft bgs in unweathered bedrock.
- B6-21E (located in the area of the southeast entry/exit): It was reported that groundwater was encountered from 15.0 to at 18.1 ft bgs in moderately to severely weathered bedrock.

The ground surface elevations decreases by approximately 107 feet from the highest point along the northwestern portion of the alignment to the southeast entry/exit. Given local water table depths as high as 15 ft bgs there is a potential for a groundwater discharge at the southeast entry/exit once the pilot bore is complete. During the drilling for the 16-inch line, there was no groundwater discharge observed at either entry/exit; however, following the installation of the 16-inch pipeline, an ongoing groundwater seep was observed at the southeast entry/exit, which flows at approximately one gpm or less. Due to the minimal discharge rate, no impact to the local water table was observed or reported by private well owners.

2.3.3 Well Yields

The published median well yield for the graphitic gneiss is typically ten gallons per minute (gpm) or less; wells can have potential yields of 35 gpm from wells properly sited and developed (Geyer and Wilshusen, 1982). The above referenced PAGWIS search indicated a range in well yields from 0 to 200 gallons per minute with an average of 21 gallons per minute.

2.3.4 SPLP Water Supply Surveys

SPLP performed a preconstruction survey of landowners with entire or part of their parcels falling within 450-feet of the HDD S3-0290 alignments. The HDD alignment with the 450-foot zone is presented on **Figure 5**. One landowner responded positively to SPLPs offer for baseline sampling. The well was identified within the 450-foot search zone (Well ID WL-01192018-628-01), approximately 172 feet northeast of the HDD alignment. A second well (WL-09052017-613-02) was located beyond the 450-foot search zone, at 565 feet from the alignment. Neither of these two well locations were impacted during the installation of the 16-inch pipeline, therefore, it is expected that neither will be impacted by the installation of the 20-inch pipeline.

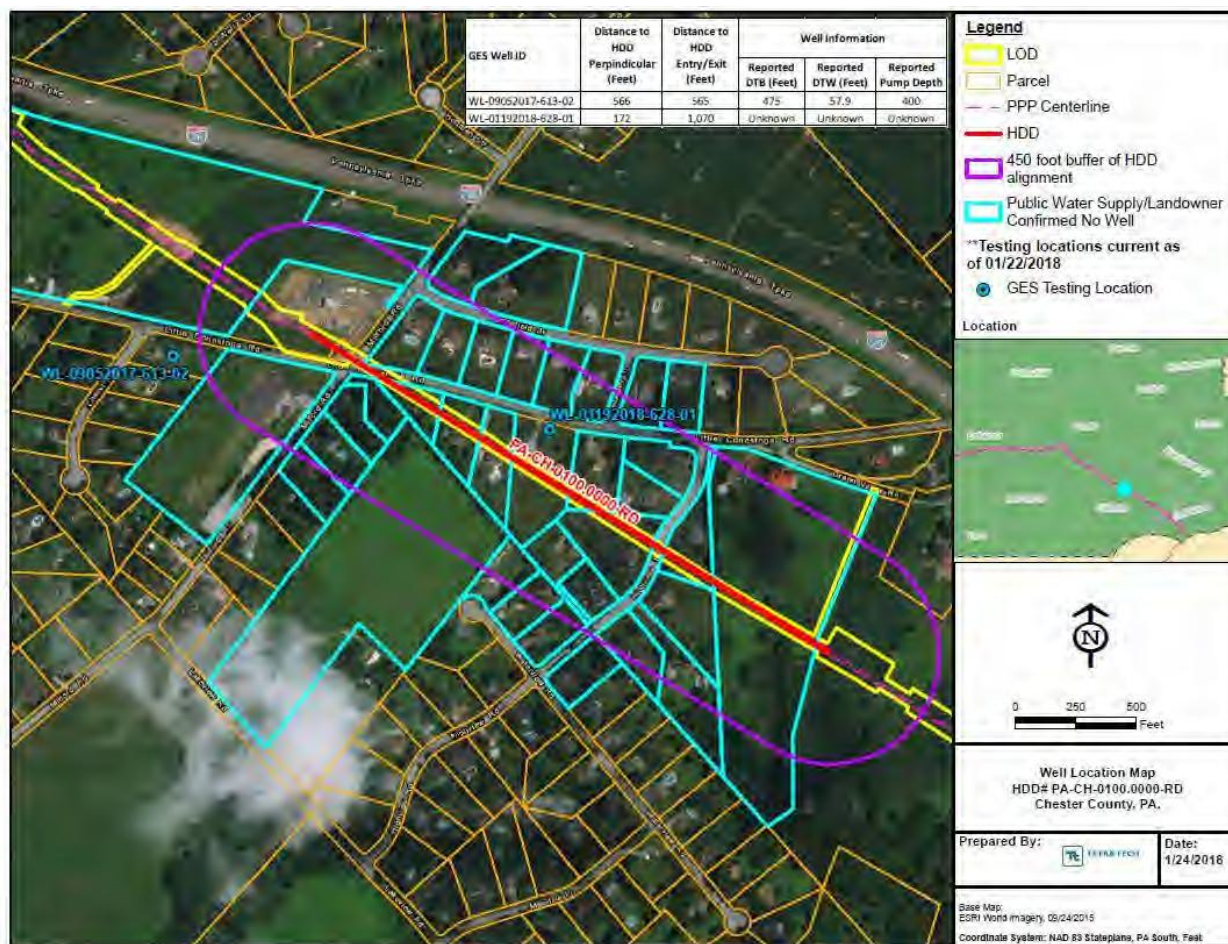


Figure 5. Well Search Map - Properties within 450 feet of HDD Alignment

2.4 Summary of Geophysical Studies

RETTEW Associates, Inc. completed a multi-method geophysical survey at the S3-0290 Milford Road/Little Conestoga Road HDD site in January 2019. The stated purpose of the survey was to detect and delineate subsurface fracture zones that could contribute to potential IRs and/or losses of circulation (LOCs), and to determine the rock profile and rock rippability as it relates to HDD drilling rates. The results of the survey are provided in **Attachment C**.

Seismic refraction, multi-spectral analysis of surface waves (MASW), and electrical resistivity methods were used to identify potential fracture zones and approximate the depth of competent bedrock along the profile. As shown on the figures in **Attachment C**, the combined methods identified potential fracture zones crossing the alignment at a frequency of approximately one every 100 to 200 feet in the northwestern part of the alignment, with a greater density (generally one every 50 to 100 feet in the southeastern part of the alignment). The highest density of potential fracture zones (approximately one every 10 to 25 feet) occurred in the wetlands area in the southeastern part of the alignment that includes the two branches to the unnamed tributary to Marsh Creek between P & P Stations 21+50 to 23+20 (proposed P & P). The two IRs described in Section 3.0 occurred adjacent to Stations 22+57 and 22+90. At these locations, both the seismic refraction data profile and the electrical resistivity profile indicate a fracture zone.

3.0 HDD OBSERVATIONS TO DATE

3.1 On This HDD Alignment

Drilling commenced for S3-0290-20 on May 27, 2017 with the 16-pipeline being pulled on November 21, 2017. Two IRs occurred during drilling activities, once during advancement of the pilot and once at the start of reaming (see locations on proposed P & P in **Attachment A**).

During pilot drilling on June 19, 2017, the HDD bore cuttings indicated a change in lithology that was observed between Stations 19+04 and 19+67 (proposed P & P) where the bedrock went from a felsic gneiss to a metadiabase, after which the felsic gneiss was once again encountered. While drilling through the metadiabase, a loss of circulation (LOC) totaling 1,500 gallons occurred; however, no IRs occurred. Based on discussion with the driller, a pressure lost was observed and drilling became notably quicker/softer at approximately P & P Station 19+52. Upon recognition of the LOC the crew began tripping the tooling out of the bore.

On June 20, 2017, the crew continued to trip out with minimal drilling fluid returns and it was estimated 20,000 gallons of drilling fluids were lost with no IRs occurring.

On June 21, 2017, as the crew continued to trip in, there was a LOC with estimated loss of 22,113 gallons of drilling fluid; however, no IRs observed. While inspecting the area of the drill bit and along the pond to the east-southeast, a local groundwater discharge from a springhouse was observed, approximately 225 feet from the HDD bore alignment. No drilling fluids were observed in the springhouse discharge.

The drill string reached bottom on June 22, 2017 and the pilot hole continued with little to no loss of drilling fluid. On June 24, 2017, an IR occurred at approximately Station 22+57 (proposed P & P), due east and off the right-of-way. The IR was located on an embankment between the wetlands and the pond. The IR volume was estimated to be 50 to 100 gallons and the area of the wetlands was affected, including the two small streams that flow into the unnamed tributary to Marsh Creek. Drilling was stopped and the area was cleaned up. Drilling then resumed with the pilot punching out later in the afternoon of June 24, 2017 at the southeast entry/exit.

The second IR occurred on August 29, 2017 after a month of project-wide suspended activity. Shortly after restart, while drilling fluid was being circulated, an IR occurred. The cause of the IR was likely due to groundwater entering the bore during the time of suspension, removing the drilling fluid caked on the borehole walls, allowing drilling fluid to migrate beyond the borehole walls when circulation was initiated. This IR occurred due west of the alignment at approximately Station 22+90.

Both IRs occurred near the southeast entry/exit where the overburden is thinning and the profile is rising to the surface. The as-built profile indicates approximately 50 to 60 feet of overburden in this zone. The geophysical survey indicates a zone of bedrock fracturing here with 20 to 25 feet of less competent weathered bedrock. The geotechnical boring logs suggest the zone of weathered bedrock could be greater than 50 feet here. In a very general sense, drilling fluid pressures tend to increase at the end of HDD profiles as they approach exit, especially for longer HDDs. To summarize, it is believed that the IRs occurred during drilling for the 16-inch line at HDD S3-0290 because the overburden was thinning as the profile rose to the surface and the overburden was comprised of a large percentage of weaker heavily weathered gneiss.

3.2 On Other HDD Alignments in Similar Hydrogeologic Settings

ME II HDDs in the same geologic setting of S3-0290 (metamorphic bedrock in Chester County) include S3-0280 to the northwest and S3-0310, S3-320 and S3-0331 (to the southeast). IRs have occurred during drilling of at S3-0320 and S3-0331. These IRs have typically occurred where bedrock is densely fractured (sometimes indicated by a fracture trace or fracture trace intersection) or where the profile approaches an entry/exit point, closer to the surface, where overburden soil and weathered bedrock thins and there is less overburden strength to contain drilling fluid pressures. In some cases, IRs have occurred at the end of a pilot bore when annular pressure is increasing to maintain circulation back to the entry as distance increases and the profile is rising to exit causing overburden to thin and have a higher proportion of unconsolidated materials.

4.0 SUMMARY AND RECOMMENDATIONS

4.1 HDD Site Conceptual Model

HDD S3-0290 is located within the headwater drainage of Marsh Creek, Marsh Creek Lake and the East Branch of the Brandywine Creek within gneissic bedrock with a relatively thick covering of saprolite and heavily weathered bedrock. Examination of geotechnical boring data and results of a geophysical study indicate the thickness of the saprolite developed on gneissic bedrock could be greater than 50 feet. Below that, fractured bedrock of variable strength occurs to 235 ft bgs or greater. The geophysical study reports a saprolitic zone from 15 to 32 feet deep and potential fracture zones along the profile. The potential fracture zones were indicated at a frequency of approximately one every 100 to 200 feet in the northwestern part of the alignment and approximately one every 50 to 100 feet in the southeastern part of the alignment. The highest density of potential fracture zones (approximately one every 10 to 25 feet) occurred in the wetland area in the southeast part of the alignment that includes two branches to the unnamed tributary to Marsh Creek between P & P Stations 21+50 to 23+20. Fracture trace analysis did not identify any photo linears crossing the alignment

The current permitted P & P shows a profile that ranges from 0 to approximately 158 ft bgs. The overburden in the area of the wetland and IRs that occurred during installation of the 16-inch line is approximately 38 to 48 ft bgs. The proposed P & P for installation of the 20-inch line shows a profile that is generally 25 feet deeper with maximum overburden thickness of 200 feet and overburden thickness of 85 to 90 feet where the former IRs occurred. Assuming a depth for highly weathered bedrock of 100 feet, it is estimated the proposed profile will pass through highly weathered bedrock for approximately 300 feet on the northwest end and approximately 460 feet on the southeast end. In addition, as stated above, the geophysical study indicates bedrock fracture zones will be encountered at some frequency along the profile.

Due to the surface elevation difference between the northwest part of the alignment and the southeast entry/exit a groundwater discharge may be created at the southeast entry/exit by completing the pilot bore. This was the case for the 16-inch pipe installation when a relatively low flow (one gpm) discharge was created. Due to the minimal discharge rate, no impact to the local water table was observed or reported by private well owners.

To date IRs that have occurred at other drills in the gneissic bedrock of northern Chester County IRs tend to occur when the saprolite and highly weathered bedrock overburden materials are not strong enough to contain drilling fluid pressures. In most cases these have occurred as the path of the pilot bore is rising towards exit, overburden is thinning and the required annular pressure to move fluid and cuttings back to the entrance is increasing. Although the profile on the proposed P & P runs deeper than the as-built profile for the 16-inch line, drilling conditions similar to those encountered during installation of the 16-inch line should be anticipated. The zone under the wetlands between Stations 21+50 and 23+20 should be considered a zone of elevated IR risk during installation of the 20-inch line.

One private water supply well was identified within 450-feet of the S3-0290 alignment and is approximately 172 feet off the alignment. The depth of this well is unknown but it is assumed the profile on the proposed P & P for the 20-inch line passes through the zone of groundwater that is the source of water to the well. The landowner associated with this well is participating in SPLP's baseline sampling program. There were no water well impact complaints associated with the installation of the 16-inch line and similar results are anticipated for installation of the 20-inch line.

4.2 Conclusions and Recommendations

The synthesis of regional and local geologic data together with past drilling performance during drilling for the 16-inch pipeline indicate that installation of the 20-inch line at HDD S3-0290 has a moderate to high risk of drilling fluid loss and IRs. This statement is based on the depth of the profile on the proposed P & P and strength of overburden materials within zones of saprolite, highly weathered bedrock, low RQD bedrock and relatively high frequency of potential bedrock fracture zones. As such, drilling plans should account for these conditions identified in this HRR.

Specifically the location of the IRs that occurred in the wetland between Stations 21+50 and 23+20 during installation of the 16-inch line has been correlated with a relatively thin overburden comprised of highly weathered bedrock and potential bedrock fracture zone indicated by the geophysical survey. Although the profile on the proposed P & P runs 34 deeper at this location, area wide information indicates the depth of weathered bedrock can be over 100 feet deep and deepening the profile does not change the frequency of fracturing characteristic of the competent bedrock at depth.

In addition, contractors should be prepared to manage a groundwater discharge at the southeast entry/exit, even though the discharge that occurred during installation of the 16-inch line was only approximately one gpm.

One local private water well has been identified within 450 feet of the alignment. This well is included in SPLP's groundwater monitoring program and the landowner will be afforded a post-construction sampling event after installation of the 20-inch line. SPLP's standard procedures include an offer to landowners to provide a temporary water supply during construction of the 20-inch line. Even though no well impacts were indicated during installation of the 16-inch line, this offer will be reaffirmed prior to the start of construction of the 20-inch line to give the landowner the opportunity to assure no water supply impacts during construction.

Based on information provided by, and the expertise of, the HDD team, as well as our experience with the relevant hydrogeology and geology, GES believes that implementation of the profile on the proposed P & P for the 20-inch line at S3-0290 and best management practices inherent to the ME II construction project, including Station specific references to areas of concern identified in this HRR, will minimize the risk of IRs and LOCs and minimize the likelihood of an impact to the environment. Furthermore, based on such information, expertise and experience, GES believes that implementation of the profile on the proposed P & P for S3-0290, in conjunction with the SPLP's temporary water supply offer to private well owners within 450 feet of the HDD alignment, will minimize the risk of any impact to an active private water supply. In the event of an impact to a private water supply, SPLP will implement the procedures of the IR PPC Plan.

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Websites

- Pennsylvania Department of Conservation & Natural Resources (PADCNR), NonFuel-Mineral Resources, <http://maps.dcnr.pa.gov/topo/quarries/>
- Pennsylvania Department of Conservation & Natural Resources (PADCNR), Marsh Creek State Park, <https://www.dcnr.pa.gov/StateParks/FindAPark/MarshCreekStatePark/Pages/History.aspx>
- Pennsylvania Department of Environmental Protection (PADEP) eMapPA, <http://www.depgis.state.pa.us/emappa/>
- Pennsylvania Groundwater Information System (PAGWIS), <http://www.docs.dcnr.pa.gov/topogeo/groundwater/pagwis/records/index.htm>
- The Penn State Pennsylvania Mine Map Atlas, <http://www.minemaps.psu.edu/>
- Pennsylvania Imagery Navigator, <http://maps.psiee.psu.edu/ImageryNavigator>
- USDA, Natural Resources Conservation Service Web Soil Survey, <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>



Attachment A

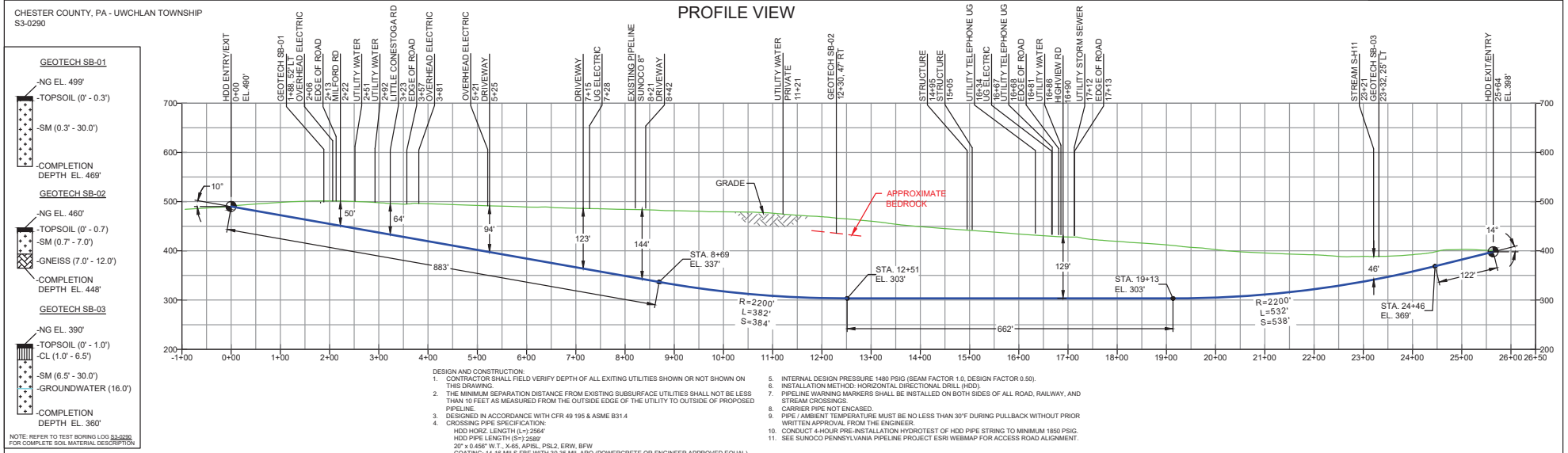
Plan and Profiles

Permitted HDD S3-0290 Plan and Profile (rev. 2/10/17)

Proposed HDD S3-0290 Plan and Profile (rev. 3/14/19), showing IRs and geology



PLAN VIEW



PROFILE VIEW

CHESTER COUNTY, PA - UWCHLAN TOWNSHIP
S3-0290

- GEOTECH SB-01**
-NG EL. 499'
-TOPSOIL (0' - 0.3')
-SM (0.3' - 30.0')
-COMPLETION DEPTH EL. 469'
- GEOTECH SB-02**
-NG EL. 460'
-TOPSOIL (0' - 0.7')
-SM (0.7' - 7.0')
-GNEISS (7.0' - 12.0')
-COMPLETION DEPTH EL. 448'
- GEOTECH SB-03**
-NG EL. 390'
-TOPSOIL (0' - 1.0')
-CL (1.0' - 6.5')
-SM (6.5' - 30.0')
-GROUNDWATER (16.0')
-COMPLETION DEPTH EL. 360'

- DESIGN AND CONSTRUCTION:**
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - 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.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ. LENGTH (L)=256'
HDD PIPE LENGTH (S)=289'
20" x 0.486" W.T., X-65, APRSL, PS2, ERW, 8FW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCURET OR ENGINEER APPROVED EQUAL)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
 - CARRIER PIPE NOT ENCASED.
 - PIPE/ AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESR WEBMAP FOR ACCESS ROAD ALIGNMENT.

- NOTES**
- ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
 - STATIONING IS BASED ON HORIZONTAL DISTANCES.
 - ROONEY ENGINEERS, 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.
 - CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
 - SUNOCO EMERGENCY HOTLINE NUMBER IS 811-800-786-7440.

REVISIONS		DLM	02/10/17	RMB	02/10/17	AMC	02/10/17
5	REVISED PROFILE WITH 2017 LIDAR	MRS	01/31/17	RMB	01/31/17	AAW	01/31/17
4	DESIGN CHANGE (02 HDD DESIGN RFI-0110)	MRS	08/12/16	RMB	08/12/16	AAW	08/12/16
3	DESIGN CHANGE	DLM	05/26/16	RMB	05/26/16	AAW	05/26/16
2	ADDED MSL LABEL	MRS	04/07/16	RMB	04/07/16	AAW	04/07/16
1	REVISED PER COMMENTS FROM REI REVIEW	MRS	03/03/16	RMB	03/03/16	AAW	03/03/16



SUNOCO PIPELINE, L.P.

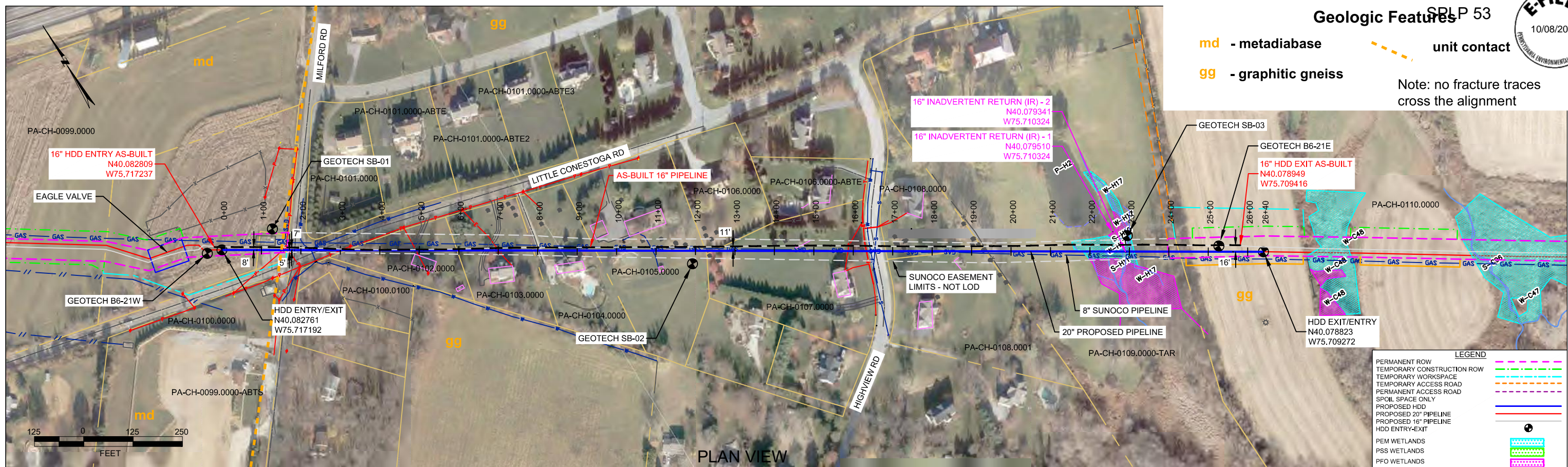
HORIZONTAL DIRECTIONAL DRILL
LITTLE CONESTOGA ROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200'
DWG. NUMBER: PA-CH-0100.0000-RD

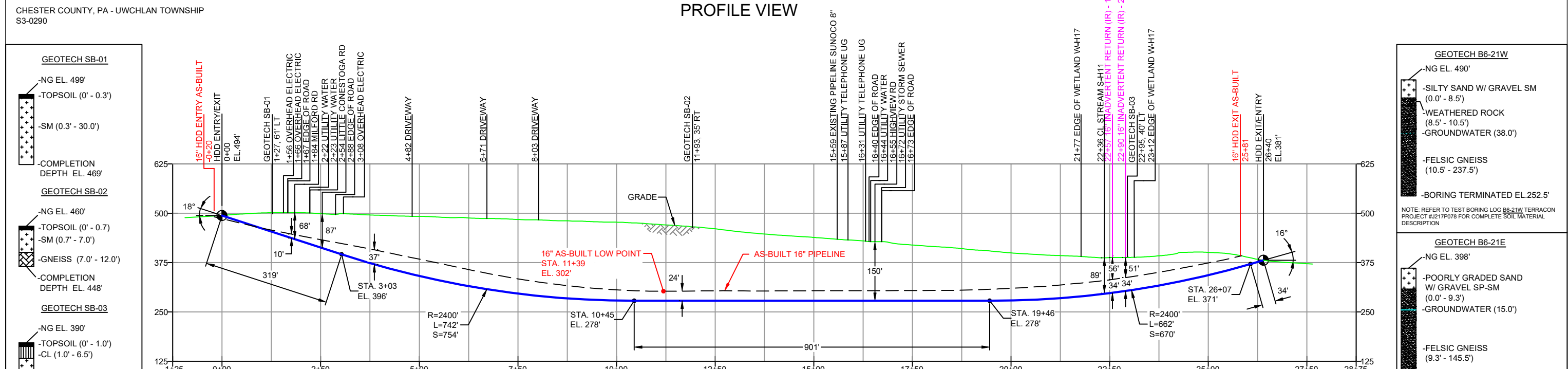
md - metadiabase
gg - graphitic gneiss

unit contact

Note: no fracture traces cross the alignment



PLAN VIEW



PROFILE VIEW

GEOTECH SB-01
-NG EL. 499'
-TOPSOIL (0' - 0.3')
-SM (0.3' - 30.0')
-COMPLETION DEPTH EL. 469'

GEOTECH SB-02
-NG EL. 460'
-TOPSOIL (0' - 0.7')
-SM (0.7' - 7.0')
-GNEISS (7.0' - 12.0')
-COMPLETION DEPTH EL. 448'

GEOTECH SB-03
-NG EL. 390'
-TOPSOIL (0' - 1.0')
-CL (1.0' - 6.5')
-SM (6.5' - 30.0')
-GROUNDWATER (16.0')
-COMPLETION DEPTH EL. 360'

NOTE: REFER TO TEST BORING LOG S3-0290 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B6-21W
-NG EL. 490'
-SILTY SAND W/ GRAVEL SM (0.0' - 8.5')
-WEATHERED ROCK (8.5' - 10.5')
-GROUNDWATER (38.0')
-FELSIC GNEISS (10.5' - 237.5')
-BORING TERMINATED EL. 252.5'

NOTE: REFER TO TEST BORING LOG B6-21W TERRACON PROJECT #J217P078 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B6-21E
-NG EL. 398'
-POORLY GRADED SAND W/ GRAVEL SP-SM (0.0' - 9.3')
-GROUNDWATER (15.0')
-FELSIC GNEISS (9.3' - 145.5')
-BORING TERMINATED EL. 252.5'

NOTE: REFER TO TEST BORING LOG B6-21E TERRACON PROJECT #J217P078 FOR COMPLETE SOIL MATERIAL DESCRIPTION

- DESIGN AND CONSTRUCTION:
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - 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.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ. LENGTH (L)=2640'
HDD PIPE LENGTH (S)=2678'
20" x 0.456" W.T., X-65, API5L, PSL2, ERW, 8FW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCONCRETE OR ENGINEER APPROVED EQUAL)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS
 - CARRIER PIPE NOT ENCASED.
 - PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.

NOTES

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- STATIONING IS BASED ON HORIZONTAL DISTANCES.
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- CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
- SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REF. DRAWING		REVISIONS		
ES-6.27	TO ES-6.29	EP3	SWITCHED 20" CENTERLINE LOCATION, INCREASED DEPTH OF DRILL AND ADDED GEOTECH INFORMATION	
SHEET 16	TO SHEET 17	EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16	
		EP1	REVISED PER PADEP COMMENTS	
		EP		
		D	ADDED GEOTECH INFO	
		C	ISSUED FOR BID	
DWG NO	DWG NO	DESCRIPTION	NO.	DESCRIPTION

Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
LITTLE CONESTOGA ROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=250' DWG. NO: PA-CH-0100.0000-RD

Attachment B

Geotechnical Boring Logs

Tetra Tech, May 2015

Terracon, September 2017



LEGEND:

⊙ Geotechnical Soil Boring (SB) Locations



GEOTECHNICAL BORING LOCATIONS
HDD S3-0290
CHESTER COUNTY, UPPER UWCHLAN 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: MILFORD AND LITTLE CONESTOGA ROADS, DOWNINGTOWN, PA			Page 1 of 1		
HDD No.: S3-0290		Dates(s) Drilled: 05-20-15		Inspector: E. WATT	
Boring No.: SB-01		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° 4' 57.699" N		75° 42' 59.880" W

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N	
	From	To	From	To									
			0.0	0.3			TOPSOIL (3")						
1	3.0	5.0	0.3		19	SM	LIGHT BROWN AND WHITE FINE TO MEDIUM SAND WITH SOME SILT.	16	30	21	18	51	
2	8.0	9.5			13		VARI-COLORED FINE TO MEDIUM SAND WITH SOME SILT, TRACE FINE GRAVEL.	3	20	50		70	
3	13.0	14.9			22		VARI-COLORED FINE TO MEDIUM SAND WITH SOME SILT, TRACE FINE GRAVEL.	3	9	22	50/5"	31	
4	18.0	18.9			7		LIGHT BROWN AND WHITE FINE TO MEDIUM SAND WITH SOME SILT, AND A LITTLE FINE QUARTZ GRAVEL.	6	50/5"			>50	
5	23.0	23.8			8		LIGHT BROWN AND WHITE FINE TO MEDIUM SAND WITH SOME SILT, AND A LITTLE FINE QUARTZ GRAVEL. (USCS: SM).	28	50/3"			>50	
6	28.0	28.7			5		LIGHT BROWN AND WHITE FINE TO MEDIUM SAND WITH SOME SILT, AND A LITTLE FINE QUARTZ GRAVEL.	5	50/2"			>50	
				30.0									
								AUGERED TO 30'.					
								CAVED AND DRY AT 28.5'.					
								SAMPLES 2 THRU 6 ARE HIGHLY DECOMPOSED ROCK SOILS. (SOILS THAT HAVE BEEN WEATHERED IN-PLACE FROM ROCK)					

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.



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: 465 LITTLE CONESTOGA ROAD, DOWNINGTOWN, PA			Page 1 of 1		
HDD No.: S3-0290		Dates(s) Drilled: 05-27-15		Inspector: E. WATT	
Boring No.: SB-02		Drilling Method: SPT - ASTM D1586		Driller: S. HOFFER	
Drilling Contractor: HAD DRILLING		Groundwater Depth (ft): NOT ENCOUNTERED		Total Depth (ft): 12.0	
Boring Location Coordinates:			40° 4' 51.263" N		75° 42' 49.239" W

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
	From	To	From	To								
			0.0	0.7			TOPSOIL (8")					
1	3.0	5.0	0.7		16	SM	BROWN AND GRAY FINE TO MEDIUM SAND AND SILT, WITH A LITTLE	13	22	28	23	50
				7.0			FINE TO COARSE UNWEATHERED ROCK GRAVEL (GNEISS). (USCS: SM).					
							AUGER REFUSAL AT 7'.					
							<u>ROCK CORING</u>					
RUN 1	7.0	12.0	7.0	11.0	60	ROCK	VERY INTENSELY FRACTURED GRAY GNEISS, SOME OXIDATION.	TCR: 100%, SCR: 35%, RQD: 20%				
			11.0	11.9			MODERATELY FRACTURED GRAY GNEISS.					
			11.9	12.0			VERY INTENSELY FRACTURED GRAY GNEISS.					
							<u>CORE TESTING RESULTS (RUN 1, DEPTH 7.7'):</u>					
							COMPRESSIVE STRENGTH: 5,690 PSI					
							UNIT WEIGHT: 172.8 PCF					
							<u>CORE TESTING RESULTS (RUN 1, DEPTH 11.5'):</u>					
							COMPRESSIVE STRENGTH: 3,360 PSI					
							UNIT WEIGHT: 160.8 PCF					
							OBSTRUCTION AT 9' PREVENTED ROCK CORE BARRELL FROM					
							BEING ADVANCED TO START RUN 2.					

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.



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:	CH-0109, DOWNINGTOWN, PA			Page 1 of 1	
HDD No.:	S3-0290	Dates(s) Drilled:	05-27-15	Inspector:	J. COSTELLO
Boring No.:	SB-03	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' 45.950" N		75° 42' 36.827" W		

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (ft)	Strata (USCS)	Description of Materials	6" Increment Blows *				N	
	From	To	From	To									
			0.0	1.0			TOPSOIL (12")						
1	3.0	5.0	1.0		24	CL	MOTTLED BROWN AND GRAY SILTY CLAY WITH A LITTLE FINE SAND, TRACE FINE ROOTS. (USCS: CL).	5	7	9	11	16	
2	8.0	10.0	6.5		20	SM	DR WEATHERED TO A VARI-COLORED FINE SAND AND SILT, TRACE FINE UNWEATHERED GRAVEL. (USCS: SM).	3	4	6	7	10	
3	13.0	15.0			23	SM	DR WEATHERED TO A WHITE, GRAY, TAN FINE TO MEDIUM SAND AND SILT, TRACE TO A LITTLE UNWEATHERED FINE GRAVEL.	1	4	6	8	10	
4	18.0	20.0			24	SM	DR WEATHERED TO A WHITE, GRAY, TAN FINE SAND AND SILT, TRACE UNWEATHERED FINE GRAVEL.	2	3	7	12	10	
5	23.0	25.0			24	SM	DR WEATHERED TO A WHITE, GRAY, TAN FINE SAND AND SILT, TRACE UNWEATHERED FINE GRAVEL.	1	4	6	10	10	
6	28.0	30.0			24	SM	DR WEATHERED TO A WHITE, GRAY, TAN FINE SAND AND SILT, TRACE UNWEATHERED FINE GRAVEL. (USCS: SM).	1	1	6	4	7	
			30.0										

Notes/Comments: Pocket Penetrometer Testing DR: DECOMPOSED ROCK
S1: > 4TSF

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 S3-0290**

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, %	
S3-0290	SB-01	1	3.0	5.0	11.7	27.8	-	-	-	-
		2	8.0	9.5	6.3	22.0	-	-	-	-
		4	18.0	18.9	7.4	31.5	-	-	-	-
		5	23.0	23.8	6.6	30.5	29	24	5	SM
		6	28.0	28.7	7.4	37.7	-	-	-	-
	SB-02	1	3.0	5.0	13.0	38.8	30	24	6	SM
	SB-03	1	3.0	5.0	20.3	83.0	41	23	18	CL
		2	8.0	10.0	21.5	48.0	36	26	10	SM
		3	13.0	15.0	23.9	42.1	-	-	-	-
		5	23.0	25.0	22.9	47.6	-	-	-	-
		6	28.0	30.0	22.9	47.6	55	37	18	SM

Rock Core Testing Results				
Boring No.	Core Run	Approximate Depth (ft)	Compressive Strength (psi)	Unit Weight (pcf)
SB-02	1	7.7	5,690	172.8
SB-02	1	11.5	3,360	160.8

Notes:

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



**ROCK CORE DESCRIPTION SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0290**

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					
S3-0290	SB-2	1	7	12	100	35	20	7	8	Moderate	Gneiss	Massive	Light gray	Fractures ranging from 0° to 45°, Avg. 29°
								8	10	Moderate	Metavolcanic inclusion	2	Gray, brown, black	Fractures ranging from 4° to 75°, Avg. 49°
								10	12	Moderate	Gneiss	Massive	Light gray	Fractures ranging from 30° to 75°, Avg. 51°



**REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S3-0290**

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
S3-0290	Little Conestoga Road, Downingtown	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	Ranges from 4 to 50 ft bgs, Avg. 27 ft bgs (.25 mile radius)	
		SB-02		Generally level, slightly sloping to the south				Ranges from 10 to 50 ft bgs, Avg. 29 ft bgs (.25 mile radius)	
		SB-03		Generally level				Ranges from 10 to 50 ft bgs, Avg. 31 ft bgs (.25 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.



October 17, 2017



Directional Project Support, Inc.
33311 Lois Lane, Suite A
Magnolia, TX 77354

Attn: Mr. Robert Sessions
P: (318) 542 6657
E: fielduspl@hotmail.com

Re: Geotechnical Site Characterization
Mariner East 2 Pipeline Project
Spread 6 – Little Conestoga Road
Commonwealth of Pennsylvania
Drawing # PA-CH-0100.0000-RD
PO # 20170908-1
Terracon Project No. J217P078

Dear Mr. Sessions:

This letter provides a summary of the bedrock characterization for the Mariner East 2 Pipeline Project crossing to be located at Little Conestoga Road (Drawing #PA-CH-0100.0000-RD) in the Commonwealth of Pennsylvania. Our services were performed in general accordance with our proposal number PJ2175108 dated July 28, 2017. Our scope of services included advancing two borings, designated as B6-21W and B6-21E, visual classification and photography of the rock core samples, and laboratory testing of representative rock samples.

Test borings, B6-21W and B6-21E were drilled between September 14 and 25, 2017 to depths of 237.5 and 145.5 feet, respectively as shown on the attached **Test Boring Location Plan**. Bedrock typically consisted of metamorphic rock primarily comprised of gneiss. Final test boring logs documenting overburden soil and bedrock conditions as well as photographs of the rock core samples are attached.

Rock compressive strength testing was performed on samples from approximately 20-foot intervals within the bedrock strata at each boring location. As an exception to the planned 20-foot intervals, rock samples from B9-21E near 35 feet and 85 feet were not tested due to highly fractured or weathered conditions. Unconfined compressive strength test results are shown on the attached reports.

**Geotechnical Site Characterization**

Mariner East 2 Pipeline – Spread 6 Little Conestoga Road ■ Pennsylvania

Drawing #PA-CH-0100.0000-RD / PO #20170908-1

October 17, 2017 ■ Terracon Project No. J217P078



When laboratory soil testing results are available, we will submit a complete data report for the subject crossing. In the meantime, if you have questions, or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

A handwritten signature in blue ink, appearing to read "Lawrence J. Dwyer".

Marc A. Gullison, E.I.T.
Staff Geotechnical Engineer

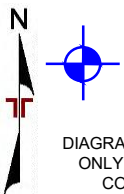
Lawrence J. Dwyer, P.E. (CT 15120)
Principal

Attch:

TEST BORING LOCATION PLAN**EXPLORATION RESULTS** (Boring Logs, Laboratory Data, Rock Core Photographs)**SUPPORTING INFORMATION** (Unified Soil Classification System, Description of Rock Properties)



TEST BORING LOCATION PLAN



**APPROXIMATE
BORING
LOCATION**

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	JGS	Project No.	J217P078
Drawn by:	SBL	Scale:	N.T.S.
Checked by:	LJD	File Name:	J217P078 BLP
Approved by:	LJD	Date:	September, 2017

Terracon
Consulting Engineers & Scientists

201 Hammer Mill Road Rocky Hill, Ct 06067
PH. (860) 721-1900 FAX. (860) 721-1939

TEST BORING LOCATION PLAN
Little Conestoga Road HDD Core B6-21W and B6-21E PA-CH-0100.0000-RD Chester County, Pennsylvania

Exhibit
A-2



EXPLORATION RESULTS



BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.082797° Longitude: -75.71732°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 490 (Ft.) +/- ELEVATION (Ft.)								

	<p>SILTY SAND WITH GRAVEL (SM), trace clay, red brown, medium dense</p>	5							
8.5	Weathered rock								
10.5	Run 1, Hard, slightly weathered, gray and brown, medium-grained FELSIC GNEISS, primary joint set, moderately dipping, very close spacing, rough, discolored, open						47	1 3 3 2 3	
15.0	Run 2, Moderately hard, moderately weathered, gray, white, and brown, medium-grained FELSIC GNEISS, primary joint set, high angle, very close spacing, rough, decomposed, open, highly fractured throughout						7	1 1 1 2 3	
20.0	Run 3, Hard, fresh, gray and brown, medium-grained FELSIC GNEISS, primary joint set, moderately dipping, moderately close spacing, rough, discolored, open						100	2 2 2 2 2	
25.0	Run 4, Similar to 27.2 feet								
27.2	At 27.2 feet: Moderately hard, moderately weathered, gray, white, and brown, medium-grained FELSIC GNEISS, primary joint set, high angle, very close spacing, rough, decomposed, open, highly fractured throughout						47	2 2 2 2 2	
30.0									

Stratification lines are approximate. In-situ, the transition may be gradual.

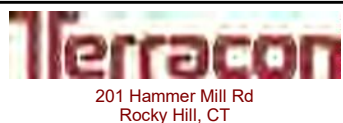
Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

WATER LEVEL OBSERVATIONS
▽ 38' on 9/19/17

Notes:



Boring Started: 09-14-2017	Boring Completed: 09-22-2017
Drill Rig: CME-850X	Driller: Terracon/Allen S.
Project No.: J217P078	Exhibit: A-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)	
	Latitude: 40.082797° Longitude: -75.71732°									
Approximate Surface Elev: 490 (Ft.) +/-		ELEVATION (Ft.)								

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17

DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
35.0	Run 5, Similar	455+/-			18		12	1 1 1 1 2	
40.0	Run 6, Hard, fresh, gray and white, medium-grained FELSIC GNEISS, primary joint set, high angle, close spacing, rough, discolored, open	450+/-	▽		60		90	2 2 3 3 3	
45.0	Run 7, Hard, fresh, gray, medium to fine-grained, FELSIC GNEISS, primary foliation joints, high angle, close to moderately close spacing, smooth to rough, planar, fresh, open; secondary joint set, low angle, wide spacing, rough, slightly undulating to stepped, discolored to fresh, open to tight	445+/-			60		77	4 4 3 4 4	
50.0	Run 8, Similar	440+/-			60		80	3 3 3 3 3	
55.0	Run 9, Similar, no secondary joints encountered	435+/-			60		90	2.5 2.5 2.5 2.5 3	
60.0	Run 10, Similar, single high angle (across foliation) secondary joint, from 56.1 to 57.3 feet, rough, undulating, slightly discolored, tight	430+/-			58		83	2.5 2.5 2.5 2.5 1.5	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

WATER LEVEL OBSERVATIONS

▽ 38' on 9/19/17

Notes:



Boring Started: 09-14-2017

Boring Completed: 09-22-2017

Drill Rig: CME-850X

Driller: Terracon/Allen S.

Project No.: J217P078

Exhibit: A-1



BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.082797° Longitude: -75.71732°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 490 (Ft.) +/- ELEVATION (Ft.)								

