MANKO | GOLD | KATCHER | FOX LLP

AN ENVIRONMENTAL AND ENERGY LAW PRACTICE

Diana A. Silva
484-430-2347
dsilva@mankogold.com

Admitted in PA and NJ

401 CITY AVENUE, SUITE 901
BALA CYNWYD, PA 19004
TEL: 484-430-5700
FAX: 484-430-5711
WWW.MANKOGOLD.COM

A LIMITED LIABILITY PARTNERSHIP
FORMED IN PENNSYLVANIA

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

February 17, 2021

Via Electronic Mail

Alexander G. Bomstein, Esquire
Kathryn L. Urbanowicz, Esquire
Clean Air Council
135 South 19th Street, Suite 300
Philadelphia, PA 19103
abomstein@cleanair.org

Delaware Riverkeeper
925 Canal Street
7th Floor, Suite 3701
Bristol, PA 19007
drn@delawareriverkeeper.org

Melissa Marshall, Esquire
Mountain Watershed Association
1414 Indian Creek Valley Rd
Melcroft, PA 15462-1002
melissa@mtwatershed.com

Re: Mariner East 2 – HDD Restart Reports

Dear Counsel:

Enclosed please find three HDD restart reports for:

- North Zinn's Mill Road (S3-0101-16) - dated January 28, 2021, February 5, 2021, and February 11, 2021

Due to the COVID-19 pandemic, this electronic transmission will be the only method of transmitting these documents. We will resume hard-copy transmittals after the COVID-19 pandemic. Additional HDD restart reports will be transmitted on a rolling basis as they become available.

Sincerely,

Diana A. Silva

Diana A. Silva
For MANKO, GOLD, KATCHER & FOX, LLP

DAS/cc/11842-009
Attachment

cc: Nels J. Taber, Esquire (w/o enclosure)
Curt C. Sullivan, Esquire (w/o enclosure)
Robert D. Fox, Esquire (w/o enclosure)
Neil S. Witkes, Esquire (w/o enclosure)

RETTEW
We answer to you.
3020 Columbia Avenue, Lancaster, PA 17603 Phone: (800) 738-8395
E-mail: rettew@rettew.com ● Web site: rettew.com

MEMORANDUM

TO:	Monica Styles, Energy Transfer (ET)
FROM:	David Reusswig, PG and David Anderson, PG, RETTEW
CC:	Matt Bruckner, PG, RETTEW
DATE:	January 28, 2021
PROJECT NAME:	Sunoco Pipeline LP Mariner East 2 Pennslyvania Pipeline - Spread 5 **PROJECT NO.:** 096302010
SUBJECT:	Restart Report – S3-0101-16 / North Zinn's Mill Road HDD, West Cornwall Township, Lebanon County, PA

Introduction and Background

This restart report presents site details and an evaluation of the inadvertent return (IR) that occurred during efforts to advance the 26-inch diameter reamer from the east end of Sunoco Pipeline LP's (SPLP) S3-0101-16, North Zinn's Mill Road horizontal directional drill (HDD) on October 19, 2020 in West Cornwall Township, Lebanon County, Pennsylvania. This report includes an updated timeline of site activity that has occurred since the Pennsylvania Department of Environmental Protection (PA DEP) approved the restart of drilling on September 23, 2020.

Pilot drilling for the 16-inch pipe was initiated from the east end of the profile on May 20, 2020, and from the west end of the profile on July 29, 2020. Drilling activities have been conducted by Michels Corporation (Michels). On August 31, 2020, two IRs occurred outside of established containment within Snitz Creek (S-A17). Following restart at the west drilling rig on September 23, 2020, an IR occurred within Snitz Creek (S-A17) just outside of the expanded containment. The containment was further expanded to capture the September 23rd IR location and drilling was halted at the east drilling rig. Drilling at the east drilling rig resumed with recirculation conducted within the further expanded permitted containment structure and the pilot hole was completed on October 5, 2020. The 26-inch reaming phase was initiated by Michels on October 6, 2020. Following the IRs on October 19, 2020, both drilling rigs at the site were shut down and are currently awaiting PA DEP restart approval following approval of this report. Currently, approximately 441 feet of 26-inch reaming has been completed from the west, and approximately 1,133 feet of 26-inch reaming has been completed from the east, for a total of 1,574 feet of 26-inch reaming completed to date. The total length of the HDD is 3,057 feet and there are 1,483 feet remaining to complete the 26-inch ream.

Overview of the HDD Activities

The following is a summary and discussion of drilling activity and other events which occurred during the HDD activities for the 16-inch pipe since September 23, 2020:

- **September 23, 2020:** Michels resumed drilling operations from the west entry pad following PA DEP approval of the restart addendum submitted on September 21, 2020. Approximately 17 feet of drilling had been completed, to a trajectory length of approximately 1,381 feet, when an IR occurred within Snitz Creek (S-A17) just outside of containment in place at the time. The new September 23rd IR location was at (N40.290110°, W76.427301°), which was within the permitted extent of the containment structures within Snitz Creek. Accordingly, to contain the IR, Precision Pipeline, LLC (Precision) extended the

approved containment structures within Snitz Creek to their permitted extents within the pipeline right-of-way (ROW). Operations continued after extension of the containment structures for a short time, with the west drilling rig completing another 14 feet of drilling for the day. At that point, SPLP shut down operations at the west drilling rig. The east drilling rig had also resumed operations this day following extension of the containment structures and completed approximately 32 feet of drilling for the day.

- **September 24, 2020:** The east drilling rig completed approximately 95 additional feet of pilot hole drilling for a total trajectory length of 1,463.54 feet from the east end. Reactivation of drilling fluids occurred at the permitted containment structures and the relief well near Route 72, but no additional IRs occurred. SPLP shut down operations at the east drilling rig pending submittal of a restart report and approval to restart the west drilling rig.
- **September 25, 2020:** Michels drilling on the east and west entry pads remained on standby awaiting PA DEP approval following the September 23, 2020 IR to advance the pilot hole. Michels injected 39 cubic yards of pressure grout downhole. Michels tripped out the grout piping.
- **September 26, 2020:** Michels tripped in 47 rods on the east side, lost circulation on Rod #47, and then tripped out all the rods.
- **September 28, 2020:** Sunoco/ETP submitted a restart report to the PA DEP for the September 23, 2020 IR. Michels injected 40 cubic yards of pressure grout downhole on the east side, then tripped out the grout piping, and then tripped in the drilling rods to the grout in preparation for drilling out the grout.
- **September 29, 2020:** Michels completed trip-in on the east side with no returns. The sensor was determined to be off-alignment approximately 4 degrees. HDD crew remained on standby.
- **September 30, 2020:** Sunoco/ETP received restart approval from PA DEP. Michels received approval to trip out drilling pipe and trip in grout pipe for grouting on 10/1/2020.
- **October 1, 2020:** Michels Injected 18.3 cubic yards of pressure grout, then tripped out the grout pipes and added the downhole assembly to the rig.
- **October 2, 2020:** Michels tripped rods back into the bedrock face and drilled 63.64 feet of new bedrock to a total trajectory of 1,527.18 feet from the east end.
- **October 3, 2020:** Michels continued drilling the pilot hole. Michels completed drilling Rods #50-54 for 160.9 feet for the day and a total trajectory length of 1,688.17 feet from the east end.
- **October 5, 2020:** Michels completed the intersection of the east and west pilot holes and the pilot hole was completed.
- **October 6, 2020:** Michels started the 26-inch ream from west to east.
- **October 9, 2020:** Michels continued the 26-inch ream from west to east and reached a trajectory length of 441 feet from west to east.
- **October 10, 2020:** Michels moved the reamer to the east entry and began reaming from east to west. Michels completed 4 rods of reaming for a total trajectory length of 125.92 feet from the east end.
- **October 12-17, 2020:** Michels continued the 26-inch ream for a total trajectory length of 1,007.74 feet from the east end.
- **October 19, 2020:** Michels continued the 26-inch reaming from east to west. An IR (approximately 150-200 gallons) occurred in Snitz Creek outside of the permitted containment BMP. The IR consisted of 20 separate and isolated discharge points within an approximately 75-foot long span within the creek starting from the southernmost discharge point located directly underneath the Route 72 bridge (STATION 12303+52; N40°17’21.51202”, W-76°25’35.17628”) to the northernmost discharge point located downstream approximately 75 feet from the Route 72 bridge (STATION 12302+00; N40°17’22.26161”,

W-76°25'36.44426"). At the time of the IR, the reaming bit was located approximately 1,133 feet from the east end and at an approximate depth of 120 feet below ground surface. Michels immediately ceased HDD operations and Precision constructed temporary containments around the discharge locations within Snitz Creek. Michels has remained on standby since the 10/19/2020 IR awaiting PA DEP approval of this restart report.