65.0	Run 11, Moderately hard to hard, slightly weathered, gray and olive gray with red brown, aphanitic to fine-grained, FELSIC GNEISS, primary foliation joint set, moderately dipping to high angle, close to moderately close spacing, rough, planar to undulating, discolored to slightly decomposed, open; secondary joint set, low angle across foliation, close to moderately close spacing, rough, planar to stepped, discolored to decomposed, open	425+/-	65		60		60	2.5 2 3.5 3.5 2	
70.0	Run 12, Similar	420+/-	70		60		45	1.5 1.5 2.5 2 2	
75.0	Run 13, Similar, slightly weathered to fresh, primary foliation joint set, moderately close spacing, discolored, open to tight; secondary joint set, moderately close spacing, discolored, open to tight	415+/-	75		60		78	2.5 3.5 4.5 4.5 4	
80.0	Run 14, Similar, high angle to vertical (across foliation) tertiary joints from 76.1 to 79.3 feet, close spacing, rough, undulating, discolored, tight	410+/-	80		60		28	5 4 3.5 3 4.5	
85.0	Run 15, Similar, no tertiary joints encountered	405+/-	85		60		66	4 3 1.5 2 2	
90.0	Run 16, Similar, fresh with near vertical tertiary joint from 85 to 86.2 feet	400+/-	90		59		62	1.5 3 3 3 3	

Stratification lines are approximate. In-situ, the transition may be gradual.

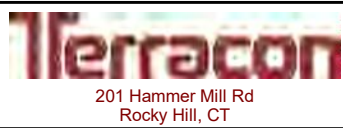
Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

WATER LEVEL OBSERVATIONS
▽ 38' on 9/19/17

Notes:



Boring Started: 09-14-2017

Boring Completed: 09-22-2017

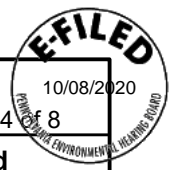
Drill Rig: CME-850X

Driller: Terracon/Allen S.

Project No.: J217P078

Exhibit: A-1

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BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.082797° Longitude: -75.71732°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 490 (Ft.) +/- ELEVATION (Ft.)								

95.0	Run 17, Hard, slightly weathered, dark gray and white banded, FELSIC GNEISS, foliation moderately dipping to high angle, very thin, planar to slightly undulating; primary foliation joint set, moderately dipping to high angle, moderately close spacing, rough, planar, discolored, tight; secondary joint set, low angle across foliation, moderately close to wide spacing, rough, planar to stepped, discolored, tight	395+/-	95		60		95	3 3.5 3 3.5 4	
100.0	Run 18, Similar	390+/-	100		60		88	5 5.5 6 6.5 8	
105.0	Run 19, Similar	385+/-	105		60		78	9 4.5 6.5 4.5 4.5	
110.0	Run 20, Similar with moderately weathered zone from 107.0 to 107.8 feet	380+/-	110		60		79	5.5 4 3.5 3 3	
115.0	Run 21, Similar with moderately weathered zone from 114.3 to 115.0 feet	375+/-	115		58		51	3.5 3 3 4 3	
120.0	Run 22, Similar with moderately weathered zone from 116.5 to 117.2 feet	370+/-	120		60		60	4 4.5 2.5 3 4	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:

WATER LEVEL OBSERVATIONS
38' on 9/19/17



Boring Started: 09-14-2017	Boring Completed: 09-22-2017
Drill Rig: CME-850X	Driller: Terracon/Allen S.
Project No.: J217P078	Exhibit: A-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.082797° Longitude: -75.71732°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 490 (Ft.) +/- ELEVATION (Ft.)								
	Run 23, Similar, no weathered zones encountered				60		78	4 5 4 5 5	
	125.0 365+/-	125			60		98	4 4 4 4.5 4	
	Run 24, Similar, with vertical tertiary joint from 128.3 to 129.0 feet, rough, slightly undulating, discolored, open				60		82	3.5 3.5 3.5 2.5 3	
	130.0 360+/-	130			60		31	3.5 3.5 4 4 3	
	Run 25, Similar, with vertical tertiary joints from 132.5 to 133.1 feet and 133.8 to 135.0 feet; frequent felsic migmatite seams along foliation				57		88	4.5 3.5 3.5 3.5 3	
	135.0 355+/-	135			60		75	5 4 3 3.5 3	
	Run 26, Similar; primary and secondary joint sets closely spaced				60				
	140.0 350+/-	140							
	Run 27, Hard, fresh, gray and white banded, FELSIC GNEISS; foliation moderately dipping, very thin, planar; primary foliation joint set, moderately dipping, wide spacing, smooth to rough, planar, discolored to fresh, tight; secondary joint set, low angle across foliation, wide spacing, rough, stepped, discolored to fresh, tight								
	145.0 345+/-	145							
	Run 28, Similar								
	150.0 340+/-	150							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:

WATER LEVEL OBSERVATIONS

38' on 9/19/17



201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 09-14-2017

Boring Completed: 09-22-2017

Drill Rig: CME-850X

Driller: Terracon/Allen S.

Project No.: J217P078

Exhibit: A-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.082797° Longitude: -75.71732°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 490 (Ft.) +/- ELEVATION (Ft.)								
	Run 29, Very hard, fresh, dark gray and olive green, medium grained, hornblende mica GNEISS with quartzite bands, primary joint set, high angle, close spacing, rough, fresh, open	155.0			60		93	4.5 4.5 4.5 5 4.5	
	Run 30, Similar, moderately close spacing, high angle joints	160.0			60		92	3 5.5 6 5.5 6	
	Run 31, Very hard, fresh, dark gray and olive green, medium-grained, hornblende mica GNEISS with quartz and calcite banding, primary joint set, moderately dipping, wide spacing, rough, fresh, tight	165.0			60		100	5 5 4 4.5 4.5	
	Run 32, Very hard, fresh, dark gray and olive green, medium-grained, hornblende mica GNEISS with quartz and calcite banding, primary joint set, moderately dipping, close spacing, rough, fresh, open; secondary joint set, high angle (across foliation) tertiary joints from 169 to 170 feet, very close spacing, polished/slickensided, fresh, tight	170.0			60		73	4 3.5 3.5 3 3.5	
	Run 33, Similar, primary foliation joint set, high angle, rough, fresh, open	175.0			60		87	5.5 4.5 5.5 6 7	
	Run 34, Similar, primary foliation joint set, tight	180.0			60		97	6 4 5.5 4.5 4	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:

Slightly reactive with hydrochloric acid from 160 to 190 feet

WATER LEVEL OBSERVATIONS

38' on 9/19/17



201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 09-14-2017

Boring Completed: 09-22-2017

Drill Rig: CME-850X

Driller: Terracon/Allen S.

Project No.: J217P078

Exhibit: A-1

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BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.082797° Longitude: -75.71732°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 490 (Ft.) +/- ELEVATION (Ft.)								

185.0	Run 35, Similar, primary foliation joint set, open	305+/-	185		60		97	5 5 6 4 3	
190.0	Run 36, Moderately hard, slightly weathered, dark gray and olive green, medium to coarse-grained, calcite hornblende mica GNEISS, primary joint set, moderately dipping, close spacing, rough, decomposed, open, vugs throughout, calcite veins	300+/-	190		60		76	3 3 3 2 3	
195.0	Run 37, Hard, fresh, dark gray and olive green, medium-grained, hornblende mica GNEISS, primary foliation joint set, high angle, close to very close spacing, rough, discolored, open; secondary mineralization (calcite) in-filling in joints, highly fractured from 193.5 to 195 feet	295+/-	195		60		49	4 5 5 4 6	
200.0	Run 38, Similar, fewer fractures	290+/-	200		60		58	5 5 4 4 3	
205.0	Run 39, Similar, fewer fractures	285+/-	205		60		93	5 5 4 5 4	
210.0	Run 40, Hard, fresh, dark gray and olive green, medium-grained, hornblende mica GNEISS, primary foliation joint set, moderately dipping, close spacing, rough, fresh, open; secondary joint set, high angle, close spacing, rough, fresh, tight	280+/-	210		60		83	3 5 5 4 4	

Stratification lines are approximate. In-situ, the transition may be gradual.

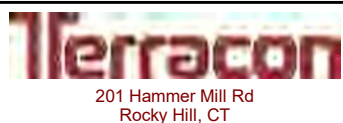
Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

WATER LEVEL OBSERVATIONS
▽ 38' on 9/19/17

Notes:
Slightly reactive with hydrochloric acid from 160 to 190 feet



Boring Started: 09-14-2017	Boring Completed: 09-22-2017
Drill Rig: CME-850X	Driller: Terracon/Allen S.
Project No.: J217P078	Exhibit: A-1

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BORING LOG NO. B6-21W Little Conestoga Road West

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.082797° Longitude: -75.71732°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 490 (Ft.) +/- ELEVATION (Ft.)								

215.0	Run 41, Similar, primary foliation joint set, moderately dipping to high angle, close to moderately close spacing, smooth to rough, planar to undulating, discolored to fresh, open to tight; secondary joint set, low angle across foliation, moderate to wide spacing, rough, stepped, decomposed to discolored, open	275+/-	215		60		80	4 4 5 4 5	
220.0	Run 42, Similar, highly to completely weathered zones from 217.3 to 218.5 feet and 219.1 to 220 feet	270+/-	220		47		20	6 26 4 3 3	
225.0	Run 43, Similar, no weathered zones, primary foliation joint set and secondary joint set, close to moderately close spacing	265+/-	225		60		30	4 3 4 4 4	
230.0	Run 44, Similar	260+/-	230		60		53	5 5 5 4 4	
235.0	Run 45, Similar, primary joint set, close to moderately close spacing, discolored to fresh, tight, secondary joint set, wide spacing, discolored to fresh, tight	255+/-	235		60		80	4 5 5 6 4	
237.5	Run 46, Similar	252.5+/-			30		73	3 3 2	

Boring Terminated at 237.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

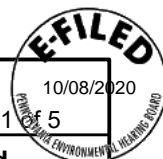
Notes:

WATER LEVEL OBSERVATIONS
38' on 9/19/17



Boring Started: 09-14-2017	Boring Completed: 09-22-2017
Drill Rig: CME-850X	Driller: Terracon/Allen S.
Project No.: J217P078	Exhibit: A-1

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



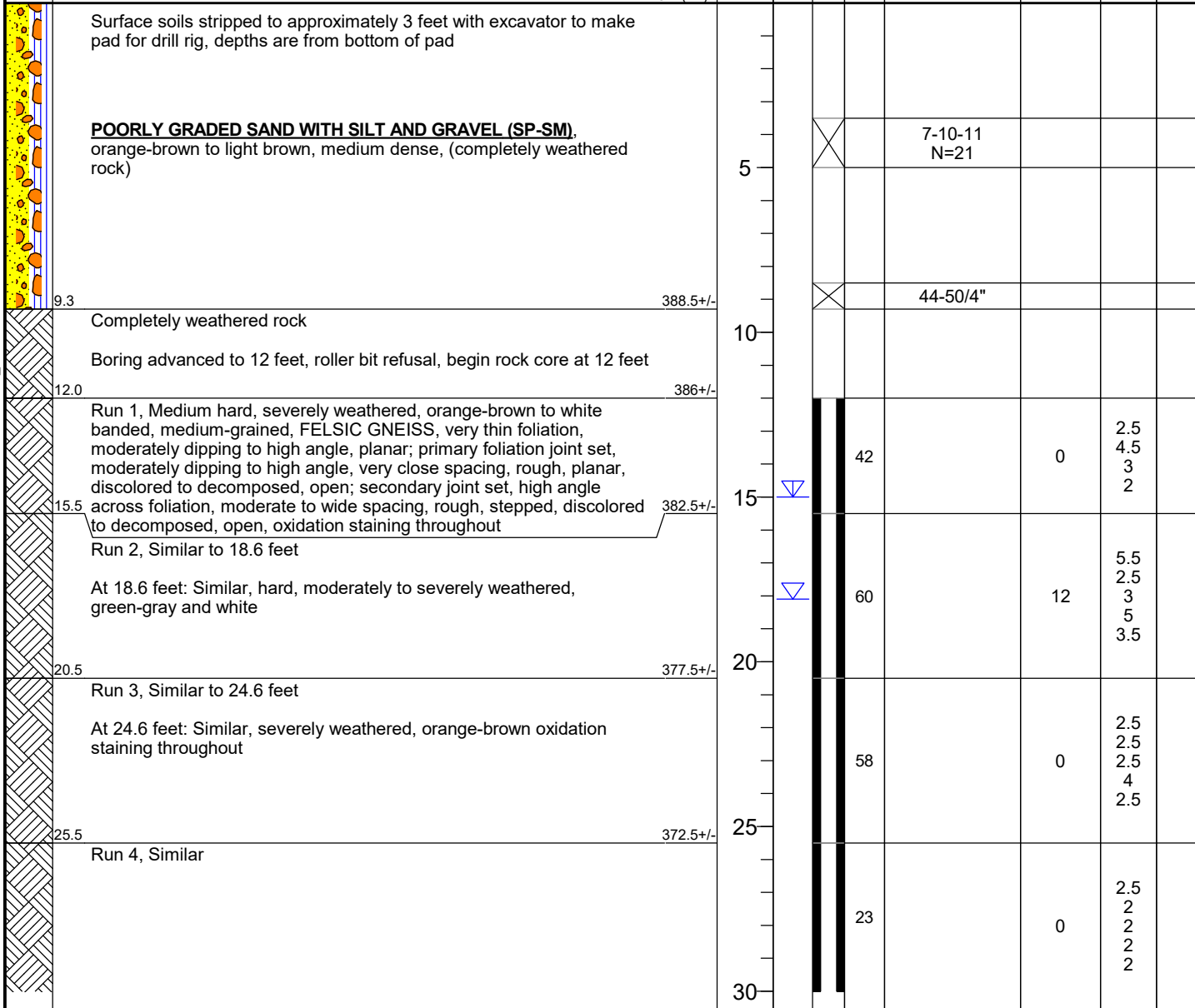
BORING LOG NO. B6-21E Little Conestoga Road East

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.079025° Longitude: -75.709583°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 398 (Ft.) +/- DEPTH ELEVATION (Ft.)								



Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:

Approximately 50% loss of water circulation from 12 to 64 feet

WATER LEVEL OBSERVATIONS

- 18.1' on 9/23/17
- 15' on 9/25/17



201 Hammer Mill Rd
Rocky Hill, CT

Boring Started: 09-22-2017

Boring Completed: 09-25-2017

Drill Rig: CME-850X

Driller: Terracon/Allen S.

Project No.: J217P078

Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



BORING LOG NO. B6-21E Little Conestoga Road East

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.079025° Longitude: -75.709583°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 398 (Ft.) +/-								
	DEPTH ELEVATION (Ft.)								
	30.5 367.5+/-								
	Run 5, Similar				51		0	1.5 2.5 3 2.5 3.5	
	35.5 362.5+/-	35							
	Run 6, Similar				24		0	2 2 2 2 1	
	40.5 357.5+/-	40							
	Run 7, Similar				34		0	1.5 1.5 2.5 2.5 3.5	
	45.5 352.5+/-	45							
	Run 8, Hard, slightly weathered, dark green-gray and white, medium-grained, FELSIC GNEISS, very thin, foliation, high angle, planar; primary foliation joint set, high angle, very close to close spacing, rough, planar, discolored to fresh, open to tight; secondary joint set, low angle to moderately dipping across foliation, rough, stepped, slightly decomposed, open, severely weathered zone from 49 to 51.5 feet				55		13	1.5 2 3.5 3 1.5	
	50.5 347.5+/-	50							
	Run 9, Similar				48		17	2 2 2 2 2	
	55.5 342.5+/-	55							
	Run 10, Similar, moderately weathered				37		7	2.5 3 2 2 2	
		60							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

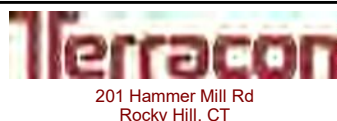
Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:
Approximately 50% loss of water circulation from 12 to 64 feet

WATER LEVEL OBSERVATIONS

- 18.1' on 9/23/17
- 15' on 9/25/17



Boring Started: 09-22-2017	Boring Completed: 09-25-2017
Drill Rig: CME-850X	Driller: Terracon/Allen S.
Project No.: J217P078	Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



BORING LOG NO. B6-21E Little Conestoga Road East

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.079025° Longitude: -75.709583°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 398 (Ft.) +/-								

60.5	Run 11, Similar, slightly weathered	337.5+/-						2.5 2.5 3 4 4	
65.5	Run 12, Similar	332.5+/-			58		27		
70.5	Run 13, Similar, fresh, primary foliation joint set, fresh, open to tight; secondary joint set, fresh, open to tight, foliation poorly developed below 74.1 feet	327.5+/-			52		27	3 2.5 3 3 3	
75.5	Run 14, Similar to 77.2 feet, poorly developed foliation	322.5+/-			60		55	3.5 3 4.5 4.5 3.5	
80.5	At 77.2 feet: Very hard, fresh, blue-green and white, coarse-grained, anatectic, PEGMATITE, non-foliated; primary joint set, high angle, close to moderately close spacing, rough, slightly undulating, slightly decomposed, (sand and silt in-filling), to fresh, open to tight; secondary joint set, low angle to moderately dipping, moderately close to wide spacing, rough, planar, slightly decomposed to fresh, open to tight	317.5+/-			60		57	3 3.5 4.5 4 5	
85.5	Complete loss of water circulation at 78.5 feet Run 15, Similar, fractured zones at joint set intersections from 85.9 to 86.1 feet and 88.4 to 88.9 feet, occasional pyrite on joint surfaces	312.5+/-			60		73	5 3.5 4.5 4.5 4.5	
	Run 16, Similar				60		56	6.5 5 5.5 6 6	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

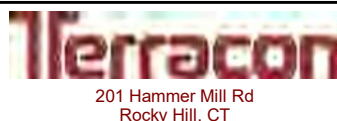
Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:

WATER LEVEL OBSERVATIONS

- ▽ 18.1' on 9/23/17
- ▽ 15' on 9/25/17



Boring Started: 09-22-2017

Boring Completed: 09-25-2017

Drill Rig: CME-850X

Driller: Terracon/Allen S.

Project No.: J217P078

Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



BORING LOG NO. B6-21E Little Conestoga Road East

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

GRAPHIC LOG	LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.079025° Longitude: -75.709583°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
	Approximate Surface Elev: 398 (Ft.) +/-								
	DEPTH ELEVATION (Ft.)								
	90.5 307.5+/-								
	Run 17, Similar to 94.1 feet								
	At 94.1 feet: Hard to very hard, fresh, light green-gray to white banded, medium to coarse-grained, GRAPHITIC FELSIC GNEISS, very thin foliation high angle to near vertical, planar to slightly undulating; primary foliation joint set, high angle to near vertical, moderately close spacing, smooth to rough, planar to slightly undulating, slightly decomposed (sand and silt in-filling), to fresh, open to tight; secondary joint set, low angle, moderately close to wide spacing, rough, undulating to stepped, slightly decomposed to fresh, open to tight, numerous fractures healed by secondary mineralization				60		72	6 6 6 5	
	95.5 302.5+/-	95							
	Run 18, Similar, frequent pyrite on joint surfaces				60		73	5 6 6 5 4.5	
	100.5 297.5+/-	100							
	Run 19, Similar				60		82	6 5 6 6 6	
	105.5 292.5+/-	105							
	Run 20, Similar				60		65	4.5 5 5.5 5 5.5	
	110.5 287.5+/-	110							
	Run 21, Similar, primary foliation joint set very close to moderately close spacing; secondary joint set, close to moderately close spacing				60		77	4 3 3 4.5 4	
	115.5 282.5+/-	115							
	Run 22, Similar, poorly-foliated green-blue gray-white granitic zone from 120.2 to 122.1 feet				60		85	4.5 3.5 3.5 4 4	
		120							

Stratification lines are approximate. In-situ, the transition may be gradual.

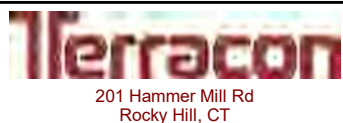
Hammer Type: Automatic

Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:

WATER LEVEL OBSERVATIONS	
▽	18.1' on 9/23/17
▽	15' on 9/25/17



Boring Started: 09-22-2017	Boring Completed: 09-25-2017
Drill Rig: CME-850X	Driller: Terracon/Allen S.
Project No.: J217P078	Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17



BORING LOG NO. B6-21E Little Conestoga Road East

PROJECT: Mariner East Pipeline Borings

CLIENT: Directional Project Support Incorporated
Magnolia, TX 77354

SITE: Spread 6

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	RQD (%)	Core rate (min/ft)	Penetrometer Test (tsf)
LOCATION PA-CH-0100.0000-RD 20170908-1 Latitude: 40.079025° Longitude: -75.709583° Approximate Surface Elev: 398 (Ft.) +/-									
120.5	277.5+/-								
Run 23, Similar, poorly-foliated GNEISS									
125.5	272.5+/-	125			60		67	5 4 5 5 5	
Run 24, Similar to 125.9 feet									
At 129.5 feet: Very soft to medium hard, severely weathered, dark green to black, medium to fine-grained, serpentine GNEISS At 126.6 feet: Hard, slightly weathered to fresh, dark green to light green-gray, coarse to medium-grained, hornblende GNEISS, foliation high angle, poorly-developed; primary joint set, high angle to near vertical, moderately close spacing, rough, undulating, discolored, open to tight; secondary joint set, low angle, moderately close spacing, rough, undulating to stepped, open, joint set intersection forms highly-fractured zone from 129.7 to 130.5 feet									
130.5	267.5+/-	130			60		43	3.5 3.5 3.5 3.5	
Run 25, Similar, primary and secondary joint sets decomposed (sand and silt in-filling) to discolored, open to tight, small slickensides on primary joint at 134.7 feet									
135.5	262.5+/-	135			60		50	4 3.5 3 3 3	
Run 26, Similar									
140.5	257.5+/-	140			60		52	2.5 2 2.5 2.5 2	
Run 27, Similar									
145.5	252.5+/-	145							
Boring Terminated at 145.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

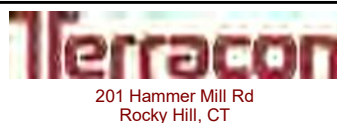
Advancement Method:
Mud rotary with wireline

Abandonment Method:
Grouted to surface

Notes:

WATER LEVEL OBSERVATIONS

- ▽ 18.1' on 9/23/17
- ▽ 15' on 9/25/17



Boring Started: 09-22-2017

Boring Completed: 09-25-2017

Drill Rig: CME-850X

Driller: Terracon/Allen S.

Project No.: J217P078

Exhibit: A-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL - J217P078 - SPREAD 6.GPJ TERRACON DATATEMPLATE.GDT 10/17/17

ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21W
 Sample No.: 9
 Sample Depth: 10 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 3 min

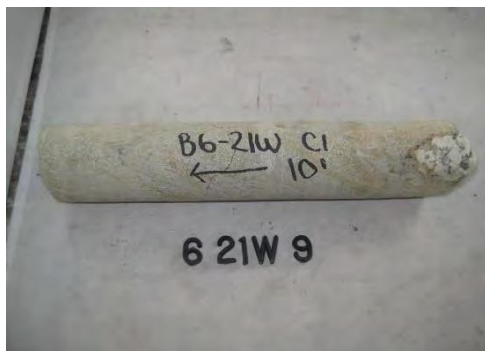
Diameter: 1.96 in
 Length: 3.84 in
 L/D: 1.96
 End Area: 3.02 in²

Maximum Axial Load at Failure: 8,670 lb
Compressive Strength: 2,874 psi
Compressive Strength: 19.81 Mpa
Unit Weight 163 pcf

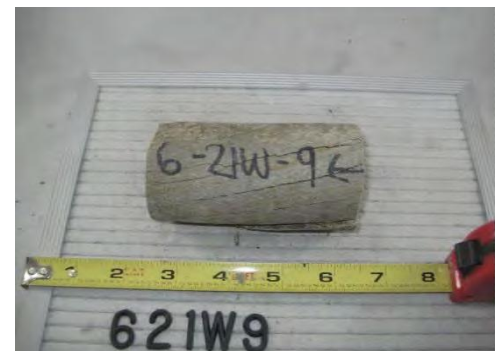
Comments :

Due to lack of available specimens, the length to diameter ratio of the tested specimen is not conformant with ASTM D7012. The results obtained during testing may differ from those obtained from the test specimens that meet the requirements.

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

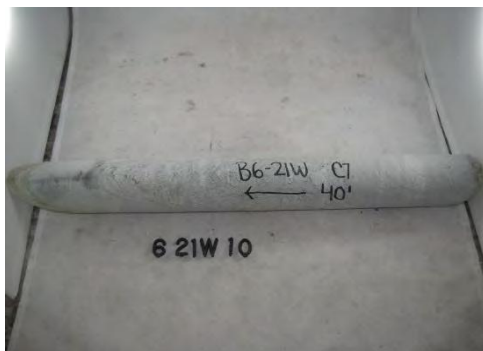
Boring No.: B6-21W
 Sample No.: 10
 Sample Depth: 40 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 3 min

Diameter: 1.98 in
 Length: 4.61 in
 L/D: 2.33
 End Area: 3.08 in²

Maximum Axial Load at Failure: 11,260 lb
Compressive Strength: 3,657 psi
Compressive Strength: 25.21 Mpa
Unit Weight 173 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	 Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21W
 Sample No.: 1
 Sample Depth: 51 feet
 Sampling Date: 9/14/17

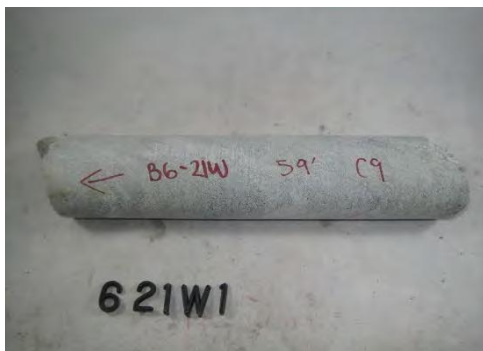
Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 11 min

Diameter: 1.98 in
 Length: 4.49 in
 L/D: 2.27
 End Area: 3.08 in²

Maximum Axial Load at Failure: 35,010 lb
Compressive Strength: 11,370 psi
Compressive Strength: 78.40 Mpa
Unit Weight 175 pcf

Photograph before the test mislabeled as 59 feet

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21W
 Sample No.: 2
 Sample Depth: 72 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 6 min

Diameter: 1.98 in
 Length: 4.66 in
 L/D: 2.35
 End Area: 3.08 in²

Maximum Axial Load at Failure: 19,940 lb
Compressive Strength: 6,476 psi
Compressive Strength: 44.65 Mpa
Unit Weight 173 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	 Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21W
 Sample No.: 3
 Sample Depth: 93 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 11 min

Diameter: 1.98 in
 Length: 4.73 in
 L/D: 2.39
 End Area: 3.08 in²

Maximum Axial Load at Failure: 37,800 lb
Compressive Strength: 12,276 psi
Compressive Strength: 84.64 Mpa
Unit Weight 175 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

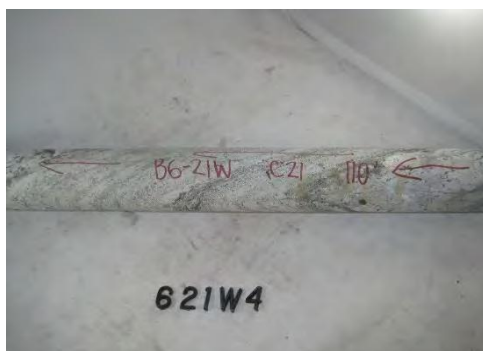
Boring No.: B6-21W
 Sample No.: 4
 Sample Depth: 110 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 4 min

Diameter: 1.99 in
 Length: 4.52 in
 L/D: 2.27
 End Area: 3.11 in²

Maximum Axial Load at Failure: 14,430 lb
Compressive Strength: 4,639 psi
Compressive Strength: 31.99 Mpa
Unit Weight 172 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	 Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

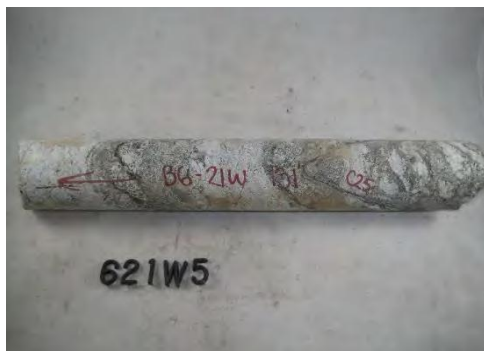
Boring No.: B6-21W
 Sample No.: 5
 Sample Depth: 131 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 2 min

Diameter: 1.99 in
 Length: 4.19 in
 L/D: 2.11
 End Area: 3.11 in²

Maximum Axial Load at Failure: 6,450 lb
Compressive Strength: 2,074 psi
Compressive Strength: 14.30 Mpa
Unit Weight 166 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	 Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21W
 Sample No.: 6
 Sample Depth: 152 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 8 min

Diameter: 1.98 in
 Length: 4.60 in
 L/D: 2.32
 End Area: 3.08 in²

Maximum Axial Load at Failure: 25,510 lb
Compressive Strength: 8,285 psi
Compressive Strength: 57.12 Mpa
Unit Weight 182 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	 Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21W
 Sample No.: 7
 Sample Depth: 175 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 7 min

Diameter: 1.95 in
 Length: 4.66 in
 L/D: 2.39
 End Area: 2.99 in²

Maximum Axial Load at Failure: 22,720 lb
Compressive Strength: 7,608 psi
Compressive Strength: 52.45 Mpa
Unit Weight 179 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21W
 Sample No.: 8
 Sample Depth: 185 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 1 min

Diameter: 1.98 in
 Length: 4.65 in
 L/D: 2.35
 End Area: 3.08 in²

Maximum Axial Load at Failure: **2,060 lb**
Compressive Strength: **669 psi**
Compressive Strength: **4.61 Mpa**
Unit Weight **157 pcf**

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

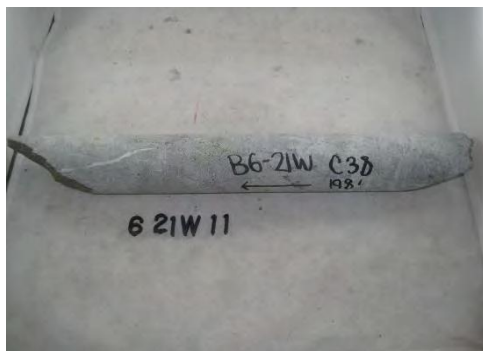
Boring No.: B6-21W
 Sample No.: 11
 Sample Depth: 198 feet
 Sampling Date: 9/14/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 10 min

Diameter: 1.98 in
 Length: 4.48 in
 L/D: 2.26
 End Area: 3.08 in²

Maximum Axial Load at Failure: 33,680 lb
Compressive Strength: 10,938 psi
Compressive Strength: 75.42 Mpa
Unit Weight 175 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21E
 Sample No.: 1
 Sample Depth: 18 feet
 Sampling Date: 9/22/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 13 min

Diameter: 1.99 in
 Length: 3.96 in
 L/D: 1.99
 End Area: 3.11 in²

Maximum Axial Load at Failure: **43,140 lb**
Compressive Strength: **13,870 psi**
Compressive Strength: **95.63 Mpa**
Unit Weight **169 pcf**

Comments :

Due to lack of available specimens, the length to diameter ratio of the tested specimen is not conformant with ASTM D7012. The results obtained during testing may differ from those obtained from the test specimens that meet the requirements.

Before the Test



Photographs are mislabeled as 6-21E-2

After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	 Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21E
 Sample No.: 2
 Sample Depth: 48 feet
 Sampling Date: 9/22/17

Lithology: Gneiss
 Moisture Content: As received
 Lab Temperature: 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 8 min

Diameter: 2.00 in
 Length: 4.58 in
 L/D: 2.29
 End Area: 3.14 in²

Maximum Axial Load at Failure: 27,070 lb
Compressive Strength: 8,617 psi
Compressive Strength: 59.41 Mpa
Unit Weight 164 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21E
 Sample No.: 3
 Sample Depth: 75 feet
 Sampling Date: 9/22/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 14 min

Diameter: 2.00 in
 Length: 3.36 in
 L/D: 1.68
 End Area: 3.14 in²

Maximum Axial Load at Failure: 45,180 lb
Compressive Strength: 14,381 psi
Compressive Strength: 99.15 Mpa
Unit Weight 214 pcf

Comments : Due to lack of available specimens, the length to diameter ratio of the tested specimen is not conformant with ASTM D7012. The results obtained during testing may differ from those obtained from the test specimens that meet the requirements.

Before the Test




Photographs are mislabeled as 6-21E-1

After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	 77 Sundial Ave., Suite 401 W Manchester, New Hampshire	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

Boring No.: B6-21E
 Sample No.: 17
 Sample Depth: 93 feet
 Sampling Date: 9/22/17

Lithology: Pegmatite
 Moisture Content: As received
 Lab Temperature: 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 6 min

Diameter: 2.01 in
 Length: 4.59 in
 L/D: 2.28
 End Area: 3.17 in²

Maximum Axial Load at Failure: 18,610 lb
Compressive Strength: 5,865 psi
Compressive Strength: 40.44 Mpa
Unit Weight 168 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>Terracon 77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

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ASTM D7012 (Method C) Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens

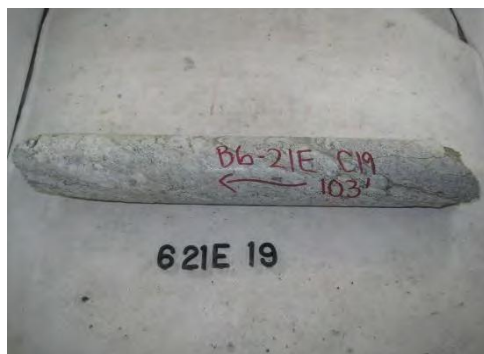
Boring No.: B6-21E
 Sample No.: 19
 Sample Depth: 103 feet
 Sampling Date: 9/22/17

Lithology : Gneiss
 Moisture Content : As received
 Lab Temperature : 70° F
 Loading Rate: 55 psi/s
 Time to Failure: 4 min

Diameter: 1.99 in
 Length: 4.51 in
 L/D: 2.27
 End Area: 3.11 in²

Maximum Axial Load at Failure: 11,760 lb
Compressive Strength: 3,781 psi
Compressive Strength: 26.07 Mpa
Unit Weight 170 pcf

Before the Test



After the Test



Drawing # : PA-CH-0100.0000-RD
 PO # : 20170908-1
 Crossing : Little Conestoga Road
 Spread : Spread 6

Project:	Mariner East Pipeline	<p>77 Sundial Ave., Suite 401 W Manchester, New Hampshire</p>	Performed by:	C. Santana
Project No.	J217P078		Test Date:	10/16/2017
Location:	Spread 6		Reviewed By :	L. Dwyer
Client :	Directional Project Support Inc.		Review Date :	10/16/2017

The information contained in this report may not be reproduced except in its entirety without the express written consent of Terracon, Inc. Reports are relevant only to the items tested and may not be attributed to other work. Testing was performed in general accordance with the stated ASTM test method.



Photograph 1: B6-21W, Samples C-1 to C-4 (10.5 to 30 feet)



Photograph 2: B6-21W, Samples C-5 to C-8 (30 to 50 feet)



Photograph 3: B6-21W, Samples C-9 to C-12 (50 to 70 feet)



Photograph 4: B6-21W, Samples C-13 to C-16 (70 to 90 feet)



Photograph 5: B6-21W, Samples C-17 to C-20 (90 to 110 feet)



Photograph 6: B6-21W, Samples C-21 to C-24 (110 to 130 feet)



Photograph 7: B6-21W, Samples C-25 to C-28 (130 to 150 feet)



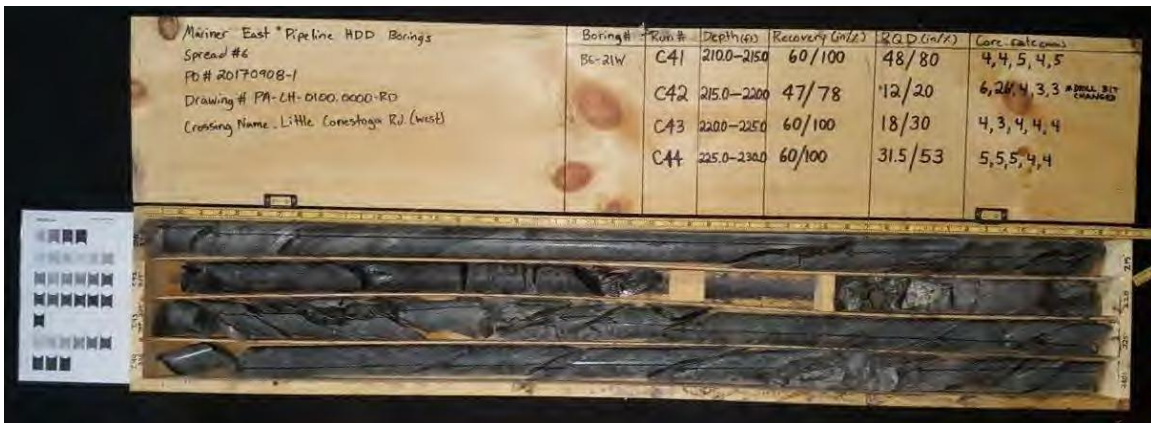
Photograph 8: B6-21W, Samples C-29 to C-32 (150 to 170 feet)



Photograph 9: B6-21W, Samples C-33 to C-36 (170 to 190 feet)



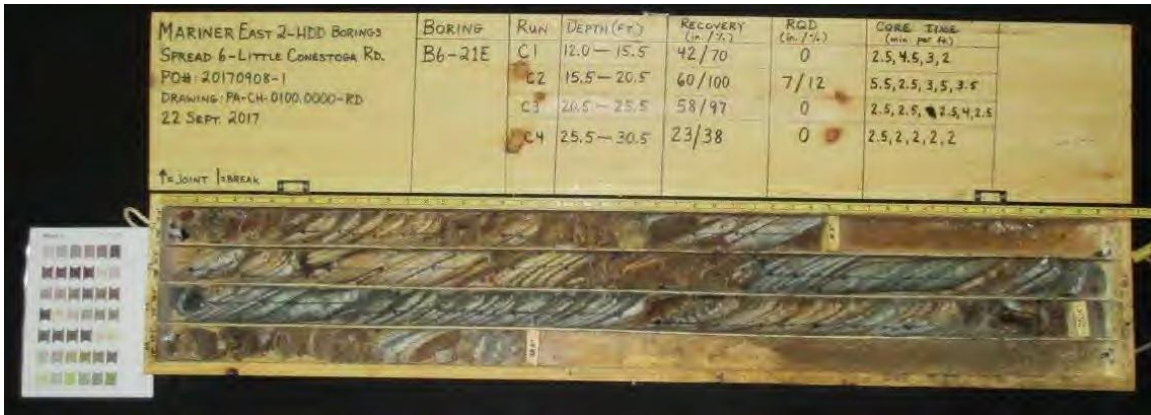
Photograph 10: B6-21W, Samples C-37 to C-40 (190 to 210 feet)



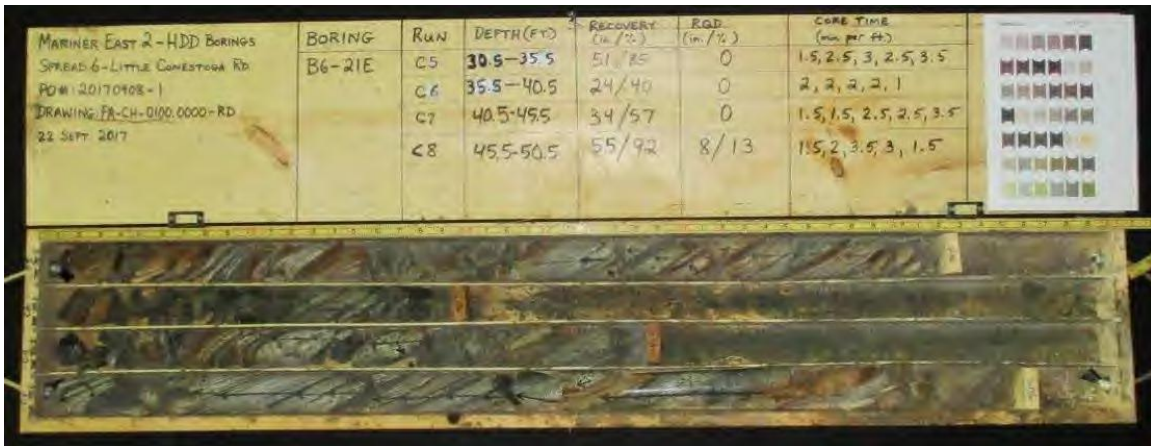
Photograph 11: B6-21W, Samples C-41 to C-44 (210 to 230 feet)



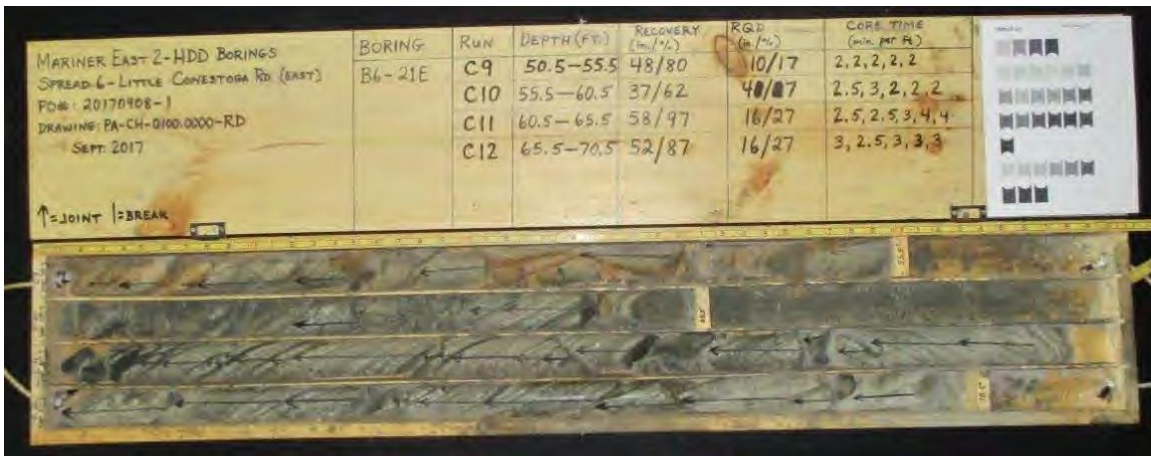
Photograph 12: B6-21W, Samples C-45 to C-46 (230 to 237.5 feet)



Photograph 1: B6-21E, Samples C-1 to C-4 (12 to 30.5 feet)



Photograph 2: B6-21E, Samples C-5 to C-8 (30.5 to 50.5 feet)



Photograph 3: B6-21E, Samples C-9 to C-12 (50.5 to 70.5 feet)



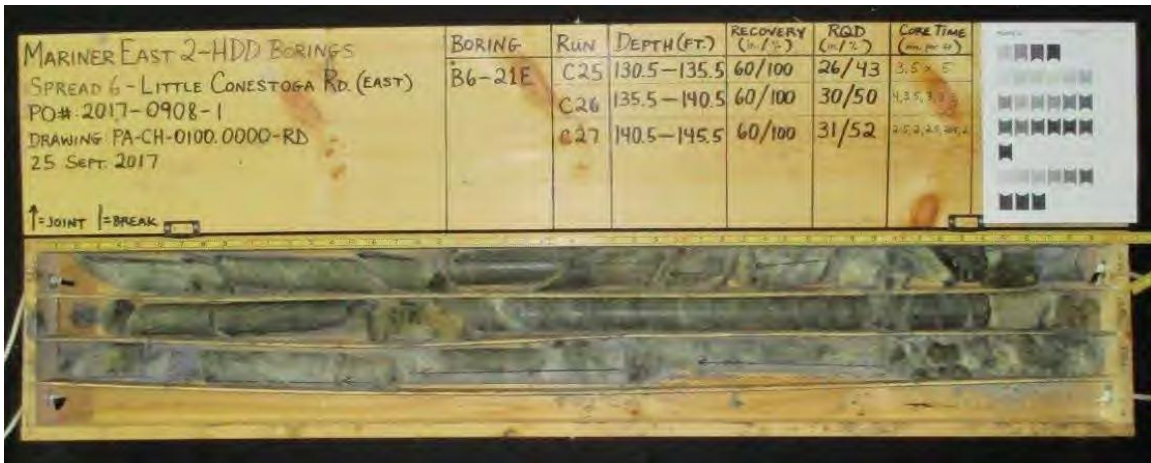
Photograph 4: B6-21E, Samples C-13 to C-16 (70.5 to 90.5 feet)



Photograph 5: B6-21E, Samples C-17 to C-20 (90.5 to 110.5 feet)



Photograph 6: B6-21E, Samples C-21 to C-24 (110.5 to 130.5 feet)



Photograph 7: B6-21E, Samples C-25 to C-27 (130.5 to 145.5 feet)

Attachment C

Geophysical Study Report

Rettew, May 2019

May 10, 2019

Mr. Larry J. Gremminger
Sunoco Logistics, L.P.
535 Fritztown Road
Sinking Spring, PA 19608

RE: Geophysical Survey
Sunoco Pipeline, L.P. Pipeline Project
Horizontal Directional Drill S3-0290 Little Conestoga Road
PA-CH-0100.0000-RD
Upper Uwchlan Township, Chester County, Pennsylvania
RETTEW Project No. 096302015

Engineers
Environmental
Consultants
Surveyors
Landscape
Architects
Safety
Consultants
Geophysicists

Dear Mr. Gremminger:

RETTEW Associates, Inc. completed a multi-technique geophysical survey at the S3-0290 Little Conestoga Road horizontal directional drill (HDD) site. The purpose of the survey was to detect and delineate subsurface fracture zones that could contribute to potential inadvertent returns (IRs) and/or a loss of circulation, and to determine the rock profile and rock rippability for ease-of-excavation along the HDD path. The following report, figures, and attachments describe the methods and results of the investigation.