Current Conditions Report

There has been no drilling activity at this HDD site since October 19, 2020. Copies of the most recent IR reports, prepared by Tetra Tech, have been submitted to the PA DEP. A copy of the most recent Current Conditions Report, prepared by Tetra Tech, will be submitted separately.

Analysis of Cause of IR and Assessment of Strata Where IR Occurred

The bedrock underlying the site consists of the Cambrian-age Snitz Creek Formation. Geyer and Wilshusen (1982) describe this formation as a gray, medium to coarsely crystalline oolitic dolomite with limestone, sandstone, and shale interbeds. This formation is well bedded and thick to massive. Fracturing consists of joints which have a blocky pattern. The joints are moderately well developed, moderately to highly abundant, are regularly spaced with a moderate distance between fractures, and are open and steeply dipping. The Snitz Creek Formation is moderately resistant to weathering; slightly to moderately weathered to a shallow depth; irregularly shaped; and the interface between bedrock and mantle is characterized by pinnacles in most places. This carbonate (karst) formation has good subsurface drainage but little surface drainage. The porosity of the weathered portion of this formation is of moderate to high magnitude, resulting in moderate to high permeability. The ease of excavation (and drilling) is classified as generally easy (fast) in the limestone but is somewhat more difficult (slowed) in the dolomite due to the presence of numerous sandstone interbeds.

Groundwater movement within these rocks is primarily through a network of interconnected secondary openings (e.g., fractures, joints, and faults) that were developed by external forces following deposition of the beds. Geotechnical rock core observations confirm that the local bedrock ranges from fractured and very broken to massive interbedded dolomite, limestone, and shale comprised of well-developed thick to massive steeply dipping joint and bedding planes. Importantly, solutioning of these structural features observed during the geotechnical investigations and HDD operations are indicative of a complex karst fracture system

The October 19, 2020 IR totaled approximately 150-200 gallons of diluted drilling fluid and occurred outside of containment within Snitz Creek (S-A17). The IR consisted of 20 isolated discharge locations within an area of Snitz Creek starting from directly underneath the Route 72 bridge to approximately 75 feet northwest of the Route 72 bridge. The northernmost discharge was located at N40° 17' 22.2161"; W-76° 25' 36.44426" at STATION 12302+00. The southernmost discharge was located at N40° 17' 21.51202"; W-76° 25' 35.17628" at STATION 12303+52. Prior to the IR occurring, recirculation of approximately 108,000 gallons of drilling fluid from within the containment was conducted at the August 17th, 2020 and the September 23, 2020 IR locations (see Revision 3 of the Erosion & Sedimentation Control & Site Restoration Plan). The IR occurred with the 26-inch reaming bit at approximately 1,133 feet from the east end of the HDD path and at a depth of approximately 120 feet.

Based on published geologic and hydrogeologic information, geotechnical borings, field observations and geophysical surveys, the October 19, 2020 IR appears to have resulted from a combination of the presence of secondary openings and relatively greater dissolution of bedrock along bedding planes, joints, faults, and fractures that are characteristic of karstic settings.

Depth and Alignment of the Drill Bit at the Time of the October 19, 2020 IR

Currently, the approximate depth of cover over the 26-inch reamed borehole at 1,133 feet from the east end and 441 feet from the west end is approximately 120 feet and 100 feet below ground surface, respectively, for a total trajectory length to date of 1,574 feet. The total length of the HDD is 3,057 feet and there are 1,483 feet remaining to complete the 26-inch ream.

Profile of the Drill Path as Constructed Overlain on the Permitted Profile

A plan of the drill path as constructed and overlain on the permitted profile is included as **Attachment 1.**

Analysis of Potential Mitigation Measures

Alternative considerations were evaluated and implemented as follows:

1. Alternative entry and/or exit points: As discussed in the HDD Revaluation Report - "Horizontal Directional Drill Analysis North Zinn's Mill Road Crossing" dated February 4, 2019 and approved by the PA DEP on May 1, 2020, the HDD entry/exit points were previously reevaluated and revised. The original profile for the HDD was redesigned to make the profile a total of 1,870 foot longer, such that the entry and exit points are in new locations.
2. Alternative entry and/or exit angles: As discussed in the February 4, 2019 HDD Revaluation Report, the entry and exit angles were previously increased. from 12-14 degrees to 16 degrees, which allowed for a sharper and quicker entry into and exit out of competent rock.
3. Alternative profile depth: As discussed in the February 4, 2019 HDD Revaluation Report, the depth of cover was increased by 47 feet at the maximum depth. The revised profile radius is also 107 feet deeper below the crossing of Snitz Creek
4. Reduced drilling fluid pressures: Due to the presence of interconnected horizontal and vertical fractures and dissolution features in the karstic bedrock, SPLP will continue to monitor and minimize drilling fluid pressures to the maximum extent practicable to avoid over pressuring the borehole.
5. Thickened drill mud and/or the use of pre-approved LCMs: Michels has used and will continue to use LCMs as needed following IR and/or LOC events to help regain circulation and reduce the risk of IRs and LOC events.
6. The use of pre-approved loss-control materials (LCM): As specified in the Re-evaluation Report dated February 4, 2019 and approved by the PA DEP on May 1, 2020, Michels used LCMs to help regain circulation and reduce the risk of further IRs and LOC during the pilot phase. During the reaming limited use of LCM will be evaluated depending on downhole conditions and current fluid flow at the relief wells. There is a potential that LCMs may plug completely or reduce the effectiveness of the relief wells.
7. Borehole casing: The IR occurred at a boring length of approximately 1,133 feet and a depth of approximately 120 feet, which is beyond the point where casing could be installed at this site.
8. Relief wells: Three relief wells (1, 2 & 3) have been completed and are being utilized at the site. Two wells are located in close proximity to Snitz Creek (S-A17), see Revisions 9 & 10 of the Erosion & Sedimentation Control & Site Restoration Plan. The third relief is located along the alignment, approximately 1,337 feet west of the east entry location (near Route 72). To address the 10/19/2020 IR, a cluster of three additional relief wells (4, 5 & 6) is proposed for the area around the current reamer location. These wells are to relieve the pressure in the bore hole. A fourth additional relief well (3A) is proposed adjacent to the existing relief well near Route 72. This well (3A) is to provide additional capacity at this location and allow for one well to be in operation

while the other well is cleaned. The locations of the relief wells are shown on the E&S sheets included in **Attachment 2**. Relief wells 4, 5 and 6 have been sited around the reamer location and will be directly over top of the HDD bore. These wells will be drilled into the bore hole and are intended to capture fluid at the point where the loss of circulation originated. Relief well 3A will be offset to the south from the HDD bore by approximately 5 feet. The offset is a required safety factor due to the proximity of the 20-inch pipeline at this location. All of the relief wells will be cased to within a few feet of the HDD bore. The relief well locations were selected based on results from existing relief wells and currently available information. Fluid and drill cuttings will be pumped from the relief wells using a vacuum pump. The pumping level in the relief wells will be adjusted based on field observations to optimize recovery of drilling fluid and cuttings. As the proposed relief wells are installed and new information is collected as the drill progresses, additional relief well locations will be evaluated. Any relief wells installed would remain operational for the duration of the HDD installation. The relief wells would be plugged and abandon after completion of the HDD.

9. Conversion of the crossing type from HDD to other trenchless technologies and open-cut; and relocation of the pipeline that will minimize the likelihood of further IRs so as to adequately protect public health, safety, and the environment: An evaluation of alternative crossing types was conducted and alternative crossings were not feasible or practicable at this location as was discussed in the HDD Revaluation Report dated February 4, 2019 and approved by the PA DEP May 1, 2020. A supplemental alternatives analysis of crossing types for this location was prepared by Tetra Tech and is included as **Attachment 3**.
10. Consideration should be given to installing the dam and flume stream containment as a proactive measure before the HDD is restarted, with prior consultation conducted with the Pennsylvania Fish and Boat Commission.
11. An evaluation of a stepped-ream approach using three HDD passes (pilot, intermediate, and final ream), as opposed to the two HDD passes (pilot and final ream) which is the method currently underway at this HDD location was completed by Michels Directional Crossings, and a summary of that evaluation is included as **Attachment 4**.

Drilling Tracking and Reporting

Upon the restart of HDD operations, the following procedure will be utilized to measure/calculate the drilling fluid used during active HDD operations on the shorter of 1-hour or 1-rod intervals. The qualified team of individuals responsible for tracking/reporting drilling fluid usage during the active HDD operations are as follows:

Mud Engineer

- Responsible for tracking drilling fluid usage (on a per rod or hourly basis, whichever comes first) and tracking any fluid recovered and transferred to the frac tanks for reuse/recirculation
- Responsible for completing the daily drilling fluid tracking report
- Responsible for communicating to the driller/drill foreman and to ET any BMP recommendations to restore full circulation, as appropriate, in the event of a LOC.

HDD Contractor Superintendent

- Responsible for overseeing and directing the drill crew on the ground. Will communicate directly with the driller and/or drill foreman and the Mud Engineer regarding specific drilling information for the

purposes of determining LOC volumes. The drilling Superintendent will provide internal verbal notifications to the field team as needed.

Lead Environmental Inspector (LEI)

In addition to the responsibilities described in the IR PPC plan the LEI will have the following site-specific responsibilities:

- Continuously monitor Snitz Creek for reactivation of IRs and continuously inspect for new IRs
- Notify the ET field team via text message of any pertinent findings. This includes reactivation of IRs within Snitz Creek, occurrence of a new IR within or in the vicinity of Snitz Creek, or initiation of pumping from a relief well.

Chief Environmental Inspector (CEI)

- Responsible for lead supervision/direction of EI and LEI
- Responsible for assisting ET in the preparation of reports submitted to the PA DEP.

Professional Geologist (PG) and/or Lead PG

In addition to the responsibilities described in the IR PPC plan the PG will have the following site-specific responsibilities:

- Visual inspection and documentation of drilling fluid returns in the pit and notifying the Mud Engineer of any observed loss of returns in the pit
- Assist the Mud Engineer as needed in taking meter readings after the completion of each rod or after each hour (whichever comes first)
- Responsible for internal text message notification to the ET Team if a LOC threshold has been exceeded as determined by the Mud Engineer of if an IR occurs
- Preparation of the PG Daily Inspection Report and submission to ET.

ET Project Manager

- Responsible for overseeing/directing the construction team
- Reports updates to ET Project team.

Construction Manager

- Responsible for overseeing/directing field construction team
- Reports to ET Project Manager.

ET Environmental Project Manager

- Responsible for oversight/direction of Environmental Inspection team
- Responsible for daily submission of Daily Fluid Tracking report and PG Daily Inspection Reports to the PA DEP. These reports will be submitted by noon of the following day
- Responsible for submissions of Restart Reports, LOC Notifications, Loss Prevention Reports, and Landowner Notifications to the PA DEP as necessary.

The procedure for real time tracking of fluid volumes is as follows:

- The onsite Mud Engineer will work and communicate directly with the driller and drill foreman to obtain the necessary information to calculate the estimated the fluid usage immediately after each rod is drilled or after one hour.
- The Mud Engineer will record the estimated volume of drilling fluid used during the drilling of the 31-foot rod or during the last hour. If any of the containments or relief wells have been activated during this time and drilling fluid is being recovered from any of the containment BMPs or the relief wells, the driller will gauge the liquid levels in the frac tanks to determine the estimated volume of fluid recovered and notify the Mud Engineer so he can determine the net fluid loss.
    - The amount of fluid consumed will be calculated as follows:
        - Where:
            - Operational fluid use = Fluid added to mud plant – Fluid recovered
            - Fluid recovered = Total volume of fluid recovered at the relief wells, Snitz Creek recirculation BMP and the mud pit on the opposite end of bore from drilling rig
            - Hole volume estimate calculation:

$$\text{Hole volume} = \left((27.53 \frac{\text{gal}}{\text{ft}} * \text{X ft}) * 1.15 \right)$$

                - *27.53 gallons = per foot volume for a 26-inch diameter hole*
                - *X = length of boring completed in past hour or rod length*
                - *1.15 = 15 % allowance for conditioning the bore hole.*
- The fluid tracking worksheet will be submitted to the PA DEP daily via email.
- A flow diagram showing the fluid circulation at the site is included in **Attachment 5**.

Drilling Fluid Viscosity

The normal drilling fluid viscosity range is 140 to 160 (sec/qt). Based on downhole conditions, the fluid viscosity may be adjusted to achieve efficient cuttings removal. At sites were an influx of groundwater is impacting downhole fluid viscosity, a higher viscosity range is used. Fluid viscosity in the mud tank will vary based on current stage the plant operator is at in adjusting the viscosity. If operator has just added more water, viscosity is low and if operator just added bentonite, viscosity will be high. The operator is routinely checking viscosity and any individual sample may not represent the actual final target range of fluid pumped down hole. The PGs have been obtaining one or two viscosity readings a day from the operator. The variation in the readings reported on the Form Bs in the PG daily report indicate the viscosity at a single point in time and do not reflect the target range utilized during drilling. Going forward the PGs will consult, at the end of the day, with the drilling superintendent regarding the fluid viscosity and the viscosity range of the fluid used that day will be reported on the Form B.

Annular Pressure Monitoring

In HDD projects, annular pressure monitoring can be conducted during the pilot phase but is very rarely conducted during the ream phase. Industry experience from pressure monitoring during ream phases has been that little to no downhole pressure in excess of naturally occurring hydrostatic pressure is generated. The pressure monitors typically have required a wire connection. No wire connection with the drilling tools is used during the ream which was one of the reasons why monitoring is not typically performed during reaming. While wireless pressure monitors are now available, the wireless monitors are specifically designed for use during piloting, not during the reaming phase. Further, the currently available wireless monitors are not sturdy enough to sustain the impacts of normal drilling operations during the reaming phase. As a result, the lifespan of the wireless monitors is estimated

to be as short as an hour during a normal reaming process. Based on industry experience, pressure monitoring during the Zinns Mill ream phase, using either a wired monitor (which is not possible), or a wireless monitor (which will not sustain the reaming process), is not available or otherwise expected to provide useful information, and therefore is not planned at this time.

Residential Water Supply Wells

As described in the "Water Supply Assessment, Preparedness, Prevention and Contingency Plan" (Plan), revised August 8, 2017, private water supplies within 450 feet of the HDD profile have been routinely sampled and monitored during the project. There are 11 wells within 450-foot radius that have been identified and sampled within the radius. A map showing the locations of the identified and sampled water supply wells is included as **Attachment 6.** A summary table of all the analytical results for all samples collected from these wells has been submitted to the PADEP separately. Per the requirements of the Plan, all the well owners have previously been offered a connection to a temporary water supply "water buffalo" or provided with a regular delivery of bottled water. Prior to restart of HDD operations, all the well owners will be re-contacted by SPLP's land agents to confirm that the landowners have contact information to notify SPLP of any concerns regarding their water supplies, and will also repeat and renew the offer of a water buffalo or bottled water delivery. SPLP will also offer to provide daily communications to the well owners (or as often or in the manner that the well owner dictates) and during drilling, an SPLP representative will be available 24/7 to respond to any concerns or complaints from the well owners.

Borehole Geophysical Logging

Borehole logging of a single boring is planned for the week of February 1, 2021. The borehole will be installed approximately 10 feet south of the HDD profile near the reamer location at the time the October 19, 2020 IR occurred. The borehole will be drilled to a depth 10 feet below the HDD profile. The exact location of the borehole will be determined in the field based on utility clearances and site access for a drilling rig. The expected suite of techniques to be completed includes natural gamma (ng), fluid conductivity, fluid temperature, 3-arm caliper (borehole diameter), along with acoustic and optical televiewer imaging. The results will be provided to the PA DEP as soon as the data analysis is completed.

Analysis of Risk of Additional IRs and Recommendations

The October 19, 2020 IR occurred during 26-inch diameter reaming from east to west following recirculation of drilling fluids within the expanded containment at the September 17th and September 23rd IR locations (see Revision 3 of the Erosion & Sedimentation Control & Site Restoration Plan). SPLP installed additional containment(s) around the October 19, 2020 IR/discharge locations. SPLP will utilize the two HDD relief points along the drill path on each side of Snitz Creek within the approved LOD, the third relief point along the east entry borehole near Route 72 where a second relief well will be installed for additional capacity, and a cluster of three new wells at a proposed relief point along Snitz Creek near the October 19, 2020 IR/discharge locations (described above). The four proposed new relief wells will make for a total of seven (7) relief wells at the site. All relief points are intended to reduce the pressure in the borehole and redirect the IR discharges to locations outside of the stream where they can be better controlled. Drilling fluid collected from the relief wells has been and will continue to be returned to the mud pit for re-use.