EXECUTIVE SUMMARY

The multi-technique geophysical survey was completed on January 15, 2019. Two different geophysical techniques were utilized to detect and delineate subsurface features and provide a bedrock profile. These methods, and their general results, are as follows:

- Seismic refraction and multi-spectral analysis of surface waves (MASW) results confirmed the presence of low-velocity zones within the bedrock that could represent fracture zones
- Electrical resistivity imaging (ERI) identified a relatively conductive surface layer over a discontinuous mildly resistive layer, with the discontinuities possibly suggesting the presence of fracture zones.

Results from the geophysical techniques are consistent with each other, and with the geology as mapped by the PA Geological Survey; all suggesting that the local bedrock is mildly fractured, with a few potential anomalous zones of concern. The top-of-rock is expected to be slightly irregular with a weathered zone above competent rock and potential fractures within the bedrock formation.

SITE DESCRIPTION

The Little Conestoga Road HDD site is located east of Marsh Creek Reservoir in Upper Uwchlan Township, Chester County, Pennsylvania (see **Figure 1**). A geophysical survey was conducted over accessible areas of the path between the HDD exit/entry locations (**Figure 2**).



The site bedrock geology consists of Precambrian-aged Graphitic felsic gneiss (The Geologic Map of Pennsylvania, PA Department of Conservation and Natural Resources Geology Interactive Map, 2017 – see **Figure 2**). The graphitic felsic gneiss includes the Pickering Gneiss and small areas of marble and serpentinite. Outside the marble, it is dominantly quartz and feldspar with varying amounts of graphite and various metamorphic minerals. It can also be medium-grained, light to dark gray and greenish-gray, and is also of probable sedimentary origin prior to metamorphosis (Berg et al., 1980). The Geologic Map of Pennsylvania (PA Department of Conservation and Natural Resources Geology Interactive Map, 2017) shows several contacts and major faults within a mile of the survey area, as seen on the geologic inset on **Figure 2**, upper right (Ibid.).

SEISMIC MASW AND REFRACTION SURVEY

Seismic Multi-Spectral Analysis of Surface Waves (MASW) and refraction methods utilize the speed of seismic waves through various geologic layers and features to characterize the subsurface geologic conditions. The methods enable determination of the general material types, and the approximate depth to bedrock or rock profile. MASW can detect low velocities below the top of rock that might be associated with fracture zones. The principles of seismic refraction are summarized in **Appendix A**.

The seismic survey consisted of a single profile along the HDD center line between the exit/entry points (see blue triangles representing every 4th geophone, **Figure 2**). Color-contour velocity models of the seismic velocity for refraction and MASW are presented on **Figures 3** and **4**, respectively. On each, the vertical scale represents relative elevation in feet, and the horizontal axis represents an along-profile distance in feet. The color contours represent average seismic velocity variations (compressional or P-wave velocities for refraction, and shear or S-wave velocities for MASW), with increasing velocities from blue to yellow to orange to brown (refraction), and purple to grey to tan to brown (MASW). Please note that high- and low-velocity data along the first and last fifteen feet of any profile have higher uncertainty. Specific seismic refraction and MASW survey parameters are listed in **Appendix B**.

ERI SURVEY

Electrical resistivity measurements involve driving an electrical current into the ground using current electrodes at the ground surface. The apparent resistivity of the subsurface is determined by measuring the potential difference, or voltage, between two potential electrodes with a known separation and position/orientation relative to the current electrodes. The depth and volume of the subsurface zone represented by the measured apparent resistivity is a function of the geometry of the current and potential electrodes. Apparent resistivities are converted to model or true resistivities by performing a joint inversion of all the measured apparent resistivities along a profile.

The resistivity survey consisted of a single profile between the exit/entry points (see orange dots representing every 4th electrode, **Figure 2**). The apparent resistivity data were mathematically inverted using EarthImager 2D by AGI to provide a cross-sectional image. This is shown as successive segments (broken by roadways and other obstructions) in **Figure 5**. Specific ERI survey parameters are listed in **Appendix B**.

RESULTS

The seismic refraction data are presented as a cross-sectional profile on **Figure 3**. The data indicate a general three-layer stratigraphy consisting of a residual or sedimentary soil mantle, a weathered rock zone, and competent bedrock. The uppermost layer has average P-wave velocities generally less than



5,000 feet per second (fps) with a thickness of approximately 10-20 feet. This is consistent with a relatively compact soil mantle (shaded blue to yellow). The deepest layers have velocities over 10,000 fps (shaded orange to brown), consistent with competent bedrock (Carmichael, R. S., 1989). The seismic refraction results show multiple low-velocity zones indicative of fracture zones. The suspected fracture zones are highlighted in magenta on the seismic profiles.

The MASW seismic cross sections are presented on **Figure 4**. The MASW velocity models show lateral velocity changes within the soil and bedrock layers across the profiles, and are relatively consistent with the seismic refraction. Velocity lows below the bedrock surface could indicate fractures which might be potential pathways for inadvertent returns (IRs) and/or locations for loss of circulation.

The seismic velocity models from the ray-tracing method (not shown) were compared to standard ripping charts (see **Appendix C**, Caterpillar, Inc., 1995) using the inferred/assumed layer compositions to determine the general rippability of each stratum. In general, the surficial layer (bounded at depth by the wavy dashed contour) should be readily to marginally rippable with a D9 multi- or single-shank ripper doing open field ripping, based on a weighted average velocity of about less than 5,000 fps. Below the 5,000-fps contour, ripping will get more difficult with depth, with the transition zone expected to become non-rippable below the 10,000-fps contour (based on the average ray-trace velocity of over 13,990 fps and Caterpillar charts). The 5,000-fps contour represents the top of weathered rock. For trenching (as opposed to open field ripping), material below approximately the 3500-fps contour color (greenish blue) may become non-rippable (for a CAT-330 tracked excavator or equivalent). The selection of the contour cut-off for trenching is based on correlations between the ray-tracing models (not shown), material properties, and various excavation strategies investigated by Kirsten (1982). The Limitations section contains additional important information regarding rippability estimation by seismic and other means.

The electrical resistivity results are shown on **Figure 5**. The electrical profiles show a general two-layer model with a relatively conductive surface layer over a discontinuous mildly resistive layer. The upper layer is relatively discontinuous, with irregularities that could represent near-surface disturbances given the site development history. The deep conductive (blue) anomalies below the inferred top-of-rock may represent fractures or weathered seams within bedrock. Note that access was limited in the western portion of the HDD due to driveways and roadways that shortened the profile lengths and locally limited the depth of investigation of the geophysical survey.

CONCLUSIONS

In general, the geophysical survey results display anomalies indicative of fractures that are possible locations for IRs and/or loss of circulation along most of the HDD alignment. **Figure 6** summarizes the anomalous areas with various colored double-arrows. Overlapping and/or adjacent arrows indicate the highest risk of IR, but any anomalous areas might have an enhanced risk.

LIMITATIONS

The survey described above was completed using standard and/or routinely accepted practices of the geophysical industry, and the equipment employed represents, in RETTEW's professional opinion, the best available technology. RETTEW does not accept responsibility for survey limitations due to inherent technological limitations or unforeseen site-specific conditions. We will notify you of such limitations or conditions, when they are identifiable.



Rippability, while historically closely-correlated with seismic P-wave velocity, also depends on geotechnical properties of the material, on the specific method of excavation, and on the variety and size of equipment employed. For mechanical excavation, the teeth or other cutting elements must be forced into discontinuities of competent rock masses, or penetrate the fabric of weak rocks. Thus, joint or fracture spacing, aperture, and infilling will all play a role in determining whether existing discontinuities in apparently-competent rock masses can allow mechanical excavation. The strength of the intact rock will also control whether fresh discontinuities can be induced during excavation activities. Therefore, while seismic data can provide reliable guidelines, RETTEW recommends that the rocks to be excavated be checked for these other geotechnical characteristics through examination of local outcrops, test pits, or boring logs.

We have enjoyed and appreciated the opportunity to have worked with you. If you have any questions, please do not hesitate to contact the undersigned.

Charles H. Rhine, MSc, PG
Senior Project Manager

Timothy D. Bechtel, PhD, PG
Senior Project Manager

Felicia Kegel Bechtel, MSc, PG
Director of Geophysics

Enclosures

- Figure 1: Topographic Basemap
- Figure 2: Data Coverage Map and Geologic Setting
- Figure 3: Seismic Refraction Survey Results
- Figure 4: Seismic MASW Survey Results
- Figure 5: Electrical Resistivity Survey Results
- Figure 6: Geophysical Results Summary
- Appendix A: Introduction to Seismic Refraction
- Appendix B: Geophysical Survey Parameters
- Appendix C: Caterpillar Ripping Charts



References

Berg, T.M., Edmunds, W.E., Geyer, A.R., and others, 1980, Geologic Map of Pennsylvania, PA Geological Survey, 4th series.

Carmichael, R. S. (1989), Physical Properties of Rocks and Minerals, CRC Press.

Caterpillar Tractor Company (1995), The Applicator, Caterpillar Tractor Company Marketing Division.

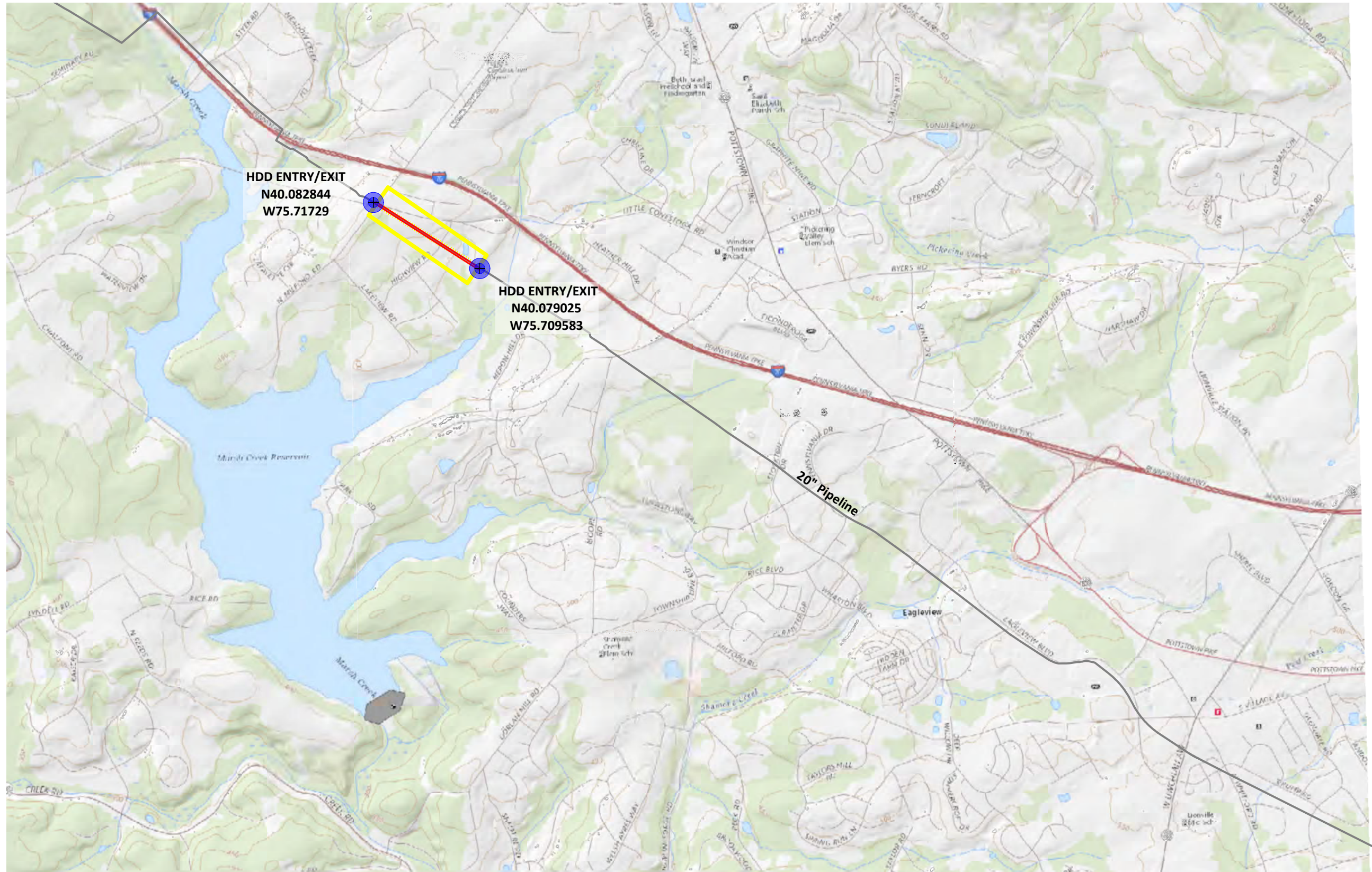
Kirsten, HAD (1982). A classification system for excavating in natural materials. Civil Engineering (Siviele Ingenieurswese), 24(7), 293-308.

PA Department of Conservation and Natural Resources Geology Interactive Map, (<http://www.gis.dcnr.state.pa.us.html>), 2017.




Z:\Shared\Projects\09630\096302015 - Spread 6 Eight Sites\GP\S3-0290 Little Conestoga Road\Report\Final\S3-0290 Little Conestoga Geophysics Final Report 5-10-19.docx

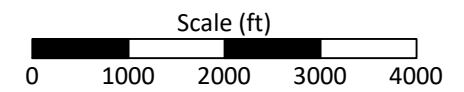


ENCLOSURES



Geophysical Survey Legend

-  Proposed 20" HDD Alignment
-  Geophysical Survey Area
-  HDD Entry/Exit Point



Notes:

Basemap extracted from USGS Topographic WMS Server, extracted 01/2019.

SP	P	53
SURVEY DATE:	01/15/2019	
RETIEW NO.:	096302015	
REVIEWED BY:	FKB	CHR
DRAWN BY:	CHR	
DATE:	02/08/2019	
SCALE:	1" = 2000'	
FIGURE NO.:	1 of 6	



RETTEW Field Services, Inc.
 3020 Columbia Avenue, Lancaster, PA 17603
 Phone 1-800-738-8395

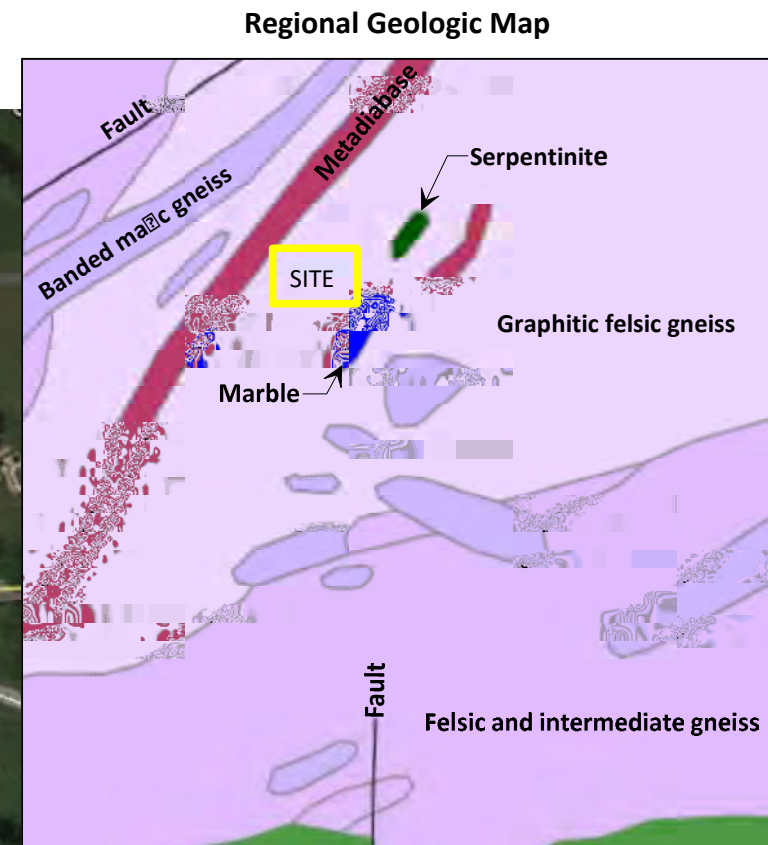
Figure 1: Topographic Basemap

Little Conestoga Road
 S3-0290
 PA-CH-0100.0000-RD

CHESTER COUNTY, PA

UPPER UICHLAN TOWNSHIP





SP P 53

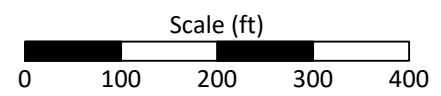
10/08/2020

SURVEY DATE: 01/15/2019
 RETIEW NO.: 096302015
 REVIEWED BY: FKB
 DRAWN BY: CHR
 DATE: 02/08/2019
 SCALE: 1" = 200'
 FIGURE NO. 2 of 6



Geophysical Survey Legend

- HDD Entry/Exit
- Electrical Resistivity Station (every 4th)
- Seismic Geophone Location (every 4th)
- 20" Product Line with Station Number



Notes:

Basemap from Google Earth Pro, extracted 11/2018.

Survey profiles/stations from DGPS survey by RETTEW.

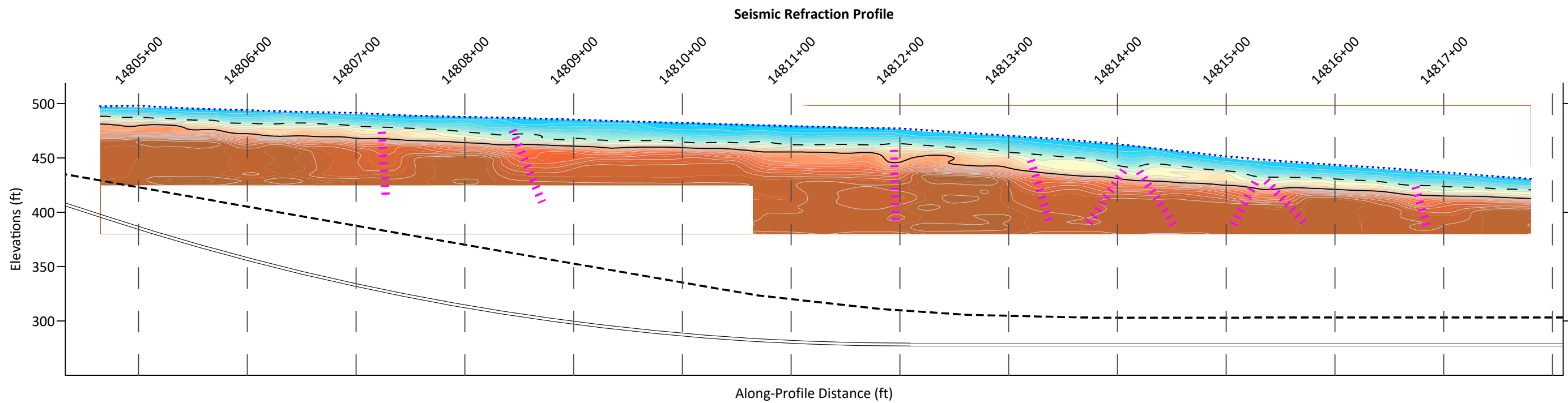
Geologic information from DCNR WMS Server, extracted 11/2018, and Wood (1980).

Figure 2: Data Coverage Map and Geologic Setting

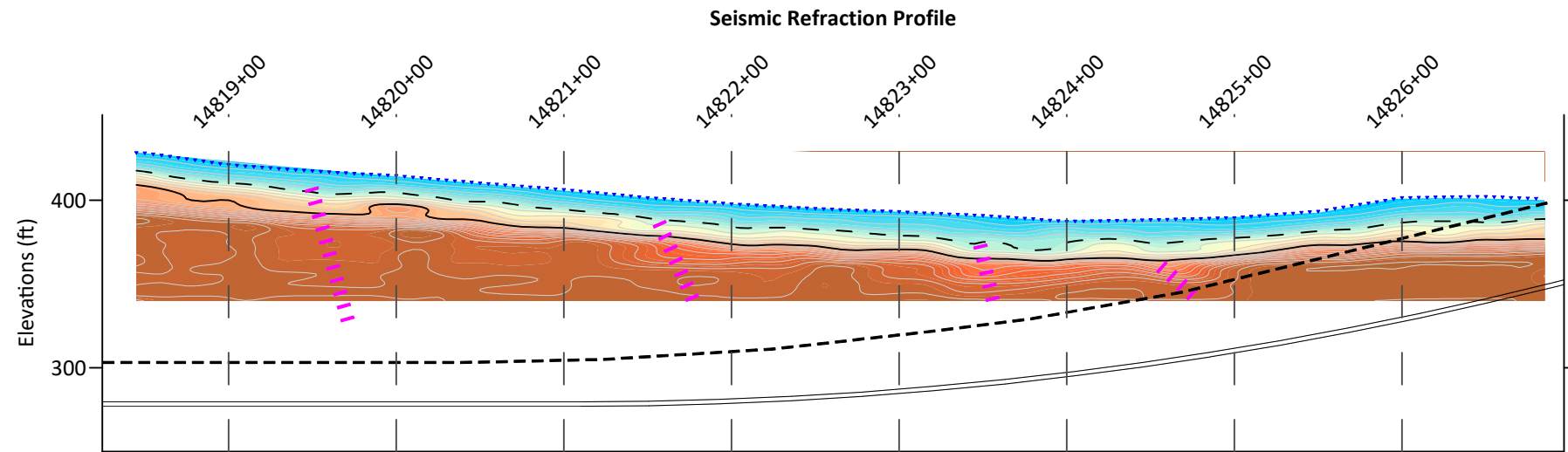
Little Conestoga Road
 S3-0290
 PA-CH-0100.0000-RD

CHESTER COUNTY, PA

UPPER UICHLAN TOWNSHIP

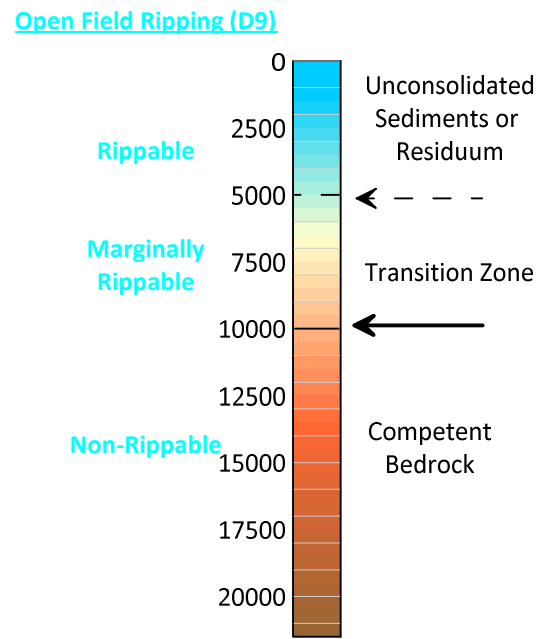


Along-Profile Distance (ft)



Along-Profile Distance (ft)

Relative P-Wave Velocity (fps)



Geophysical Survey Legend

- Seismic Geophone Location
- Possible Fracture Zone
- Proposed 16" HDD
- AS-BUILT 16" HDD
- Station Number

Weighted Average Velocity (Trg)

$$V_1 = 4,439 \text{ fps}$$

$$V_2 = 13,990 \text{ fps}$$

Notes:

Seismic data from Geometrics 24-channel Geode with 4.0 Hz geophones.

Relative seismic velocity models from SeisImager (by Oyo Corporation) tomographic and ReMi inversions.

SP	P	53
SURVEY DATE:	01/15/2019	
RETTEW No.:	096302015	
REVIEWED BY:	FKB	
DRAWN BY:	CHR	
DATE:	05/09/2019	
SCALE:	1" = 100'	
FIGURE NO.:	3 of 6	

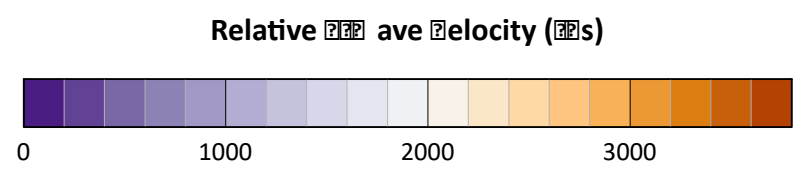
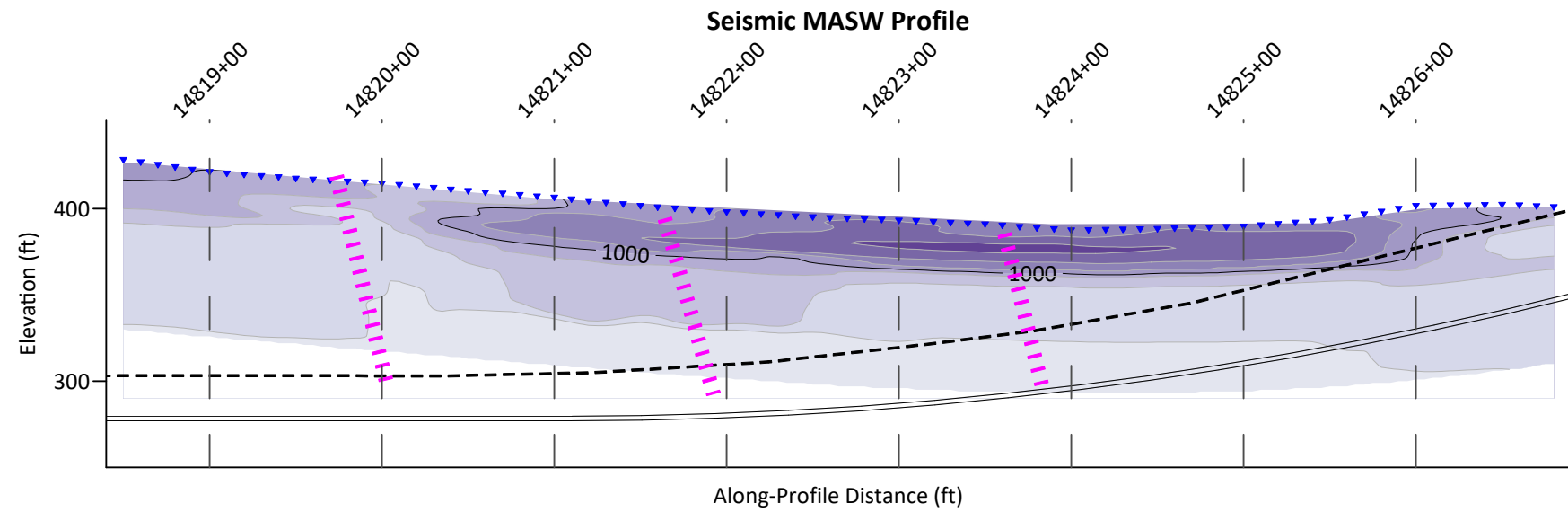
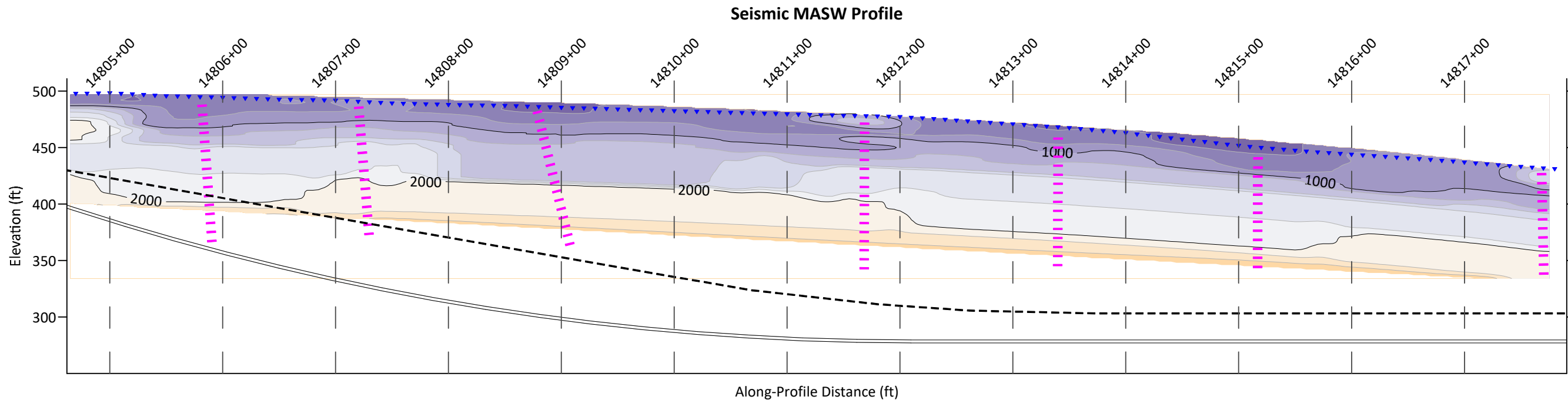


RETTEW Field Services, Inc.
3020 Columbia Avenue, Lancaster, PA 17603
Phone 1-800-738-8395

Figure 3: Seismic Refraction Survey Results

Little Conestoga Road
S3-0290
PA-CH-0100.0000-RD





- Geophysical Survey Legend**
- Seismic Geophone Location
 - Possible Fracture Zone
 - Proposed 16" HDD
 - AS-BUILT 16" HDD
 - Station Number

Notes:

Seismic data from Geometrics 24-channel Geode with 4.0 Hz geophones.

Relative seismic velocity models from SeisImager (by Oyo Corporation) tomographic and ReMi inversions.

SP 53

SURVEY DATE: 01/15/2019

RETIEW NO.: 096302015

REVIEWED BY: FKB

DRAWN BY: CHR

DATE: 05/09/2019

SCALE: 1" = 100'

FIGURE NO. 4 of 6

10/08/2020

E-FILED



Figure 4: Seismic MASW Survey Results

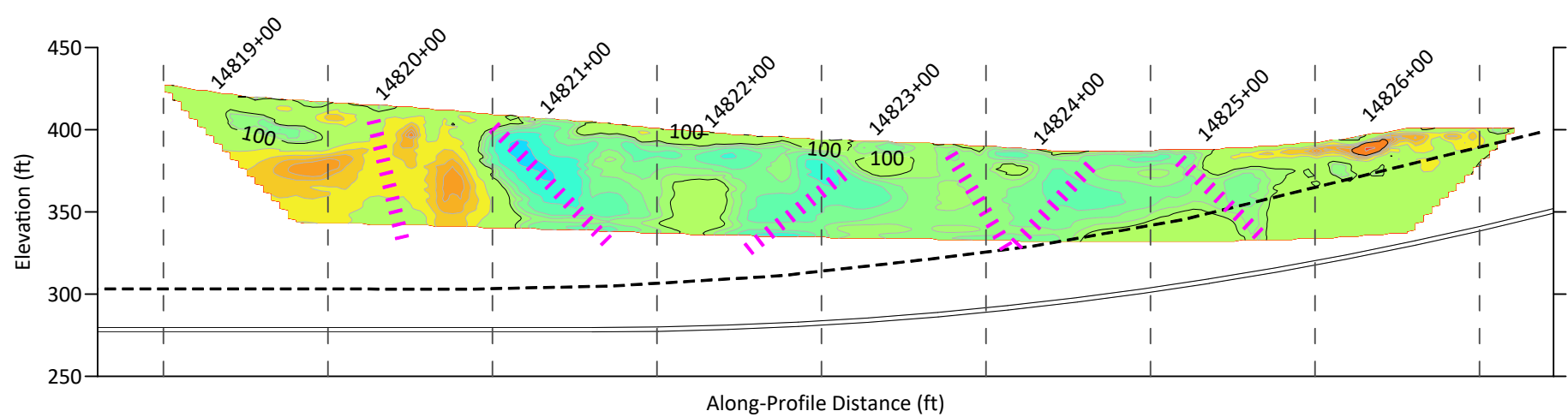
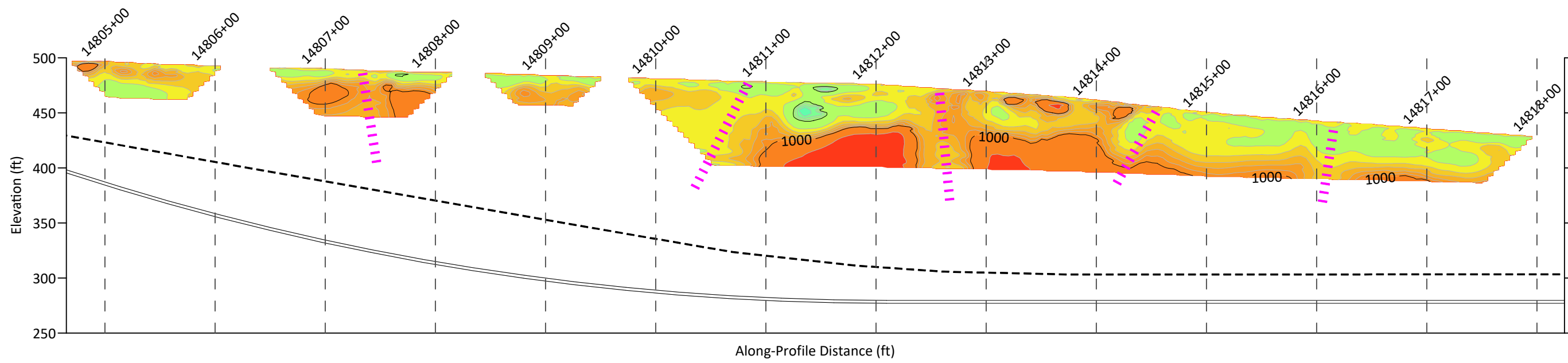
Little Conestoga Road
S3-0290
PA-CH-0100.0000-RD

CHESTER COUNTY, PA

UPPER UICHLAN TOWNSHIP

SPL 53

SURVEY DATE: 01/15/2019
 RETTEW No.: 096302015
 REVIEWED BY: FKB
 DRAWN BY: CHR
 DATE: 05/09/2019
 SCALE: 1" = 100'
 FIGURE NO.: 5 of 6



Geophysical Survey Legend

- Possible Fracture Zone
- Proposed 16" HDD
- AS-BUILT 16" HDD
- Station Number

Electrical Resistivity (ohm*m)



Notes:
 Resistivity data from AGI Super Sting R-8, 56 channels, 5-ft electrode spacing.
 Resistivity models from EarthImager 2D (by AGI Corporation) inversions.



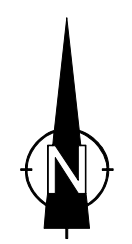
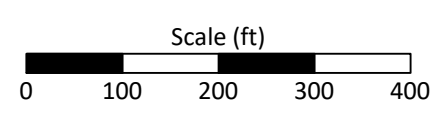
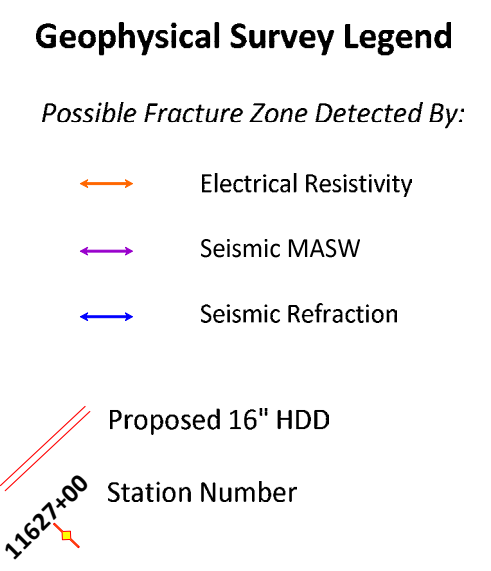
RETTEW Field Services, Inc.
 3020 Columbia Avenue, Lancaster, PA 17603
 Phone 1-800-738-8395

Figure 5: Electrical Resistivity Survey Results

Little Conestoga Road
 S3-0290
 PA-CH-0100.0000-RD

CHESTER COUNTY, PA

UPPER UWICHAN TOWNSHIP



Notes:
 Basemap from Google Earth Pro, extracted 01/2019.
 Geophysical results from previous figures.

SP	P	53
SURVEY DATE:	01/15/2019	
RETIEW NO.:	096302015	
REVIEWED BY:	FKB	
DRAWN BY:	CHR	
DATE:	02/08/2019	
SCALE:	1" = 200'	
FIGURE NO.:	6 of 6	



Figure 6: Geophysical Results Summary

Little Conestoga Road
 S3-0290
 PA-CH-0100.0000-RD

CHESTER COUNTY, PA

UPPER UICHLAN TOWNSHIP



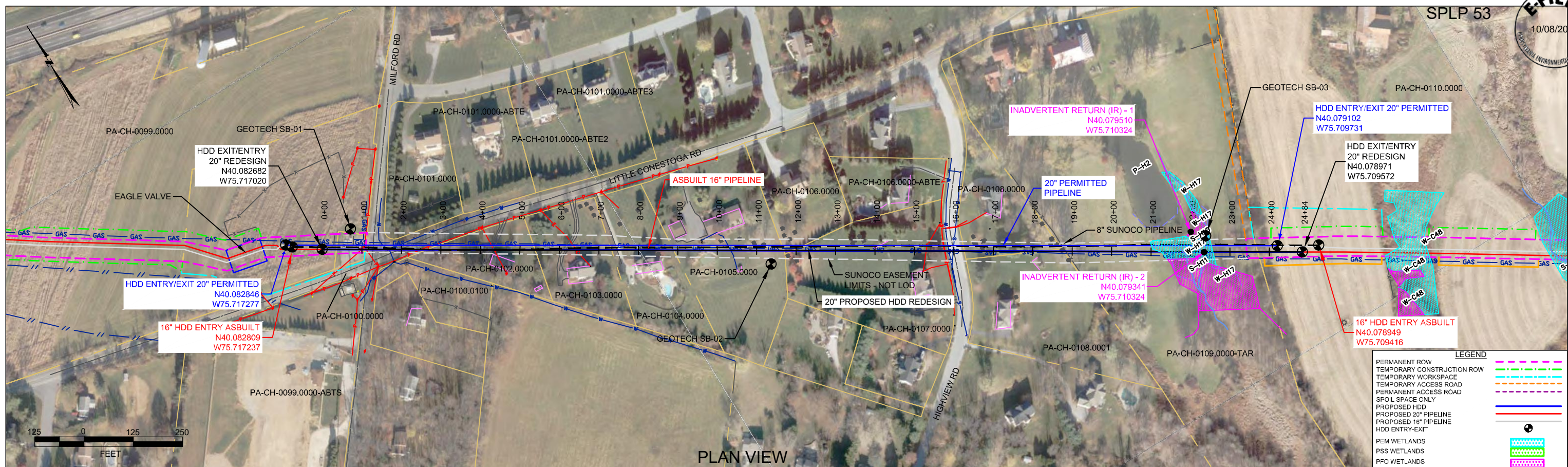
SPLP 53



**HORIZONTAL DIRECTIONAL DRILL ANALYSIS
LITTLE CONESTOGA ROAD CROSSING
PADEP SECTION 105 PERMIT NO.: E15-862
PA-CH-0100.0000-RD
(SPLP HDD# S3-0290)**

ATTACHMENT 2

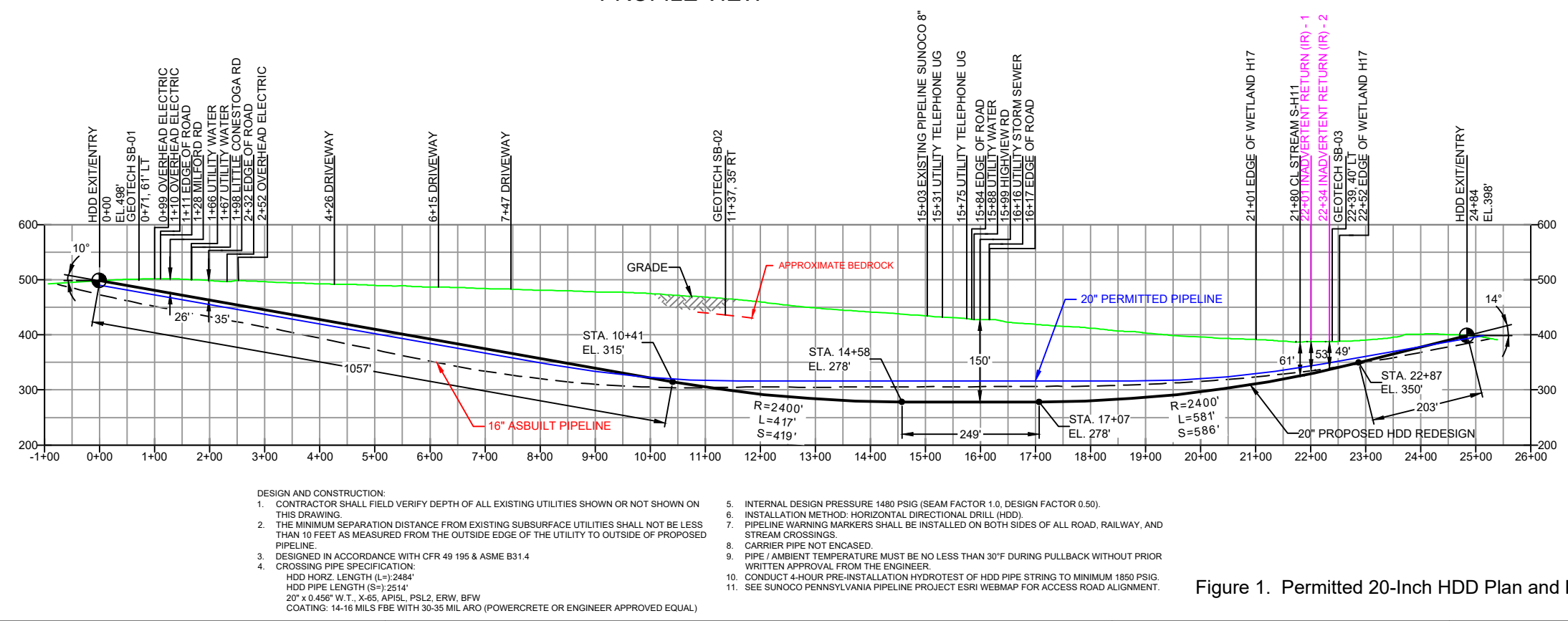
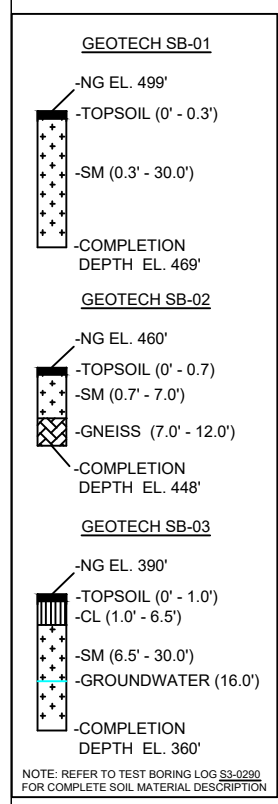
HORIZONTAL DIRECTIONAL DRILL PLAN AND PROFILES



CHESTER COUNTY, PA - UWCHLAN TOWNSHIP
S3-0290

PLAN VIEW

PROFILE VIEW



- DESIGN AND CONSTRUCTION:
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - 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.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ LENGTH (L)=2484'
HDD PIPE LENGTH (S)=2514'
20" x 0.456" W.T., X-65, API5L, PSL2, ERW, BFW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCRETE OR ENGINEER APPROVED EQUAL)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
 - CARRIER PIPE NOT ENCASED.
 - PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.