Based on information provided by, and the expertise of the HDD team, as well as our experience with the relevant hydrogeology and geology, RETTEW agrees with the approach to utilize previously approved and expanded containment BMPs, as well as the recent containments surrounding the October 19, 2020 IR/discharge locations and the four proposed relief wells once approved by the PA DEP. In addition, RETTEW believes that the application of LCM measures and further conditioning of other locations along the borehole will prevent or minimize the risk

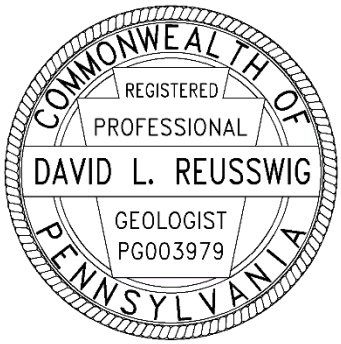
of new IRs in other locations along this HDD. Consistent with the IR PPC Plan, if a new IR were to occur outside of the currently authorized containments the procedure from Section 5.1.5 "Monitoring Protocol for Condition 3 – Inadvertent Returns" in the "HDD Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan", prepared by Tetra Tech, Inc. and revised April 2018, will be implemented. Materials and equipment for containing and controlling IRs are immediately available on-site, as required by permit, during all drilling activities. As mentioned above, a dam and flume stream containment should also be considered prior to the resumption of drilling activities.

Proposed Schedule for Recommencement of HDD Operations & Anticipated Duration of the HDD Operations
SPLP proposes to perform the aforementioned recommended measures upon restart approval from the PA DEP. The anticipated duration to complete HDD operations for the 16-inch pipe is three weeks from restart of drilling, following restart approval.

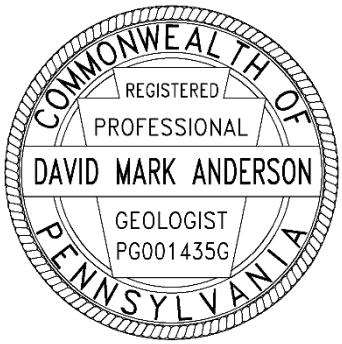
Based on information provided by, and the expertise of, the HDD team, as well as our experience with the relevant hydrogeology and geology, RETTEW believes that the implementation of the measures outlined above will minimize the risk of a new IR in another location on this HDD and minimize the likelihood that further drilling will result in an impact to the environment. Furthermore, based on such information, expertise and experience, RETTEW believes that these measures represent the practicable means, as identified in the April 2018 IR PPC Plan, that can be taken to minimize impacts to any private water supplies. In the unlikely event of an impact to a private water supply, SPLP will implement the procedures of the IR PPC Plan.

Certification
This report was prepared in collaboration with the horizontal directional drilling team, relying on information gathered and prepared by others. By affixing my seal to this document, I am certifying that the hydrogeologic and geologic information contained herein is true and correct, to my knowledge and belief. I further certify that I am licensed to practice in the Commonwealth of Pennsylvania.

David L. Reusswig, PG
License No. PG003979

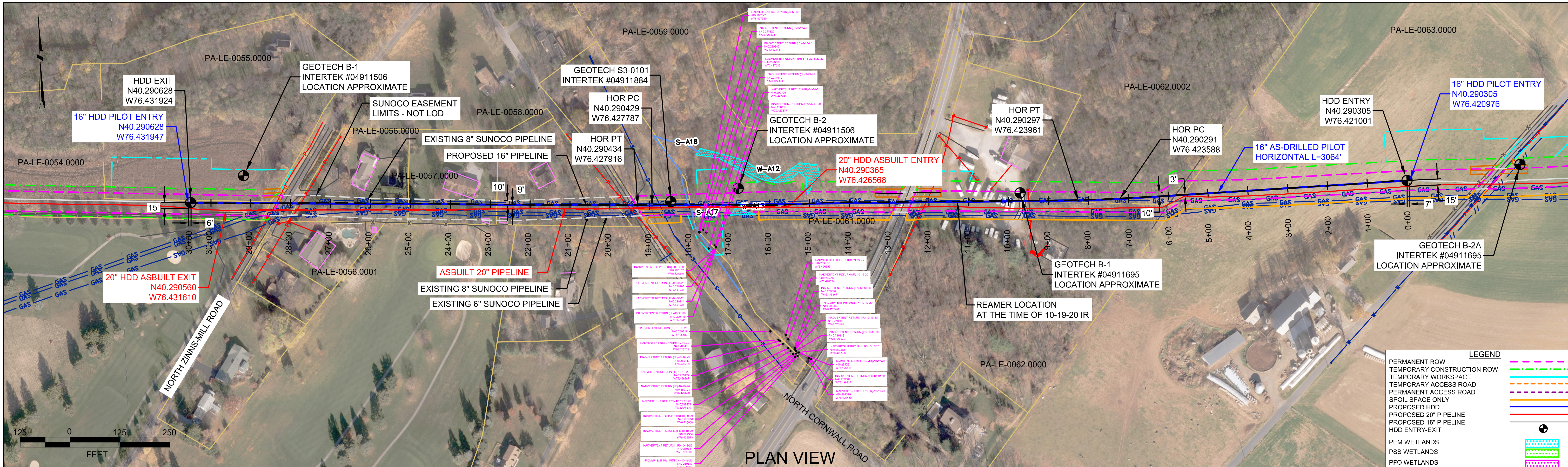


David M. Anderson, PG
License No. PG001435G



Enclosure
Attachment 1 – PA-LE-0055.Rd-16-IR-Overlay: As-Drilled Pilot Overlay
Attachment 2 – Relief Well Locations (5958ES001–Rev 4 Layout 1, .32-IR-Rev 16 Layout 1, .32 IR.b-Rev 16-Layout1)
Attachment 3 – Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)
Attachment 4 – Sunoco Zinn's Mill Road Single Pass Reaming Discussion
Attachment 5 – Mud Flow Diagram
Attachment 6 – Residential Well Location (within 450') – Map

ATTACHMENT 1
PA-LE-0055.Rd-16-IR-Overlay: As-Drilled Pilot Overlay



LEBANON COUNTY, PENNSYLVANIA - WEST CORNWALL TOWNSHIP
S3-0101-16

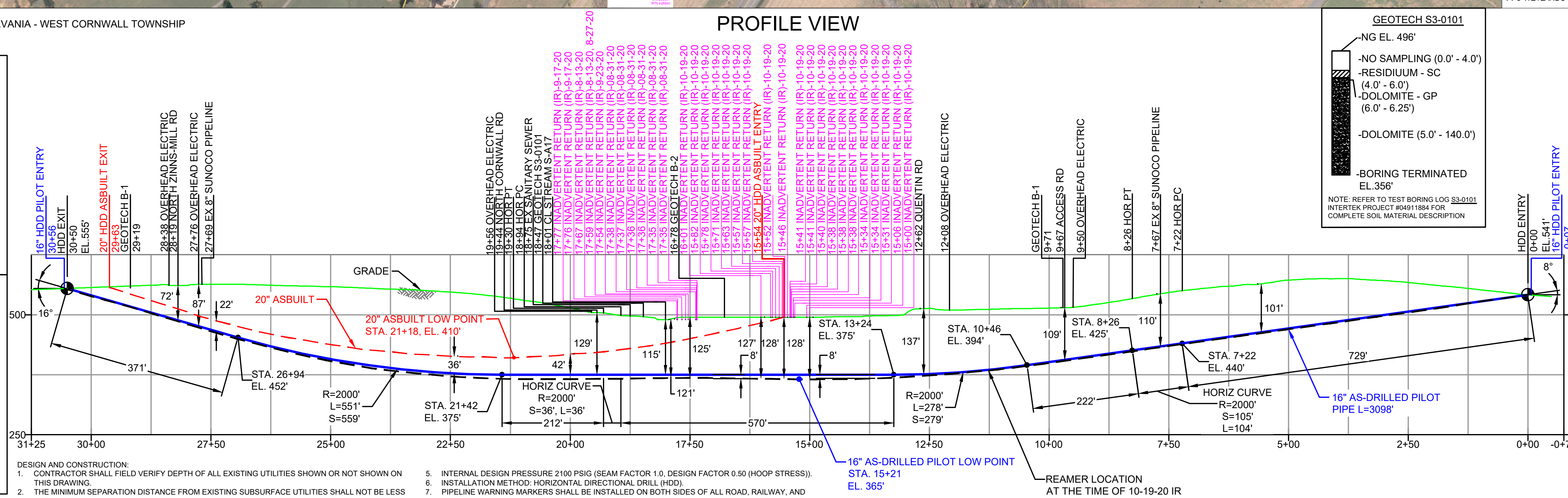
PROFILE VIEW

GEOTECH B-1
- NG EL. 556'
- RESIDIUUM-CLAY CL (0.0' - 5.0')
- GROUNDWATER (43.0')
- DOLOMITE/LIMESTONE /SHALE (5.0' - 170.0')
- BORING TERMINATED EL.386'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911506 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-2
- NG EL. 495'
- FILL ML (0.0' - 3.5')
- GROUNDWATER (2.9')
- FILL MH (3.5' - 8.5')
- DOLOMITE/LIMESTONE (8.5' - 105.0')
- BORING TERMINATED EL.390'

NOTE: REFER TO TEST BORING LOG B-2 INTERTEK PROJECT #04911506 FOR COMPLETE SOIL MATERIAL DESCRIPTION



GEOTECH S3-0101
- NG EL. 496'
- NO SAMPLING (0.0' - 4.0')
- RESIDIUUM - SC (4.0' - 6.0')
- DOLOMITE - GP (6.0' - 6.25')
- DOLOMITE (5.0' - 140.0')
- BORING TERMINATED EL.356'

NOTE: REFER TO TEST BORING LOG S3-0101 INTERTEK PROJECT #04911884 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-1
- NG EL. 515'
- NO SAMPLING (0.0' - 5.0')
- FILL GP-GM (5.0' - 15.0')
- GROUNDWATER (24.0')
- LIMESTONE/DOLOMITE (15.0' - 152.0')
- BORING TERMINATED EL.363'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911695 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-2A
- NG EL. 543'
- NO SAMPLING (0.0' - 9.5')
- GROUNDWATER (27.0')
- LIMESTONE/DOLOMITE (9.5' - 153.0')
- BORING TERMINATED EL.390'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911695 FOR COMPLETE SOIL MATERIAL DESCRIPTION

DESIGN AND CONSTRUCTION:
1. CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
2. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HORZ. LENGTH (L=): 3050'
   HDD PIPE LENGTH (S=): 3083'
   16" x 0.438" W.T., X-70, API5L, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 2100 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 2625 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
12. SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
13. SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

HDD IR OVERLAY

NOTES

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

REF. DRAWING

DWG NO		DWG NO	DESCRIPTION
ES-5.32	TO	ES-5.32	EROSION & SEDIMENT PLAN
SHEET 18	TO	SHEET 18	AERIAL SITE PLAN

REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
EP12	ADDED 10-19-20 IR AND REAMER LOCATION INFORMATION	MRS	10/20/20	RMB	10/20/20	AMC	10/20/20
EP11	ADDED 9-23-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	09/25/20	RMB	09/25/20	AMC	09/25/20
EP10	ADDED 9-17-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	09/21/20	RMB	09/21/20	AMC	09/21/20
EP9	ADDED 8-27-20 IR INFORMATION	MRS	08/27/20	RMB	08/27/20	AMC	08/27/20
EP8	ADDED 8-13-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	08/18/20	RMB	08/18/20	AMC	08/18/20
EP7	ADDED GEOTECH INFORMATION	MRS	02/25/20	RMB	02/25/20	AMC	02/25/20

Sunoco Logistics Partners L.P.

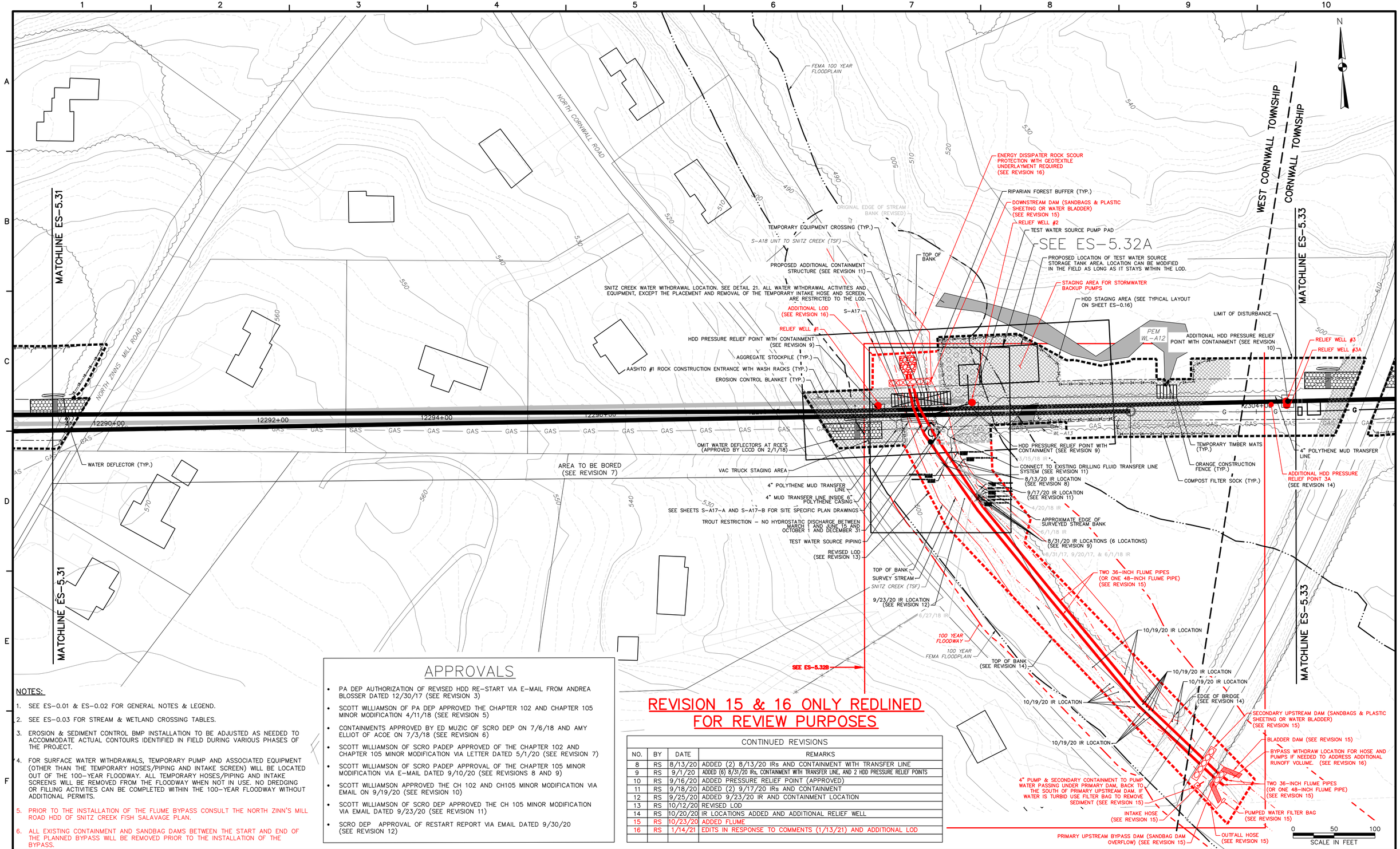
TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
N ZINNS MILL ROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=250' | DWG. NO. PA-LE-0055.0000-RD-16

ATTACHMENT 2
Relief well locations (5958ES001–Rev 4 Layout 1, .32-IR-Rev 16 Layout 1, .32 IR.b-Rev 16-Layout 1)



NOTES:

1. SEE ES–0.01 & ES–0.02 FOR GENERAL NOTES & LEGEND.
2. SEE ES–0.03 FOR STREAM & WETLAND CROSSING TABLES.
3. EROSION & SEDIMENT CONTROL BMP INSTALLATION TO BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONTOURS IDENTIFIED IN FIELD DURING VARIOUS PHASES OF THE PROJECT.
4. FOR SURFACE WATER WITHDRAWALS, TEMPORARY PUMP AND ASSOCIATED EQUIPMENT (OTHER THAN THE TEMPORARY HOSES/PIPING AND INTAKE SCREEN) WILL BE LOCATED OUT OF THE 100–YEAR FLOODWAY. ALL TEMPORARY HOSES/PIPING AND INTAKE SCREENS WILL BE REMOVED FROM THE FLOODWAY WHEN NOT IN USE. NO DREDGING OR FILLING ACTIVITIES CAN BE COMPLETED WITHIN THE 100–YEAR FLOODWAY WITHOUT ADDITIONAL PERMITS.
5. PRIOR TO THE INSTALLATION OF THE FLUME BYPASS CONSULT THE NORTH ZINN'S MILL ROAD HDD OF SNITZ CREEK FISH SALAVAGE PLAN.
6. ALL EXISTING CONTAINMENT AND SANDBAG DAMS BETWEEN THE START AND END OF THE PLANNED BYPASS WILL BE REMOVED PRIOR TO THE INSTALLATION OF THE BYPASS.