Figure 1. Permitted 20-Inch HDD Plan and Profile with 16-Inch IR Data

- NOTES**
- ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
 - STATIONING IS BASED ON HORIZONTAL DISTANCES.
 - 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.
 - CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
 - SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
5	REVISED PROFILE WITH 2017 LIDAR	DLM	02/10/17	RMB	02/10/17	AMC	02/10/17
5	DESIGN CHANGE (OZ HDD DESIGN RFI-0110)	MRS	01/31/17	RMB	01/31/17	AAW	01/31/17
4	REVISED PER ENGINEERING COMMENTS	MRS	08/12/16	RMB	08/12/16	AAW	08/12/16
3	DESIGN CHANGE	DLM	05/26/16	RMB	05/26/16	AAW	05/26/16
2	ADDED MLV LABEL	MRS	04/07/16	RMB	04/07/16	AAW	04/07/16
1	REVISED PER COMMENTS FROM REI REVIEW	MRS	03/03/16	RMB	03/03/16	AAW	03/03/16

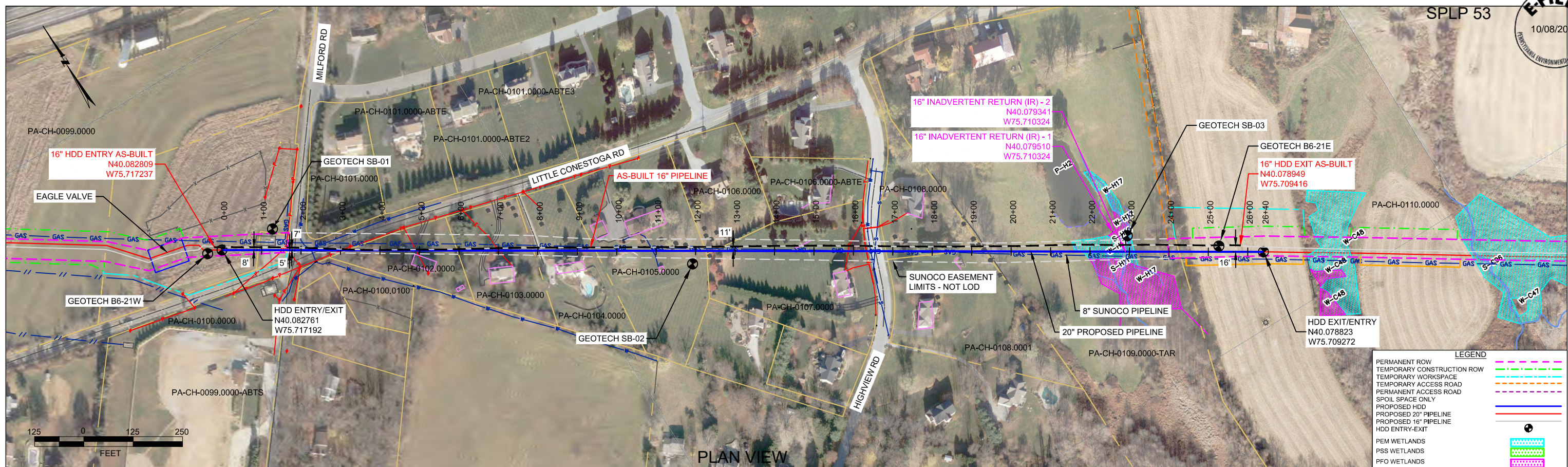
Sunoco Logistics Partners L.P.

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

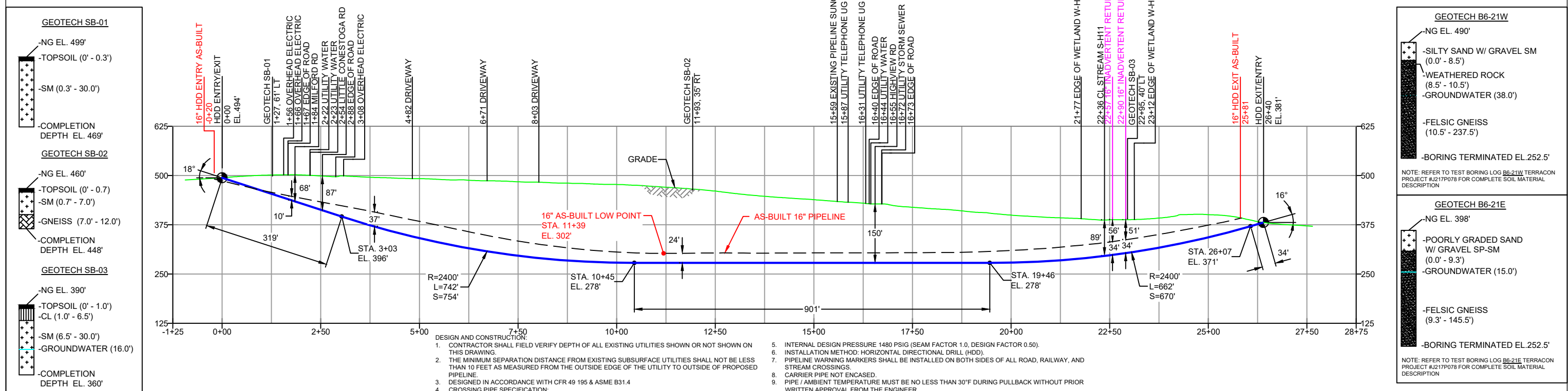
HORIZONTAL DIRECTIONAL DRILL
LITTLE CONESTOGA ROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200' DWG. NO. PA-CH-0100.0000-RD-20 IR EX



CHESTER COUNTY, PA - UWCHLAN TOWNSHIP
S3-0290

PROFILE VIEW



NOTE: REFER TO TEST BORING LOG S3-0290 FOR COMPLETE SOIL MATERIAL DESCRIPTION

NOTE: REFER TO TEST BORING LOG B6-21W TERRACON PROJECT #J217P078 FOR COMPLETE SOIL MATERIAL DESCRIPTION

NOTE: REFER TO TEST BORING LOG B6-21E TERRACON PROJECT #J217P078 FOR COMPLETE SOIL MATERIAL DESCRIPTION

- DESIGN AND CONSTRUCTION:
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - 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.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ. LENGTH (L)=2640'
HDD PIPE LENGTH (S)=2678'
20" x 0.456" W.T., X-65, API5L, PSL2, ERW, BFW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCONCRETE OR ENGINEER APPROVED EQUAL)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
 - CARRIER PIPE NOT ENCASED.
 - PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.

Figure 2. Revised 20-Inch HDD Plan and Profile

NOTES

- ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
- STATIONING IS BASED ON HORIZONTAL DISTANCES.
- 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.
- CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
- SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REF. DRAWING		REVISIONS	
ES-6.27	TO ES-6.29	EP3	SWITCHED 20" CENTERLINE LOCATION, INCREASED DEPTH OF DRILL AND ADDED GEOTECH INFORMATION
SHEET 16	TO SHEET 17	EP2	REVISED PER PADEP COMMENTS RECEIVED 09-06-16
		EP1	REVISED PER PADEP COMMENTS
		EP	
		D	ADDED GEOTECH INFO
		C	ISSUED FOR BID
DWG NO	DWG NO	DESCRIPTION	NO.

	SUNOCO PIPELINE, L.P.		
	HORIZONTAL DIRECTIONAL DRILL LITTLE CONESTOGA ROAD PENNSYLVANIA PIPELINE PROJECT		
	SCALE: 1"=250'	DWG. NO.	PA-CH-0100.0000-RD



EXHIBIT 6



pennsylvania
DEPARTMENT OF ENVIRONMENTAL
PROTECTION

January 23, 2020

Mr. Matthew Gordon
Sunoco Pipeline, L.P.
535 Fritztown Road
Sinking Spring, PA 19608

Re: Hydrogeological HDD Reevaluation Report
Little Conestoga Road Crossing Horizontal Directional Drill (S3-0290)
Permit No. E15-862
Upper Uwchlan Township
Chester County

Dear Mr. Gordon:

The Department of Environmental Protection (DEP) has reviewed the supplemental Horizontal Directional Drill (HDD) analysis that Sunoco Pipeline, L.P. (SPLP), submitted for the Little Conestoga Road Crossing, 20-inch HDD Location (S3-0290) and permitted under Permit E15-862. The SPLP HDD reevaluation was posted on DEP's Pipeline Portal on May 28, 2019. The information is adequate with the understanding that you will be proceeding as set forth in your reevaluation.

DEP's review of the geologic aspects of this HDD reevaluation were completed by a Licensed Professional Geologist.

You may proceed with the permitted HDD activity in the manner proposed in your reevaluation and in accordance with all applicable permit terms and conditions, including the HDD IR and Water Supply PPC Plans.



Mr. Matthew Gordon

- 2 -

January 23, 2020

If you have additional questions, please contact me at the telephone number located in the first page footer.

Sincerely,

A handwritten signature in cursive script that reads "John Hohenstein".

John Hohenstein, P.E.
Environmental Program Manager
Waterways and Wetlands

cc: Mr. Gremminger - Energy Transfer Partners
Ms. Styles - Energy Transfer Partners
Mr. Simcik - TetraTech
Mr. Prosceno - TetraTech
Mr. Staron, P.G. - DEP
Mr. Sofranko - CCCD
Upper Uwchlan Township
Re 30 (GJS20WAW)23



EXHIBIT 7



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.	:	
	:	
v.	:	EHB Docket No. 2020-085-L
	:	
COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION	:	

AFFIDAVIT OF JOSHUA A. PROSCENO

Joshua A. Prosceno states as follows:

1. My name is Joshua A. Prosceno. I have a bachelor’s degree in geography and environmental planning from Bloomsburg University.

2. I previously worked for the Columbia County Conservation District from 2011 to 2013. I then worked for AK Environmental as an environmental inspector for the Tennessee Gas Pipeline, both for the Northeast Upgrade and 300 Line projects. AK Environmental was then merged with a company called NV5, where I then continued to work on pipeline projects, including the Columbia Gas 1278 Project in Chester County, where I worked as a lead environmental inspector. I then went to work for my current employer, Tetra Tech, in February 2017.

3. I currently serve as the Chief and Lead Environmental Inspector for Construction Spreads 5 and 6 for the Mariner East 2/2X pipeline project. Spread 6 includes Chester County, Pennsylvania. I also previously served as the Chief and Lead Environmental Inspector for Construction Spread 4.

4. My responsibilities as a Chief and Lead Environmental Inspector include providing oversight and guidance to a team of environmental inspectors that are in the field for the Mariner East project. I also directly perform environmental inspections in the field and assist in responding



to environmental incidents as necessary. I am responsible for coordinating with the local County Conservation Districts and the Pennsylvania Department of Environmental Protection (the “Department”) for field inspections. I am also responsible for preparing and coordinating various environmental reports submitted to the Department that are required by the Department’s permits for the Mariner East project, including incident reports, corrective action reports, current conditions reports, and reports when an inadvertent return (“IR”) occurs at a horizontal directional drill (“HDD”) site. I work on the Mariner East project six days a week, Monday through Saturday, from 6:00 a.m. to 5:00 p.m. each day, and often am called upon to respond to events on my off-hours.

5. One of the locations that I am responsible for as a Chief and Lead Environmental Inspector is a construction location known as HDD 290, also known as the “Milford Road/Little Conestoga Road” HDD, which is located in Upper Uwchlan Township, Chester County. I was present at the HDD 290 site immediately following the IR of drilling fluid that occurred at this location on August 10, 2020.

6. The IR was discovered at approximately 3:30 p.m. by the onsite professional geologist at HDD 290 when he was walking the area as part of the daily inspection of active work areas.

7. The IR first emerged into a wetland (identified as wetland W-H17, which is partially a palustrine emergent wetland and partially a palustrine forested wetland). Within wetland W-H17 are two unnamed tributaries to Marsh Creek Reservoir (the “lake”) (identified as streams S-H10 and S-H11), which lead to and discharge to the lake (identified as Pond H3). After the IR emerged in wetland W-H17, it then entered streams S-H10 and S-H11, and flowed down the streams ultimately into the lake (Pond H3).



8. Consistent with established practices and the applicable requirements of the permits, a system of sandbags and silt fence dams were constructed within stream S-H10 to contain the IR. Two turbidity curtains were installed at the confluence of stream S-H10 and the lake (Pond H3). Field response crew members began immediate cleanup of the IR and recovery of the drilling fluid starting at the IR release point and working their way toward the lake (Pond H3). Cleanup efforts were accomplished using pumps and hand tools to recover the drilling fluid from the wetland and streams into storage tanks on-site.

9. Immediately after the discovery of the IR, I walked the stream bed from the IR source down to its confluence with the cove of the lake, a distance of approximately 1,933 feet. I visually observed the IR discharge flowing down the low-flow and slow-moving stream. The IR discharge was just reaching the inlet to the cove as the initial two turbidity curtains, which were brought in from an adjacent agriculture field, were being placed at the stream's confluence with the cove. Since there was no rainfall immediately prior to or during the discharge, the discharge was visually evident in the stream. Two turbidity curtains were initially placed at the base of the stream near its confluence with the cove to prevent any additional discharge from entering the cove. The turbidity curtains act as a temporary dam, slowing down the water and allowing the sediments to settle out upslope of the turbidity curtain prior to reaching the cove. Once the two turbidity curtains were placed, visual observations indicated that there was no further IR discharge entering the cove. The sediment-laden water, along with stream flow, was pumped out from behind the turbidity curtains and used to wash the vegetation upstream, and thereafter pumped to vac trucks and disposed offsite. Because the turbidity curtains were placed as the discharge was reaching the cove of the lake prohibiting further discharge of the IR sediments, only a small amount of drilling fluid from the IR reached the lake.



10. Upon discovery, the HDD activity was stopped and the IR was immediately reported verbally to the Department by telephone call to the following individuals at the Southeast Regional Office: Frank DeFrancesco at 3:51 p.m.; Desiree Henning-Dudley at 3:52 p.m.; John Hohenstein at 3:54 p.m.; and the Department's emergency hotline number at 3:57 p.m. The IR was also reported to Officer Robert Bonney at the Pennsylvania Fish and Boat Commission at 4:01 p.m.; Dave Caplan at the United States Army Corps of Engineers at 4:04 p.m.; Joseph Sofranko at the Chester County Conservation District at 4:43 p.m.; and Shanna Lodge, Township Manager of Upper Uwchlan Township at 5:00 p.m. The Department of Conservation and Natural Resources was also notified at 5:30 p.m.

11. The IR was also reported to the local public water supplier, Aqua America, at 4:25 p.m. A subsequent written notice was also sent to Aqua America by letter on August 11, 2020. Written notices were also sent to the two landowners with private water supplies located within 450 feet of the HDD profile.

12. I prepared the written Initial IR Report submitted to the Department the following day on August 11, 2020. I also prepare the written Interim IR Reports that are submitted to the Department every five business days after the initial report, and that will be submitted until completion of construction at the HDD 290 location.

13. I or my subordinates took the photographs that are included in the Initial IR Report and the Interim IR Reports.

14. I or my subordinates have also visited the HDD 290 location multiple times each day since August 10, 2020 and have taken photographs of the conditions of wetland W-H17, streams S-H10 and S-H11, and the lake. These photographs are compiled into daily Current Condition Reports that are included in the Interim IR Reports that are sent to the Department.



15. In addition, as part of my role as a Chief and Lead Environmental Inspector, I have been responsible for inspection of various other HDD locations following an IR, including locations where a containment structure was built surrounding the IR that then was used as a relief point for the drilling fluid to allow the HDD to complete construction while minimizing further releases of the drilling fluid from the discrete confined area. The Department has routinely approved containment structures around an IR location by a redline permit modification approval for the sandbags and silt fence in both uplands and waters of the Commonwealth, which has allowed construction of the HDD to be completed. I and my subordinates have been responsible for inspecting these IR containment structures and monitoring and reporting the amounts of drilling fluid that is recaptured from within the containment structures and recycled/reused as part of the HDD operations.

16. In fact, during the construction of the 16-inch pipeline at the HDD 290 location, on June 24, 2017 an IR occurred in wetland W-H17 and streams S-10 and S-H11 (which is the same area as the most recent August 10, 2020 IR), and a sandbag dam and pump were also set up in the wetland and stream to contain the IR. The Department allowed construction of the HDD for the 16-inch pipeline to continue with the sandbag containment structure in place for the remainder of the HDD construction, with additional sandbags being added when a second IR occurred at the same location on August 29, 2017. After the construction of the first 16-inch pipeline at this location was successfully completed and the pipeline was installed, the sandbag containment structure was then removed and the wetland and streams were restored.


17. I have seen the sandbag and silt fence containment structures that were approved by the Department successfully minimize further releases of the drilling fluid from the discrete confined area of the containment, and allowed the HDD to be completed at a number of locations



both in Chester County and Spread 6, as well as other areas of the project for which I am currently, or was previously responsible. That in fact was the case for the 16-inch pipeline installation at HDD 290, where a containment structure was approved and used to complete to complete the pipeline installation, as described above.

18. I understand that this affidavit is provided subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020



Josh Prosceno



EXHIBIT 8



COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

In the matter of:

Sunoco Pipeline, L.P. 535 Fritztown Road Sinking Springs, PA 19608	: Violations of The Clean Streams Law : and DEP Chapters 93, 102, and 105 of : Title 25 of the Pennsylvania Code. : : PA Pipeline Project—Mariner East II : E&S Permit No. ESG0100015001 : : WO&E Permit No. E15-862
--	---

ADMINISTRATIVE ORDER

Now this 11th day of September, 2020, the Commonwealth of Pennsylvania, Department of Environmental Protection (“Department”), has found and determined the following facts and findings and by this Administrative Order imposes the specified performance obligations upon Sunoco Pipeline, L.P. (“Sunoco”).

Findings

Parties

A. The Department is the agency with the duty and authority to administer and enforce The Clean Streams Law, Act of June 22, 1937, P.L. 1987, *as amended*, 35 P.S. §§ 691.1-691.1001 (“Clean Streams Law”); the Dam Safety and Encroachment Act, the Act of November 26, 1978 P.L. 1375, as amended, 32 P.S. §§ 693.1 et seq. (“Dam Safety and Encroachment Act”); Section 1917-A of the Administrative Code of 1929, Act of April 9, 1929, P.L. 177, *as amended*, 71 P.S. § 510-17 (“Administrative Code”); and the rules and regulations promulgated thereunder (“rules and regulations”).

B. Sunoco Pipeline, L.P. (“Sunoco”) is a foreign limited partnership doing business in Pennsylvania and maintains a mailing address of 535 Fritztown Road, Sinking Springs, PA 19608.



Sunoco Logistics Partners Operations GP LLC is the general partner of Sunoco Pipeline, L.P. Joseph Colella is Executive Vice President for Sunoco Logistics Partners Operations GP LLC. Mr. Colella has been granted authority by Sunoco Logistics Partners Operations GP LLC to sign documents for Sunoco on behalf of the General Partner.

C. Sunoco owns and operates numerous pipelines in Pennsylvania used to transport petroleum and natural gas products. Sunoco has undertaken an effort to expand existing transportation systems for natural gas liquids in Pennsylvania, which is collectively referred to as the Pennsylvania Pipeline Project – Mariner East II (“PPP-ME2”). As part of PPP-ME2, Sunoco is conducting pipeline installation activities in seventeen counties in Pennsylvania, including Chester County.

Permits

- D. To construct PPP-ME2 through Chester County, Sunoco obtained:
- a. An Erosion and Sediment Control Permit under 25 Pa. Code Chapter 102, Permit Number ESG0100015001 (“Chapter 102 Permit”) and;
 - b. A Water Obstructions and Encroachment (“WOE”) Permit under 25 Pa. Code Chapter 105, Permit Number E15-862 (“Chapter 105 Permit”).
- E. For purposes of this Administrative Order, Horizontal Directional Drilling (“HDD”) is defined to include any steerable trenchless technology that controls the direction and deviation to a predetermined underground target or location.

Site

F. The work area for PPP-ME2 in Chester County, Pennsylvania includes the horizontal directional drill (“HDD”) installation of a 16-inch diameter pipeline and a 20-inch diameter pipeline that traverses Little Conestoga Road in Upper Uwchlan Township, Chester



County, Pennsylvania (“HDD S-3-0290”). The alignment of HDD S-3-0290 passes from the northwest to the southeast in the Marsh Creek Watershed with groundwater flow in the HDD bore alignment being towards Marsh Creek/Marsh Lake to the south and southwest.

G. The 16-inch pipeline was installed in 2017. During that installation, the HDD had an inadvertent return (“IR”) of approximately 100 gallons of drilling fluids to wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11, to Marsh Creek Lake on June 24, 2017. S-H 10 and S-H 11 are listed as High Quality-Trout Stocked Fisheries. On August 29, 2017, another IR of approximately 40 to 50 gallons occurred in wetland WL-17 along Stream S-H 11 approximately 40 feet from the original IR location during drill ream operations on HDD S-3-0290.

H. In accordance with the Corrected Stipulated Order entered by the Environmental Hearing Board on August 10, 2017 at Docket No. 2017-009-L, Sunoco conducted a re-evaluation of HDD S-3-0290 for installation of the 20-inch pipeline. The HDD S-3-290 re-evaluation report was submitted to the Department on May 28, 2019 and approved by the Department on January 23, 2020 (“Re-evaluation Report”).

I. As part of that re-evaluation, Sunoco reported that:

A 1.01 mile reroute to the north of the HDD is technically feasible. This would entail adjusting the project route prior to this HDD’s northwest entry/exit point to proceed north, cross under the Pennsylvania Turnpike, then proceed east for 0.7 miles parallel to the turnpike, cross Little Conestoga Road, then turn south, cross under the turnpike, and then re-intersect the existing project route just east of this HDDs southeast entry/exit point. There is no existing utility corridor here, however; therefore, this route would create a Greenfield utility corridor and would result in encumbering previously unaffected properties. The route would still cross two Waters of the Commonwealth and possible forested wetlands, and would pass in near proximity or immediately adjacent to five residential home sites. Both crossings of the turnpike would require “mini” HDD’s or direct pipe bores to achieve the required depth of cover under the highway. Considered against the possibility of additional IR’s occurring on the proposed HDD, **which are readily contained and cleaned up with minimal affect to natural resources,** the permanent taking of the new



easement and likely need to use condemnation against previously unaffected landowners results in SPLP's opinion that managing the proposed HDD is the preferred option. (emphasis added). Re-evaluation Report at p. 6 "Re-Route Analysis".

J. The Re-evaluation Report also included an "HDD Hydrogeologic Reevaluation Report – HDD S3-0290 dated May 2019 ("Hydro Report"). It was noted as a conclusion in that report that "[t]he synthesis of regional and local geologic data together with past drilling performance during drilling for the 16-inch pipeline indicate that **installation of the 20-inch line at HDD S3-0290 has a moderate to high risk of drilling fluid loss and IRs.**" (emphasis added) Hydro Report at p. 15.

K. In February 2020, Sunoco commenced drilling the pilot hole for the 20-inch pipeline at HDD S-3-0290.

L. In spite of Sunoco's assurances that it could readily contain and clean up any IRs that might occur on HDD S-3-0290 with minimal affect to natural resources, on August 10, 2020, the Department received notice from Sunoco of an IR at HDD Site S-3-0290, PA-CH-0100.0000-RD, in the vicinity of Green Valley Road in Upper Uwchlan Township, Chester County. Sunoco ultimately reported that approximately 8163 gallons of drilling fluids had surfaced in wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11, the same aquatic resources impacted by the 2017 IRs.

M. At the time of the Department's inspection on August 10, 2020, Sunoco had attempted to contain the IR by deploying various silt fences in wetland WL-17 and unnamed tributaries S-H 10 and S-H 11 and two sets of instream silt containment booms (weighted silt curtains) to reduce the amount of bentonite entering Marsh Creek Lake. There was no sandbag containment in wetland WL-17 to capture drilling fluids. An effort was being made to pump some of the drilling fluids from wetland WL-17. Representatives from Sunoco indicated that they were



still attempting to obtain landowner permission in order to gain access to areas to fully address the IR. Despite Sunoco's efforts to contain and clean up the IR, the IR discharged to wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11 and then flowed and discharged into Marsh Creek Lake, a water of the Commonwealth. Wetland WL-17 and two unnamed tributaries, S-H 10 and S-H 11 were coated with a thick layer of drilling mud. A plume of drilling mud filled a cove of Marsh Creek Lake.

N. Marsh Creek Lake is in Marsh Creek State Park, one of the most visited state parks in Pennsylvania. Marsh Creek State Park receives more than 1,000,000 visitors each year. Marsh Creek Lake is one of the primary recreational resources in the park. The 535-acre lake is used year-round for fishing and boating. It also provides important habitat for migrating waterfowl. Following the inadvertent return, 33 acres of Marsh Creek Lake had to be closed to the public.

O. On August 11, 2020, the Department received notice of a subsidence event in wetland WL-17 measuring 15 foot in diameter and 8 foot deep. The subsidence event allowed drilling fluids into the underground horizon and the wetland, adversely impacting the functions and values of the wetland, and constituting a discharge of industrial waste to groundwater, a water of the Commonwealth and wetlands, a water of the Commonwealth.

P. Immediately after the inadvertent return the Department conducted inspections of this area on August 10, 2020, August 11, 2020, August 12, 2020, and August 13, 2020.

Q. On August 17, 2020, Sunoco submitted a Restart Report for HDD S-3-290. In that report, Sunoco proposes to construct "unconventional pressure relief points" ("UPRPs"), which consist of sand-bag dams constructed at the location of the two IRs that occurred in 2017 and in wetland WL-17. Sunoco asserts, once again, that if a future IR were to occur at any of those locations, this time the drilling fluids will be collected and transported to either the entry or exit



pits for HDD S-3-0290 and recycled at the mud plant. Sunoco did recognize that placement of the sandbag dam within wetland WL-17 would require additional permitting. The Department has not approved the Restart Report for HDD S-3-0290.

R. On August 20, 2020, the Department issued a Notice of Violation to Sunoco, requesting that Sunoco provide plans to address the impacts of the inadvertent return and subsidence events to waters of the Commonwealth and information regarding various aspects of the HDD. To date the Department has not received all information requested by that Notice of Violation.

S. Sunoco's efforts to clean up the inadvertent return and assess its impacts to waters of the Commonwealth continues as of the date of this order. The Department continues to monitor conditions and cleanup efforts at this site. The 33-acre portion of Marsh Creek Lake referenced in Paragraph M, above, remains closed to recreational boating and fishing and all other public use due to the presence of drilling fluids on the lake bottom.

Violations

T. The drilling fluids described in Paragraphs L, M and O, above, constitute Industrial Waste. Sunoco's discharge of Industrial Waste to waters of the Commonwealth without a permit is a violation of 25 Pa. Code § 92a.1(b) and Section 301 of the Clean Streams Law, 35 P.S. § 691.301 and Section 18 of the Dam Safety and Encroachments Act, 32 P.S. § 693.18.

U. The violations described in Paragraphs L, M and O, above, constitute unlawful conduct under Sections 401 and 611 of the Clean Streams Law, 35 P.S. §§ 691.401 and 691.611; and a statutory nuisance under Sections 401 and 601 of the Clean Streams Law, 35 P.S. §§ 691.401 and 691.601. The violation in Paragraph L constitutes unlawful conduct under Section 18 of the



Dam Safety and Encroachments Act, 32 P.S. § 693.18; and a statutory nuisance under Section 19 of the Dam Safety and Encroachments Act, 32 P.S. § 693.19.

NOW, THEREFORE, pursuant to Section 20 of the Dam Safety and Encroachments Act, 32 P.S. § 693.20; Sections 5, 402, and 610 of The Clean Streams Law, 35 P.S. § 691.5, 691.402, and 691.610; and Section 1917-A of the Administrative Code, 71 P.S. § 510-17, the Department hereby ORDERS the following:

1. Except as specified herein, Sunoco shall immediately suspend all work authorized by the permits described in Paragraph D, above, for HDD S-3-0290 until the Department provides written authorization to resume work, except as is necessary to stabilize the site to prevent erosion and sedimentation in accordance with Paragraph 6, and to prevent additional pollutants from entering waters of the Commonwealth, including wetland WL-17, unnamed tributaries S-H 10 and S-H 11 of Marsh Creek Reservoir, and the Marsh Creek Reservoir, which is located in Marsh Creek State Park. In no event shall Sunoco undertake any pipeline installation activities at the site of HDD S-3-0290, including drilling or drilling-related preparation and drilling support activities, or the installation of casing, unless expressly authorized by the Department in writing.

2. Sunoco shall take all steps necessary, including the submission of appropriate applications and supporting materials for permit amendments, to implement the reroute of HDD S-3-290 that Sunoco previously found to be technically feasible in the Re-evaluation Report.

3. Within 30 days of the effective date of this Administrative Order, Sunoco shall submit a report to the Department that fully explains how the August 10, 2020 inadvertent return described in Paragraph L above, occurred and how the August 11, 2020 subsidence event described in Paragraph N above, occurred. Such report shall also detail the results of all geophysical testing



conducted by or on behalf of Sunoco from January 1, 2010 to the date of this Order for the 2000-foot-long by 50-foot-wide section of the HDD profile centered on the August 10, 2020 IR location areas of the HDD profile, as well as the results of all geophysical testing conducted on behalf of Sunoco from January 1, 2010 to the date of this Order in any other areas or resources that were impacted by the August 10, 2020 IR and subsidence event. The geophysical testing data shall include all results of microgravity, electrical resistivity, seismic refraction and any other geophysical testing. The report shall include analyses of each of the tests, verified by a qualified professional,

4. Sunoco shall address, to the Department's satisfaction, all impacts to waters of the Commonwealth that occurred as a result of the August 10, 2020 inadvertent return and the August 11, 2020 subsidence event by restoring and remediating impacted aquatic life, biota, and habitat, including the functions and values of the impacted wetlands resources, and all impacted recreational uses, to a condition equal to or better than that in place before the incidents occurred.

a. On or before October 1, 2020, unless the Department approves a later date in writing, Sunoco shall submit an impact assessment ("Impact Assessment") and a cleanup and restoration plan for HDD S-3-0290 Drill Site ("Restoration Plan") to the Department for review and approval to address all temporary and/or permanent impacts to waters of the Commonwealth that occurred as a result of the August 10, 2020 inadvertent return and August 11, 2020 subsidence event. The Impact Assessment and the Restoration Plan shall include a detailed resource delineation and function assessment for the wetland, stream, and reservoir in the areas impacted by the IR and subsidence event, as well as reference areas. The Restoration Plan shall provide for at least five (5) years of monitoring after the restoration activities are completed. For the first two (2) years, Sunoco shall submit



monitoring reports under the Restoration Plan to the Department on a quarterly basis with monitoring reports due on January 30th, April 30th, July 30th, and October 30th of each year for the preceding calendar quarter. After the initial two (2) year monitoring period, monitoring reports shall be submitted on an annual basis, with the first annual report due on January 30th following year three (3).

b. If the Department finds that Sunoco's implementation of the Restoration Plan has failed to eliminate impacts to waters of the Commonwealth, then Sunoco shall submit a mitigation plan for the HDD S-3-0290 Drill Site ("Mitigation Plan") to the Department for review and approval to address impacts to waters of the Commonwealth that occurred as a result of the August 10, 2020 inadvertent return and the August 11, 2020 subsidence event. The Mitigation Plan shall provide for replacement of the functions and values of all impacted wetlands at a minimum area of 0.25 acre or at a ratio of 2:1, whichever is greater, within the Marsh Creek watershed. In accordance with Permit No. E15-862, special condition EE, the Mitigation Plan shall provide for at least five (5) years of monitoring after the restoration activities are completed.

c. Sunoco shall conduct the Impact Assessment and implement the Restoration Plan at Paragraph 4.a., above, immediately upon receipt of written approval from the Department unless the Department extends that timeframe in writing. If the Department determines that a Mitigation Plan is needed pursuant to Paragraph 4.b., then Sunoco shall implement the Mitigation Plan at Paragraph 4.b., above, within 90 days of receiving written approval from the Department, unless the Department extends that timeframe in writing.



5. In the event the Department determines that additional information, revisions, modifications or amendments are necessary to any permit, plan, any other submission, or restoration and remediation work required by this Order, then within ten (10) days after receipt of written notice from the Department, Sunoco shall submit to the Department such information, revisions, amendments or modifications, and/or complete the modified work, unless an alternative timeframe is approved by the Department in writing.

6. Effective immediately, Sunoco shall secure the partially constructed borehole with grouting or an equivalent method and stabilize all disturbed areas at HDD S-3-0290 in accordance with the approved E&S Plans and in compliance with 25 Pa. Code § 102.22(a) and/or (b), as appropriate. Sunoco shall continue routine monitoring of the installed BMPs and shall perform all necessary ongoing operation and maintenance activities to ensure the BMPs continue to perform as designed, in accordance with the approved E&S Plan and permit until the disturbed areas along the current alignment for HDD S-3-0290 are permanently stabilized.

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa.C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, P.O. Box 8457, Harrisburg, PA 17105-8457, 717-787-3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800-654-5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's rules of practice and procedure may be obtained from the Board. The appeal form and the Board's rules of practice and procedure are also available in braille or on audiotape from the Secretary to the Board at 717-787-3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.



IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST REACH THE BOARD WITHIN 30 DAYS. YOU DO NOT NEED A LAWYER TO FILE AN APPEAL WITH THE BOARD.

IMPORTANT LEGAL RIGHTS ARE AT STAKE, HOWEVER, SO YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD (717-787-3483) FOR MORE INFORMATION.

FOR THE COMMONWEALTH OF
PENNSYLVANIA, DEPARTMENT OF
ENVIRONMENTAL PROTECTION:

A handwritten signature in cursive script, appearing to read "John Hohenstein".

John Hohenstein, P.E.
Environmental Program Manager



EXHIBIT 9



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.	:	
	:	
v.	:	EHB Docket No. 2020-085-L
	:	
COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION	:	
	:	

AFFIDAVIT OF BRAD SCHAEFFER

Brad Shaeffer states as follows:

1. My name is Brad Schaeffer, and I am a Senior Biologist and Project Manager at Tetra Tech for the Mariner East 2 and 2X pipeline project (the “Project”).
2. I have personally visited the site of the inadvertent return (“IR”) associated with HDD S3-0290 (“HDD 290”) occurring on August 10, 2020 in wetland W-H17 in Upper Uwchlan Township, Chester County, PA. While there, I viewed streams S-H10 and S-H11, wetland W-H17, and the IR containment structure that was previously constructed in wetland W-H17 as an emergency response measure following the discovery of the IR.
3. The location where the drilling fluid emerged on August 10, 2020 is expected to be the path of least resistance for any future IR that may develop during the completion of HDD 290.
4. To prevent and mitigate impacts associated with any IR that may develop at this location during the completion of HDD 290, the containment structure surrounding the location of the IR will be used as an unconventional pressure relief point.
5. I assisted in the preparation of an Emergency Permit application submitted to the Pennsylvania Department of Environmental Protection (the “Department”) to permit the IR



containment structure located in wetland W-H17 to remain in place and be used as an unconventional pressure relief point for a borehole grout operation. Although the Emergency Permit application was submitted to permit the IR containment structure for the grouting of the borehole, the exact same IR containment structure would be used during the completion of HDD 290.

6. The containment structure is designed to include a stacked sandbag wall approximately six feet high at its maximum and 30 feet long. The convex shaped wall is positioned upslope and immediately downslope from the IR location. For added protection against impacts to wetland W-H17 and streams S-H10 and S-H11, this wall is supported on the downslope side with a belted reinforced silt fence secured with steel and wooden stakes. An additional stacked sandbag wall approximately three feet downslope from this structure is designed to be three feet maximum in height. A containment structure of this size can contain approximately 14,000 gallons of drilling fluid, which is approximately double the amount of drilling fluid that resulted from the IR on August 10, 2020.

7. Within the containment structure is a 4-inch self-contained hydraulic pump, which will pump any material discharged from the IR through hoses to storage tanks located nearby in an adjacent upland area. Although there currently is constant groundwater input into the containment structure as evidenced by ponding of water upslope of the structure, this 4-inch pump will be used to dewater the relief point in order to maintain a constant capacity to receive any IR material during completion of HDD 290. Any water or IR material, or combination thereof, emerging as a result of the completion of the drill will be pumped to storage tanks using vacuum trucks or pumps. The storage tanks will be periodically emptied by additional vacuum trucks to assure they always have enough capacity.



8. At least one backup vacuum truck will always be staged on composite matting in the adjacent uplands to mitigate a release rate that may threaten to overwhelm the containment or in case of equipment failure. Additionally, extra pumps, hoses, silt fence, compost filter sock, and sandbags will be staged within the adjacent uplands in case they are needed. The topography of the area is conducive to lengthening and heightening of the existing structure and this extra equipment and material could be used for that purpose.

9. In addition to the structural and hydraulic means to control any discharge resulting from the IR, an environmental inspector and professional geologist will be on-site at all times during drilling operation to review the operation of the containment structure. The adjacent areas, drill alignment, and downslope areas of the IR location including streams S-H10 and S-H11 will be visually inspected at least twice a day.

10. The IR containment structure and related measures described above can successfully manage and contain any new discharges that may result from an IR occurring during the completion of drilling of HDD S3-0290.

11. This design of an IR containment structure has previously been permitted by the Department and successfully used to complete other HDDs for the Project, including but not limited to HDDs: S2-0121, S2-0142, S2-0210, S2-0220, S2-0247, and S3-0081.

12. Once HDD 290 is constructed, the IR containment structure and its apparatus will be removed and the area of wetland W-H17 will be restored in accordance with the permit issued by the Department. A five-year monitoring program will begin to ensure successful restoration of this area, with periodic reports prepared and submitted to the Department.

13. An impact assessment conducted by Tetra Tech in streams S-H10 and S-H11 after the immediate cleanup of the IR that occurred on August 10, 2020 found that any physical



impacts that occurred to the streams as a result of the IR were minor and temporary, as the streams have already been restored to their original condition. The IR and associated remediation and restoration activities did not involve any permanent changes to flow patterns, bed and bank grades, bed substrate or any channel deepening/dredging activities, addition of structures or impervious surfaces in the stream floodways, or loss of riparian forested vegetation.

14. The figure attached as Exhibit A is an illustration of the Reroute described in the Reevaluation Report, along with permanent and temporary rights-of-way and temporary workspaces.

15. The time necessary to prepare complete Chapter 102 and Chapter 105 major permit modification applications for the Reroute described in the Reevaluation Report for submittal to the Department is expected to take between approximately eight to twelve months. Past submittals of major permit modification applications for other sections of the Project have taken the Department over a year to approve after application submittal.

16. All of the conclusions and opinions set forth in this Affidavit are provided to a reasonable degree of scientific certainty.

17. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020

A handwritten signature in black ink that reads "Bradley A. Schaeffer".






Brad Schaeffer

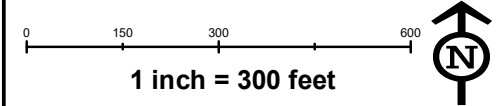


EXHIBIT A



Legend

-  Centerline
-  Permanent ROW
-  Temporary ROW
-  ATWS
-  Temporary Access Road



Prepared By: 	Date: 10/5/2020
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Base Map; ESRI World Imagery 09/2019.

Coordinate System: NAD 83 Stateplane, PA South, Feet



EXHIBIT 10



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.

v.

**COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF ENVIRONMENTAL
PROTECTION**

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EHB Docket No. 2020-085-L

AFFIDAVIT OF JOSHUA COLLINS

Joshua Collins states as follows:

1. My name is Joshua Collins and I am employed as a Project Manager at AECOM Technical Services, Inc. (“AECOM”), a consulting services firm. My office is located in Conshohocken, Pennsylvania.

2. I have a Bachelor of Arts in Psychobiology from Arcadia University.

3. I am the project coordinator on a project in which AECOM is performing an assessment of impacts to the Marsh Creek Reservoir (the “lake”) from the Inadvertent Return (“IR”) that occurred on August 10, 2020 within wetland W-H17 and flowing into streams S-H10 and S-H11, which drain into the lake, as well as preparing a Restoration Plan to address impacts to the lake.

4. As part of the impact assessment of the IR to the lake, AECOM performed visual inspections, sediment probing, and coring of the bottom of the lake near the mouth of streams S-H10 and S-H11 and determined that approximately 7.3 acres of 535 acres, or approximately 1%, of the lake, were impacted by newly deposited sediments from a range of potential sources which may include stormwater runoff and the IR.

5. AECOM collected sediment samples of the newly deposited sediment for United States Geological Survey Full Clay Phase Analysis by X-ray diffraction. Laboratory analyses



were performed by RJ Lee Group. Four samples of the newly deposited sediments collected within the 7.3-acre impacted area contained trace amounts (less than 5%) of bentonite.

6. AECOM also developed a conceptual Restoration Plan for the area of the lake that was impacted by the IR. The Restoration Plan recommends hydraulic dredging within a portion of the impacted area of the lake to remove newly deposited sediments where estimated thicknesses were greater than 1-inch. The Restoration Plan also includes a 2-year monitoring period with reports to be sent to the Pennsylvania Department of Environmental Protection (the "Department") to demonstrate the effectiveness of the Restoration.

7. Implementation of the Restoration Plan will provide a temporary net benefit to the lake by the removal of noxious aquatic plants associated with the hydraulic dredging, improving current habitat and recreational conditions.

8. Unrelated real estate development, construction, and agricultural activities present in the watershed that drains into streams S-H10 and S-H11 and ultimately to the lake may serve as sources of increased sediment transport and deposition within the impacted area of the lake, particularly following large storm events.

9. The Department currently lists the lake as impaired for recreation due to noxious aquatic plants and aquatic life due to nutrients from urban runoff and storm sewers, agriculture, and municipal point source discharges, and fish consumption due to mercury

10. I have made the statements in this Affidavit to the best of my knowledge, information, and belief. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020

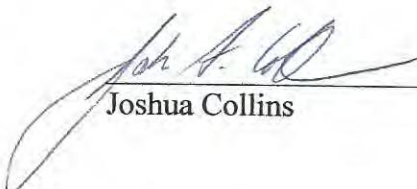

Joshua Collins



EXHIBIT 11



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.,

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v.