APPROVALS

- PA DEP AUTHORIZATION OF REVISED HDD RE–START VIA E–MAIL FROM ANDREA BLOSSER DATED 12/30/17 (SEE REVISION 3)
- SCOTT WILLIAMSON OF PA DEP APPROVED THE CHAPTER 102 AND CHAPTER 105 MINOR MODIFICATION 4/11/18 (SEE REVISION 5)
- CONTAINMENTS APPROVED BY ED MUZIC OF SCRO DEP ON 7/6/18 AND AMY ELLIOT OF ACOE ON 7/3/18 (SEE REVISION 6)
- SCOTT WILLIAMSON OF SCRO PADEP APPROVED OF THE CHAPTER 102 AND CHAPTER 105 MINOR MODIFICATION VIA LETTER DATED 5/1/20 (SEE REVISION 7)
- SCOTT WILLIAMSON OF SCRO PADEP APPROVAL OF THE CHAPTER 105 MINOR MODIFICATION VIA E–MAIL DATED 9/10/20 (SEE REVISIONS 8 AND 9)
- SCOTT WILLIAMSON APPROVED THE CH 102 AND CH105 MINOR MODIFICATION VIA EMAIL ON 9/19/20 (SEE REVISION 10)
- SCOTT WILLIAMSON OF SCRO DEP APPROVED THE CH 105 MINOR MODIFICATION VIA EMAIL DATED 9/23/20 (SEE REVISION 11)
- SCRO DEP APPROVAL OF RESTART REPORT VIA EMAIL DATED 9/30/20 (SEE REVISION 12)

REVISION 15 & 16 ONLY REDLINED FOR REVIEW PURPOSES

CONTINUED REVISIONS

NO.	BY	DATE	REMARKS
8	RS	8/13/20	ADDED (2) 8/13/20 IRs AND CONTAINMENT WITH TRANSFER LINE
9	RS	9/1/20	ADDED (6) 8/31/20 IRs, CONTAINMENT WITH TRANSFER LINE, AND 2 HDD PRESSURE RELIEF POINTS
10	RS	9/16/20	ADDED PRESSURE RELIEF POINT (APPROVED)
11	RS	9/18/20	ADDED (2) 9/17/20 IRs AND CONTAINMENT
12	RS	9/25/20	ADDED 9/23/20 IR AND CONTAINMENT LOCATION
13	RS	10/12/20	REVISED LOD
14	RS	10/20/20	IR LOCATIONS ADDED AND ADDITIONAL RELIEF WELL
15	RS	10/23/20	ADDED FLUME
16	RS	1/14/21	EDITS IN RESPONSE TO COMMENTS (1/13/21) AND ADDITIONAL LOD

TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921–7090 | F: (412) 921–4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	3/28/17	INCORPORATED THE SPECIAL CONDITIONS SET FORTH IN DEP'S CHAPTER 102 AND CHAPTER 105 PERMITS
2	RS	5/25/17	DRAWINGS PROVIDED TO FIELD
3	RS	12/15/17	REVISED HDD
4	RS	2/8/18	EROSION/SEDIMENT CONTROL MODIFICATION FOR RCE
5	RS	3/29/18	ATWS FOR INADVERTENT RETURN RESPONSE AND INSERT
6	RS	6/28/18	ATWS FOR 2ND IR CONTAINMENT (ON 6/6/18), & ADD. CONTAINMENTS
7	RS	12/10/18	REVISED 16" HDD

COMMONWEALTH OF PENNSYLVANIA – REGISTERED PROFESSIONAL ENGINEER – ROBERT F. SIMCIK – ENGINEER PE084455-E

SUNOCO PIPELINE LP
SINKING SPRING, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT CONSTRUCTION SPREAD 4

1–20" & 1–16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

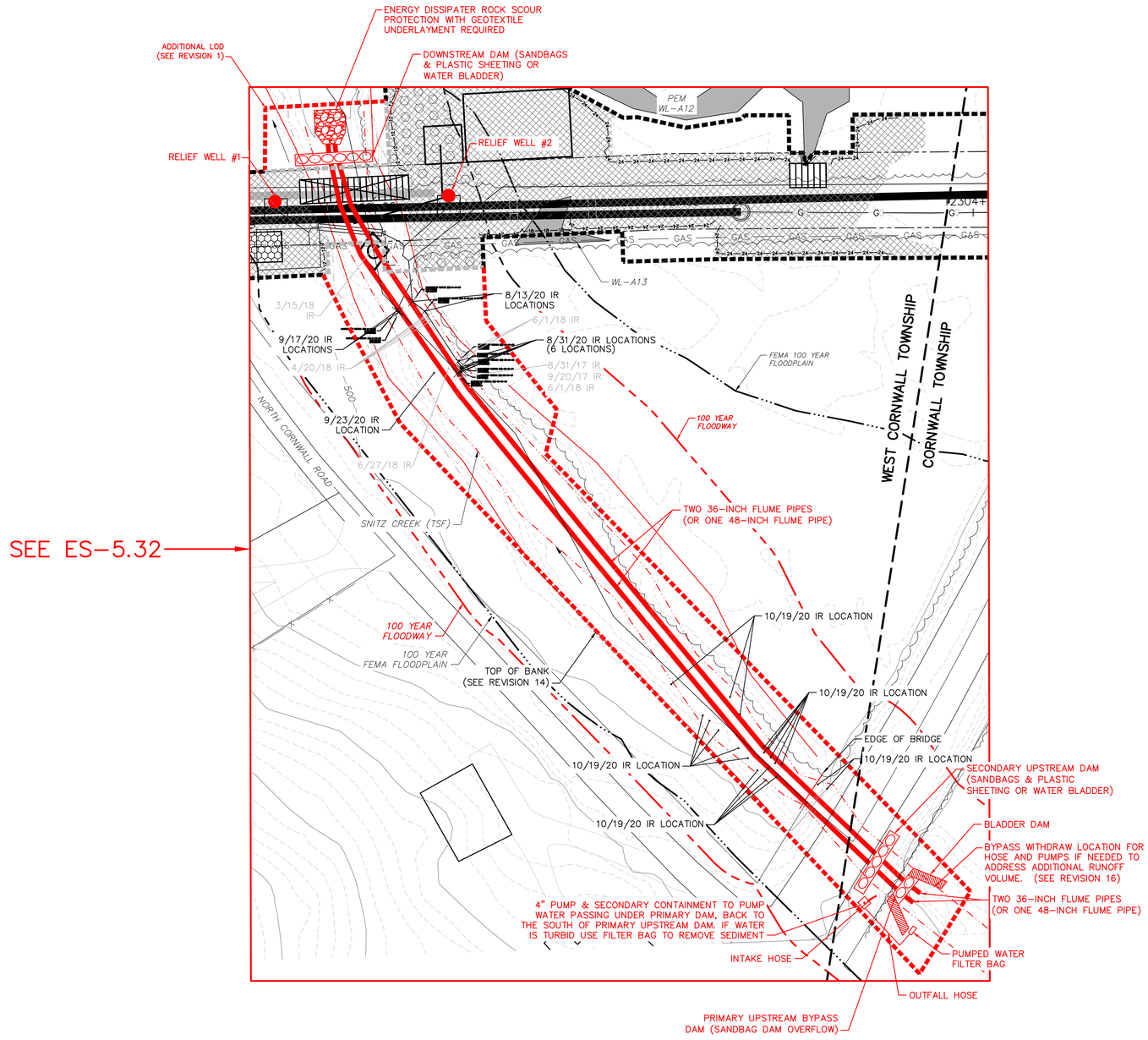
LEBANON COUNTY CONSERVATION DISTRICT EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN

SHEET 32 OF 69

DATE:	2/8/2017
PROJECT NO.:	112IC05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES–5.32
SHEET 5.32 OF 127

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.32–IR – REV 16.dwg PIT NIKKI.DILLA 1/28/2021 8:05:19 AM



TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	1/14/21	REVISED LOD AND BYPASS WITHDRAW LOCATION FOR ADDITIONAL RUNOFF

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROBERT F. SIMCIK ENGINEER 073644-E

SUNOCO PIPELINE LP
SINKING SPRING, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT
CONSTRUCTION SPREAD 4

1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

LEBANON COUNTY CONSERVATION DISTRICT
EROSION & SEDIMENT CONTROL &
SITE RESTORATION PLAN
SHEET 32 OF 69

DATE:	2/8/2017
PROJECT NO.:	112IC05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES-5.32B
SHEET 5.32 OF 127

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.32-IR.b – REV 16..dwg PIT NIKKI.DILLA 1/28/2021 7:26:51 AM

MATCHLINE ES-5.32

MATCHLINE ES-5.34

WOODED AREA

QUENTIN ROAD

TICE LANE

ADDITIONAL TEMPORARY WORK SPACE FOR CONVENTIONAL BORE CROSSING (SEE TYPICAL LAYOUT ON SHEET ES-0.17)

AGGREGATE STOCKPILE (TYP.)

AASHTO #1 ROCK CONSTRUCTION ENTRANCE WITH WASH RACKS (TYP.)

LIMIT OF DISTURBANCE

EROSION CONTROL BLANKET (TYP.)

TEMPORARY UPSLOPE DIVERSION BERM (TYP.)

TEMPORARY SLOPE PIPE (TYP.)

RELIEF WELL #3

RELIEF WELL #3A

RELIEF WELL #4

RELIEF WELL #5

RELIEF WELL #6

PROPOSED LOCATIONS FOR RELIEF WELLS (SEE REVISION 4)

20-INCH AREA TO BE BORED

16-INCH AREA TO BE BORED

AREA TO BE BORED

BORE PIT (TYP.)

PERMANENT WATER BAR (TYP.)

COMPOST FILTER SOCK (TYP.)

TRENCH PLUGS (TYP.)

TEMPORARY WATER BAR (TYP.)

REVISED 16" HDD ENTRY/EXIT LOCATION

FEMA 100 YEAR FLOODPLAIN

12304+00 12306+00 12308+00 12310+00 12312+00 12314+00 12316+00 12318+00

NOTES:

1. SEE ES-0.01 & ES-0.02 FOR GENERAL NOTES & LEGEND.
2. SEE ES-0.03 FOR STREAM & WETLAND CROSSING TABLES.
3. EROSION & SEDIMENT CONTROL BMP INSTALLATION TO BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONTOURS IDENTIFIED IN FIELD DURING VARIOUS PHASES OF THE PROJECT.

APPROVALS

- SCOTT WILLIAMSON OF SCRO PADEP APPROVAL OF THE CHAPTER 102 AND 105 MINOR MODIFICATION VIA LETTER DATED 5/1/20 (SEE REVISION 3)

REVISION 4 ONLY REDLINED FOR REVIEW PURPOSES

0 50 100
SCALE IN FEET

TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	3/28/17	INCORPORATED THE SPECIAL CONDITIONS SET FORTH IN DEP'S CHAPTER 102 AND CHAPTER 105 PERMITS
2	RS	5/25/17	DRAWINGS PROVIDED TO FIELD
3	RS	1/14/18	REVISED 16" HDD AND ATWS ADDITION
4	RS	10/20/20	ADDED PROPOSED LOCATIONS FOR RELIEF WELLS

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER ROBERT F. SIMCIK PE084435-E

SUNOCO PIPELINE LP
PHILADELPHIA, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT CONSTRUCTION SPREAD 5

1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

LEBANON COUNTY CONSERVATION DISTRICT EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN SHEET 33 OF 69

DATE:	2/6/17
PROJECT NO.:	112C05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES-5.33
SHEET 5.33 OF 95

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.33 – REV 4.dwg PIT NIKKI.DILLA 1/26/2021 4:53:20 PM

ATTACHMENT 3
Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)

TETRA TECH

Memorandum

Prepared by:	Stephen A. Compton, Senior Program Director, Tetra Tech, Inc.
Prepared for:	Energy Transfer
cc:	Brad Schaeffer, Project Manager, Tetra Tech, Inc.
Date:	January 27, 2021
Subject:	Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)

SUPPLEMENTAL ALTERNATIVES ANALYSIS
North Zinns Mill Road Crossing
SPLP HDD-S3-0101-16

Original Project-Wide Alternatives Analysis – Original Proposed "Reduced Length" HDD

As part of the 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. The baseline route provided for the pipeline construction was to cross every wetland and stream on the project by open cut construction procedures. The Alternatives Analysis submitted to PADEP conceptually analyzed the potential feasibility of any alternative to baseline route trenched resource crossings (e.g., reroute, conventional bore, HDD). The decision-making processes for selection of the HDD instead of an open cut crossing methodology is discussed thoroughly in the submitted alternatives analysis and was an important part of the overall PADEP approval of HDD plans as originally permitted.

The original proposed 16-inch-diameter HDD (HDD-S3-0101-16) mirrored the original proposed and installed 20-inch-diameter HDD (HDD-S3-0101-20), both located in West Cornwall Township, Lebanon County, Pennsylvania. The original proposed 16-inch-diameter HDD was designed with a horizontal length of 1,180 feet, entry/exit angle of 12-14 degrees, maximum depth of cover of 90 feet, depth below Snitz Creek of 8 feet, and pipe design radius of 1,600 feet. The original HDD (from west to east) began at the western exit site located approximately 144 feet to the west of North Zinns Mill Road, traversed (in addition to numerous buried and overhead utilities) beneath North Zinns Mill Road, residential lands and associated infrastructure, North Cornwall Road, and Snitz Creek (Stream A17) and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway, and terminated at the eastern entry site located approximately 247 feet east of the centerline of Snitz Creek; the eastern entry site workspace also encompassed palustrine emergent (PEM) Wetland A13.

Accordingly, the original proposed HDD comprised a "reduced length" (1,180 feet) HDD alternative compared to the currently proposed HDD (3,050 feet), as further discussed below. Due to inadvertent returns (IRs) that occurred during the installation of the 20-inch-diameter HDD, this "reduced length" 16-inch-diameter HDD plan was re-evaluated in accordance with Condition No. 3 of the Stipulated Order issued under Environmental Hearing Board Docket No. 2017-009-L, and thereby revised with an "increased length" to avoid or minimize the potential for future IRs. As a result, the "reduced length" HDD alternative was eliminated from further consideration and replaced with the proposed re-evaluated and "increased length" HDD.

Proposed (Reevaluated or "Increased Length") HDD

The re-evaluated ("Increased Length") 16-inch-diameter HDD was presented in the Horizontal Directional Drill Analysis (or "Reevaluation Report") for HDD-S3-0101-16 submitted to the Department on February 4, 2019. This re-evaluated 16-inch-diameter HDD has been further revised based on supplemental filings, including additional information presented herein, including relocation of the entry and exits sites and lengthening of the HDD to include crossing of Route 72/Quentin Road (for which an open cut crossing is not allowed) and to accommodate adequate open space for the longer pull back string. As part of this redesign, SPLP has considered and adopted a

TETRA TECH
301 Ellicott Street, Buffalo, New York 14203
Tel 716.849.9419 Fax 716.849.9420 tetratech.com

number of additional mitigation measures to further avoid or minimize the potential for IRs (see Analysis of Potential Mitigation Measures in this Restart Report). These mitigation measures include, but are not limited to, relocation of the of the entry and exit sites; increasing the length (by 1,870 feet), entry/exit angle (from 12-14 up to 16 degrees), depth of cover along the bore path (by 47 feet at maximum depth), and depth of cover beneath Snitz Creek (by 107 feet) and its associated floodplain. Specifically, as currently proposed, the re-evaluated HDD is designed with a horizontal length of 3,050 feet, entry/exit angle of 8-16 degrees, maximum depth of cover of 137 feet, depth below Snitz Creek of 115 feet, and pipe design radius of 2,000 feet. The currently proposed HDD (from west to east) begins at the western exit site was located approximately 231 feet west of North Zinns Mill Road, traverses (in addition to numerous buried and overhead utilities) beneath North Zinns Mill Road, residential lands and associated infrastructure, North Cornwall Road, Snitz Creek (Stream A17) and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway, PEM Wetland A13, Route 72/Quentin Road, and additional residences and associated infrastructure, and terminates at the eastern entry site in an open field located approximately 1,262 feet east of Route 72/Quentin Road.

SPLP presented an overall alternatives analysis of HDD-S3-0101-16 in its Reevaluation Report submitted to the Department on February 4, 2019. As presented therein, as required by the Order, the reanalysis of HDD S3-0101-16 included an evaluation of open cut alternatives and a re-route analysis. In addition, as requested by the Department, SPLP presented additional alternatives analyses in its Letter Response to DEP Response (Information Request) to Hydrogeological HDD Re-Evaluation Report, dated August 29, 2019. As described in this submittal, SPLP evaluated Flexbor and Direct Pipe Bore, as well as conventional auger bore, alternatives along the HDD alignment. Based on the analyses of each of these alternative analyses, SPLP confirmed the conclusions reached in the previously submitted Alternatives Analysis that completion of the HDD construction method – which is anticipated to require three (3) weeks to complete from restart of drilling – will cause the least amount of direct impact to the environment and remains the best option for this location.

As further requested by the Department, the following presents a summary of previous, as well as supplemental, analyses of alternatives to the currently proposed HDD-S3-0101-16.

Open Cut – Entire HDD Alignment and Snitz Creek Crossing

As presented in its submittal to the Department dated February 4, 2019, SPLP evaluated the use of the open cut construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment described above. SPLP specifications require a minimum of 48-inches of cover over the installed pipelines, and the Pennsylvania Department of Transportation (PADOT) requires 60-inches of cover under public roadways.