EHB Docket No. 2020-085-L

**COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF ENVIRONMENTAL
PROTECTION,**

AFFIDAVIT OF BRIAN MAGEE, PH.D.

Brian Magee, Ph.D states as follows:

1. My name is Brian Magee, and I am a Senior Vice President and Principal Toxicologist with Arcadis U.S., Inc. I have over 35 years’ experience in the fields of toxicology and risk assessment. A copy of my curriculum vitae is attached as Exhibit A.

2. I provide this affidavit to address the materials and products used in the horizontal directional drilling (“HDD”) process at HDD 290, that were released as a result of the inadvertent return of drilling fluid on August 10, 2020.

3. I have reviewed documents regarding the drilling fluid released at the HDD 290 location, including the products that were used as part of the HDD process. In addition to water, the materials used in the drilling fluid at HDD 290 include the following products:

- a. Bentonite (Bara-Kade®Plus Bentonite) (Bentonite Performance Minerals LLC)
- b. Bentonite (PLUGZ-IT™ MAX) (WYO-BEN, Inc.)
- c. Bentonite (SUPER GEL-X®) (CETCO)
- d. Sodium Bicarbonate (Univar/Arm & Hammer)
- e. Citric Acid – Food Grade (Univar/Tate & Lyle Ingredients Americas, LLC)



f. Soda Ash/Sodium Carbonate (Ciner)

4. I have reviewed each of these products and it is my opinion, to a reasonable degree of scientific certainty, that none present concern for human health in the concentrations found in, around, and downstream from the release of drilling fluid as a result of the inadvertent return on August 10, 2020.

5. First, bentonite is a natural mineral clay material that is non-toxic. Bentonite is a food additive approved by the U.S. Food and Drug Administration (“FDA”) with no concentration limitation. Bentonite is approved by the World Health Organization (“WHO”) as a food additive. Bentonite is a drinking water safe product that is certified for use in the construction of home water supply wells and is certified by the National Sanitation Foundation (“NSF”)/American National Standards Institute (“ANSI”) Standard 60. In particular, the bentonite products used at HDD 290, Bara-Kade®Plus Bentonite, PLUGZ-IT™ MAX, and SUPER GEL-X®, are each approved by the Pennsylvania Department of Environmental Protection (the “Department”) as an HDD additive, as noted on the Department’s website¹ and/or the NSF website.² In fact, bentonite is often utilized by public water suppliers and intentionally added into the water supply as an NSF/ANSI approved drinking water treatment chemical. Bentonite is also used in animal feed. Bentonite is added to fruit juice, wine, and beer as a clarifier. Bentonite is used medicinally for oral use to address gastrointestinal issues. Bentonite is used in a variety of common household products, like clay face masks, sunscreens, fabric softener, and pet litter.

6. Second, the drilling process at various times also utilized sodium bicarbonate to address an operational condition with the HDD. This product is NSF/ANSI 60 certified as a

¹ Available at: <https://www.dep.pa.gov/Business/Energy/OilandGasPrograms/OilandGasMgmt/IndustryResources/InformationResources/Pages/default.aspx>

² Available at: <https://info.nsf.org/Certified/PwsChemicals/>



drinking water treatment chemical. Sodium bicarbonate is more commonly known as baking soda and is consumed routinely in foods, such as baked goods. It is low in systemic toxicity and it is approved as a food additive without limitation by the FDA and the WHO.

7. Third, the drilling process at various times also utilized citric acid to address an operational condition with the HDD. This product is NSF/ANSI 60 certified as a drinking water treatment chemical. Citric acid is a major component of citrus fruit juices and is consumed routinely in foods. It is low in systemic toxicity and it is approved as a food additive without limitation by the FDA and the WHO.

8. Fourth, the drilling process at various times also utilized sodium carbonate to address an operational condition with the HDD. This product is NSF/ANSI 60 certified as a drinking water treatment chemical. Sodium carbonate is low in systemic toxicity and it is approved as a food additive without limitation by the FDA and the WHO.

9. It is my opinion, to a reasonable degree of scientific certainty, that the bentonite, sodium bicarbonate, citric acid, and sodium carbonate, used as components of drilling fluid at the HDD 290 location, are all non-toxic at the levels found in and around the inadvertent return and do not present a concern for human health.

10. Furthermore, I understand that Sunoco Pipeline L.P.'s ("Sunoco Pipeline") existing protocols and permit conditions require that when an inadvertent return occurs, Sunoco Pipeline notifies both local water suppliers and residents with a private water supply located within 450-feet of the HDD profile. I understand that a local public water supplier, Aqua Pennsylvania ("Aqua"), has a nearby water supply well that serves as a fraction of its source water. I have reviewed Sunoco Pipeline's notice to Aqua, as well as Aqua's response, in which Aqua did not identify any issues or that Aqua had any concerns following the inadvertent return. In addition,



two residents with nearby, upgradient private wells were notified, and no concerns with water quality were raised.

11. I have reviewed the sampling results of the inadvertent return materials that were released into the wetland, streams, and Marsh Creek Reservoir (the “lake”) on August 10, 2020. Surface water samples were collected on August 28, 2020 in the cove where the affected streams enter the lake. These samples were all less than the health-based Federal and Department primary drinking water standards. The samples were taken from locations within the 4.06-acre zone where drilling fluid was observed. To conservatively estimate risks, I assumed that the measured concentrations were representative of the water in the entire cove area, which is 14.03 acres in area. Assuming an average depth of 5 feet (Pennsylvania Department of Conservation and Natural Resources (“PADCNR”), 2015), the volume of water in this cove area is approximately 70 acre-feet. The volume of water in the lake is 13,000 acre-feet (PADCNR, 2014). I estimated the reasonable maximum concentrations of measured constituents in the lake by multiplying the highest measured concentration by the ratio of the cove water volume to the lake water volume (70/13,000). Constituent concentrations estimated in the lake are less than the health-based Federal and Department drinking water standards by factors of 280 to 28,000. The concentrations observed in the lake are less than the Federal and Department non-enforceable secondary drinking water standards, which are not health-based, by factors of 50 to 238,000. Moreover, while no one drinks water directly from the lake, the fact that the levels of constituents observed in the lake were so low demonstrates that any potential incidental contact with and even inadvertent ingestion of water in the lake would not cause any harm to recreators visiting or utilizing the lake.

12. The inadvertent return also did not cause harm to anyone consuming water downstream from the lake, along the East Branch of Brandywine Creek. The lake is the source of



some of the water in the East Branch of Brandywine Creek, which is source water for the Downingtown Municipal Water Authority (“DMWA”) and also provides some of the source water for Aqua, which purchases water from DMWA. According to the Department’s Source Water Assessment (2003), “The Authority owns and operates a water filtration plant where the surface water source goes through an extensive treatment process involving chemical additions, mixing, flocculation, settling, filtration and disinfection prior to distribution.” Thus, any constituents from the inadvertent return that were released into the lake would undergo this extensive filtration and treatment process before being piped into consumers’ homes for public consumption. Therefore, the levels of the constituents observed, which were already below drinking water standards, were reduced even further before anyone consumed the water. Consequently, the release of the inadvertent return did not cause any adverse effects on health from drinking water.

13. I have also reviewed the x-ray diffraction results for the samples of the inadvertent return materials released on August 10, 2020. The Total Suspended Solids (TSS) measured in the cove surface water were 13, 14, and 27 mg/L in three samples taken within the 4.06-acre zone where the recent sedimentation was measured. Although the TSS concentration was likely less in the entire area of the cove, I conservatively assumed that the TSS concentration in the entire 14.03-acre cove was the highest measured value of 27 mg/L. I also assumed that all of the TSS in the water column was the bentonite-containing drilling fluid, even though water in the lake also contains native sediments and also silts that are periodically deposited in the lake during rain events. I estimated the reasonable maximum concentrations of TSS in the lake by multiplying the highest measured TSS concentration (27 mg/L) by the ratio of the cove water volume to the lake water volume (70/13,000). Thus, the estimated TSS concentration in the lake from the inadvertent return materials was 0.0145 mg/L. The highest bentonite concentration measured in the sediment



was reported as “trace” which is defined as less than 5% by weight of the mineral content in a sample. Conservatively assuming that the suspended sediment contained bentonite at the maximum possible concentration of 5%, the estimated bentonite concentration in the lake water from the inadvertent return materials was 0.007 mg/L.

14. While there are no drinking water standards for bentonite, to estimate risk, I compared the estimated lake concentration to the concentration of bentonite used in the food and beverage industry to clarify fruit juices, wines, and beers. According to Purdue University (2010), bentonite levels of 60-1800 mg/L are used to clarify wines. Similar levels are added to fruit juices and beers. The estimated bentonite levels in the lake are **over 8,000 to 247,000 times lower** than the levels added to wines.

15. It is therefore my opinion, to a reasonable degree of scientific certainty, that this very small amount of bentonite observed in the lake water did not cause harm to recreators who might have had incidental contact with the water or inadvertent ingestion of the water, nor did it cause harm to people consuming or bathing with water from DMWA or Aqua.

16. I understand that this affidavit is provided subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020

A handwritten signature in cursive script that reads "Brian Magee".

Brian Magee, Ph. D.



EXHIBIT A

**Education**

Ph.D., Toxicology,
Massachusetts Institute of
Technology, Cambridge, 1986
M.P.A., Science and Public
Policy, University of
Washington, Seattle, 1978
M.S., Chemistry, University of
California, San Diego, 1975
B.S. Chemistry, University of
Virginia, Charlottesville, 1973

Years of Experience

Total - 36
With ARCADIS – 10

Professional Qualifications

Member, Governor's Pesticide
Board
Member, Society of Toxicology
Member, American College of
Toxicology
Member, International Society
for Regulatory Toxicology and
Pharmacology
Member, Society for Risk
Analysis
Member, Society for
Environmental Toxicology and
Chemistry
Member, Society of the Sigma
XI

Brian Magee, Ph.D.

Senior Vice President/Principal Toxicologist

Dr. Magee has over 35 years' experience in toxicology and risk assessment. Dr. Magee directs site and community risk assessment projects for a wide range of industrial and governmental clients and provides senior technical review of projects in which the critical evaluation of toxicological and pharmacokinetic data is essential. Dr. Magee has performed community risk assessments of former and operating phosphate and hard rock mines, former manufactured gas plants, petroleum refineries, operating chemical plants, landfills, and petroleum spill sites. In addition, he has derived risk-based clean-up criteria for numerous CERCLA, RCRA, and state-listed sites. Dr. Magee has also performed community risk assessments for over 20 combustion facilities, which include municipal solid waste combustors, hazardous waste combustors, petroleum- and petroleum coke-fired power plants, coal-fired power plants, cement kilns, and industrial boilers. Additionally, Dr. Magee has provided expert testimony regarding the risks posed by exposure to ammonia, formaldehyde, chlorinated solvents, petroleum mixtures, including creosote, diesel fuel, and fuel oils, chlordane, lead, complexed cyanides, and other chemicals.

Summary of Core Skills

Risk Assessment

Dr. Magee has performed hundreds of site and community risk assessments for Superfund, RCRA, and state-lead waste sites. These include baseline risk assessments, derivation of risk-based clean-up levels, risk assessments to evaluate the efficacy of proposed corrective actions, development of risk-based sampling plans for site investigations, risk calculations in support of litigation, and community risk assessments as requirements for permitting activities.

Toxicological Evaluations/Investigations

Dr. Magee has performed numerous toxicological evaluations in support of regulatory compliance activities, risk assessments, and litigation support. These activities include the design, execution, and evaluation of primary toxicological research, such as the derivation of toxicologically relevant analytical method development and the design of animal experiments to support bioavailability adjustment factors. Toxicological research also involves summarization and evaluation of primary literature to determine health-based dose levels and evaluate the ability of a chemical to cause specific adverse effects.

Expert Witness and Litigation Support

Dr. Magee has performed courtroom testimony, prepared affidavits, undergone depositions, prepared written testimony for submission to courts, and provided strategic consulting for litigation regarding toxic torts and regulatory compliance cases with respect to chlorinated solvents, combustor emissions, heavy metals, creosote, coal tar, naphthalene, metal-cyanide complexes, formaldehyde, and other chemicals.



Regulatory Toxicology

Dr. Magee has written and evaluated environmental laws and regulations. He has prepared regulatory comments on many proposed rules, guidance manuals, and proposed methodologies that affect his clients. These comment documents are submitted to the relevant regulatory agency and become part of the docket for the proposed legal action.

Representative Project Experience

Community Health Risk Assessment Projects

Nu-West Mining, Inc., ID –Providing senior oversight on human health and ecological risk assessments of the Georgetown Canyon Phosphate Mine Site in Bear Lake and Caribou Counties, Idaho. Constituents of potential concern include aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium, zinc and selected volatile and semivolatile compounds. Provided detailed critique of non-radiological toxicity factors for uranium.

NuWest Mining, Inc., ID –Providing senior oversight on human health and ecological risk assessments of the Champ Phosphate Mine Site in Caribou County, Idaho. Constituents of potential concern include aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium, zinc. Provided detailed critique of toxicity factors for thallium and selenium.

NuWest Mining, Inc., ID –Providing senior oversight on human health and ecological risk assessments of the Mountain Fuel Phosphate Mine Site, Caribou County, Idaho. Constituents of potential concern include aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium, zinc. Provided detailed critique of toxicity factors for thallium and selenium.

Public Works and Government Services Canada, Canada – Provided toxicological and risk community assessment technical support for the design and execution of a perimeter and community air monitoring program for arsenic for the Giant Mine Remediation Project to clean up a former gold mine contaminated with tons of arsenic trioxide waste materials. Derived Risk-Based Action Levels for arsenic and PM10 for numerous specific activities, including roaster building demolition, mine tailings working, above and below ground drilling, and asbestos waste re-packaging. Provided toxicological support concerning the derivation and implementation of a worker Biological Exposure Index for arsenic in urine and the influence of dietary arsenic exposure on urinary arsenic. Performed a Lessons Learned conference concerning on-site and off-site air monitoring during 2014 and made recommendations on changes to the 2015 air monitoring program. Summarized 2014 air monitoring data and made presentations to the Technical Working Group overseeing the remediation.

Freeport-McMoRan, AZ – For an operating open pit copper mine (Sierrita), provided planning and senior oversight of a comprehensive community human health risk assessment of metals (copper, molybdenum, arsenic, et al.) and radionuclides (uranium and radium) in mining waste tailings and waste rock stockpiles.



Freeport-McMoRan, AZ- For an operating open pit copper mine (Cyprus Tohono) on land leased from the Tohono O'odham Nation, provided senior oversight for a community human health risk assessment. Constituents evaluated included arsenic, lead, copper, other metals, organic constituents, and radionuclides in soil, groundwater, sediment, and water. Human health exposure scenarios evaluated include residential and commercial as well as recreational (swimming, irrigation, wading and fishing) scenarios.

Confidential Client, Southwest. For an operating copper mine that is planning to expand operations into the future, provided senior oversight for a comprehensive community human health risk assessment of impacts of metals and radionuclides in dust that may be transported to off-site receptors. Sources of dust included numerous point and nonpoint sources. Exposure pathways include direct inhalation, deposition onto surfaces, and uptake from garden soil into vegetables and fruit. Time points will include current and future emissions.

Confidential Client, Midwest. Critically evaluated an EPA RI/FS on lead and arsenic affected residential community adjacent to former smelting and metal refining facilities. The project was an investigation effort to evaluate EPA's RI/FS, determine if errors were made, prepare *de novo* remedial goals, prepare detailed comments, and determine alternate remedial cost estimates.

City of El Paso, TX – Served as the Mayor's office and the City Health Department's expert on the exposure assessment and community risk assessment of lead in soil in ten residential neighborhoods near a smelter site that EPA was considering listing as CERCLA sites. Made presentations to EPA, TDOH, TNRCC, and ATSDR on City's behalf and served on working groups with the above agencies as the City's designated representative. Evaluated and commented on work plans for and results of residential soil sampling, site-specific testing for model parameterization of EPA's Integrated Exposure Uptake Biokinetic Model for lead in children, site-specific bioavailability studies, and health surveys attempting to identify the principal causes of children's lead levels in those with levels higher than 10 ug/dL in the study area. Compiled and evaluated historical and current children's blood lead levels in the study area, other areas in El Paso County, and other jurisdictions. Investigated other sources of children's blood lead levels besides residential soil. Participated in derivation of site-specific action levels and identification of potential remedial approaches.

Confidential Client, Washington, D.C. – Prepared generic community multipathway risk assessment for lead emissions from 21 cement kilns permitted by RCRA to combust hazardous waste according to EPA's 1994 Screening Level Risk Guidance. Compared estimated child blood lead levels and estimated lifetime cancer risk associated with baseline emissions levels and proposed MACT standards. Direct and indirect pathways were evaluated, including beef, pork, chicken, egg, dairy product, and fish ingestion.

Covanta Energy, Fairfield, New Jersey – Managed the preparation of an Environmental Impact Statement and Clean Air Act PSD permit application for the expansion of the City and County of Honolulu's H-POWER Energy-from-Waste facility. The proposed project involved the addition of a new Mass Burn boiler and a new electric generation turbine. Constituents of concern include SO_x, NO_x, PM₁₀, PM_{2.5}, dioxins/furans, mercury, and others.

Covanta Energy, Fairfield, New Jersey – Performed human health risk assessment for and provided senior technical oversight of an Environmental Impact Statement and Clean Air Act PSD permit application for the expansion of the City and County of Honolulu's H-POWER



Energy-from-Waste facility. The proposed project involved the addition of a third Refuse Derived Fuel boiler unit to the currently operating facility. The project was not built due to the decision of the City Council in 2005.

Covanta Energy, Fairfield, New Jersey – Performed community human health risk assessment of PM10 and PM2.5 from Covanta’s Marion County, Oregon Energy-from-Waste facility using published concentration-response functions. Estimated levels of increased mortality and morbidity from all causes and from selected specific causes. Demonstrated that not one person would die or become ill from emitted fine particulate matter due to the facility expansion even using conservative concentration-response functions from epidemiological studies that have debatable scientific soundness.

Covanta Energy, Fairfield, New Jersey – Performed community human health risk assessment of PM10 and PM2.5 from Covanta’s Minneapolis, Minnesota Energy-from-Waste facility using published concentration-response functions. Estimated levels of increased mortality and morbidity from all causes and from selected specific causes. Demonstrated that not one person would die or become ill from emitted fine particulate matter due to the facility expansion even using conservative concentration-response functions from epidemiological studies that have debatable scientific soundness.

City and County of Honolulu, Honolulu, Hawaii – Performed a multipathway community human health risk assessment of emissions from the combustion of municipal solid waste at the City’s combustor facility in advance of a permit application to build and operate a third boiler unit. Chemicals evaluated included lead, other heavy metals, polycyclic aromatic hydrocarbons and dioxin and furan congeners. Indirect risk assessment was performed in accordance with U.S. EPA combustor risk assessment guidance and included residents, farmers and fishers. Pathways included inhalation, ingestion of soil, ingestion of backyard produce, ingestion of drinking water, ingestion of fish, and ingestion of farm products. Using site-specific data the algorithms for the fate and transport of mercury were modified from EPA default values.

New Brunswick Power, Fredericton, New Brunswick – Performed toxicological evaluation of respirable particulate matter. Approximately fifty epidemiology studies and government documents allegedly linking quantifiable cases of health effects with respirable particulate matter were evaluated and critiqued. These documents included the Canadian “National Ambient Air Quality Objectives for Particulate Matter,” the U.S. “Air Quality Criteria for Particulate Matter,” and dozens of scientific papers from the primary literature. In addition, several computer models allegedly estimating quantifiable cases of health effects were evaluated and critiqued. These include the Illness Costs of Air Pollution (ICAP) model developed for the Ontario Medical Association and the Air Quality Valuation Model (AQCM) developed by Health Canada/Environment Canada.

Department of Public Works, Sydney, Nova Scotia – Performed Environmental Impact Analysis for air emissions associated with the environmental remediation of the Tar Ponds and Coke Ovens sites, which comprise over 100 hectares of industrial property containing 560,000 tonnes of soil contaminated with petroleum hydrocarbons, PAHs, and metals, 1,300 tonnes of PAH-contaminated sediments, 25,000 tonnes of coal-tar contaminated soil, 700,000 tonnes of sediments contaminated with PAHs and metals, and 35,000 tonnes of PCBs in excess of 50 ppm. Airborne constituents of concern included SO_x, NO_x, CO, and particulate matter from construction vehicles, particulate matter from excavation and grading activities, and site-related VOCs from excavation and stabilization activities. Evaluated air monitoring program and health-



based air criteria. Attended public consultation meetings, meetings with local medical specialists, and meetings with public health officials. Performed a multipathway risk assessment of emissions from a proposed PCB combustor, which included PCBs, dioxins/furans, PAHs, and selected metals as Constituents of Potential Concern. Performed a worker and off-site resident risk assessment of the remediation of pond sediments containing PCBs, PAHs, other organic constituents and metals as well as similar risk assessments for the remediation of soils, groundwater, stream sediments, and surface waters in other areas of the sites.

Belt Collins Hawaii Ltd., Honolulu, HI – For the Mamalahoa Highway – Kawaihae Road Connector Project in Waimea, HI, performed a community human health and environmental assessment of the impacts of the proposed roadway with regards to both the road's impact on adjacent agriculture and the impact of agricultural practices on individuals using the road. Constituents of concern were SO_x, NO_x, CO, and particulate matter from vehicles using the roadway and selected pesticides and herbicides from the farm operations.

Westinghouse, Pittsburgh, PA – Prepared a protocol document for a multipathway community risk assessment of a proposed PCB incinerator in Bloomington, IN. Derived absorption adjustment factors for PCBs. Attended meetings with and negotiated approaches and assumptions with EPA Region V.

Beazer East, Inc., Nashua, NH – Designed and executed a NHDES-approved air monitoring program to ensure that community public health was adequately protected against exposure to respirable particulates, volatile & semivolatile constituents, and metals during site regrading activities at a former wood treating site which had historical releases of naphthalene, creosote, and other constituents. Monitors included Hi-Vol sampling and analysis for metals, SVOCs and VOCs using EPA approved methods. Real time PM₁₀ monitoring was also performed using fixed location and hand-held monitors. Derived health-based fence line criteria that were protective of nearby residents' health for respirable particles and for individual chemicals present in site soils.

New Brunswick Power, Fredericton, New Brunswick – Performed multipathway community human health risk assessment of emissions from the combustion of Orimulsion® (Venezuelan bitumen product) as fuel in the proposed refurbishment of an existing heavy fuel oil-fired power generation facility in Lorneville, New Brunswick. The risk assessment was a component study used to prepare an Environmental Impact Assessment required for a governmental operating permit. Approximately fifty epidemiology studies and government documents allegedly linking quantifiable cases of health effects with respirable particulate matter were evaluated and critiqued. These documents included the Canadian "National Ambient Air Quality Objectives for Particulate Matter," the U.S. "Air Quality Criteria for Particulate Matter," and dozens of scientific papers from the primary literature. In addition, several computer models allegedly estimating quantifiable cases of health effects were evaluated and critiqued. These include the Illness Costs of Air Pollution (ICAP) model developed for the Ontario Medical Association and the Air Quality Valuation Model (AQCM) developed by Health Canada/Environment Canada. Evaluated criteria and noncriteria chemical emissions. Chemicals evaluated included sulfur dioxide, nitrogen oxides, particulate matter, metals, polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds. Indirect risk assessment was performed in accordance with U.S. EPA combustor risk assessment guidance and included residents, farmers and fishers. Pathways included inhalation, ingestion of soil, ingestion of backyard produce, ingestion of drinking water, ingestion of fish, and ingestion of farm products. Attended meetings with and presented results



to regulatory officials, members of the public and members of intervener groups. Risk assessment results were well received and did not precipitate any adverse comments from any members of the governmental Technical Advisory Committee, which accepted and approved the report as written.

New Brunswick Power, Fredericton, New Brunswick – Performed community multipathway human health risk assessment of emissions from the combustion of a mixture of Heavy Fuel Oil and Petroleum Coke. Pathways included inhalation, ingestion of soil, ingestion of backyard produce, ingestion of drinking water, ingestion of fish, and ingestion of farm products.

Department of Public Works, Sydney, Nova Scotia – Performed dust and volatile chemical emission modeling and community risk assessment of coke, coal, and coal tar in support of the definition of exclusion zones for demolition of a former coke oven facility and coal tar distillery. Used EPA-approved models for estimation of PM10 emission factors associated with excavation, trucking, and storage activities and for estimation of volatile chemical emissions. Derived health-based criteria that were protective for nearby residents for short-term and long-term emissions of respirable particles, naphthalene, other volatile and semivolatile chemicals and selected metals. Performed risk assessment of deposited dust onto soil and garden produce. Derived emission factors for volatile chemicals for sludge excavation, dewatering, and stockpile storage associated with sewer pipe installation activities.

Covanta Energy, Inc., Haverhill, MA (MSW Combustion Ash) – Prepared a Scope of Work for the community multipathway human health risk assessment of a landfill disposal area for municipal solid waste combustion ash in accordance with MADEP guidance using EPA combustor risk assessment guidance. Designed and performed a site-specific monitoring program to measure total and respirable suspended particulates with Hi-Vol samplers and NIOSH personal monitors and to measure PM10 levels with a Personal DataRAM real-time monitor. In addition, total metals, such as arsenic, nickel and mercury, were analyzed, as was diesel particulate (organic and elemental carbon). Prepared report arguing that dust levels attributable to ash disposal were caused by diesel exhaust and not ash dumping or compacting.

Department of Public Works, Sydney, Nova Scotia – Performed dust and volatile chemical emission modeling and community risk assessment of coke, coal, and coal tar in support of the definition of exclusion zones for demolition of a former coke oven facility and coal tar distillery. Used EPA-approved models for estimation of PM10 emission factors associated with excavation, trucking, and storage activities and for estimation of volatile chemical emissions. Derived health-based criteria that were protective for nearby residents for short-term and long-term emissions of respirable particles, arsenic, lead, other metals, naphthalene, PAHs, and other volatile and semivolatile chemicals. Performed risk assessment of deposited dust onto soil and garden produce. Derived emission factors for volatile chemicals for sludge excavation, dewatering, and stockpile storage associated with sewer pipe installation activities.

City and County of Honolulu, Honolulu, HI – Prepared a scope of work for a field sampling program to measure respirable particulate generation during asphalt roadway demolition using cold planer machines by cold planing. Executed a field sampling program for particulate monitoring using NIOSH total and respirable dust methods and real-time PM10 monitors during roadway demolition. Concluded that respirable particulate generation from asphalt road demolition does not pose a significant risk to people adjacent residents or to workers. Prepared a report entitled "Air Monitoring of Roadway Demolition Activities, Beneficial Use of H-POWER Municipal Solid Waste Ash as an Aggregate for Road Materials."



City and County of Honolulu, Honolulu, HI – Designed and performed sampling for total particulates and respirable particulates and analyzed for metals, crystalline silica, and particle-bound and vapor phase mercury in ambient air at an operating municipal solid waste landfill adjacent to a residential development during a demonstration project in which municipal solid waste ash was used as daily landfill cover. Evaluated and validated laboratory data. Prepared risk assessment reports that addressed the health of landfill workers, members of the public that visited the landfill, and nearby residents. Concluded that use of ash as alternate daily landfill cover does not pose significant adverse human health risks. Provided technical support on issues raised during the public hearing process with regard to a proposal to extend the landfill operating permit.

NiSource, Merrillville, IN – Provided community risk assessment and toxicology consulting to gas utility concerning elemental mercury vapor because of Region V regulatory actions. Predicted indoor air mercury levels at various times assuming various spill scenarios using EPA models. Evaluated levels of mercury vapor commonly detected in dentists' offices and in locations of historical mercury spills. Evaluated health based criteria for mercury vapor exposure. Evaluated mercury vapor detection instruments.

Gas Research Institute, Pittsburgh, PA – Performed detailed review of a computer-based model developed to evaluate exposures and risks posed by mercury in surface and subsurface soils. Evaluated fate and transport, exposure assessment, and toxicity aspects of this model.

Confidential Client, New Brunswick, Canada – Critically evaluated report prepared for a medical waste combustor in support of an argument that a carbon injection air pollution control system to control mercury emissions was not required for government approval to increase the waste combustor operating conditions.

Dominion Energy, Richmond, VA (Coal Combustion) – Managed community multipathway risk assessment for proposed coal fired power plant permit. Selected contaminants of concern, relevant receptors, and exposure pathways. Oversaw calculations and prepared documentation.

Hilo Coast Power Company, HI (Coal Combustion Ash) – Performed risk assessment consulting on risks posed by leaching of metals from coal combustion ash. Evaluated laboratory methods and reporting limits. Evaluated the need to sample ash for additional metals based on the probability that such metals are present in coal ash. Performed fate and transport modeling and human health risk assessment. Participated in meeting with Hawaii Department of Health concerning beneficial reuse permit.

AES, HI (Coal Combustion Ash) – Performed community risk assessment consulting on risks posed by leaching and surface runoff of metals from coal combustion ash. Commented on proposed beneficial use permit. Performed fate and transport modeling and human health risk assessment.

Ogden Projects, Inc., Stanislaw, CA – Performed technical oversight of air dispersion modeling of a hypothetical accidental release of anhydrous ammonia. Conducted toxicological evaluation of acute toxicity data on ammonia. Determined appropriate health-based benchmarks for various exposure times.

American Ref-Fuel, New York – Provided peer review for a community multipathway risk assessment prepared by another company for a proposed municipal solid waste combustor.



Provided strategic risk assessment consulting. Chemicals of potential concern included dioxins/furans and metals.

American Ref-Fuel, New York – Provided strategic risk assessment consulting services by critiquing and modifying a previously prepared protocol for a hazardous waste combustor. Chemicals of potential concern included dioxins/furans and metals. Met with NYSDOH and NYSDEC on numerous occasions. Negotiated innovative and more realistic approaches with the agencies.

Hazardous Waste Treatment Council, American Industrial Health Council, Chemical Manufacturer's Association, Washington, D.C. – Prepared comprehensive comments on EPA's draft indirect risk assessment guidance for submission to the Agency. Evaluated EPA's proposed approach for evaluating uptake of dioxin vapor directly into plants and developed an alternative method.

Hazardous Waste Treatment Council, Washington, DC – Presented a seminar on multipathway risk assessments for incinerators and industrial furnaces to the Thermal Treatment Committee. Discussed the implications of the EPA's 1993 risk assessment initiative and critical strategic issues in performing risk assessments for these facilities.

Covanta Energy, Inc., Salinas, CA – Performed screening level air dispersion modeling of emissions from an internal combustion engine burning landfill gases. Evaluated risk assessment methodology used to determine compliance with State regulations.

American Envirotech, Inc., Houston, Texas – Prepared indirect pathway community risk assessment for proposed hazardous waste incinerator in accordance with major aspects of EPA's draft Addendum: Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions. Prepared a detailed protocol document in negotiation with the Texas Natural Resources Conservation Commission. Developed alternate approach for assessing direct uptake of dioxin vapor into plants. Evaluated risks for six different receptors and performed risk zone analysis per EPA and TNRCC requests.

Environmental Technology Council, Washington, D.C. – Submitted Affidavit, Supplemental Affidavit, and Expert Report to Federal District Court in Louisiana in support of litigation against GTX, Inc. Hazardous Waste Combustor, Morgan City, Louisiana (formerly Marine Shale, Inc.). Chemicals of potential concern included dioxins/furans and mercury. Evaluated risk assessments prepared for GTX, Inc. using the 1998 *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (1998)* with a commercial risk assessment program, IRAP-h, sold by Lakes Environmental. Evaluated the IRAP-h model for consistency with documentation requirements that are standard in the field of risk assessment and with the 1998 EPA guidance. Programmed and executed a side-by-side risk assessment using all of the same input parameters to test the accuracy of the IRAP-h model. Discovered many errors and flaws in the GTX risk assessments, including the inability of the IRAP-h program to allow reviewers to verify the correctness of the internal code. Prepared detailed summary report that outlined deficiencies in the GTX risk assessments and prepared a comprehensive risk assessment document using the EPA guidance.

Environmental Technology Council – Prepared comments on 1998 *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (1998)* for submission to EPA. Protocols and methodologies were taken from a more generic document that has not yet been released to the public: *Methodology for Assessing Health Risks Associated with Multiple*



Exposure Pathways to Combustor Emissions. Major aspect of the evaluation focused on the treatment by USEPA of mercury emissions from combustion facilities, including the vapor/particle partitioning, the valence state interactions, and the methylation processes.

ENSCO, El Dorado, AR – Prepared a Scope of Work for the multipathway human health risk assessment of the emissions from a hazardous waste combustor facility in accordance with U.S. EPA combustor risk assessment guidance and in accordance with comments from state regulators.

Municipal Solid Waste Combustor, Pennsylvania – Performed a multiple exposure pathway, multiple compound, multiple media risk assessment for permitting a new combustor in accordance with Pennsylvania and state-of-the-art guidelines. Projected emissions dispersion and performed deposition modeling to provide ground-level ambient concentrations and accumulation of emitted materials in solids, dusts and food chains. Chemicals of potential concern included dioxins/furans and metals. Although food chain exposures posed the largest potential risks, no unacceptable risks were identified by the assessment. Attended public meetings.

UCAR Carbon, Nashville, TN – Evaluated coal tar pitch volatile emission data from various carbon anode preparation unit activities and toxicology literature on PAH-containing mixtures. Prepared recommendations concerning monitoring protocols for coal tar pitch volatiles and fence-line concentrations that are protective of human health.

Energy Answers, Rochester, MA (MSW Combustion Ash) – Performed risk assessment of the use of aggregate material produced from municipal solid waste combustor bottom ash in asphalt roadway construction. Evaluated leaching of lead and other metals from ash-aggregate-amended asphalt. Performed human health and environmental risk assessment of surface runoff and groundwater leachate. Participated in negotiations with MADEP. Assisted in preparation of Beneficial Use Permit.

Norlite Light Aggregate Kiln, NY (Fossil Fuel Ash Aggregate) – Performed risk assessment consulting to light aggregate kiln that was co-firing fuel oil and hazardous waste solvents and was producing an aggregate material that was mixed with combustion ash. Assisted in decision-making regarding the marketability of the product. Risk assessment activities focused on lead.

Ogden Projects, Fairfield, NJ (MSW Combustion Ash) – Performed critical evaluation of risk assessment documents addressing the beneficial reuse of municipal solid waste combustor ash from two municipal waste combustors. Risk assessment activities focused on the presence of lead in the combustor ash. Prepared a technical memorandum and participated in client conferences with the document authors.

Confidential Client, Washington, D.C. – Prepared generic multipathway risk assessment for lead emissions from 21 cement kilns permitted by RCRA to combust hazardous waste according to EPA's 1994 Screening Level Risk Guidance. Compared estimated child blood lead levels and estimated lifetime cancer risk associated with baseline emissions levels and proposed MACT standards. Direct and indirect pathways were evaluated, including beef, pork, chicken, egg, dairy product, and fish ingestion.

City and County of Honolulu, Honolulu, HI (MSW Combustion Ash) – Prepared three human health risk assessments of the beneficial use of municipal solid waste combustion ash from the City and County of Honolulu's H-Power facility. One project considered the proposed



use of the ash *in lieu* of clay as part of the final cover in the closure of a city-owned landfill. The risk assessment considered risks from lead, other heavy metals, and dioxin and furan congeners. Risks during and after the closure were evaluated under several potential scenarios using EPA's IEUBK model and California's LeadSpread model. Receptors included workers, on-site trespassing children, and off-site children. Affected media included the ash, ash leachate, ash-derived dust, surface water and sediment, and fish. Dust generation and dispersion modeling was performed as well as modeling of surface runoff of ash into nearby surface water and sediment. Ash-specific absorption adjustment factors were derived for lead and other metals. A second project considered the proposed use of combustor ash as alternate daily cover at the City's operating municipal solid waste landfill. A third project considered the use of combustor ash as aggregate in road materials.

City and County of Honolulu, Honolulu, HI (MSW Combustion Ash) – Prepared a work plan for the environmental testing of a test roadway that would contain municipal solid waste combustion ash as a partial substitute for aggregate in the asphalt preparation. Prepared an operations plan for the manufacture of the ash-amended asphalt and the construction of the test roadway. Prepared a draft and final work plan for the evaluation of the leachate quality from the roadway materials containing ash. Constituents of concern were lead and other heavy metals. Provided oversight of the manufacture of ash-amended asphalt and the construction of the test roadway. Executed the four-year field sampling program for environmental testing of the test and control roadways. Summarized the environmental testing of municipal solid waste ash-amended asphalt. Test results included wash water analyses, analyses of the soil at the location of surface water runoff from the test and control roadways, and analysis of SPLP leachate of test cores of test and control asphalt. Prepared a plan for long-term testing of ash-amended asphalt.

City and County of Honolulu, Honolulu, HI (MSW Combustion Ash) — Performed risk assessment, air sampling, and legislative testimony in Senate committee hearing to address emergency concerns by the State, environmental activists, and local citizens concerning some unpermitted waste disposal activities at a former municipal solid waste incinerator. Disposal activities included disposal of solid waste combustion ash on the facility site and disposal on the adjacent ash landfill. Prepared a Human Health Risk Assessment of the City and County of Honolulu's Refuse Division and Department of Parks and Recreation workers who currently work at the closed Waipahu Incinerator complex, children and adults who use the adjacent Waipio Peninsula Soccer Complex, nearby residents, and hypothetical trespassers at the Waipahu Ash Landfill. Constituents of concern were lead, other heavy metals, and dioxins and furans.

City and County of Honolulu, Honolulu, HI (MSW Combustion Ash) – Prepared Closure Plan for Subtitle D closure of a unused municipal solid waste incinerator. Performed facility inventory and wipe sampling of internal facility surfaces for lead and other metals present in deposited ash-like material. Responded to State Department of Health (DOH) questions and attended meeting with DOH on client's behalf. Closure Plan includes plans for soil sampling and analysis, equipment cleaning, removal and recycling, building surface wipe sampling and risk assessment, groundwater modeling, ecological reconnaissance, and site wide risk assessment.

Confidential MSW Ash Landfill (MSW Combustion Ash) – Provided risk assessment consulting services concerning the permitting requirements for expanding a municipal landfill that accepts municipal solid waste combustor ash, which contains lead, other heavy metals, and



dioxins/furans. The landfill wished to gain state permission to use MSW combustor ash as landfill daily cover.

Confidential MSW Facility (MSW Combustion Ash) – Provided litigation support regarding a personal injury case in which plaintiffs alleged that they were harmed by heavy metals, such as lead and cadmium, from a municipal solid waste combustor's stack emissions and/or fugitive dust from the municipal solid waste combustor ash. Evaluated plaintiff's medical data, identified various potential sources of heavy metal exposures, and performed various risk assessment calculations. Assisted in preparing interrogatories and responses to interrogatories.

City and County of Honolulu, Honolulu, HI – Prepared a scope of work for a field sampling program to measure dust generation during asphalt roadway demolition using cold planer machines by cold planing. Executed a field sampling program for dust generation monitoring using NIOSH total and respirable dust methods and real-time PM10 monitors during roadway demolition. Constituents of concern included lead and other heavy metals. Concluded that dust generation from asphalt road demolition does not pose a significant risk to people adjacent residents or to workers. Prepared a report entitled "Air Monitoring of Roadway Demolition Activities, Beneficial Use of H-POWER Municipal Solid Waste Ash as an Aggregate for Road Materials.

Confidential Polymer Processor, CT – Performed toxicological evaluation of numerous chemicals to determine the cause of alleged health symptoms reported by people living near the facility. Focused on eye and lung irritation and delayed sensitization effects. Derived toxicological benchmarks for use in a human health risk assessment. Interfaced with client lawyers and negotiated with the state toxicologist.

Confidential Tannery, MN – Conducted toxicological investigation of products and formulations to determine the cause of alleged respiratory sensitization symptoms in workers in one department. Evaluated ambient air monitoring reports and analytical methodologies. Performed literature searches and critical reviews of scientific papers.

NiSource, Merrillville, IN – Provided risk assessment and toxicology consulting to gas utility concerning elemental mercury vapor because of Region V regulatory actions. Predicted indoor air mercury levels at various times assuming various spill scenarios using EPA models. Evaluated levels of mercury vapor commonly detected in dentists' offices and in locations of historical mercury spills. Evaluated health-based criteria for mercury vapor exposure. Evaluated mercury vapor detection instruments.

Ogden Projects, Inc., Stanislaw, CA – Performed technical oversight of air dispersion modeling of a hypothetical accidental release of anhydrous ammonia. Conducted toxicological evaluation of acute toxicity data on ammonia. Determined appropriate health-based benchmarks for various exposure times.

Worker Risk Assessment Projects

Bank of America, NJ – Evaluated site data and assisted in work plan development for White Swan Superfund Site downgradient from a former dry cleaning facility. Tetrachloroethylene and other solvents had migrated beneath a large residential neighborhood. Attended meetings with US EPA and participated in scoping of RI/FS process.

Confidential Client, NJ – Prepared a toxicological evaluation of tetrachloroethylene in an office building formerly used as a dry-cleaning facility. Evaluated reported health symptoms associated



with PCE exposure and evaluated specific symptoms and health effects reported by building staff. Prepared memorandum summarizing findings and briefed client and client legal staff.

Confidential Medical Clinic, Nationwide – Evaluated the toxicological consequences of an event in which a fire extinguisher containing ABC Dry Chemical Fire Extinguishant accidentally discharged in the storage room a medical clinic. The accidental discharge released the contents of the fire extinguisher, resulting in aerial dispersion of the extinguishant to the storage area and to a neighboring room that houses equipment used to prepare materials for on-site patient treatment. Prepared toxicological evaluation of monoammonium phosphate and other ingredient and performed a human health risk evaluation.

Confidential Medical Clinic, Nationwide – Evaluated the toxicological consequences of an event in which a pump motor causes a small fire that partially burned plastic piping that carried solutions used in clinical treatment. Client was concerned that the heat may have caused the release of constituents in the plastic piping into the solutions within the pipe. Critically evaluated the situation, assisted in designing a testing program, evaluated the test data and performed a toxicological evaluation.

Confidential Medical Clinic, Nationwide – Evaluated the toxicological consequences of an event in which unspecified contaminated water from the town water supply entered the clinic and may have mixed with solutions used for patient treatment. Critically evaluated the situation, assisted in designing a testing program, evaluated the test data and performed a toxicological evaluation.

Confidential Electric Power Plant, Nationwide - Evaluated the hazards and risks to workers posed by the release of two fire-resistant hydraulic fluids (Fyrquel EHC & Fyrquel EHC Plus) at an operating power plant. Evaluated the toxicological properties of the constituents, which were mixtures of tri-aryl phosphates. Performed human health risk evaluation and briefed workers at the plant.

Confidential Electric Power Plant, Nationwide - Evaluated the hazards and risks to workers posed by the release of ash containing small amounts of respirable crystalline silica from routine operations. Designed sampling and analysis program. Evaluated data and assisted managers in defining exclusion zones. Briefed workers on risks of respirable crystalline silica.

Confidential Electric Power Plant, Nationwide- Evaluated the hazards and risks to workers posed by the release of a white powder containing amorphous silica from a siloxane removal system. Workers were concerned that they had been exposed to crystalline silica. Critically evaluated test data and prepared a summary report for workers that explained the risk profiles of crystalline silica versus amorphous silica. Briefed workers and addressed worker concerns. Presented risk evaluation results at meeting of regulatory officials.

Payette Company, MA – Performed indoor air quality assessment of an office building in which people were complaining about headaches and subjective symptoms. Evaluated the building, chemicals used, and staff complaints. Prepared memorandum summarizing findings.

Rite Aid Pharmacy, PA – Performed a critical evaluation of an Industrial Hygiene report on indoor air quality at an operating pharmacy building in New Jersey that was located adjacent to property that formerly housed a service station and a dry cleaner. Performed risk assessment calculations on chlorinated solvents and petroleum hydrocarbons. Made presentations to Rite Aid workers concerning indoor air quality.



Rite Aid Pharmacy, NC – Evaluated indoor air quality data on several warehouse buildings in North Carolina that were situated atop groundwater containing chlorinated solvents, including TCE and PCE, presumably released from former occupants of the buildings and other adjacent buildings. Planned and executed additional air quality sampling in several buildings. Performed risk assessment calculations and prepared a report.

Confidential Polymer Processor, CT – Performed toxicological evaluation of numerous chemicals to determine the cause of alleged health symptoms reported by people living near the facility. Focused on eye and lung irritation and delayed sensitization effects. Derived toxicological benchmarks for use in a human health risk assessment. Interfaced with client lawyers and negotiated with the state toxicologist.

City and County of Honolulu, Honolulu, HI – Performed indoor surface wipe testing of dust in a former municipal solid waste incinerator that is currently used as a maintenance shop and office space for employees of two City departments. Tested collected dust samples for lead and other heavy metals. Evaluated dust loading standards for the definition of lead-based paint as defined by EPA and HUD in residential buildings. Evaluated OSHA workplace floor dust criteria. Performed risk assessment calculations for workers using standard practices.

Confidential Client, Nationwide – Prepared risk-based lead wipe sample criteria for commercial buildings for a company that was vacating buildings and cleaning them for commercial re-use.

ENSCO, El Dorado, AR – Evaluated the scientific literature and prepared a toxicological evaluation of 2,4-dichlorophenol, phenol, and other chlorophenols to assist ENSCO in setting waste acceptance criteria that would be protective of worker's health.

New Brunswick Power, Fredericton, NB – Performed detailed toxicological evaluation of vanadium and prepared report that was submitted to potential clients of synthetic gypsum (flue gas desulfurization residue) who use it to manufacture wallboard. The report evaluated respiratory toxicological data to determine if vanadium released in the manufacture and use of synthetic gypsum wallboard might have the potential cause certain respiratory effects that are known to be associated with a specific vanadium compound, vanadium pentoxide, which serves as the basis of the US EPA Reference Concentration for vanadium. Designed in vivo inhalation toxicology study to directly determine inhalation toxicity of both natural and synthetic gypsum. Designed in vitro toxicology study to determine the bioavailability of both natural and synthetic gypsum. Designed exposure study to measure the amount of dust released during the cutting of wallboard during use in construction activities.

3M Company, Minneapolis, MN – Conducted toxicological investigation of 70 chemicals and chemical mixtures, including solvents, dyes and pigments, and plastic resins and additives. Determined presence of chemicals on various regulatory lists and evaluated primary toxicological information. Chemicals were then prioritized to assist 3M in pollution prevention planning.

NiSource, Merrillville, IN – Provided risk assessment and toxicology consulting to gas utility concerning elemental mercury vapor because of Region V regulatory actions. Predicted indoor air mercury levels at various times assuming various spill scenarios using EPA models. Evaluated levels of mercury vapor commonly detected in dentists' offices and in locations of historical mercury spills. Evaluated health based criteria for mercury vapor exposure. Evaluated mercury vapor detection instruments.



Boston Gas Company, Medford, MA – Performed risk assessment consulting regarding a building formerly used for chemical manufacturing and formulating that was being considered for redevelopment as an office building. Performed a site inspection, a toxicological investigation of site-related chemicals, and risk assessment calculations.

Confidential Client, NY – Evaluated chemical composition data from an off-specification caulk product that was present in an office building. Prepared a toxicological evaluation of the constituents and evaluated potential risk to office workers.

Confidential Client, NM – Performed strategic consulting to client on indoor air quality sampling and data evaluation for an office building above a former TCE plume associated with a former Superfund site in Albuquerque, NM.

Confidential Tannery, MN – Conducted toxicological investigation of products and formulations to determine the cause of alleged respiratory sensitization symptoms in workers in one department. Evaluated ambient air monitoring reports and analytical methodologies. Performed literature searches and critical reviews of scientific papers.

Goodwin Proctor, UniFirst Corporation, MA – Performed risk assessment for one of the largest and most complex chlorinated solvent site in Massachusetts. Tetrachloroethylene was released from the site of a former dry-cleaning warehouse facility and migrated beneath 40-50 homes and businesses in a residential neighborhood in Somerville, MA. Provided technical assessment of a State-proposed Unit Risk Factor (URF) for PCE and succeeded in convincing regulators to allow use of a realistic URF. Participated in Massachusetts Department of Environmental Protection Indoor Air Workgroup, attended meetings, and provided critical comments to draft Indoor Air Guidance documents. Attended public meetings, meetings with regulators, and meetings with staff and teachers at an affected school. Performed risk assessment calculations for PCE, TCE and other solvents and prepared multiple reports.

Duke Energy, IN – Evaluated indoor air quality data from an office building adjacent to and on top of a former manufactured gas plant site. Performed Peer Review of risk assessment calculations and report. Advised client of significance of detected constituents.

Boston Gas Company, Boston, MA – Performed a Method 3 Phase II Risk Characterization of a former Manufactured Gas Plant site currently used as a private membership yacht club and marina. gas storage and distribution center. Chemicals evaluated included PAHs, TPH, cyanide, and lead. Receptors included on-site workers, construction and utility workers, and club members.

Consolidated Edison, NY – Prepared risk communication course for workers at Consolidated Edison's Astoria, Queens facility to discuss the RCRA RFI process in the areas previously used as a Manufactured Gas Plant facility. Discussed toxicological information regarding PAHs, coal tar, complexed cyanides, and other MGP-related chemicals.

Boston Gas Company, MA – Prepared toxicological evaluation of ferric ferrocyanide for presentation to workers at a former MGP site. Performed risk characterization of site groundwater to determine if volatile chemicals present in water in building basements could volatilize into the building.

Confidential Manufacturing Client, US – For a confidential electronic manufacturing client, provided senior oversight and technical review of a summary of information pertaining to radioactivity from the long-term releases from the malfunctioning Fukushima nuclear reactor



complex located in Fukushima Prefecture, Japan. This summary discussed the potential for adverse worker safety-related impacts to workers at the client's facilities that received electrical components from suppliers located in Japan.

GEMCORE Site, CA – For Chevron Environmental Management Company, provided senior oversight and peer review of a risk assessment that evaluated the potential for adverse human health effects from exposure to arsenic, lead, and naturally occurring radioactive material (NORM) in soil at the Former Unocal/GEMCOR Geothermal Facility in Calipatria, California. The risk evaluation considered the hypothetical future exposure of solar power facility maintenance workers. For NORM, human exposures were estimated and radiological doses and cancer risks were calculated using RESRAD, Version 6.5.

City and County of Honolulu, Honolulu, HI – Performed indoor surface wipe testing of dust in a former municipal solid waste incinerator that is currently used as a maintenance shop and office space for employees of two City departments. Tested collected dust samples for lead and other heavy metals. Evaluated dust loading standards for the definition of lead-based paint as defined by EPA and HUD in residential buildings. Evaluated OSHA workplace floor dust criteria. Performed risk assessment calculations for workers using standard practices.

Regulatory Product Toxicology

Simplot, ID – Assisted the Far West Agribusiness Association to remove ammonium sulfate from Washington Department of Ecology (DOE)'s list of "toxic air pollutants" under WAC 173-460-150 based on the most recent, best available health effects information. Critically evaluated primary toxicological data, prepared a summary report and testified at a regulatory hearing.

Confidential Client, US – Provided product registration services to a client who filed a Premanufacture Notice under the Toxic Substances Control Act (TSCA) with incorrect information about the identify of a reactant, which was supplied as a confidential trade-marked reactant. Prepared amendment to the Premanufacture Notice and investigated the potential legal liability associated with supplying incorrect information to the USEPA.

Confidential Chemical Company, US – Provided toxicology support for chemical product registration in US under TSCA for a new chemical entity. Concluded that the new chemical entity has structural features that are classified as low hazard and are similar to the features of chemicals included on the low-hazard monomer and reactant list. The specific monomer unit included in the PMN chemical is derived from a chemical that is different from the one for which EPA reviewers expressed concern. Based on these considerations, concluded that the PMN chemical did not "present unreasonable risk of injury to human health or the environment," that additional toxicity testing is not warranted, and that a use restriction for a specific application requested by EPA was not needed.

Confidential Electronics Company, US - Reviewed compliance with TSCA LVE and R&D exemptions and other TSCA-related matters for silane chemicals. Provided guidance on the number of isotopic and deuterated products to determine whether any additional listings are necessary for these products.

Confidential Specialty Engineered Materials Company, US – Provided toxicology support for filing of a Premanufacture Notice under the Toxic Substances Control Act for a metallic chemical entity containing four metal elements. The objective of this review was to identify potential concerns that might be reflected on a product Safety Data Sheet for the chemical entity or during



the U.S. Environmental Protection Agency's (US EPA) review of a Premanufacture Notice or exemption request filed under the Toxic Substances Control Act (TSCA).

Expert Witness Support on Proposition 65 Issue – Provided Proposition 65 risk assessment support to confidential brass part manufacturer who was being sued for failure to warn of the presence of lead in commercial metal parts. For this project, he critically evaluated the testing and risk assessment of the plaintiff and showed that the No Significant Risk Level was not exceeded, and warning was not necessary.

Toxicology Excellence in Risk Assessment, Cincinnati, OH – Served on independent expert panel to review and evaluate a toxicological evaluation of coal tar shampoo that derived a No Significant Risk Level in accordance with California Proposition 65. Risk assessment was performed in support of litigation by coal tar shampoo manufacturers.

Confidential Pharmaceutical Client, Switzerland – Provided product registration services to a client who was required to register pharmaceutical intermediates under the EU REACH program. Performed toxicological read-across assessments for 30 intermediates to determine if toxicological data from Active Pharmaceutical Ingredients and/or other chemicals in commerce would be reasonable surrogate data.

Confidential Pharmaceutical Client, Switzerland – Provided toxicological assessment services to a client who was required to derive Permitted Daily Exposure levels (PDEs) and Derived No Effect Levels (DNELs) for eight pharmaceutical active ingredients per European Medicines Agency requirements. Reviewed and evaluated toxicological data and derived PDEs and DNELs.

Confidential Pharmaceutical Client, US – Provided toxicological assessment services to a client who wished to derive acceptable levels in wastewater from manufacturing facilities for more than 25 pharmaceutical active ingredients. Reviewed and evaluated toxicological data and derived toxicological Acceptable Daily Intakes and microbial resistance Acceptable Daily Intakes for humans and wildlife.

Farchemia, Milan, Italy – Derived and documented human health risk-based guidelines for drinking water consumption for two pharmaceuticals that were released to surface water. For carbamazepine and dimetridazole, no Tolerable Daily Intake (TDI) or an Acceptable Daily Intake (ADI) values were available in the published literature. AMEC risk assessors searched the published toxicology literature, summarized the literature on adverse effects and the dose levels at which they occurred, and derived a TDI using the methods and procedures that are in normal use by regulatory agencies. From the TDIs, groundwater remedial goals for the two pharmaceuticals were derived and documented.

Babst, Calland, Clements, and Zomnir, PA – Derived and documented an oral health-based toxicological criterion (Reference Dose) for resorcinol based on newly available data from a range finding study of a guideline compliant two-generation reproduction and developmental toxicity study in rats sponsored by the Resorcinol Task Force. Evaluated the published literature. Prepared a comprehensive toxicological evaluation. Presented proposed Reference Dose at expert panel meeting arranged by Toxicology Excellence in Risk Assessment (TERA). Evaluated and responded to panel comments. Presented updated findings to TERA panel. Presented Reference Dose at meeting of Pennsylvania Science Advisory Board.



Resorcinol Task Force, Gloucestershire, United Kingdom – Attended various annual meetings, derived a Reference Dose (RfD) for resorcinol, discussed the RfD and approval by a review panel convened by TERA, and participated in discussions about RTF's draft report of the guideline-compliant full two generation reproductive study in rats. Assisted in the evaluation of the WHO CICAD and in the preparation of the recent SIAR as a toxicology reviewer.

Babst, Calland, Clements, and Zomnir, PA – Critically evaluated and prepared comments on the EPA's High Production Volume Data Summary and Test Plan for resorcinol.

Babst, Calland, Clements, and Zomnir, PA – Critically evaluated and prepared comments on an ATSDR Public Health Assessment on the Bear Creek Waste Disposal Area. Evaluated and prepared comments on the toxicological evaluations of resorcinol, benzene sulfonate, meta benzene disulfonate, and para hydroxyl benzene sulfonate.

Babst, Calland, Clements, and Zomnir, PA – Derived and documented oral health-based toxicological criteria (Reference Doses) for benzene sulphonate, meta benzene disulphonate, and para hydroxyl benzene sulphonate from toxicological studies designed, placed, managed, and evaluated for the client. Toxicological studies for the three constituents included: mutagenicity studies in bacteria and mammalian cells, 17-day range finding studies in rats, and 13-week studies in rats.

Beazer East, Inc., PA – Designed, placed, managed, evaluated and summarized dermal irritation toxicological studies in rabbits for benzene sulphonate, meta benzene disulphonate, and para hydroxyl benzene sulphonate. Results were published in a peer-reviewed journal.

Schultheis Tabler and Wallace, Ephrata, WA – Performed detailed toxicological evaluation of ammonia and prepared expert report for submission to the court. The report evaluated respiratory toxicological data to determine if a single, short-term exposure might have caused chronic respiratory effects as alleged by a railway worker who was working near a site from which ammonia fumes were alleged to have been released into the atmosphere. Attended deposition.

Osaka Gas Company, Japan – Evaluated toxicology and risk assessment laws and regulations for UK, US, Canada, Germany, Netherlands, and other European countries, prepared report comparing approaches to waste site management among countries, and made recommendations concerning the best approach for a waste site in Japan.

Beazer East, Inc., PA – Designed, placed, managed, evaluated and summarized dermal penetration studies in human skin for benzene sulphonate, meta benzene disulphonate, and para hydroxyl benzene sulphonate. Results were published in a peer-reviewed journal.

Confidential Tannery, MN – Conducted toxicological investigation of products and formulations to determine the cause of alleged respiratory sensitization symptoms in workers in one department. Evaluated ambient air monitoring reports and analytical methodologies. Performed literature searches and critical reviews of scientific papers.

Commonwealth of Pennsylvania, Pittsburgh, PA – Evaluated toxicological evaluation of TPH from diesel fuel prepared by Conrail in support of a state-wide clean-up standard for TPH. Presented alternative approach that was incorporated into the document.

U.S. EPA, Washington, DC – Assessed the suitability of using the EPA RQ scheme for ranking chronic toxic effects for the purpose of Emissions Inventory Reporting. Prepared additional toxicity criteria for implementation of Section 313 of the Superfund Amendments.



Hawaii Department of Health, Honolulu, HI – Served as toxicology consultant to HDOH in addressing the concerns of a community group who alleges abnormally high rates of birth defects and learning disabilities in their children due to pesticide residues from former agricultural use of the land upon which their community was built. Performed toxicological evaluation of 50 chemicals of potential concern, which included organic herbicides, chlorinated hydrocarbons, arsenic, chromium and dioxins/furans. Risk assessment calculations demonstrated that the chemicals detected in residential soils could not have been causally related to any effects alleged by community members. Made presentations to members of the public and attended meetings with HDOH.

Massachusetts Natural Gas Council, MA – Performed toxicological evaluation of ferric ferrocyanide for submission to the U.S. Environmental Protection Agency to assist them in determining if ferric ferrocyanide should be listed as a CERCLA Hazardous Substance.

California Dept. of Health Services – Prepared a comprehensive human health effects assessment of inorganic nickel. Derived health-related limits and goals for use in emergency and remedial actions at California hazardous waste sites. This project required a critical evaluation of scientific reports regarding all aspects of the toxicology of nickel compounds. An important aspect of this assessment was the derivation of toxicokinetic factors from comparisons of the absorption, metabolism, and elimination of the contaminant by humans and the experimental animals that were used in the quantitative toxicity studies.

American Red Cross, Washington, DC – Served on expert panel of toxicologists that evaluated the use of bis(2-ethylhexyl)phthalate (BEHP) and a new citrate based plasticizer in blood bags. Because BEHP, which has a history of safe use in blood bags, has been shown to cause tumors in rodents who are fed large doses over their lifetime, alternative plasticizers were developed by blood bag vendors. Upon comparison of the toxicological data from both chemicals, the panel recommended that use of BEHP be continued.

U.S. EPA, Washington, DC – Prepared a critical evaluation of the available information on the carcinogenicity, mutagenicity, reproductive effects and developmental effects caused by inorganic fluorides. U.S. EPA used this report in making decisions regarding the merit of a petition to have inorganic fluoride added to the SARA Section 313 list.

IBM, NY – Provided peer review of a toxicological analysis of perchloroethylene. Analysis was prepared to apprise IBM corporate staff of current developments in the toxicology and pharmacokinetic modeling of PCE. Topics presented included epidemiology, animal carcinogenicity bioassays, potential mechanisms of carcinogenicity, physiologically-based pharmacokinetic modeling, and relevance to human risk of PCE carcinogenicity in experimental animals.

Confidential Client, TX – Provided senior review and oversight of a risk assessment of perchloroethylene in groundwater associated with an industrial laundry. Risk assessment was prepared for litigation support and included a critical evaluation of the EPA's current cancer slope factor. Evaluated current pharmacokinetic modeling studies and presented alternate cancer slope factors based on best available science.

Boise Cascade Corporation, International Falls, MN – Prepared a critique of EPA's cancer slope factor for chloroform that was published in the Journal of the Technical Association of the Pulp and Paper Industry. Prepared comprehensive evaluation of the metabolism and bioavailability metabolism of chloroform.



Boston University School of Medicine – Served as Adjunct Assistant Professor of Toxicology, 1989-1992. Taught graduate level course in toxicology to medical doctors and graduate students in public health.

City of Detroit Legal Department – Provided expert testimony regarding a legal case in which PCBs from a Region V Superfund site were alleged to have caused specific adverse health effects. Prepared a written interrogatory and gave an oral deposition regarding the significance of specific PCB serum levels as an indicator of site-specific exposure versus general background exposure.

New Brunswick Power, Fredericton, New Brunswick – Performed toxicological evaluation of respirable particulate matter. Approximately fifty epidemiology studies and government documents allegedly linking quantifiable cases of health effects with respirable particulate matter were evaluated and critiqued. These documents included the Canadian "National Ambient Air Quality Objectives for Particulate Matter," the U.S. "Air Quality Criteria for Particulate Matter," and dozens of scientific papers from the primary literature. In addition, several computer models allegedly estimating quantifiable cases of health effects were evaluated and critiqued. These include the Illness Costs of Air Pollution (ICAP) model developed for the Ontario Medical Association and the Air Quality Valuation Model (AQCM) developed by Health Canada/Environment Canada.

Beazer East Inc., Pittsburgh, PA – Critically evaluated acute toxicity data on arsenic and derived acute toxicity benchmark for use at a former wood treatment site. Benchmark was used to determine if one-time exposures to soil hotspots would be protective of acute toxicity endpoints.

Ogden Projects, Inc., Stanislaw, CA – Performed technical oversight of air dispersion modeling of a hypothetical accidental release of anhydrous ammonia. Conducted toxicological evaluation of acute toxicity data on ammonia. Determined appropriate health-based benchmarks for various exposure times.

PACIFIC Division Naval Facilities Engineering Command, CLEAN, HI – Prepared and submitted comments to the National Toxicology Program regarding their proposal to list naphthalene as "reasonably anticipated to be a human carcinogen" in the Eleventh Edition of *Report on Carcinogens*.

Confidential Client – Performed critical review of dioxin toxicology literature. Identified and critically reviewed the key historical and recent papers on the potential toxicity of dioxin and related compounds in support of possible litigation. Human and animal studies investigating reproductive and developmental effects, immunologic effects, carcinogenic effects, and mechanism of action and pharmacokinetics were included in the review.

Massachusetts Natural Gas Council – Developed and validated a Physiologically Available Cyanide Method for measuring cyanide in soil samples from hazardous waste sites. The method was developed under strict supervision of the Massachusetts DEP and is used to implement an agency-derived "imminent threat" benchmark concentration.

Massachusetts Natural Gas Council, MA – Critically evaluated and prepared formal comments on Massachusetts Department of Environmental Protection proposed policy on risk assessment of PAHs. Demonstrated that experimental data on naphthalene and other PAHs were not sufficient to classify them as potentially carcinogenic PAH. Presented information



showing that literature on PAH interactions does not support a conclusion that PAH given together result in synergistic effects.

New England Power Company, Westborough, MA – Evaluated health effects of electromagnetic fields associated with high voltage power lines for an Environmental Impact Statement. Briefed NEP management on state of the science regarding potential health effects.

Confidential Client, MT – For this rail yard site, performed a detailed toxicological evaluation of diesel fuel. Evaluated state and federal clean-up level precedents for total petroleum hydrocarbons. Proposed a risk-based sampling plan for site soils. Derived groundwater action levels for three groundwater use scenarios: ingestion, incidental contact, and watering of produce.

Atochem, Tacoma, WA – Reviewed and evaluated data showing that EPA's cancer slope factor for arsenic is inappropriate. Current information demonstrates that low doses of ingested arsenic are efficiently metabolized to a nontoxic form in the body. At the high doses at which toxic effects are seen, this process is saturated and is inefficient. Thus, linear low dose extrapolation models are inappropriate. Also, performed laboratory experiment to estimate the site-specific bioavailability of arsenic, which was less than the default value assumed by Washington state regulators.

ThermalKEM, SC – Served as ThermalKEM's representative on Advisory Committee for a University of South Carolina epidemiology study around a hazardous waste incinerator.

American Paper Institute, Washington, DC – Evaluation of body weight versus surface area dose scaling for dioxin. Critically evaluated the appropriate method for scaling laboratory animal dioxin doses to humans. Documented in a written report that body weight scaling was scientifically appropriate and that EPA's cancer slope factor was an overestimate.

Georgia-Pacific, NC – Critically evaluated the North Carolina Department of Health's use of toxicity data to derive a fish advisory for dioxin. Recommended to DOH that pathology data from EPA's animal study using current NTP pathology guidelines be used, as well as body weight dose scaling.

DuPont, Wilmington, DE – Critically evaluated the primary toxicity studies from which EPA derived RfC's for CrVI and CrIII. While the value was not unreasonable for CrVI, it was scientifically inappropriate to use the same data from chromate workers to derive a RfC for CrIII. Data were presented to demonstrate that CrIII is much less toxic than CrVI. EPA subsequently removed both values from its IRIS database, but a RfC for total chromium, regardless of speciation, was proposed using the same CrVI data.

American Ref-Fuel, Houston, TX – Critically evaluated the state's derivation of a cancer slope factor for chromium that is four times higher than EPA's value. Presented dosimetry arguments to demonstrate that EPA's value adequately health protective.

American Ref-Fuel, Houston, TX – Prepared scientific arguments that municipal solid waste combustor emitted CrVI would significantly transform to CrIII before reaching an exposure point and that absorbed CrVI would significantly transform to CrIII in the human body before reaching target tissues. Cited EPA reports that document such processes. Presented arguments to New York and Texas regulators, respectively, that such processes should be quantitatively modeled. Both regulators agreed with the conceptual arguments and agreed to carefully consider quantitative estimates, if presented.



Solvent Risk Assessment/Indoor Air Risk Assessment

Confidential Client, Alaska – Performed risk assessment of petroleum refinery chemical released to groundwater used as drinking water. Derived toxicological reference value for risk assessment from primary toxicological data. Assessed use of groundwater for bathing, washing and vegetable garden watering in addition to drinking. Performed vapor intrusion modeling. Attended agency meetings and derived acceptable levels in water to protect those ingesting the water.

Owens Corning, Berlin, NJ – Performed risk assessment of a heat transfer agent containing biphenyl and diphenyl oxide that was released to groundwater used as drinking water. Assessed state and federal toxicological criteria. Assessed use of groundwater for bathing, washing, industrial uses and direct consumption for residents, commercial workers, and school children. Attended agency meetings and participated in 4 public involvement meetings.

Confidential Client – Prepared Comments on EPA's *Proposed Classification of Trichloroethylene and Proposed Unit Risk Factor, February 2010*. Prepared 50 page scientific comment document and concluded that EPA's proposals were deficient because the implications of the proposal were not discussed, and no validation exercise was performed to determine if cancer incidence predictions made with the proposed Unit Risk Factor match the known incidence rates of RCC, liver and biliary cancer and NHL in the context of the many well characterized risk factors for these cancers.

Timex, AK – Evaluated groundwater and indoor air quality data from office buildings adjacent to and on top of former manufacturing facilities. Constituents of concern included TCE and other chlorinated and non-chlorinated solvents. Performed senior review and oversight of risk assessment calculations and report.

Goodwin Proctor, UniFirst Corporation, MA – Performing risk assessment consulting for a UniFirst –owned commercial building, a building containing a day care center, and a residential neighborhood at the Wells G&H Superfund site. Constituents of concern include TCE and PCE. Commented on EPA vapor intrusion criteria, participated in workplan development, reviewed site data, prepared risk assessments, prepared reports, and attended meetings with EPA project managers. Planned and executed indoor air and subslab soil vapor sampling in numerous buildings and prepared sampling and analysis reports and human health risk assessment reports. Attended meetings with USEPA and parents of children at the day care center.

Confidential Client, NM – Performed strategic consulting to client on indoor air quality sampling and data evaluation for an office building above a former TCE plume associated with a former Superfund site in Albuquerque, NM.

Rite Aid Pharmacy, PA – Performed a critical evaluation of an Industrial Hygiene report on indoor air quality at an operating pharmacy building in New Jersey that was located adjacent to property that formerly housed a service station and a dry cleaner. Performed risk assessment calculations on chlorinated solvents and petroleum hydrocarbons. Made presentations to Rite Aid workers concerning indoor air quality.



Goodwin Proctor, UniFirst Corporation, VT – Performed risk assessment for a chlorinated solvent site in Vermont. Tetrachloroethylene was released from the site of a former dry-cleaning operation and migrated beneath residential dwellings. Attended meetings with regulators. Performed risk assessment calculations for PCE, TCE, and other solvents.

Goodwin Proctor, UniFirst Corporation, NC – Performed risk assessment for a chlorinated solvent site in North Carolina. Tetrachloroethylene was released from the site of a former dry-cleaning operation and migrated beneath the building which is now used as a warehouse for dry cleaning operations. Attended meetings with regulators. Performed risk assessment calculations for PCE, TCE, and other solvents and prepared multiple memoranda. Evaluated site data and made recommendations regarding site sampling and remedial options. Performed site-specific modeling of indoor air quality.

Goodwin Proctor, UniFirst Corporation, CA – Performed risk assessment for a chlorinated solvent site in Stockton, CA. Tetrachloroethylene was released from the site of a former dry-cleaning operation and migrated beneath the building. Evaluated site data and made recommendations regarding site sampling and remedial options. Performed third party review of site-specific modeling of indoor air quality.

Confidential Client, NY – Prepared a toxicological evaluation of tetrachloroethylene in an office building adjacent to a former dry-cleaning facility. Evaluated reported health symptoms associated with PCE exposure and evaluated specific symptoms and health effects reported by building staff. Prepared memorandum summarizing findings and briefed client and client legal staff.

IBM, NY – Provided peer review of a toxicological analysis of perchloroethylene. Analysis was prepared to apprise IBM corporate staff of current developments in the toxicology and pharmacokinetic modeling of PCE. Topics presented included epidemiology, animal carcinogenicity bioassays, potential mechanisms of carcinogenicity, physiologically-based pharmacokinetic modeling, and relevance to human risk of PCE carcinogenicity in experimental animals.

Confidential Client, TX – Provided senior review and oversight of a risk assessment of perchloroethylene in groundwater associated with an industrial laundry. Risk assessment was prepared for litigation support and included a critical evaluation of the EPA's current cancer slope factor. Evaluated current pharmacokinetic modeling studies and presented alternate cancer slope factors based on best available science.

Boise Cascade Corporation, International Falls, MN – Prepared a critique of EPA's cancer slope factor for chloroform that was published in the Journal of the Technical Association of the Pulp and Paper Industry. Prepared comprehensive evaluation of the metabolism and bioavailability metabolism of chloroform.

Hanley & Patch Attorneys, CA – Provided litigation support for lawsuit in which perchloroethylene was alleged to have been released by the client and to have decreased property values and caused unacceptable risks. Provided expert advice and courtroom testimony on the toxicity of perchloroethylene and the potential risks posed by their presence. Modeled volatilization into ambient and indoor air. Compared estimated exposures to typical



exposures at dry cleaning facilities. Client won lawsuit based in large part on risk assessment testimony.

Massachusetts Attorney General's Office – Prepared an affidavit for Federal Court demonstrating that an imminent threat to public health was posed by the presence of chlorinated solvents in a residential area adjacent to a former electronics manufacturing facility. Prepared a supporting appendix, which was a detailed risk assessment. Gave courtroom testimony concerning the risk assessment approach.

Texas Commission on Environmental Quality, TX – Performed strategic consulting to TCEQ on indoor air quality sampling and data evaluation for residences and schools above a petroleum plume associated with a historical release in McAllen, TX.

ThermoRetec, Concord, MA – Prepared iterative Method 3 risk characterization pursuant to Massachusetts Contingency Plan requirements for a former Manufactured Gas Plant that was planned for redevelopment as mixed land use that included underground parking, office space, a hotel, and residential housing. Performed risk calculations according to several potential development scenarios. Informed developer that certain areas were acceptable for development and others were not. Estimated the risks due to volatilization of site-related constituents into current off-site buildings and into a potential underground parking garage.

Northern Utilities, NH – Performed risk assessment of volatiles entering sewer pipes and homes at a former manufactured gas plant site by the use of volatilization modeling approaches. Assisted in drafting scope of work for additional sample collection.

Science Policy/Science Communication

Boston University School of Medicine – Served as Adjunct Assistant Professor of Toxicology, 1989-1992. Taught graduate level course in toxicology to medical doctors and graduate students in public health.

U.S. EPA, Washington, DC – Participated in policy development and rulemaking for the Toxic Substance Control Act at the Office of Toxic Substances. Developed technical aspects of rules to monitor significant new uses of chemicals. Prepared strategy documents, program plans, and briefing reports regarding these and other rules. Assisted in managing a technical contract regarding chemical use patterns.

Environmental Law Institute, Washington, DC – Served as Staff Scientist. Edited Environmental Law Reporter reports and other Institute documents for scientific accuracy. Prepared and submitted to EPA comments on proposed Resource Conservation and Recovery Act regulations. Gained familiarity with Federal databases concerning air and water quality and chemical exposure assessment methodologies.

The World Bank, United Nations, Washington, DC – Prepared reports and memoranda on a variety of topics germane to Third World development, including the effects of U.S. pesticide regulations on marketability of pyrethrum pesticides produced in Tanzania and the role of the World Bank as a technology transfer institution.

U.S. EPA, Seattle, WA – Participated in the formulation of a regional water quality strategy as an Environmental Protection Specialist at EPA Region X. Gained familiarity with Federal water pollution laws and regulations and the Environmental Impact Statement review process.



WGBH, Boston, MA – Served as a AAAS Mass Media Fellow. Research, directed and produced ten radio reports on scientific and environmental issues. Reports broadcast on "All Things Considered" included a three-part series on the technical and policy issues surrounding the saccharin ban and a report on sickle cell anemia.

University of Washington – Served as a Teaching Assistant in the Graduate School of Public Affairs for a course in statistical methods.

Seattle Community College – Designed and co-taught a course in environmental issues.

University of California – Served as a Lecturer. Managed the undergraduate general chemistry laboratory course, including design of experiments, publication of a revised lab manual, direction and production of a series of six instructional videotapes concerning experimental techniques, and supervision of three graduate teaching assistants.

Toxicology Research

Toxicology Program, Massachusetts Institute of Technology – Performed toxicology research and received training that focused on biochemical toxicology, genetic toxicology, chemical dosimetry, and molecular mechanisms of mutagenesis/carcinogenesis.

Toxicology Program, Massachusetts Institute of Technology – Characterized a previously unknown role of human hemoglobin in the metabolic transformation of xenobiotic substances, including numerous environmental contaminants. Determined the effects of point mutations in human hemoglobin on the enzymatic activity.

Toxicology Program, Massachusetts Institute of Technology – Developed methods to identify and quantitate foreign compounds and their metabolites in biologic fluids. Gained extensive experience in the techniques of bioanalytical chemistry, including HPLC, GC/MS, FPLC, electrophoresis, ultrafiltration, and others.



Selected Publications/Presentations

- Magee, Brian H. and Norman D. Forsberg. Testing the Validity of a Proposed Dermal Cancer Slope Factor for Benzo[a]pyrene. (manuscript submitted)
- Forsberg, Norman D., Joseph T. Haney, Jr. Glenn C. Hoeger, Anita K. Meyer, Brian, H. Magee. 2020. Oral and dermal bioavailability studies of polycyclic aromatic hydrocarbons from weathered soils containing fragments of clay pigeon shooting targets. (in review).
- Haney, Joseph, Norman D Forsberg, Glenn Hoeger, Brian Magee, Anita Meyer. 2020. Risk Assessment Implications of Site-Specific Oral Relative Bioavailability Factors and Dermal Absorption Fractions for Polycyclic Aromatic Hydrocarbons in Surface Soils Impacted by Clay Skeet Target Fragments. *Regulatory Toxicology and Pharmacology* 113:104649.
- Forsberg, Norman and Brian Magee. 2019. Read-Across Evaluation for Vinyl Propionate: Filling Data Gaps for Germ Cell Mutagenicity and Carcinogenicity to Support REACH Registration. Society of Toxicology. Baltimore, MA. March 2019.
- Forsberg, Norman and Brian Magee. 2019. Development of Inhalation Reference Concentrations for Chlorotrifluoroethylene (CTFE) and 1,2-Dichloro-1,2,2-trifluoroethane (HCFC-123a). Society of Toxicology. Baltimore, MA. March 2019.
- Lee, Dan, Brian Magee, and Danielle Pfeiffer. 2018. Recommendations on the Use of Existing Toxicological Data/Information for Evaluating Noncancer Hazards of Uranium at Mining Sites. SETAC. Sacramento, CA. November, 2018.
- Forsberg, Norman, Erin Osborn, Brian Magee, Paul Anderson, Neil J. Parke. 2018. Effect of differing regulatory guidance on acceptable environmental levels of active pharmaceutical ingredients in industrial wastewater discharges. SETAC. Sacramento, CA. November, 2018.
- Pfeiffer, Danielle, Dan Lee, Brian Magee, Michael Hay. 2018. Development of an area-specific bioavailability factor for assessing human exposure-risk to arsenic in soils in Southeastern Idaho. SETAC. Sacramento, CA. November, 2018.
- Forsberg, Norman D., Brian H. Magee, Shawn L. Sager. 2018. Deriving no effect levels using probabilistic approaches: application to TCE and potential impacts to risk-based exposure concentrations. SETAC EU. Rome, Italy. May, 2018.
- Magee, B.H.; N.D. Forsberg; A.K. Meyer. 2018. Methods for deriving site-specific relative bioavailability factors from animal bioavailability data. SETAC EU. Rome, Italy. May, 2018.
- Forsberg, Norman D.; Brian H. Magee; Anita K. Meyer; Glenn C. Hoeger; Carlos M. Duarte. 2018. Using A Risk-Based Approach to Guide Remedial Goals: Oral Relative Bioavailability of PAHs at Formerly Used Defense Sites. Eleventh international conference on remediation of chlorinated and recalcitrant compounds. Palm Springs, CA. June, 2018.
- Forsberg, Norman D., Brian H. Magee, Shawn L. Sager. 2018. A probabilistic approach for determining risk-based exposure concentrations for trichloroethylene (TCE). 28th Annual International Conference on Soil, Water, Energy, and Air. Amherst, MA. October 2018.
- Magee, Brian and Norm Forsberg. 2017. U.S. EPA's Expanded-List PAHs in Environmental Media. SETAC EU. Nantes, France.



- Magee, Brian and Norm Forsberg. 2017. U.S. EPA's Expanded-List PAHs in Environmental Media. SETAC EU. Nantes, France.
- Magee, Brian, Norm Forsberg, and Meredith Frenchmeyer. 2017. Major Changes in USEPA's Risk Assessment of PAHs. Railroad Environmental Conference. Urbana-Champaign, IL.
- Magee, Brian, Norm Forsberg, and Meredith Frenchmeyer. 2017. States' Approaches to Assessing PAH Risks. SETAC NA. Minneapolis, MN.
- Magee, Brian. 2017. Impact of New USEPA Policies on Risk-Based Remedial Decisions. Luncheon Presentation. MGP Symposium. New Orleans, LA.
- Magee, Brian, Norm Forsberg, and Glenn C. Hoeger. 2016. Design and Implementation of In vitro Dermal Absorption Studies of PAHs from Impacted Soils for Application in Human Health Risk Assessment. SETAC. Orlando, FL.
- Million B. Woudneh, Jonathan P. Benskin, Richard Grace, M. C. Hamilton, Brian H. Magee, Glenn C. Hoeger, Norman D. Forsberg, John R. Cosgrove. 2016. Challenges in Analysis of Hydroxy PAHs in Urine. SETAC. Orlando, FL.
- Magee, Brian and Anne LeHuray. 2016. PAHs in the Real World: Sources, Sinks, Bioavailability, and Toxicity. SETAC. Orlando, FL.
- Magee, Brian, Norm Forsberg, and Glenn C. Hoeger. 2016. Bioavailability Studies of PAHs in Soil. Railroad Environmental Conference. Champaign Urbana, IL.
- Magee, Brian, Norm Forsberg, and Glenn C. Hoeger. 2016. Oral Bioavailability Study of PAHs in Coal Tar/Coal Tar Pitch Clay Pigeon Target Fragments from Range Sites. SETAC EU. Nantes, France.
- Magee, Brian, Norm Forsberg, and Glenn C. Hoeger. 2016. Dermal Absorption Study of PAHs in Coal Tar/Coal Tar Pitch Clay Pigeon Target Fragments from Range Sites. SETAC EU. Nantes, France.
- Magee, Brian and Norman Forsberg. 2016. Implications of EPA's Proposed Dermal Slope Factor on Risks Posed by Dermal Contact with Grilled Meats. Society of Toxicology Annual Meeting.
- Magee, Brian and Norman Forsberg. 2016. Implications of EPA's Proposed Dermal Slope Factor on Risks Posed by Dermal Contact with Grilled Meats. AEHS National Meeting, Amherst, MA.
- Magee, Brian, Norm Forsberg, and Glenn C. Hoeger. 2016. Dermal Absorption Study of PAHs from Coal Tar/Coal Tar Pitch in Clay Pigeon Target Fragments from Range Sites. AEHS National Meeting, Amherst, MA.
- Magee, Brian, Norman Forsberg and Claire Hamadji. 2015. Utility of Short Term Assays for Assessing Carcinogenicity of PAHs. 54th Society of Toxicology Annual Meeting, San Diego, CA.
- Magee, Brian and Norman Forsberg. 2015. Testing the Validity of EPA's Proposed Dermal Slope Factor for Benzo[a]pyrene: Genetic Alteration Signatures in Common Skin Cancers. 54th Society of Toxicology Annual Meeting, San Diego, CA.



- Magee, Brian, Norm Forsberg, and Katy Baker. 2015. USEPA's Dermal Slope Factor for Benzo(a)pyrene Predicts That Skin Cancer in London is Caused by PAHs in Soil. Society of Environmental Toxicology and Chemistry Annual Meeting, Barcelona, Spain.
- Magee, Brian, Norm Forsberg, and Glenn C. Hoeger. 2015. PAH Composition of Clay Pigeon Target Fragments at Two Military Range Sites. Society of Environmental Toxicology and Chemistry Annual Meeting, Barcelona, Spain.
- Magee, Brian and Norm Forsberg. 2015. PAHs Do Not Have Dioxin-Like Activity. Society of Environmental Toxicology and Chemistry Annual Meeting, Barcelona, Spain.
- Magee, Brian, Janet Keating-Connolly, and Norm Forsberg. 2015. Implications of USEPA's Proposed Dermal Slope Factor on Human Skin Cancer Risk Estimates. 31st Annual International Conference on Soils, Sediments, Water and Energy, Amherst, Massachusetts.
- Magee, Brian, Norm Forsberg, and Glenn C. Hoeger. 2015. Oral and Dermal Bioavailability Studies on PAHs in Target Fragments from Range Sites. 31st Annual International Conference on Soils, Sediments, Water and Energy, Amherst, Massachusetts.
- Connor, Kevin and Brian Magee. 2014. A Quantitative Assessment of Risks of Heavy Metal Residues in Laundered Shop Towels and Their Use by Workers. Regulatory Toxicology and Pharmacology. DOI: 10.1016/j.yrtph.2014.06.020
- Magee, Brian. 2014. Critical Evaluation of EPA's Toxicological Assessment of Benzo(a)pyrene
- Magee, Brian, Glenn C. Hoeger, and Million B. Woudneh. 2014. Pilot Study for Relative Bioavailability Study of PAH in Coal Tar Pitch of Clay Target Fragments.
- Magee, Brian. 2014. Critical Evaluation of EPA's Toxicological Assessment of Benzo(a)pyrene
- Hoeger, G. and B. Magee. 2013. Relative Bioavailability Study of PAH in Coal Tar Pitch of Clay Target Fragments. SETAC NA, Nashville, TN.
- Magee, B. and J. Keating-Connolly. 2013. Critical Evaluation of EPA's Proposed Toxicity Factors for Benzo(a)pyrene. SETAC NA, Nashville, TN.
- Magee, B. and G. Hoeger. 2013. Relative Bioavailability Methods. SETAC NA, Nashville, TN.
- Pfeiffer, Danielle and B. Magee. 2013. Derivation of Alternate Dermal Absorption Factors for Benzo(a)pyrene and other Carcinogenic Polycyclic Aromatic Hydrocarbons in Aged Site Soils. SETAC NA, Nashville, TN.
- Magee, Brian, Glenn Hoeger, Janet Keating-Connolly, and Anne LeHuray. 2013. Risk Assessment for Coal Tar-Based Pavement Sealants. ISPAC. Corvallis, OR.
- Magee, B. and G. Hoeger. 2013. Animal Bioavailability Study of PAH In Coal Tar Pitch Target Fragments. ISPAC. Corvallis, OR.
- Magee, B. and Barbara Pugh. 2013. Dermal Permeability Coefficients for PAH Risk Assessment. ISPAC. Corvallis, OR.
- Magee, Brian, Carpenter, Donald, Ferree, Robert, Gabriel, Jing, Fischer, Thomas J. 2013. Protection of Community Health During MGP Remediation By Air Monitoring. MGP 2013. Savannah, GA.



- Magee, Brian. 2013. Human Health Risk Assessment Issues. Panel Discussion. MGP 2013. Savannah, GA.
- Magee, B., D. Lee, S. Katz. 2013. SETAC EU. Glasgow, Scotland. Differences Between U.S. EPA Reference Doses (RfDs) & European Chemicals Agency (ECHA) Long-term Derived No Effect Levels (DNELs) for Selected Metals.
- Magee, B., K. Connor and D. Chin. 2013. Critical Evaluation of USEPA's Toxicological Assessment of Benzo(a)pyrene and PAH Mixture Toxicity. SETAC EU. Glasgow, Scotland.
- Hoeger, G. and B. Magee. 2013. Relative Bioavailability Study of PAH in Coal Tar Pitch of Clay Target Fragments. SETAC NA, Nashville, TN.
- Magee, B. and J. Keating-Connolly. 2013. Critical Evaluation of EPA's Proposed Toxicity Factors for Benzo(a)pyrene. SETAC NA, Nashville, TN.
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- Pfeiffer, Danielle and B. Magee. Derivation of Alternate Dermal Absorption Factors for Benzo(a)pyrene and other Carcinogenic Polycyclic Aromatic Hydrocarbons in Aged Site Soils. SETAC NA, Nashville, TN.
- Magee, Brian, Glenn Hoeger, Janet Keating-Connolly, and Anne LeHuray. 2013. Risk Assessment For Coal Tar-Based Pavement Sealants. ISPAC. Corvallis, OR.
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- Magee, B. and Barbara Pugh. 2013. Dermal Permeability Coefficients For PAH Risk Assessment. ISPAC. Corvallis, OR.
- Magee, B. and Jeff Lewis. 2013. What do Occupational and Population Risk Assessments of Naphthalene Induced Nasal Tumors Show Us? Society for Risk Analysis. Special Session on Naphthalene. Baltimore, MD.
- Pugh, Barbara, B. Magee, A. McManus, and R. Chatrathi. 2013. Human Health Risk Assessment Techniques to Support the Establishment of Cleanup Target Levels for Infrequently Spilled Compounds. Railroad Environmental Conference. Urbana-Champaign, IL.
- M. Jackson; R. Lemus; C. Inhof; Z. Yin; B. Magee; B. Locey; K. Connor. 2013. Differences Between U.S. EPA Integrated Risk Information System (IRIS) Inhalation Reference Concentrations (RfCs) and European Chemicals Agency (ECHA) Long-term Inhalation Derived No Effect Levels (DNELs) for the General Population.
- Magee, B. 2013. SOT. San Antonio, TX. Derivation of a Reference Dose for Resorcinol.
- Magee, B., K. Connor, D. Chin, V. Houck. 2013. SOT. San Antonio, TX. Validation of Oral Slope Factors for Benzo(a)pyrene Using Whole Mixtures. Magee, B., D. Lee, S. Katz. 2013. SETAC EU. Glasgow, Scotland. Differences Between U.S. EPA Reference Doses (RfDs) & European Chemicals Agency (ECHA) Long-term Derived No Effect Levels (DNELs) for Selected Metals.
- Magee, B. 2013. SOT. San Antonio, TX. Derivation of a Reference Dose for Resorcinol.
- Magee, B., K. Connor, D. Chin, V. Houck. 2013. SOT. San Antonio, TX. Validation of Oral Slope Factors for Benzo(a)pyrene Using Whole Mixtures.



Magee, B., K. Connor, D. Chin, V. Houck. SETAC NA. Long Beach, CA. Critical Evaluation of USEPA's Toxicological Assessment of Benzo(a)pyrene.

Magee, B. S. Evert. SETAC NA. Long Beach, CA. PAH Mixtures: Additivity, Synergism or Antagonism?

Magee, B, Chin, D. 2012. Manufactured Gas Plants 2012. Chicago, IL; Proposed Increases in PAH Relative Potency Factors Will Greatly Increase Risks at All PAH Sites.

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Magee, B. 2011. Environment, Safety, and Occupational Health (ESOH). Nashville, TN. Evaluation of A Proposed EPA Unit Risk Factor for Naphthalene Using Screening-Level Population Risk Assessment Of Nasal Tumors In The United States.

Magee, B. and G. Hoeger. 2011. Environment, Safety, and Occupational Health (ESOH). Nashville, TN. Evaluation of Polycyclic Aromatic Hydrocarbons. In Clay Target Fragments And Surface Soil At Shot Gun Range Sites.

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Baker, K., J. White and B. Magee. 2011. Society for Environmental Chemistry & Toxicology. Pharmaceuticals at Sites Affected By Contamination: A UK Approach To Assessing Risk To Human Health.

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Magee, B., Weaver, A. 2011. Society for Environmental Chemistry & Toxicology. Risks of Intact Residential Lead Based Paint Versus Risks of Remediation.

Magee, B., Keating-Connolly, J., Chew, B. 2011. Society for Environmental Chemistry & Toxicology. Comprehensive Risk Assessment of a Proposed \$30M Cleanup Plan at Sydney, Nova Scotia. Magee, B, Samuelian, J, Haines, K, Chappel, M, Penn, I, Chin, D, Anders, D, Hinz, J. 2010. Screening-level population risk assessment of nasal tumors in the US due to naphthalene exposure. *Regulatory Toxicology and Pharmacology* 57: 168-180.

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Huntley, S., P. Anderson and B. Magee. 2010. Application of Dioxin Epidemiology Data For Deriving Toxicity Values For 2,3,7,8-TCDD For Use In Risk Assessments. Presented at DIOXIN2010, San Antonio, Texas, October, 2010.

Nadine Weinberg, Brian Magee, Nancy Bonnevie, Margaret Bartee. 2010. Weight of Evidence Evaluations: A Comparative Analysis of Human and Ecological Approaches. Presented at Society for Risk Analysis Annual Meeting. Salt Lake City, UT, December 2010.

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Magee, Brian H. 2009. India: Environmental & Chemical Regulatory Developments. ORC Worldwide, International Safety and Health Forum. Washington, D.C., November 12, 2009.

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EXHIBIT 12



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

<p>ETC NORTHEAST PIPELINE, LLC; SUNOCO PIPELINE L.P.; ENERGY TRANSFER LP</p> <p style="text-align: center;">v.</p> <p>COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION</p>	<p>: : : : : : : : : : :</p>	<p>EHB Docket No. 2019-021-R</p>
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AFFIDAVIT OF DAVID RUNTE

David Runte states as follows:

1. My name is David Runte. I am the Senior Director of Engineering and Senior Project Director for Energy Transfer Partners and Sunoco Pipeline L.P. (“Sunoco Pipeline”).
2. I participate in managing construction contracts concerning the Mariner East 2 Pipeline (“ME2”) Project.
3. I have personal knowledge of the resources required to complete construction of the ME2 Project.
4. ME2 is owned and operated by Sunoco Pipeline.
5. I understand that the Pennsylvania Department of Environmental Protection (the “Department”) issued an Administrative Order dated September 11, 2020, which stopped the installation of a 20-inch diameter pipeline under Little Conestoga Road in Upper Uwchlan Township, Chester County, Pennsylvania (“HDD 290”) and required that Sunoco Pipeline implement the re-route of HDD 290 described in the Reevaluation Report approved by the Department. The Department’s Administrative Order will result in significant delays and additional construction costs to complete construction of the ME2 Project.



6. The total costs incurred by Sunoco Pipeline to-date to install the 20-inch pipeline at HDD 290 are approximately \$16,916,423. If required to re-route, Sunoco Pipeline would be unable to recover these costs.

7. The total cost to grout the borehole at HDD 290 will be approximately \$482,000.

8. If allowed to continue to construct HDD 290, the anticipated total cost to complete construction of HDD 290 will be between approximately \$4,585,900 and \$5,632,300 depending on whether the borehole is grouted before recommencing construction of HDD 290.

9. The estimated time remaining to complete construction of HDD 290 is approximately 37 to 45 days depending on whether the borehole is grouted before recommencing construction of HDD 290.

10. The anticipated total cost to construct the re-route described in the Reevaluation Report approved by the Department will be between approximately \$18,073,700 and \$23,590,000 depending on conditions encountered in the field during construction.

11. Construction of the re-route would not begin until all property rights necessary to construct the re-route have been obtained, as described in the Affidavit of Mark McConnell.

12. Construction of the re-route would not begin until Sunoco Pipeline obtains all Department permits and approvals necessary to allow Sunoco Pipeline to commence construction of the re-route, as described in the Affidavit of Brad Schaeffer.

13. Once all property rights necessary to construct the re-route have been obtained and Sunoco Pipeline has obtained all permits and approvals necessary to commence construction of the re-route, the estimated time to construct the re-route described in the Reevaluation Report



approved by the Department and prepare the 20-inch pipeline for service is anticipated to take between approximately four to five months.

14. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020



David Runte



EXHIBIT 13



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.	:	
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v.	:	EHB Docket No. 2020-085-L
	:	
COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION	:	
	:	

AFFIDAVIT OF MARK MCCONNELL

Mark McConnell states as follows:

1. My name is Mark McConnell, and I am Project Manager—Field Services for Percheron LLC.
2. I currently serve as the Land Project Manager on behalf of Sunoco Pipeline L.P. (“Sunoco Pipeline”) for a project known as the Mariner East 2 Pipeline project (the “Project”). Part of the Project involves installing a 20-inch pipeline by horizontal directional drill (“HDD”) in Upper Uwchlan Township, Chester County, referred to as HDD 290.
3. As Land Project Manager, one of my roles is to secure for Sunoco Pipeline all property rights necessary to construct, operate, and maintain the Project. Those property rights include: (1) permanent easements for a 50-foot area that encompasses the 20-inch pipeline route and any access roads necessary to maintain the pipeline; (2) temporary easements for another 25 linear feet of temporary workspace; and (3) temporary easements for additional temporary workspaces and access roads determined to be necessary to construct the pipeline.
4. I have reviewed the re-route map attached as Exhibit A to the Affidavit of Brad Schaeffer which depicts a 1.01-mile re-route for HDD 290 described in Reevaluation Report submitted to the Department by Sunoco Pipeline (the “re-route”), which the Department has



ordered Sunoco Pipeline to implement pursuant to an Administrative Order dated September 11, 2020. According to the Affidavit of Brad Schaeffer, this re-route map includes all permanent easements, workspaces, and access roads necessary to construct, operate, and maintain the re-route.

5. I directed Russel Jones, Field Project Manager—TRC Field Services, to use this map and query the Chester County Graphical Information System (“GIS”) website to identify: (1) the tax parcels that correspond to the construction areas, workspaces and access roads depicted on the re-route map; and (2) the owner of each of the parcels. This is the manner in which we identify this information when acquiring property rights necessary to construct a pipeline, and the information is often referred to as a “line list.” The line list for the re-route is depicted on a table attached as Exhibit A.

6. As indicated in the line list, other than parcels owned by Sunoco Pipeline, the re-route will require securing new temporary and permanent easements on eleven parcels owned by eight individuals or entities. A map depicting the re-route and the parcel boundaries and identification numbers is attached as Exhibit B.

7. To secure the necessary property rights for the re-route, Sunoco Pipeline will need to either negotiate an agreement with the current landowner or, if negotiations are unsuccessful, initiate a condemnation action based on Sunoco Pipeline’s status as a public utility.

8. The negotiation process with a private landowner involves achieving agreement on not only monetary compensation, but also a host of other issues, including, but not limited to, space restrictions, the presence of above-ground appurtenances, liquidated damages for crops and timber, the relocation of existing features, and seed mixes used for restoration.



9. Based on my experience on the Project, a successful negotiation process with a private landowner typically takes 30-60 days.

10. In addition, the Pennsylvania Turnpike Commission owns two of the parcels on which Sunoco Pipeline will need temporary or permanent easements to construct the re-route. Assuming that the Pennsylvania Turnpike Commission is willing to enter into negotiated agreements with Sunoco Pipeline for the required temporary or permanent easements, in my experience on the Project, the administrative requirements that the Pennsylvania Turnpike Commission follows to finalize such an agreement typically takes three to six months.

11. If attempts to negotiate an agreement for property rights are unsuccessful, Sunoco Pipeline will need to initiate a condemnation action to obtain the required temporary or permanent easements. Based on my experience with the Project and my review of the line list, I expect that Sunoco Pipeline will be required to initiate condemnation proceedings to secure the necessary property rights to construct, operate, and maintain the re-route for at least two of the parcels on the line list.

12. It typically takes five to seven months for Sunoco Pipeline to secure the right to enter a property using the condemnation process. This time period includes two to four weeks to obtain a detailed appraisal, followed by procedural timelines that are dictated by statute and, for the re-route of the HDD 290 site, the rules and schedules of the Chester County Court of Common Pleas.

13. Each negotiation or condemnation process is unique, and therefore the final cost that Sunoco Pipeline may be required to pay landowners along the re-route to secure the necessary property rights to construct, operate, and maintain the pipeline will depend on a number of varying factors.



14. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020


Mark McConnell



EXHIBIT A



Line List - Re-Route of HDD 290					
Tract#	UP#	Landowner	Address	City/State	Note
PA-CH-0100.0000	32-3-34.4	SUNOCO PIPELINE LP	1818 MARKET ST, STE 1500	PHILADELPHIA PA	
PA-CH-0099.0001	32-3-34.7	SUNOCO PIPELINE LP	1900 DALROCK RD	ROWLETT TX	
PA-CH-0099.0000	32-3-34	PA TURNPIKE COMMISSION	PO BOX 67676	HARRISBURG PA	
	32-3-34.3	SECURE HOLDINGS LLC	PO BOX 826	ARDMORE PA	
	32-3-9.6	MOSER MICHELLE & GRUBB JAMES	102 HOFFMAN CIR	DOWNINGTOWN PA	
	32-3-9.7	WADSWORTH DENNIS L & MARGARET M ETAL	101 HOFFMAN CIR, PO BOX 496	UWCHLAND PA	
	32-3-15.2	PA TURNPIKE COMMISSION	PO BOX 67676	HARRISBURG PA	
	32-3-15.2A	DILLON VERNON H & JOAN	445 MILFORD RD	DOWNINGTOWN PA	
	32-3-23.64	RESERVE AT CHESTER SPRINGS COMMUNITY ASSOCIATION	250 GIBRALTAR RD	HORSHAM PA	
	32-3-23.63	RESERVE AT CHESTER SPRINGS COMMUNITY ASSOCIATION	250 GIBRALTAR RD	HORSHAM PA	
	32-3-61.1A	SENN STEPHEN F & FAYE	395 LITTLE CONESTOGA RD	DOWNINGTOWN PA	
PA-CH-0110.0000	32-3-59	MAGNAYON RHODELLE M & MEGAN L	55 GREEN VALLEY RD	DOWNINGTOWN PA	5.01 acres; acreage split and sale post acquisition
PA-CH-0110.0000	32-3-59.36	RESERVE AT CHESTER SPRINGS COMMUNITY ASSOCIATION	250 GIBRALTAR RD	HORSHAM PA	46.12 acres; acreage split and sale post acquisition

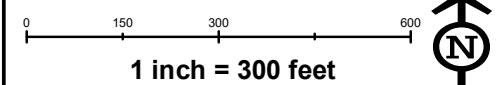


EXHIBIT B



Legend

- Parcel Boundary
- Centerline
- Permanent ROW
- Temporary ROW
- ATWS
- Temporary Access Road



Prepared By: TETRA TECH	Date: 10/6/2020
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Base Map; ESRI World Imagery 09/2019.

Coordinate System: NAD 83 Stateplane, PA South, Feet



EXHIBIT 14



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.

v.

**COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF ENVIRONMENTAL
PROTECTION**

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EHB Docket No. 2020-085-L

AFFIDAVIT OF RICHARD BILLMAN

Richard Billman states as follows:

1. My name is Richard Billman. I am the Vice President of Business Development for Sunoco Pipeline L.P. ("Sunoco Pipeline").
2. I participate in, or have personal knowledge of, the negotiations of commercial contracts concerning the Mariner East 1 Pipeline ("ME1") Project, the Mariner East 2 Pipeline ("ME2") Project, and the Mariner East 2X Pipeline ("ME2X") Project.
3. I have personal knowledge of the revenues and operating expenses associated with the projects identified above.
4. ME1, ME2, and ME2X are owned and operated by Sunoco Pipeline.
5. The ME1 Project involved, in part, converting a substantial portion of an existing 8-inch pipeline system from Delmont, Pennsylvania to the Marcus Hook Industrial Complex ("Marcus Hook") located in Delaware County, Pennsylvania, which will ultimately allow Sunoco Pipeline to transport refined petroleum products between Delmont, Pennsylvania and Marcus Hook when construction of the ME2X Project and the ME2 Project is completed.



6. The ME2X Project, portions of which are still under construction, involves installing a 16-inch pipeline from Delmont, Pennsylvania to Marcus Hook to transport natural gas liquids (“NGLs”).

7. The ME2 Project, portions of which are still under construction, involves installing a 20-inch pipeline from Scio, Ohio, through Houston, Pennsylvania, to Marcus Hook to transport NGLs.

8. With respect to the ME2 Project, Sunoco Pipeline has installed a 20-inch pipeline from Scio, Ohio, through Houston, Pennsylvania, to Montello, Pennsylvania but is still in the process of installing a 20-inch pipeline at certain locations between Montello, Pennsylvania and Marcus Hook, including the location of HDD 290 in Upper Uwchlan Township, Chester County, Pennsylvania.

9. Until construction of the ME2 Project is completed and the 20-inch pipeline is fully installed, ME2 is utilizing a combination of an existing 12-inch pipeline as well as a section of the 16-inch pipeline that would otherwise be used by ME2X from Montello, Pennsylvania to Marcus Hook.

10. Until construction of the ME2X Project and the ME2 Project is completed and the 16-inch pipeline and the 20-inch pipeline are fully installed, Sunoco Pipeline will be unable to use the converted ME1 8-inch pipeline between Montello, Pennsylvania and Marcus Hook to transport refined petroleum products.

11. As a result of being unable to fully utilize a 20-inch pipeline, and instead having to utilize a combination of the existing 12-inch pipeline and a section of the 16-inch pipeline from Montello, Pennsylvania to Marcus Hook, the NGL capacity of ME2 is approximately



[CONFIDENTIAL] barrels per day (“bpd”) less than it will be when construction of the ME2 Project is completed and ME2 fully utilizes a 20-inch pipeline from Scio, Ohio to Marcus Hook.

12. As a result of being unable to use the converted ME1 8-inch pipeline to transport refined petroleum products between Montello, Pennsylvania and Marcus Hook, Sunoco Pipeline’s refined petroleum products capacity is [CONFIDENTIAL] bpd less than it will be approximately four months after construction of the ME2X Project and the ME2 Project is completed.

13. The projected daily revenue attributable to transporting [CONFIDENTIAL] bpd of NGLs is approximately [CONFIDENTIAL], which represents the daily anticipated revenue from the reduced capacity of ME2 until construction of the 16-inch pipeline is completed.

14. The projected daily revenue attributable to transporting [CONFIDENTIAL] bpd of refined petroleum products is approximately [CONFIDENTIAL], which represents the daily potential revenue from the transport of refined petroleum products on the ME1 8-inch pipeline between Montello, Pennsylvania and Marcus Hook, beginning approximately four months after construction of the ME2X Project and the ME2 Project is completed.

15. Sunoco Pipeline currently anticipates to complete construction of the ME2X Project by December 31, 2020.

16. Before the Pennsylvania Department of Environmental Protection issued an Administrative Order dated September 11, 2020, which stopped the installation of HDD 290 and required Sunoco Pipeline to implement a re-route of HDD 290, Sunoco Pipeline anticipated completing construction of the ME2 Project by March 31, 2021.

17. Unless the Administrative Order is superseded to allow Sunoco Pipeline to complete construction of HDD 290 by March 31, 2021, every day that completion of construction of the ME2 Project is delayed after March 31, 2021, Sunoco Pipeline will lose approximately



[CONFIDENTIAL] in revenue every day for the first four months after March 31, 2021 due to the lower capacity of ME2, and thereafter will lose between approximately [CONFIDENTIAL] in revenue every day due to the lower capacity of ME2 and the inability to use the converted ME1 8-inch pipeline to transport refined petroleum products between Montello, Pennsylvania and Marcus Hook, until construction of the ME2 Project is completed.

18. According to the Affidavit of Mark McConnell, it will take Sunoco Pipeline three to six months to obtain an administrative agreement with the Pennsylvania Turnpike Commission for the re-route of HDD 290 to cross the Pennsylvania Turnpike, and it will take Sunoco Pipeline five to seven months to acquire the necessary property rights to allow Sunoco Pipeline to construct the re-route of HDD 290.

19. According to the Affidavit of Brad Schaeffer, it will take Sunoco Pipeline twenty to twenty-four months to obtain the Department permits and approvals necessary to allow Sunoco Pipeline to commence construction of the re-route of HDD 290.

20. According to the Affidavit of David Runte, it will take Sunoco Pipeline approximately four to five months to complete construction of the re-route of HDD 290 once all necessary Department permits and approvals are obtained.

21. If Sunoco Pipeline is required to construct the re-route of HDD 290, completing the re-route of HDD 290 is anticipated to take a total of approximately twenty-four to twenty-nine months.

22. Even if Sunoco Pipeline began the necessary condemnation proceedings and began preparation of the necessary permit applications for the re-route of HDD 290 today, the expected ME2 Project completion date of March 31, 2021 would be delayed by approximately eighteen to twenty-three months.



23. If completion of the ME2 Project is delayed by eighteen to twenty-three months, Sunoco Pipeline would expect to lose a total of between approximately [CONFIDENTIAL] in revenue due to the Administrative Order.

24. Operating expenses associated with the incremental volumes cited above are expected to be approximately [CONFIDENTIAL] of the anticipated incremental revenues cited above, which means that profits associated with the incremental volumes cited above are expected to be approximately [CONFIDENTIAL] of the anticipated incremental revenues cited above.

25. Factoring in operating expenses, if completion of the ME2 Project is delayed by eighteen to twenty-three months, Sunoco Pipeline would expect to lose a total of approximately [CONFIDENTIAL] in profits due to the Administrative Order.

26. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020



Richard Billman



EXHIBIT 15



**COMMONWEALTH OF PENNSYLVANIA
BEFORE THE ENVIRONMENTAL HEARING BOARD**

SUNOCO PIPELINE L.P.,

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v.

EHB Docket No. 2020-085-L

**COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF ENVIRONMENTAL
PROTECTION,**

AFFIDAVIT OF STEPHEN A. COMPTON

Stephen A. Compton states as follows:

1. My name is Stephen A. Compton, and I am currently a Senior Program Director at Tetra Tech, Inc. (“Tetra Tech”). I hold a Bachelor of Science degree from Cornell University, Ithaca, New York, and a Master of Science degree from Utah State University, Logan, Utah. I have over 30 years of experience in managing and conducting environmental research, environmental field studies, environmental technical studies, environmental permitting, environmental assessment (including Environmental Impact Statement [“EIS”], Environmental Assessment [“EA”], Biological Assessment, and Biological Evaluation preparation), construction environmental auditing and inspection, and post-construction restoration monitoring. This experience encompasses designing, collecting, analyzing, managing, and reporting environmental data relating to wetlands, waterbodies, plants/vegetation, fish/essential fish habitat, marine mammals, general wildlife, migratory birds, bald and golden eagles, threatened and endangered species, cultural resources, land use, recreation, transportation, and noise, and associated federal, state, and local environmental permitting. The majority of my work has been associated with linear pipeline projects.



2. I have served as the Environmental Project Principal/Director or Environmental Project Manager on over 100 natural gas, natural gas liquids, refined products, crude oil, CO₂, and water pipeline projects, totaling over 5,000 linear miles and including numerous major aboveground facilities, nationwide. I have extensive experience and working knowledge of National Environmental Policy Act (“NEPA”) compliance, with particular emphasis on alternatives analysis and cumulative impact analysis. I have managed and authored technical sections on over 100 federal NEPA and state EISs and EAs, including over 60 EISs and EAs on natural gas, crude oil, and water pipeline projects. I served as a program manager for NEPA compliance and prepared dozens of EISs and EAs under direct contract to the Federal Energy Regulatory Commission (“FERC”), United States Department of the Army, and the United States Army Corps of Engineers. A copy of my curriculum vitae is attached as Exhibit A.

3. I was part of a team of Tetra Tech professionals hired by Sunoco Pipeline L.P. (“Sunoco Pipeline”) to assist with planning and permitting for a project known as the Mariner East 2 pipeline project (the “Project”). Part of the Project is a horizontal directional drill (“HDD”) in Upper Uwchlan Township, Chester County, known as HDD 290. On the team, I was the Senior Task Manager responsible for management, coordination with the interdisciplinary project management team including project engineers, and preparation of the Alternatives Analysis, Trenchless Construction Feasibility Analysis, and Cumulative Impact Analysis.

4. The analysis and opinions presented in this affidavit were prepared based on my professional experience with environmental research, environmental field studies, environmental technical studies, environmental permitting, environmental assessment, construction phase



environmental compliance auditing and inspection, and post-construction restoration monitoring on pipeline installation projects, and my development and/or review of the following items:

a. Information regarding previous and current status of the original HDD 290 (“Original HDD”) Original HDD and associated inadvertent returns as set forth in the Affidavits of Brad Schaeffer, Joshua Prosceno, and Nicholas Bryan and other reports and relevant documents Sunoco Pipeline previously submitted to the Department.

b. A re-route map attached as Exhibit A to the Affidavit of Brad Schaeffer which depicts a 1.01-mile-long re-route for HDD 290 described in the Reevaluation Report for HDD 290 submitted to the Department by Sunoco Pipeline (the “HDD Reroute”), and which the Department has ordered Sunoco Pipeline to implement pursuant to an Administrative Order dated September 11, 2020. According to the Affidavit of Brad Schaeffer, this re-route map includes all permanent easements, workspaces, and access roads necessary to construct, operate, and maintain the re-route;

c. Overlay, mapping, and other information from publicly-available desktop geographic information system (“GIS”) data sources and aerial imagery;

d. Desktop engineering design of the re-route centerline; permanent, temporary, and additional temporary workspace; and baseline construction methods (i.e., open cut, bore, mini-HDD) for infrastructure and resource crossings, as provided by Sunoco Pipeline;

e. Desktop identification of current land parcel boundaries, landowners, and line list of directly affected landowners as set forth in the Affidavit of Mark McConnell;

f. The original project-wide Alternatives Analysis, and the Reevaluation Report for HDD 290; and



g. Field reconnaissance from publicly accessible viewing points.

5. An alternatives analysis is required to be performed under federal and Pennsylvania regulations to receive a permit for construction of linear projects, like the Project, that affect aquatic resources. The purpose of an alternatives analysis is to identify practicable alternatives that avoid and minimize environmental and human environment impacts. As noted in the Department's Chapter 105 regulations, an alternative is practicable if it is capable of being carried out after taking into consideration cost, existing technology, and logistics.

6. It is my opinion, to a reasonable degree of scientific certainty, that even though the HDD Reroute was "technically feasible" as stated in the Reevaluation Report for HDD 290, the HDD Reroute cannot be considered a practicable alternative to complete the 20-inch pipeline in this area based on my review of currently available information and my field reconnaissance.

7. There are numerous potential risks related to potentially affected environmental and human environment resources regarding logistics related to typical processes required for reroute development, survey, design, approvals, permitting, construction, and operation that cause the HDD Reroute to not be practicable. These include, but are not limited to: landowner easement restrictions and requirements; potential inconsistency with current and future residential and commercial development plans and associated land uses; restrictions or unavailability of practicable road, infrastructure, and resource crossing alignments and construction methods; possibly unallowable, un-permittable, or un-constructible road and infrastructure crossings and construction methods; and the resultant significant delays and costs in completing project development, design, survey, approvals, permitting, construction, in-service commissioning, and operation.



8. According to the Affidavit of David Runte, the estimated time to complete construction of HDD 290 is approximately 37 to 45 days and is expected to cost approximately \$4,585,900 to \$5,632,300. In contrast, according to the Affidavit of David Runte, construction of the HDD Reroute is expected to take approximately four to five months and is expected to cost approximately \$18,073,700 to \$23,590,000 depending on conditions encountered in the field during construction.

9. According to the Affidavit of Mark McConnell, it will take Sunoco Pipeline five to seven months to acquire the necessary property rights to allow Sunoco Pipeline to construct the re-route of HDD 290. And, according to the Affidavit of Brad Schaeffer, it will take Sunoco Pipeline twenty to twenty-four months to obtain the Department permits and approvals necessary to allow Sunoco Pipeline to commence construction of the re-route of HDD 290.

10. According to the Affidavit of Richard Billman, every day that completion of construction of the ME2 Project is delayed after March 31, 2021, Sunoco Pipeline will lose approximately [CONFIDENTIAL] in revenue every day for the first four months after March 31, 2021, and thereafter will lose approximately between [CONFIDENTIAL] in revenue every day, until construction of the ME2 Project is completed. According to the Affidavit of Richard Billman, if completion of the ME2 Project is delayed by eighteen to twenty-three months after March 31, 2021, Sunoco Pipeline would expect to lose a total of approximately [CONFIDENTIAL] in profits.

11. These logistical issues and the costs associated with the significant delays in completing project development, design, survey, approvals, permitting, construction, in-service commissioning, and operation, are substantial and cause the HDD Reroute to not be practicable.



12. It is also my opinion, to a reasonable degree of scientific certainty, that the HDD Reroute would also cause greater direct and indirect impacts to wetlands and waterbodies, as well as other environmental (land uses, protected species) and human environment (landowners, residences, roadways) resources, and based on field reconnaissance has a high potential to result in additional impacts to these resources pending completion and results of detailed in-field surveys, compared to the Original HDD. Therefore, the Original HDD is the technically feasible and practicable alternative that results in the lesser impact on wetland and waterbody resources and avoids significant impacts on other environmental and human environment resources as compared to the HDD Reroute.

13. The methodology I used to reach my opinion consisted of calculating and comparing direct impacts and typical indirect impacts to environmental and human environment resources, assuming implementation of Sunoco Pipeline's impact avoidance, minimization, and mitigation measures and typical agency permit conditions as applied to the Project to date, affected by the Original HDD and HDD Reroute using overlay, mapping, and other information from publicly-available desktop GIS data sources and aerial imagery. The construction activities associated with the Original HDD that have already been completed are not included in the calculation and comparison of the direct impacts and typical indirect impacts. The results of the comparison are summarized below.

14. Land requirements and impacts: The 0.64 miles remaining for the Original HDD alignment (consisting of an approximately 0.01-mile-long open cut segment at the begin point, 0.49-mile-long HDD segment not installed, and 0.14-mile-long (765 feet) open cut construction method segment for the 20-inch-diameter pipeline previously installed to the east of the HDD exit site) would require a total of 2.82 acres of land area entirely within previously authorized



and disturbed limits of disturbance (“LOD”) with ground disturbance limited to the HDD entry and exit sites. The 2.82 acres is comprised of previously authorized and disturbed LOD, including approximately 2.38 acres of open and 0.44 acre of commercial/industrial/roadway land uses. By contrast, the 1.01-mile-long HDD Reroute would require a total of 12.10 acres of land area, including a 50-foot-wide permanent easement (6.15 acres) and 25-foot-wide temporary easement, 11 additional temporary workspaces, and temporary access (totaling 5.95 acres), that would be entirely new land disturbance with the limited exception of the two tie-in points to the previously installed 20-inch-diameter pipeline. This new land disturbance is comprised of approximately 2.18 acres of forest, 0.57 acre of residential, 7.80 acres of open, and 1.55 acres of commercial/industrial/roadway land uses. Therefore, the HDD Reroute would result in almost entirely new and substantively greater (+9.28 acres) land disturbance, including new forested and residential land uses, as compared to the Original HDD.

15. Roadways: The remaining construction associated with the Original HDD would require HDD construction beneath three roadways (Milford Road, Little Conestoga Road, Highview Road), which will not result in any travel lane disturbance. The 1.01-mile-long HDD Reroute would require use of the open cut or direct pipe bore construction methods and surface travel lanes across three roadways (Hoffman Circle, Milford Road, Little Conestoga Road), and mini HDD crossings or direct pipe bores of Interstate-76/Pennsylvania Turnpike inclusive of the proposed future expansion area of the Turnpike. Therefore, the HDD Reroute would result in substantively greater open cut construction method and surface travel lane disturbance, including but not limited to potential road closures, traffic interruptions, traffic control, and associated public safety hazards, as compared to the Original HDD.



16. Landowner Impacts: The remaining construction work associated with the Original HDD alignment and workspace traverses 11 land parcels, for which negotiations and agreements for survey permission and right-of-way easements have been successfully negotiated and acquired, nor have condemnation proceedings been initiated. Only three of these parcels would be subject to ground surface disturbance. The HDD Reroute alignment and workspace traverses 11 new land parcels for which negotiations and agreements with affected landowners for survey permission and right-of-way easements have not been undertaken. Furthermore, the HDD Reroute would require open cut construction on these parcels, which will result in ground disturbance, equipment and personnel transit, construction noise, and visual and aesthetic impacts, for an anticipated construction period of four to five months, resulting in substantively greater construction related impacts to landowners compared to the Original HDD. Post-construction, the HDD Reroute would result in a substantively increased amount of new, permanent land disturbance and encumbrances on existing private residential development, private land uses, and affected private landowners; potential inconsistency with county comprehensive plans; permanent reduction in availability of land for future development; and potential inconsistency with current and future residential and commercial development plans and associated land uses, particularly with regard to any potential future expansion of Interstate-76/Pennsylvania Turnpike beyond current plans and potential residential development lands owned by the Reserve at Chester Springs Community Association (three parcels). In sum, the HDD Reroute would result in a substantively increased amount of impacts on new landowners both during and after construction as compared to the Original HDD.

17. Residences: Completing the Original HDD would not result in ground disturbance within 300 feet of any residences because the 20-inch pipeline will be installed using HDD



construction methods. By contrast, the HDD Reroute would require ground disturbance within 300 feet of eight newly affected residences, including five newly affected residences in very close proximity—between 8 and 68 feet—from the edge of the new LOD. In addition, the use of open cut construction for the HDD Reroute would result in equipment and personnel transit, construction noise, and visual and aesthetic impacts, in very close proximity to these eight newly affected residences. Accordingly, the HDD Reroute would result in a substantively increased amount of impacts on residences as compared to the Original HDD.

18. Wetlands: Based on desktop database review of publicly available National Wetland Inventory (“NWI”) and National Hydrography Dataset (“NHD”) information, completing the Original HDD alignment would require use of a temporary construction travel lane across 0.05 acre of wetlands (0.02 acre palustrine emergent [“PEM”] and 0.03 acre Riverine) in the area previously disturbed by the open cut construction method installation of the existing 20-inch-diameter pipeline crossing of these wetlands. Also based on desktop database review, the HDD Reroute would require impacts to 0.20 acre of wetlands, including open cut construction method crossings (0.06 acre palustrine forested [“PFO”] and 0.12 acre Riverine) inclusive of 0.03 acre of PFO permanent cover type conversion, temporary workspace (<0.01 acre freshwater pond [“PuB”]), and temporary access road (0.01 acre PEM and 0.01 acre Riverine). For the wetlands crossed by the HDD Reroute, the use of temporary access, such as timber matting, would be required to be in place in these wetlands for an anticipated construction period of four to five months for the HDD Reroute. Therefore, the HDD Reroute would result in greater temporary construction impacts to wetlands (+0.15 acre) and PFO permanent cover type conversion (+0.03 acre) as compared to the Original HDD.



19. Waterbodies: Based on desktop database review of publicly available NWI and NHD information, completing the Original HDD alignment would require use of a temporary construction travel lane across one perennial UNT to March Creek (56 linear feet within construction right-of-way) in the area previously disturbed by the open cut construction method installation of the existing 20-inch pipeline crossing of this waterbody. Also based on desktop database review, the HDD Reroute would require impacts to two waters of the Commonwealth at a total of three locations, including open cut construction method crossings two UNTs to Marsh Creek Reservoir (totaling 340 linear feet in the construction right-of-way) and temporary access road crossing of one UNT to Marsh Creek Reservoir (21 linear feet in temporary access road crossing). For the two waterbodies crossed by the HDD Reroute, equipment bridges would be required to be in place for temporary access across these waterbodies for an anticipated construction period of four to five months, and in-stream dry crossing materials and equipment would be required to be in place for the anticipated 24- to 48-hour duration of the HDD Reroute construction of crossings of these waterbodies. Therefore, the HDD Reroute would result in substantively greater impacts to waterbodies as compared to the Original HDD.

20. Protected Species: Based on desktop database review, biological survey, and consultation with and clearances received from the appropriate federal and state agencies (United States Fish and Wildlife Service, Pennsylvania Fish and Boat Commission, Pennsylvania Department of Conservation and Natural Resources, and Pennsylvania Game Commission), neither the Original HDD nor the HDD Reroute would affect any known, mapped, or designated critical habitat; Pennsylvania Natural Heritage Program (“PNHP”) County Natural Heritage Inventory (“CNHI”) core or supporting areas; known records of historic occurrence; or potential habitat for federally- or state-listed protected (endangered, threatened, proposed) species.



However, the HDD Reroute tie-in to the existing installed 20-inch pipeline would involve open cut construction in wetland C47, which previously required Phase I Bog Turtle Survey that determined this wetland to be potential suitable habitat, but via Phase II Bog Turtle Survey was determined to be negative at the time for the presence of bog turtle, as previously completed for the Original HDD. However, the additional potential PEM/PFO wetland(s) traversed by the HDD Reroute and those adjacent wetlands (within 300 feet of the workspaces) likely would require Phase I Bog Turtle Survey and have the potential of being determined positive for the presence of bog turtle through Phase II surveys.

21. Other factors: Based on desktop database reviews, there are no discernible differences in impacts related to private water supplies, public water supplies, or cultural resources between the Original HDD and the HDD Reroute. Each of these factors, however, would require detailed in-field survey and additional consultation with landowners, public water suppliers, and the Pennsylvania Historical and Museum Commission, Pennsylvania State Historic Preservation Office, respectively, prior to construction, and such surveys and consultations could reveal additional impacts associated with the HDD Reroute that are not currently known.

22. I understand that the statements set forth herein are made subject to 18 Pa. C.S. § 4904 relating to unsworn falsification to authorities.

Dated: October 7, 2020


Stephen A. Compton



EXHIBIT A



EXPERIENCE SUMMARY

Mr. Compton has over 30 years of experience managing and executing siting, impact assessment, and comprehensive federal, state, and local environmental permitting and licensing of development projects. As a Senior Program Director for Tetra Tech, he directs and manages large, multi-disciplinary teams to permit and license energy projects, including biological, environmental, and cultural resource field studies; siting/alternatives evaluations; agency liaison; public scoping meetings/hearings; National Environmental Policy Act (NEPA) analysis and compliance; comprehensive environmental permitting and mitigation planning; and environmental compliance training, inspection, and auditing of energy project construction and restoration. Mr. Compton has prepared and provided expert reports and expert witness written and oral testimony regarding environmental permitting, environmental assessment, and alternatives analysis in various regulatory certification and hearing proceedings.

Mr. Compton possesses in-depth knowledge of NEPA requirements based on managing and preparing over 200 federal and state Environmental Impact Statements (EISs) and Environmental Assessments (EAs) under direct and third-party contracts, as well as over 1,000 technical studies on a wide variety of federal civil works; military; recreational; site facility; roadway; fiber optic cable; electric transmission line; hydroelectric facility; natural gas pipeline and underground salt dome cavern and field storage; crude oil pipeline, storage, and trucking; LNG import/regasification and liquefaction/export; LPG pipeline, storage and export; NGL fractionation; ethane cracker; wind generation; and solar generation development projects, nationwide. He also served as Program Manager/Deputy Program Manager on multi-year ID/IQ contracts with the Federal Energy Regulatory Commission (FERC) NEPA and certificate compliance programs, USDA Forest Service NEPA programs, and the U.S. Army Corps of Engineers Biological, Environmental, and Cultural Resource (BECR) programs successfully assigning and managing large, multi-disciplinary teams of in-house and subcontractor staff on over 100 delivery orders primarily in New York and New Jersey.

EDUCATION

M.S., Forest Ecology, Utah State University, College of Natural Resources, Logan, Utah, 1992.
B.S., Environmental Studies, Cornell University, College of Agriculture and Life Sciences, Ithaca, New York, 1986.

EMPLOYMENT HISTORY

Senior Program Director, Tetra Tech, Inc., Houston, TX	May 2010–Present
Program Director, TRC Environmental Corporation, Houston, TX	May 2005–May 2010
Principal Scientist, Northern Ecological Associates Inc., New York/Maine	June 1994–May 2005
Terrestrial Ecologist/Analyst, Pioneer Environmental Services, Inc., Logan, UT	May 1992–May 1994
Wildlife Habitat Suitability Analyst, USDA Forest Service, Ogden, UT	April 1992
M.S. Research Assistantship, Utah State University, Logan, UT	March 1989–March 1992
Research Technician, Cornell University, Dept. Nat. Resources, Ithaca, NY	Sept. 1986–February 1989
Research Internship, Cornell University, Dept. Nat. Resources, Ithaca, NY	June 1986–August 1986
Research Technician, Cornell University, Nat. Res. Coop. Extension, Ithaca, NY	June 1984–May 1986

AREAS OF EXPERTISE

- Natural Gas, Liquids, Petrochemical Pipeline, Storage, and Import and Export Terminal Projects
- Electric Transmission Lines and Other Linear Projects
- Routing and Siting Fatal Flaw/Alternatives Studies
- Environmental Feasibility Studies
- Federal and State Licensing, Permitting, and Mitigation Planning of Energy Projects
- NEPA Environmental Impact Statements and Assessments
- Management of Biological and Cultural Resource Field Studies
- Energy Pipeline Compliance Inspection and Training
- Forest/Wildlife Habitat Suitability Modeling
- Threatened and Endangered Species Status Surveys

SELECTED RELEVANT PROJECT EXPERIENCE**Liquids and Petrochemical Project Permitting Experience**

Sunoco Logistics, LLC, Mariner East-Phase II/Pennsylvania Pipeline Project – Pennsylvania and Ohio (2016-present) – Project Director for QA/QC review of various federal, state, and local permit application and NEPA documents for a large-scale 305-mile and 54-mile natural gas liquids (NGL) pipeline installation project in Pennsylvania. Task Manager for preparation of Alternatives Analysis, Trenchless Construction Feasibility Analysis, and Cumulative Impact Analysis as part of the Joint Permit Application for a Pennsylvania Water Obstruction & Encroachment Permit and a U.S. Army Corps of Engineers Section 404 Permit Application.

Ingleside Ethylene, LLC, Ingleside Ethane Cracker Facility and Ethylene Pipeline – Coastal Texas (Project Manager: 2012-2015) – Managed performance of initial feasibility study, agency consultation, environmental permitting plan, and is conducting environmental permitting for a proposed new ethane cracker facility, including cracking furnaces, thermal oxidizers, high pressure ground flare, emergency generator, firewater pond, cooling tower, stormwater outfall, and pressurized, low pressure, and atmospheric storage vessels, as well as temporary construction staging areas on an approximately 500-acre site in coastal, Texas. The project also involves an approximately 115-mile ethylene pipeline and 20-mile ethane feedstock pipeline. Tetra Tech supported Greenhouse Gas (GHG) and TCEQ air permit applications, and managed and executed application and acquisition of federal and state environmental permits pursuant to the Endangered Species Act, Marine Mammal Protection Act, Magnuson-Stevens Fisheries Management and Conservation Act, State-listed Protected Species Regulations, Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, State Submerged Lands Miscellaneous Easement, Section 401 Water Quality Certification, Section 402 TPDES Stormwater Outfall Permit, Section 106 of the National Historic Preservation Act, and Coastal Zone Management Act.

Occidental Chemical Corporation, Occidental Ingleside Energy Center – Ingleside, Texas (Project Manager: 2012-2013). Managed a variety of tasks to support environmental planning and permitting of a multi-faceted petrochemical storage, truck loading, and marine terminal facility near Ingleside, Texas. Prior to OxyChem acquisition of an approximately 800-acre property, Tetra Tech conducted visual impact simulations to support local City of Ingleside Zoning Board approval. Tetra Tech reviewed initially-proposed project facilities and plans and developed an environmental permitting plan addressing comprehensive potential multi-media permit requirements. Finally, Tetra Tech prepared U.S. Coast Guard Notice of Intent and Preliminary and Follow-on Waterway Suitability Assessments to support permitting of liquefied hazardous gas marine vessel transport from the proposed terminal.

Occidental Energy Ventures Corp., Ingleside NGL Fractionation Plant – Ingleside, Texas (Project Manager: 2011-2013). Managed performance of initial feasibility study, agency consultation, environmental permitting plan, and is completing final stages of environmental permitting for a proposed new natural gas liquids (NGL) fractionation plant, including NGL fractionation facilities, a control building, an electrical switch yard, pipe racks, an on-site ethane connection to a pipeline, two thermal oxidizers, an emergency enclosed ground flare, aboveground non-refrigerated product storage facilities, aboveground contaminated water and water stripping tanks, aboveground chemical tanks, rail siding/rail car loading facility, truck loading facility, barge dock modifications for barge transportation of fractionated hydrocarbon products, and temporary construction staging areas on an approximately 470-acre site near Ingleside, Texas. The project also involved four new pipelines, including one NGL feedstock and three fractionated hydrocarbon product send-out pipelines in an approximately 18.5-mile-long right-of-way. Tetra Tech supported Greenhouse Gas (GHG) and TCEQ air permit applications and TCEQ wastewater discharge permitting, and managed and executed application and acquisition of federal and state environmental permits pursuant to the Endangered Species Act, Marine Mammal Protection Act, Magnuson-Stevens Fisheries Management and Conservation Act, State-listed Protected Species Regulations, Section 404 of the Clean Water Act, Section 401 Water Quality Certification, Section 106 of the National Historic Preservation Act, and Coastal Zone Management Act.

Confidential Client, Big Jack NGL Pipeline, North Dakota, Montana, Wyoming, Colorado (Project Manager: 2008-2009). Tetra Tech staff managed and prepared a fatal flaw, feasibility, and federal and state permit scoping analysis, including environmental permitting risk analysis and compliance inspection/monitoring cost estimate range, for a proposed 600-mile NGL pipeline project that included multiple pumping stations. The study included GIS constraints mapping, assessment of Special Use Permit requirements for crossing several federal land holdings (BLM, National Park Service, US Forest Service), and assessment of wetland/waterbody, biological, cultural resource, and air quality permitting requirements.

Confidential Client, LPG Import Terminal and Pipeline – Harris and Chambers Counties, Texas (Project Director: 2007-2008). Project Director for comprehensive environmental planning and permitting for a proposed tanker berth in the Houston Ship Channel, adjacent import terminal, and an approximately 18-mile-long, 16-inch-diameter pipeline located in Chambers and Harris Counties, Texas. Directed and/or participated in pre-application meetings with federal and state regulatory agencies. Managed wetland delineation, threatened and endangered species surveys, and cultural resource surveys. Managed preparation of technical reports and permit applications to USACE-Galveston District (Section 404/10), USFWS (Endangered Species Act), National Marine Fisheries Service (Endangered Species Act, Essential Fish Habitat), Texas Railroad Commission (Section 401 Water Quality Certification), Texas GLO (Coastal Management Program Consistency Determination), TCEQ (TPDES Industrial Outfall, and SWPPP), and Texas Historical Commission (Section 106 of the National Historic Preservation Act), and county and city permits.

Crude Oil Pipeline, Storage, and Terminal Permitting Experience

Plains All American Pipeline, LP, ACC Gathering and Transport System Projects – SE New Mexico and West Texas (Project Director: 2014 – Present). Project Director responsible BLM ROW Grant, Plan of Development, Environmental Best Management Procedures, and comprehensive federal, state, and local environmental permitting for a new 382-mile-long and numerous subsequent facilities (totaling 600+ miles) of variable-diameter crude oil pipeline, four major crude oil storage/breakout, one trucking, and several appurtenant facilities. Coordinated with and obtained Nationwide Permit (NWP) 12 – Utility Line Activities permit verification from the USACE-Albuquerque District. Developed original and over 50 additional BLM NEPA EAs. Provided Principal Direction-QA/QC review of over 50 Federal and State Listed Species Assessments and 50 Wetland and Waterbody Determination and Delineation Reports.

Oryx Midstream Services, LLC, Southern Delaware Basin Gathering System, Texas (Project Director: 2015–2016). Project Director responsible for comprehensive federal, state, and local environmental permitting and QA/QC review of all environmental documents for new midstream crude oil pipeline system and appurtenant aboveground facilities in Crane, Pecos, Reeves, and Ward Counties, Texas.

Sunoco Pipeline, L.P., Colorado City to Corsicana 24-inch Crude Oil Pipeline and Terminal Project – Texas (Project Manager: 2013-2015). Project Manager for comprehensive environmental siting, routing, permit planning, agency consultation, field surveys, technical reporting, and permitting of proposed 278-mile-long, 24-inch-diameter crude oil pipeline, truck unloading and storage terminal, booster station, and receiving terminal in Texas. Managing wetland/waterbody, vegetation/habitat, wildlife, threatened and endangered species, and cultural resource field surveys; preparation of technical survey reports; and managing execution of application and acquisition of federal and state environmental permits pursuant to the Clean Air Act, Section 404 of the Clean Water Act, Section 401 Water Quality Certification, Endangered Species Act, and Section 106 of the National Historic Preservation Act.

Sunoco Pipeline, L.P., Garden City to Colorado City 20-inch Crude Oil Pipeline and Terminal Project – Texas (Project Manager: 2013-2014). Project Manager for comprehensive environmental siting, routing, permit planning, agency consultation, field surveys, technical reporting, and permitting of

proposed 59-mile-long, 20-inch-diameter crude oil pipeline, truck unloading and storage terminal, booster station, and receiving terminal in Texas. Managed wetland/waterbody, vegetation/habitat, wildlife, threatened and endangered species, and cultural resource field surveys; preparation of technical survey reports; and managing execution of application and acquisition of federal and state environmental permits pursuant to the Clean Air Act, Section 404 of the Clean Water Act, Section 401 Water Quality Certification, Endangered Species Act, and Section 106 of the National Historic Preservation Act.

Sunoco Pipeline, L.P., Corsicana Station Tank Expansion Project – Texas (Project Manager: 2013). Project Manager for comprehensive environmental permit planning, agency consultation, field surveys, technical reporting, and permitting of the proposed expansion of the existing Corsicana Station, including one (1) new 15,400 gallon per minute (GPM) centrifugal mainline pump (approximately 5000 hp), one (1) new 13,300 GPM centrifugal mainline pump, two (2) new 140,000 barrel (BBL) working capacity storage tanks, and associated interconnection piping to existing tank suction line and tank fill line. Managed wetland/waterbody, vegetation/habitat, wildlife, threatened and endangered species, and cultural resource field surveys; preparation of technical survey reports; and execution of application and acquisition of federal and state environmental permits pursuant to the Clean Air Act, and verification of compliance with Section 404 of the Clean Water Act, Section 401 Water Quality Certification, Endangered Species Act, and Section 106 of the National Historic Preservation Act.

Sunoco Pipeline, L.P., Colorado City Station Tank Reactivation Project – Texas (Project Manager: 2013). Project Manager for comprehensive environmental permit planning, agency consultation, field surveys, technical reporting, and permitting of American Petroleum Institute (API) 653 tank reconditioning of six (6) existing storage tanks at the existing Colorado City Station, including five (5) existing 125,000 barrel (BBL) storage tanks, and one (1) existing 176,000 BBL storage tank, and the reconditioning and upgrading of existing tank booster pumps, mixers, facility tank transfer lines, motor operated valves, and electrical infrastructure for all motor operated equipment associated with these six tanks. Managed wetland/waterbody, vegetation/habitat, wildlife, threatened and endangered species, and cultural resource field surveys; preparation of technical survey reports; and execution of application and acquisition of federal and state environmental permits pursuant to the Clean Air Act, and verification of compliance with Section 404 of the Clean Water Act, Section 401 Water Quality Certification, Endangered Species Act, and Section 106 of the National Historic Preservation Act.

Sunoco Pipeline, L.P., Granite Wash Extension Crude Oil Terminal and Pipeline Project – Oklahoma and Texas (Project Manager: 2012-2014). Project Manager for comprehensive environmental siting, routing, permit planning, agency consultation, field surveys, technical reporting, and permitting of proposed 186-mile-long, 12-inch-diameter crude oil pipeline, truck unloading and storage terminal, booster station, receiving terminal, and appurtenant facilities in Oklahoma and Texas. Managed wetland/waterbody, vegetation/habitat, wildlife, threatened and endangered species, and cultural resource field surveys; preparation of technical survey reports; and managed and executed application and acquisition of federal and state environmental permits pursuant to the Clean Air Act, Section 404 of the Clean Water Act, Section 401 Water Quality Certification, Endangered Species Act, and Section 106 of the National Historic Preservation Act. Provided construction phase Also prepared and presented pre-construction Environmental Compliance Training to company and construction contractor supervisors, and conducted and reported to company independent, periodic Environmental Compliance Inspection Audits during project construction.

Confidential Client, NGL and Crude Oil Pipeline Projects, Environmental Feasibility Studies – Pennsylvania, Ohio, Oklahoma, Texas, Louisiana (Project Manager: 2012). Project Manager for preparation of environmental routing and permitting feasibility studies, including desktop constraints mapping, preliminary pipeline routing, identification of fatal flaws, development of permitting lists/tables, permitting schedule, and feasibility-level cost estimates for 12 NGL (ethane/propane) and crude oil pipeline projects totaling over 1,000 linear miles in Pennsylvania, Ohio, Oklahoma, Texas, and Louisiana.

Natural Gas Pipeline, Storage, and LNG Import and Export Terminal Licensing Experience

Federal Energy Regulatory Commission (FERC), Texas Eastern Transmission, LP and Pomelo Connector, LLC – South Texas Expansion Project and Pomelo Connector Pipeline Project, Texas (2017). Directed / Principal QA/QC review of the FERC 7(c) Third-Party NEPA EA for a new compressor station and pipeline interconnection; modifications to existing compressor stations; and construction of approximately 13.6 miles of new 30-inch-diameter natural gas pipeline and associated aboveground facilities in east Texas.

FERC, Natural Gas Project NEPA EISs/EAs (Project Director/Project Manager: 1994 – 2005). On multiple, multi-year, task-order contracts, served as subcontractor Project Director / Project Manager / Task Manager for management and preparation of NEPA EISs and EAs or technical sections for natural gas pipeline, storage field expansion and replacement, and liquefied natural gas (LNG) terminal expansion projects, including reviewing company 7(c) certificate filings, preparing data requests, and coordinating review with FERC Task Monitors and applicable cooperating federal and state agencies, for the following projects:

- **Elba III Project EIS, Southern Natural Gas Corporation, Georgia and South Carolina (Project Manager: 2006-2007).** Managed preparation of the EIS addressing expansion of the existing Elba Island LNG Terminal adding two 200,000 m³ LNG storage tanks, and expansion and modifications to LNG ship unloading berth and turning basin, LNG unloading and vapor return arms, vaporization facilities, and control and maintenance buildings; as well as an associated 188-mile, 42-inch-diameter send-out pipeline (73 miles of Greenfield pipeline), new compressor station, and ancillary facilities.
- **Islander East Pipeline Project EIS, Duke Energy Gas Transmission, Connecticut and New York (Task Manager: 2002-2003).** Managed subcontractor resources for preparation of biological, recreation, and land use sections of EIS for a 45-mile pipeline, including a 17-mile offshore pipeline crossing of Long Island Sound, a 6-mile lateral, a new compressor station, and ancillary facilities.
- **Eastern Long Island Extension Project DEIS, Iroquois Gas Transmission System, L.P., Connecticut and New York (Task Manager: 2002-2003).** Managed preparation of biological, recreation, and land use sections of DEIS for a 29-mile pipeline, including a 17-mile offshore pipeline crossing of Long Island Sound, new compressor station, two existing compressor station modifications, meter station, and ancillary facilities.
- **Horizon Project EA, Horizon Pipeline Company, L.L.C., Illinois (Project Manager: 1999-2000).** Managed and authored sections of EA for a 28-mile pipeline and new compressor station just west of Chicago that traversed several county conservation lands requiring specialized construction and revegetation plans.
- **Tioga Storage Project EA, NE Hub Partners, L.P., Pennsylvania (Project Manager: 1995-1997).** Managed and authored sections of EA for a controversial project that involved development of a solution-mined storage cavern by drilling through an existing natural gas storage field in northern Pennsylvania. Reviewed copious intervenor comments and coordinated expert testimony at a FERC Technical Conference to address impacts of the project on existing storage field capacity and functioning. Project involved a new compressor station, multiple natural gas pipeline interconnections, freshwater and brine pipelines, and a third-party salt plant with railcar siding.
- **Coco Storage Project EA, Columbia Gas Transmission Corporation, West Virginia (Project Manager: 1993-1994).** Managed and authored EA for a complex storage field project that involved replacement of existing storage wells, gathering lines, methanol lines, and appurtenant facilities in rugged terrain.
- **Coco Transmission Project EA, Columbia Gas Transmission Corporation, West Virginia (Project Manager: 1993-1994).** Managed and authored EA for an 11-mile pipeline in rugged terrain.

Tennessee Gas Pipeline Company, L.L.C., Susquehanna West Project, PA (2014–2017). Project Director-QA/QC for FERC 7(c) ER/permitting for 8.1 miles of pipeline looping and modifications to 3 compressor stations in Bradford and Tioga Counties, PA.

Tennessee Gas Pipeline Company, L.L.C., Triad Expansion Project, PA (2014–2017). Project Director-QA/QC Manager for FERC 7(c) ER/permitting for 8.1 miles of pipeline looping in Susquehanna County, PA.

Tennessee Gas Pipeline Company, L.L.C., Orion Project, PA (2015–2017). Project Director-QA/QC Manager for FERC 7(c) ER/permitting for 12.9 miles of pipeline looping in Wayne and Pike Counties, PA.

Shell Exploration & Production, LLC, Elba LNG Liquefaction and Export Project – Georgia (Program Director: 2012-2016). Program Director for supporting Shell's strategy, schedule, and coordination of engineering design and environmental support role in Joint Venture with Kinder Morgan on the proposed LNG Liquefaction and Export Project at the existing Elba Island LNG Terminal near Savannah, Georgia. Program Team supporting FERC 7(c) Environmental Report, including coordinating engineering design support, writing, and review of Resource Reports 11 (Reliability & Safety) and 13 (Detailed LNG Engineering); and technical environmental review of remaining Resource Reports 1-10 and 12, technical survey reports, and other FERC filings (Pre-filing Request, Third-party EA/EIS RFP, Public Comment responses, Draft Resource Report comments, Data Requests, etc.).

Shell Exploration & Production, LLC, LNG Liquefaction/Export and LNG Transport Program – North America (FERC/Permitting Expert: 2011-2012). Served as FERC/Permitting Expert on Shell's North American LNG Program development team evaluating confidential opportunities. Conducted in-house reviews, presentations, and meeting participation, including project/site evaluation, strategic planning, resource planning, U.S. Department of Energy-Office of Fossil Energy export permits to Free Trade Agreement and Non-Free Trade Agreement nations, FERC and state regulatory requirements and permit tables, regulatory consultation, engineering data requirements, comprehensive environmental risk assessments, risk mitigation planning, program and detailed project scheduling, review of draft and final technical documents, tracking of publicly-available LNG project databases, staff training in FERC requirements, and review of FERC Petition for Declaratory Order.

TransCanada/ANR Pipeline Company, ANR Grand Haven Lateral – Line 411 Pipeline Abandonment Project, Michigan (Project Director: 2011). Served as Project Director to perform comprehensive federal and state environmental permitting for the ANR Grand Haven Lateral – Line 411 Pipeline Abandonment Project in Ottawa and Kent counties, Michigan. The project involved the abandonment of approximately 16.55 miles of existing 6-inch-diameter natural gas pipeline through a combination of in-place pipe abandonment and excavation and removal. Tetra Tech managed and executed project planning / scoping conference calls and an initial site visit to identify environmental permit requirements, timelines, and critical issues, and prepared a refined scope of work. Tetra Tech conducted desktop review and field surveys for wetlands, stream crossings, threatened and endangered (T&E) species, and cultural resources, and identified relevant potential resource impacts. Tetra Tech conducted agency consultation and obtained clearances from the appropriate federal and state agencies with jurisdiction. This included but was not limited to wetland and waterbody delineation in accordance with U.S. Army Corps of Engineers and Michigan Department of Environmental Quality requirements; Section 7 of the Endangered Species Act Clearance from the U.S. Fish and Wildlife Service, East Lansing Ecological Services Field Office; State-Listed Threatened and Endangered Species Clearance from the Michigan Department of Natural Resources; and Section 106 of the National Historic Preservation Act Clearance from the Michigan State Housing Development Authority, State Historic Preservation Office. Tetra Tech prepared and submitted to ANR Pipeline Company a final summary report documenting permit acquisition dates and permit documents to ANR to support its FERC Annual Report compliance requirements.

Kinder Morgan, Natural Gas Pipeline Facilities O&M Project Permitting – Nationwide (including Texas) (Project Manager: 2008-2012). Project Manager for comprehensive environmental permitting for operations, maintenance, and pipeline integrity projects along Kinder Morgan's nationwide pipeline system, including Natural Gas Pipeline (NGPL) and Kinder Morgan Texas Pipeline (KMTP) systems throughout Texas. Manage routine daily assessment and identification of environmental permit requirements, staffing and performance of required field surveys (biological, cultural), and preparation of technical reports. In Texas, routinely manage agency consultation and preparation of permit applications to the USACE-Galveston and USACE-Fort Worth Districts (Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act), U.S. Fish and Wildlife Service-Austin and Arlington Texas Field Offices (Endangered Species Act), Texas Historical Commission (Section 106 of the National Historic Preservation Act), Texas General Land Office (Coastal Management Zone Consistency Determination, Miscellaneous Easements), Texas Commission on Environmental Quality (Section 401 Water Quality Certification, Water Withdrawal Permits), Railroad Commission of Texas (Hydrostatic Test Water Discharge Permits); and Texas Parks and Wildlife Department (State-listed threatened and endangered species consultation).

Midcontinent Express Pipeline, LLC, MEP Expansion Project – Texas, Louisiana, Mississippi (Project Manager: 2008-2010). Project Manager for FERC 7(c) Environmental Report and comprehensive federal and state environmental permitting for the MEP Expansion Project. The Project consisted of construction and operation of significant horsepower expansions and modifications at four existing compressor stations (Atlanta, Texas; Lamar, Texas; Perryville, Louisiana; and Vicksburg, Mississippi); and a new 1.2-mile, 16-inch-diameter SESH lateral and meter station in Richland Parish, Louisiana. Directed and managed agency consultation and preparation of permit applications to the USACE-New Orleans District (Section 404); USFWS (Endangered Species Act); Texas CEQ, Louisiana DEQ, and Mississippi DEQ (Air Permits); Louisiana DEQ (Section 401 Water Quality Certification, Water Withdrawal Permit, Hydrostatic Test Water Discharge Permits); Texas Parks and Wildlife Department, Louisiana Department of Wildlife and Fisheries, and Mississippi Department of Wildlife, Fisheries, and Parks (state T&E species consultation), and Texas Historical Commission; Louisiana Department of Culture, Recreation, and Tourism; Mississippi Department of Archives and History; and Native American Tribes (Section 106 of the National Historic Preservation Act).

Midcontinent Express Pipeline, LLC, Midcontinent Express Pipeline (MEP) Project – Oklahoma, Texas, Louisiana, Mississippi, Alabama (Task Manager: 2008). Project Manager (interim) for comprehensive FERC, federal, state, and local environmental permitting for the 507-mile-long, 42- and 36-inch-diameter MEP Project. Task Manager for preparation of detailed FERC environmental data responses, Migratory Bird Treaty Act Compliance Plan, and a comprehensive post-construction environmental compliance manual. Prepared FERC data response addressing infeasibility of horizontal directional drilling (HDD) construction technique at sensitive waterbodies.

Trunkline Gas Company, LLC, Field Zone Expansion Project – Texas and Louisiana (Project Director/Manager: 2006-2007). Project Director/Manager for completion of FERC 7(c) Environmental Report, Applicant-prepared NEPA EA, and comprehensive federal and state environmental permitting for the Trunkline's Field Zone Expansion Project. The Project consisted of the 45-mile-long, 36-inch-diameter North Texas Expansion (NTX) Project in Jasper and Newton counties, Texas, and Beauregard Parish, Louisiana; the 13.5-mile-long, 36-inch-diameter Henry Hub Lateral in Vermillion Parish, Louisiana; the 10,350-horsepower (hp) Longville Compressor Station expansion in Beauregard Parish, Louisiana; the 3,000-hp Kaplan Compressor Station expansion in Vermillion Parish, Louisiana; and the 4,000-hp Kountze Compressor Station expansion in Hardin County, Texas. Directed and managed agency consultation and preparation of permit applications to the USACE-Galveston and New Orleans Districts (Section 404/10), USFWS (Endangered Species Act), National Marine Fisheries Service (Endangered Species Act, Essential Fish Habitat), Texas CEQ and Louisiana DEQ (Section 401 Water Quality Certifications, Air Permits, Groundwater Certifications), Texas Railroad Commission and Louisiana DEQ (Water Withdrawal Permit, Hydrostatic Test Water Discharge Permits), Texas GLO and Louisiana DNR (Coastal Management Program Consistency Determination), TPWD and Louisiana Department of Wildlife

and Fisheries (state T&E species consultation), and Texas Historical Commission, Louisiana Department of Culture, Recreation, and Tourism, and Native American Tribes (Section 106 of the National Historic Preservation Act).

Spectra Energy, Southeast Supply Header, Louisiana, Mississippi, Alabama (Project Director: 2006-2007). Directed FERC 7(c) and comprehensive Federal and state environmental permitting for a 268-mile; 42- and 36-inch-diameter Greenfield pipeline with three new compressor stations and ancillary facilities.

Spectra Energy, Covich County Storage Project, Mississippi (Project Manager: 2007). Managed a fatal flaw, feasibility, and federal and state permit scoping analysis for a proposed significant capacity expansion of a natural gas storage facility located in Covich County, Mississippi. The project increased the working capacity of the proposed salt cavern storage from the previously authorized 3.3 billion cubic feet (Bcf) to 15.5 Bcf of natural gas, with interconnections with Spectra Energy's Texas Eastern Transmission system and the Southeast Supply Header Project.

Spectra Energy, Egan Fourth Cavern, Louisiana (Project Director: 2007). Directed FERC 7(c) and comprehensive Federal and state environmental permitting for a new 10.5 Bcf salt-dome storage cavern and an associated 16.5-mile send-out pipeline and ancillary facilities.

Duke Energy, Egan SWD6 Project, Louisiana (Project Director: 2006). Directed FERC blanket certificate and comprehensive Federal and state environmental permitting for a replacement deep-injection saltwater disposal well and associated piping and ancillary facilities at the existing Egan Hub Storage Project.

Duke Energy, Egan Horsepower Reconfiguration Project, Louisiana (Project Director: 2006). Directed FERC 7(c) and comprehensive Federal and state environmental permitting for a reconfiguration amendment of a previously-certificated compressor station upgrade at existing Egan Hub Storage Project.

Foothills Energy Ventures, LLC, Monroe Gas Storage Project, Mississippi (Project Manager: 2006). Managed a fatal flaw, feasibility, and federal and state permit scoping analysis for the proposed new Monroe Gas Storage Project. The project will provide up to 12 Bcf of storage capacity, and includes drilling six horizontal and three vertical wells, the conversion of five existing wells to observation wells in the depleted natural gas reservoir, construction of approximately 2.0 miles of gathering lines, installation of compression and related facilities, construction of a 5.7-mile pipeline interconnecting to the Texas Eastern Transmission Company pipeline in Monroe County, Mississippi, and a 17.2-mile pipeline interconnecting to the Tennessee Gas Pipeline in Lamar County, Alabama. The project was successfully issued a FERC 7(c) certificate and all other federal and state environmental permits.

CenterPoint Energy, Midcontinent Express (MCX) II Project – Oklahoma and Texas (Project Manager: 2006). Project Manager for preparation of a comprehensive GIS-based environmental constraints (fatal flaw) routing study for a proposed 450-mile-long natural gas pipeline project. Worked closely with project study team (business development, engineering design, right-of-way consultant) in developing preferred and alternative routes. Identified federal and state environmental permit requirements, prepared a permitting timeline, and prepared an environmental permitting cost estimate. Study area included a 20-county area in southern Oklahoma and north-central Texas.

Confidential LNG Header Project, Louisiana (Project Manager: 2005). Managed and prepared licensing cost estimate, risk assessment, and alternative routing assessment based on desktop map review and informal Federal and state agency consultations for 134-mile pipeline in southwest Louisiana.

CenterPoint Energy Gas Transmission, Liberty Gas Storage Project, Louisiana (Task Manager: 2005). Coordinated response to data requests on the FERC 7(c) Application to convert two commercial brine production caverns in the Sulphur Mines salt dome to natural gas storage caverns; construct an interconnecting 23.3-mile, 30-inch-diameter pipeline; and construct one on-site 17,650-hp and one remote 9,470-hp compressor stations and one meter and regulating station in Calcasieu and Beauregard Parishes, Louisiana.

CenterPoint Energy Gas Transmission, Elm Grove Project, Louisiana (Project Manager: 2005-2006). Managed preparation of FERC 45-day Prior Notice to construct approximately 17 miles of new 12-inch-diameter pipeline, including the 3.5-mile Line FT-22 interconnect with existing Lines ST-10 and FT-2, abandonment in place and replacement of the 14.5-mile Line FT-2, and increase of the MAOP from 450 to 929 psi; and construct the 2,200-hp Minden Compressor Station and appurtenant facilities in Webster and Bienville Parishes, Louisiana. Acquired Federal and state environmental clearances and permits pursuant to the Endangered Species Act, National Historic Preservation Act, Section 404 of the Clean Water Act, and Louisiana Pollutant Discharge Elimination System for construction activities and hydrostatic testing.

Sempra Energy LNG Corporation, Cameron LNG Project, Louisiana (Task Manager: 2006). Coordinated preparation of a summary table of all compliance requirements specified in the FERC Implementation Plan and other planning documents for the proposed Cameron LNG Terminal; three 160,000-m³ LNG storage tanks; two LNG ship unloading berths, jetties, and associated dredging; LNG unloading and vapor return arms; vaporization facilities; control and maintenance buildings; and a 35.4-mile send-out pipeline in Cameron, Calcasieu, and Beauregard Parishes, Louisiana.

Sempra Energy LNG Corporation, Cameron LNG Expansion Project, Louisiana (Task Manager: 2005). Assisted with preparation of FERC Resource Reports for the FERC 7(c) Application for the proposed Cameron LNG Terminal expansion via a fourth 160,000-m³ LNG storage tank, increase in LNG ship deliveries, construction and demolition of a temporary material unloading dock, and appurtenant interconnect facilities in Cameron Parish, Louisiana.

Sempra Energy LNG Corporation, Port Arthur LNG Project – Louisiana and Texas (Task Manager: 2005). Assisted with preparation of FERC DEIS data responses for the proposed Port Arthur LNG Terminal, including six 160,000-m³ LNG storage tanks; LNG ship unloading berth and turning basin; LNG unloading and vapor return arms; vaporization facilities; control and maintenance buildings; and a 73-mile, 36-inch-diameter send-out pipeline in Jefferson and Orange Counties, Texas, and Cameron, Calcasieu, and Beauregard Parishes, Louisiana.

FERC, 2004 Annual Report Compliance Review Task – Nationwide (Project Director: 2005). Project Director for formal compliance review and assessment of all Annual Reports filed by natural gas pipeline companies with the FERC pursuant to Section 157.207 (Blanket Certificates [Automatic Authorizations and Prior Notice projects]) and Section 2.55(a) (Auxiliary Installations) and 2.55(b) (Replacement of Facilities), nationwide. Managed preparation of comprehensive Environmental Assessment Reviews (EARs) of all projects reported in 68 Annual Reports and performance of 62 project-specific compliance inspections, nationwide.

Town of Somerset Conservation Commission, Fall River (Weaver's Cove) LNG Project, Massachusetts (Project Principal: 2004-2005). Principal-in-Charge for review of Notices of Intent (NOIs) filed by Mill River Pipeline, LLC and Weaver's Cove LNG, LLC with the Town of Somerset Conservation Commission (Commission) for a permit pursuant to the MA Wetlands Protection Act (MAWPA). Proposed project involved an onshore LNG terminal, a 200,000-gallon LNG tank, dredging of a navigation channel and turning basin in the Tauton River, and associated interconnect pipelines. Assisted the Commission with NOI review, prepared data requests, prepared and gave presentations at public hearings, and prepared recommendations for incorporation into the Commission's Order of Conditions pursuant to the MAWPA.

Confidential Offshore LNG Project, New York and New Jersey (Task Manager: 2004). Managed preliminary permit scoping and Principal review of Resource Reports 2 (Water Resources) and 3 (Vegetation and Wildlife) as part of the U.S. Coast Guard Deepwater Port Permit Filing for an offshore LNG terminal with open rack cooling system.

Tennessee Gas Pipeline Company, Northeast ConneXion – NY/NJ Project, Pennsylvania and New Jersey (Project Principal: 2004-2005). Directed FERC 7(c) Filing for 10 miles of pipeline looping, two compressor station upgrades, one meter station upgrade, and appurtenant facilities.

National Fuel Gas Supply Corporation, Empire-Millennium Connector, New York (Project Manager: 2004). Managed and prepared detailed alternative routing analysis based on field reconnaissance and desktop map review for 80-mile pipeline in Finger Lakes region of New York State.

El Paso Energy, Adrian Gas Storage Field Project, New York (Project Manager: 2003). Managed Federal and state permitting and construction auditing for proposed capacity increase of two existing storage wells and a 0.1-mile interconnect pipeline.

El Paso Energy, Augusta Michigan Lateral, Michigan (Project Manager: 2003). Managed Federal and state permitting for a 2-mile lateral pipeline.

FERC, 2002 Annual Report Compliance Review Task, Nationwide (Project Director: 2003). Project Manager for formal compliance review and assessment of all Annual Reports filed by natural gas pipeline companies with the FERC pursuant to Section 157.207 (Blanket Certificates [Automatic Authorizations and Prior Notice projects]) and Section 2.55(a) (Auxiliary Installations) and 2.55(b) (Replacement of Facilities), nationwide. Managed preparation of comprehensive EARs of all projects reported in 64 Annual Reports and performance of 39 project-specific compliance inspections, nationwide.

El Paso Energy, TGP Line 500 Replacement Projects, Mississippi (Project Manager: 2002). Managed environmental field review and construction recommendations to repair pipe exposures at two creek crossings.

El Paso Energy, Hamburg Line 200-1 Anomaly Replacement Project, New York (Project Manager: 2002). Managed Federal and state permitting to repair 18 pipeline anomalies.

National Fuel Gas Supply Corporation, Summit Storage Abandonment Project, Pennsylvania (Project Manager: 2001). Managed FERC 7(c) Filing and Federal and state permitting for the abandonment in-place and by removal of gathering lines and abandonment of wells by capping.

Tennessee Gas Pipeline Company, Line 500 MLV Replacement Projects, Mississippi (Project Manager: 2001). Managed the design, performance, and reporting of gopher tortoise survey of three mainline valve sites.

Tennessee Gas Pipeline Company, Mississippi 500-Line Expansion (Petal Gas Storage) Project, Mississippi (Project Manager: 2000-2001). Managed preparation of complete FERC 7(c) Filing, environmental and cultural resource surveys, wetland/waterbody delineation report, Phase I Cultural Resource Investigation Report, and Endangered Species Act clearance for a 30-mile pipeline (ultimately incorporated into the 60-mile Petal Gas Storage Project).

National Fuel Gas Supply Corporation, Northwinds Pipeline Project, New York and Pennsylvania (Project Manager: 2000). Managed preparation of a complete FERC 7(c) Filing, including environmental and cultural resource field surveys, Federal and state interagency meetings and field walkovers, and preliminary Federal and state permitting for a proposed 145-mile pipeline that included a crossing of Lake Erie.

National Fuel Gas Supply Corporation, Niagara Spur Alternative, New York and Pennsylvania (Project Manager: 1999). Managed preparation of complete FERC 7(c) Filing and Canadian National Energy Board (NEB) Environmental and Socioeconomic Impact Assessment (ESIA) for a proposed 101-mile pipeline. Project involved detailed review of existing field survey and agency contact data, supplemental agency contacts and baseline data collection, verification of previous wetland/waterbody delineations, and supplemental environmental and cultural resource surveys to ensure complete datasets for FERC and NEB filings.

El Paso Energy, Joint PNGTS/Maritimes & Northeast Facilities Pipeline, Massachusetts, New Hampshire, Maine (Task Manager: 1998). Task Manager responsible for daily preparation, tracking, and acquisition of FERC, Federal, and state clearances for over 200 time-sensitive variance requests during construction of a 101-mile pipeline.

El Paso Energy/Tennessee Gas Pipeline Company, Portland Natural Gas Transmission System, New Hampshire, Vermont, Maine (Task Manager: 1995-1997). Assisted with preparation of FERC 7(c) Filing and Federal and state permit applications for a controversial 191-mile pipeline in New England. Assisted in preparation of permit applications and written testimony for Section 404 of the Clean Water Act, Section 401 State Water Quality Certificates (WQC), the Maine Land Use Regulatory Program (LURP), and the New Hampshire Energy Facilities Siting and Evaluation Commission (EFSEC). Conducted routing walkovers with Vermont Agency for Natural Resources representatives to facilitate State 401 WQC permitting process for the 60-mile project segment in Vermont.

El Paso Energy, PNGTS New Hampshire Alternative, New Hampshire and Vermont (Project Manager: 1997). Prepared an accelerated FERC 7(c) Filing and Federal and state permit applications for a 75-mile pipeline alternative incorporated into the final PNGTS route. Successfully managed environmental and cultural resource field surveys, environmental resource data collection, and alternatives analysis, and submitted a complete Supplemental FERC 7(c) Filing in only 3.5 months.

El Paso Energy, Joint PNGTS/Maritimes & Northeast Facilities Pipeline, Massachusetts, New Hampshire, Maine (Task Manager: 1997). Prepared accelerated Resource Reports 1 (Project Description) and 10 (Alternatives) as part of FERC 7(c) Filing for a 101-mile pipeline. Successfully prepared joint facility reports based on existing RRs 1 and 10 prepared for the separate and competing PNGTS and Maritimes & Northeast Phase I pipeline projects in only one week to meet accelerated filing deadline requirements.

National Fuel Gas Supply Corporation, Line K-California Road Replacement, New York (Project Manager: 1996). Managed FERC 7(c) Filing and comprehensive Federal and state permitting for a 1-mile pipeline replacement project in an industrial setting near Buffalo, New York. Managed environmental and cultural resource surveys, acquired clearances pursuant to Federal and state Endangered Species Acts and Section 106 of the National Historic Preservation Act, and prepared permit applications pursuant to Section 404 of the Clean Water Act, Section 401 Water Quality Certification, and State Pollutant Discharge Elimination System (SPDES) hydrostatic test water discharge regulations.

National Fuel Gas Supply Corporation, Line S-43 Summit Storage Replacement, Pennsylvania (Project Manager: 1995). Project Manager for FERC 7(c) Filing and comprehensive Federal and state permitting for a 2-mile storage pipeline replacement project. Managed environmental and cultural resource surveys, acquired clearances pursuant to Federal and state Endangered Species Acts and Section 106 of the National Historic Preservation Act, and prepared permit applications pursuant to Section 404 of the Clean Water Act, Section 401 Water Quality Certification, and SPDES hydrostatic test water discharge regulations.

NYSEG, Town of Plattsburgh Franchise, New York (Project Manager: 1995). Project Manager responsible for comprehensive Federal and state permitting of a 65-mile intrastate distribution franchise pipeline system in residential and industrial setting. Managed environmental and cultural resource surveys, participated in interagency meetings and field walkovers, acquired clearances pursuant to Federal and state Endangered Species Acts and Section 106 of the National Historic Preservation Act, and prepared EM&CP for Article VII Permit from New York State Public Service Commission, resource constraints map and Long Environmental Assessment Form required pursuant to the New York State Environmental Quality Review Act (SEQRA), and permit applications pursuant to Section 404 of the Clean Water Act, Section 401 Water Quality Certification, and SPDES construction and hydrostatic test water discharge regulations.

NYSEG, Plattsburgh-Dannemora Franchise, New York (Project Manager: 1994). Responsible for comprehensive Federal and state permitting of a 25-mile intrastate distribution franchise pipeline system in the Adirondack Park. Managed environmental and cultural resource surveys, participated in interagency meetings and field walkovers, acquired clearances pursuant to Federal and state Endangered Species Acts and Section 106 of the National Historic Preservation Act, and prepared EM&CP for Article VII Permit from New York State Public Service Commission, resource constraints map and Long Environmental Assessment Form required pursuant to SEQRA, and permit applications pursuant to the Adirondack Park Agency Act, Section 404 of the Clean Water Act, Section 401 Water Quality Certification, and SPDES construction and hydrostatic test water discharge regulations.

USDI Bureau of Land Management, Barrett Resources Natural Gas Pipeline, Colorado (Task Manager: 1993). Managed design, performance, and reporting of comprehensive, year-round, wildlife surveys for federal endangered / threatened species and general wildlife species for a proposed 50-mile natural gas pipeline in northwestern Colorado.

USDI Bureau of Land Management and FERC, Uinta Basin Lateral Pipeline EA, Utah, Colorado, Wyoming (Task Manager: 1992). Task Manager for preparation of third-party EA sections, third-party Biological Assessment / Biological Evaluation, and pre-construction rare plant and eagle/raptor nest field surveys for Colorado Interstate Gas Company's proposed 222-mile natural gas pipeline.

Pipeline Inspection and Training Experience

Southern Gas Association, Environmental Permitting, Inspection, and Construction Compliance Workshops (Trainer: 1998-2006, 2018-2019). As an invited trainer, panel member, and moderator, prepared and presented numerous training presentations at annual workshops covering topics on FERC, federal, and state permits and regulations; communication requirements; environmental inspection/auditing; construction compliance; working with contractors; third-party inspection models; and biological resource protection.

ANR Pipeline, WestLeg Project, Illinois and Wisconsin (Project Manager: 2004). Managed full-time environmental compliance inspection program, including agricultural monitoring, on controversial 36-mile pipeline construction and restoration project.

ANR Pipeline, South Stevens Point Loop, Wisconsin (Project Manager: 2003). Managed full-time environmental compliance inspection program on 2-mile pipeline loop construction and restoration project in Portage County, WI.

ANR Pipeline, Covert Michigan Lateral Project, Michigan (Project Manager: 2002). Project Manager for full-time environmental compliance inspection program on 3-mile lateral pipeline construction and restoration project in Covert, Van Buren Co., MI.

Tennessee Gas Pipeline Company, Adrian Gas Storage Field Project, New York (Project Manager: 2002). Managed environmental compliance audit of storage field expansion/well-upgrade project.

FERC, Maritimes & Northeast Phase II Pipeline Project, FERC Compliance Inspection, Maine (Project Manager: 2001-2002). Managed scheduling, performance, and reporting of over 30 week-long environmental compliance inspections during construction of 203-mile pipeline. Performed QA/QC report and inspection reviews and direct coordination with FERC.

FERC, Southern Natural Gas Company North Alabama Pipeline Project, FERC Compliance Inspection, Alabama (Project Manager: 2000). Managed scheduling, performance, and reporting of over 15 week-long environmental compliance inspections during construction of 122-mile pipeline. Performed QA/QC report and inspection reviews and direct coordination with FERC.

FERC, Annual Inspections – Nationwide (Project Manager: 1996–1999). Conducted and reported environmental compliance inspections during construction and/or restoration of over 60 natural gas pipeline projects in NY, OH, WV, KY, IA, NC, SC, UT, CO, AZ, NM, and TX.

FERC, Post-Certificate Inspections, Nationwide (Environmental Inspector: 1996-1999). Project/Task Manager for over 100 natural gas pipeline and storage project environmental compliance inspections throughout the US.

Panhandle Eastern Pipe Line Corporation, Environmental Compliance Training and Compliance Auditing – Ohio West Virginia, Pennsylvania, and Texas (Task Manager: 1994–1995). Task Manager for preparation and presentation of environmental training programs to over 200 supervisors for all 1995 construction projects. Prepared guidance documents on FERC regulations. Performed compliance audits and Environmental Inspector evaluations on five separate natural gas pipeline construction projects in PA, WV, and OH.

FERC, Florida Gas Transmission Phase III Expansion Project, Florida, Mississippi, Alabama, Louisiana, (Environmental Inspector: 1993-1994). Conducted and reported over 30 environmental compliance inspections during construction/restoration of 800-mile pipeline.

USDI Bureau of Land Management and FERC, Uinta Basin Lateral Pipeline, Utah, Colorado, Wyoming (Environmental Inspector: 1992). Full-time Environmental Inspector responsible for monitoring and reporting environmental compliance during construction and restoration of 222-mile natural gas pipeline.

SPECIALIZED TRAINING

- Forty-Hour OSHA Health and Safety Training, March 1995
- Eight-Hour OSHA Health and Safety Training Updates, 1996-2001
- Mexican Spotted Owl Inventory/Monitoring Training Program; USDA Forest Service, Southwestern Region, 1993
- Wildlife Habitat Management Shortcourse, USDA Forest Service, 1991
- Forest Survey Inventory Methods; USDA Forest Service, Intermountain Range & Forest Experiment Station, 1989
- Forest Habitat Types and Successional Stages of the Northern Rocky Mountains; University of Montana, 1989

SELECTED PUBLICATIONS AND PRESENTATIONS

- Trettel, J.R., S.A. Compton, and D.J. Santillo. 2000. Methods and Results of A Comprehensive Monitoring Program to Document Turbidity and Suspended Sediment Generated During Pipeline Construction. Pp. 743-752 in 7th International Symposium, Environmental Concerns in Rights-of-Way Management, 9-13 September 2000, Calgary, Alberta, Canada.
- Compton, S.A., D.J. Santillo, and P.G. Fellion. 2000. Effects of Soil Segregation Treatments on Revegetation of Wetlands Affected by Pipeline Construction. Pp. 583-590 in 7th International Symposium, Environmental Concerns in Rights-of-Way Management, 9-13 September 2000, Calgary, Alberta, Canada.
- Compton, S.A., and R.D. Hugie. 1993. Addendum to the Status Report on *Zapus hudsonius preblei*, a Candidate Subspecies. Prepared for the U.S. Fish and Wildlife Service, Colorado State Office, Golden, CO.
- Compton, S.A., and R.D. Hugie. 1992. Status Report on *Zapus hudsonius preblei*, a Candidate Subspecies. Prepared for the U.S. Fish and Wildlife Service, Colorado State Office, Golden, CO.
- Compton, S.A. 1992. Dynamic multi-species animal habitat modeling with forest succession models. M.S. Thesis, Utah State Univ., Logan, UT.
- Compton, S.A. 1987. Optimal sampling intervals for measures of meadow vole (*Microtus pennsylvanicus*) activity using radiotelemetry. 7th Annual College of Natural Resources Symposium, Cornell University. Ithaca, NY.
- Goff, G.R., and S.A. Compton. 1986. Demonstration of the Effects of Alternative Forestry Practices on Natural Resources at the Arnot Forest Teaching and Research Forest. 6th Annual College of Natural Resources Symposium, Cornell University. Ithaca, NY.