Although an open cut installation of the pipeline is potentially technically feasible along portions of the HDD alignment, several important factors result in use of this method being either not technically feasible or not practicable regarding logistics and existing technology.

Use of the open cut construction method to cross Route 72/Quentin Road is not allowed by PADOT and thereby requires a trenchless crossing. Therefore, use of this method across the entire length of the HDD alignment is not technically feasible. The following discussion addresses the potential use of the open cut construction method across the remainder of the HDD alignment.

The logistics associated with this method would significantly increase the length of time the affected properties would be subject to construction disturbance and would directly affect adjacent residential home sites due to the workspace requirements to accommodate the open trench method while constructing between two existing in-service pipelines.

The HDD alignment crosses one (1) minor perennial stream crossing (Snitz Creek, Stream A17) and one (1) PEM wetland (Wetland A13). Although this stream is not listed as high quality or exceptional value, use of the open cut construction method would result in a direct increase in the physical disturbance to Wetland A13 as well as Snitz Creek and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway. Open cut impacts to these resources would be minimal but would require modification of the state and federal permits. In addition, an open cut crossing would require the temporary and permanent clearing of forested riparian buffer areas on each side of

Snitz Creek and within its associated floodplains, and upland forested areas and potentially individual trees immediately adjacent to residential properties.

Furthermore, any produced groundwater in the open excavations would be pumped to a discharge filtration structure. The current feasible filtration ability, however, does not exceed 50 microns. Therefore, cloudy water (from suspended fine clay and silt particles) would be discharged downstream regardless of all control methods employed for the entire duration of the use of open cut construction techniques.

Moreover, based on additional experience and observations gained via the completed installation of the 20-inch-diameter HDD, construction activities for 16-inch-diameter HDDs, IRs, and supplemental geotechnical investigations, an open cut construction method crossing of Snitz Creek (Stream A17) would likely not be technically feasible. Specifically, due to the presence of a shallow groundwater table associated with this perennial stream, a dry open cut excavation through Snitz Creek would be extremely difficult to maintain, requiring a robust groundwater management system including constant pumping of groundwater from the excavated trench, conveyance around the construction area, filtration (as discussed above), and discharge. Due to the volume of groundwater anticipated, it is likely that establishing and maintaining dry trench conditions would not be technically feasible.

Based on this analysis, use of the open cut construction method, either along the currently proposed 3,050-foot-long HDD alignment or only across Snitz Creek, is likely not technically feasible, and therefore is eliminated from further consideration.

Conventional Auger Bore – Entire HDD Alignment

As presented in its submittal to the Department dated February 4, 2019, SPLP evaluated the use of the conventional auger bore construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment described above. A conventional auger bore is generally limited to 200 linear feet at a time, varying by the underlying substrate. Due to the spacing of constraints at the HDD location and changes in elevation at the resources to be bored beneath, there are no subset of locations within this length of area to feasibly employ this type of installation method. Therefore, use of the conventional auger bore method along the entire HDD alignment is eliminated from further consideration.

Conventional Auger Bore – Snitz Creek

SPLP considered the use of the conventional auger bore construction method to install the 16-inch-diameter pipeline at the crossing of Snitz Creek (Stream A17) and determined it is likely not technically feasible solely due to the shallow groundwater table, and furthermore several important factors result in use of this method being not technically feasible regarding logistics and existing technology, as discussed below.

First, use of the conventional auger bore construction method requires the excavation, stabilization, maintenance, and safe use of bore pits on both sides of the crossing for the duration of the construction process. Due to the shallow groundwater table at Snitz Creek, the bore pits should be setback a minimum of 50 feet from the top of banks of Snitz Creek to minimize the potential for groundwater intrusion. However, this or greater setback distances still would place the bore pits within the floodplain of Snitz Creek. Groundwater intrusion into bore pits not only requires extensive management (pumping, conveyance, filtering, discharge) for the duration of the construction process, but moreover presents significant safety concerns for construction equipment, materials, and personnel, working in saturated and unstable soil conditions. Despite a 50-foot setback, it is likely bore pits would experience extensive groundwater intrusion, resulting in suboptimal (at the least) bore pit conditions.

Second, potentially available workspace on the west side of the Snitz Creek crossing area is very constrained with a maximum of approximately 115 feet between the eastern edge of North Cornwall Road and the western top of bank of Snitz Creek. Assuming the best case scenario use of a typical exit bore pit (instead of the larger entry bore pit) in this area (to support conventional auger bore crossings of both North Cornwall Road and Snitz Creek), such an exit bore pit would be a minimum of 56 feet long, setback from the road by a minimum of 50 feet, and setback from Snitz Creek by 50 feet to maximize potential of avoiding its shallow groundwater table; thereby requiring a typical minimum total of approximately 156 feet. Therefore, available workspace is not available to accommodate the typical minimum conventional auger bore construction method setup, even assuming use of the

smaller exit bore pit, between North Cornwall Road and Snitz Creek, such that use of this method is not technically feasible.

Finally, use of the conventional auger bore construction method requires the excavation, stabilization, maintenance, and safe use of bore pits on both sides of the crossing for the duration of the construction process. In addition, SPLP specifications require a minimum of 60-inches (5 feet) of cover over the installed pipeline beneath streams. Assuming flat topography across the crossing profile including the stream, the bore pit depth is a minimum of 8 feet given the base of the boring machine sits approximately 3 feet below the auger. In practice, bore pit depths are deeper to accommodate typical undulating topography and the degree to which the stream bed is incised across the crossing profile, with typical bore pit depths on the order of 10 to 12 feet. However, based on the existing topographic rise from the Snitz Creek stream bed west toward North Cornwall Road, and the highly incised profile of the Snitz Creek banks and stream bed, use of the minimum conventional auger exit bore pit lengths and setbacks (see above) would result in the west exit pit being a minimum of 15 – 20 feet (east – west faces) deep, thereby presenting significant safety concerns for construction equipment, materials, and personnel, as pit walls would require extensive and engineered shoring and diligent monitoring to prevent failure or collapse during the lengthy boring process. These safety concerns are exacerbated by the presence of a shallow groundwater table at Snitz Creek as discussed above. In addition, the shallow groundwater table also presents a substantive risk of collapse of the stream bed along the bore path.

In addition, conventional auger bore crossings of Snitz Creek and North Cornwall Road would also require the temporary and permanent clearing of forested riparian buffer areas on each side of Snitz Creek and within its associated floodplain, and upland forested areas and potentially individual trees adjacent to residential properties. As a result, the conventional auger bore method is not the most practicable alternative that results in the least impact on wetlands, waterbodies, and other environmental resources at this location.

Based on this analysis, use of the conventional auger bore construction method to cross Snitz Creek is not technically feasible, and therefore is eliminated from further consideration.

Combination Open Cut-Conventional Auger Bore

As discussed above, use of either the open cut or conventional auger bore construction methods to cross Snitz Creek is considered not technically feasible. Therefore, use of a combination of open cut and conventional auger bore construction methods along the currently proposed 3,050-foot-long HDD alignment, including the crossing of Snitz Creek, is eliminated from further consideration.

Direct Pipe Bore – Entire HDD Alignment

As presented in its submittal to the Department dated August 29, 2019, SPLP evaluated the use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment (due to, but not limited to, the requirement to cross Route 72/Quentin Road by trenchless construction method) described above. 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 annular 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 feet in extent on the Mariner II East Project. However, the length of the Snitz Creek/North Zinns Mill Road HDD is 3,050 ft, which exceeds the limits of Direct Pipe Bore technology. Therefore, use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline along entire length of the currently proposed 3,050-foot-long HDD alignment is not technically feasible, and therefore has been eliminated from further consideration.

Direct Pipe Bore – Reduced Length Alignment

As presented in its submittal to the Department dated August 29, 2019, SPLP evaluated the use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline for shorter lengths along the currently proposed 3,050-foot-long HDD alignment described above. However, due to the presence of surface developments, multiple adjacent utility lines, natural resources, and variation in surface elevations, there are no feasible entry-exit points at the crossing of Snitz Creek to employ this technology, including use of the Direct Pipe Bore construction method along the original proposed 1,180-foot-long, 16-inch-diameter HDD alignment described above. This construction method could be employed to avoid surface impacts in the residential area west of Snitz Creek; however, that would then require use of the open cut or conventional auger bore construction methods to cross Snitz Creek and the adjacent lands. As discussed above, use of either the open cut or conventional auger bore construction methods to cross Snitz Creek is considered not technically feasible. Therefore, the use of Direct Pipe Bore construction method for reduced length alignments, either including a Direct Pipe Bore crossing of Snitz Creek or alternatively incorporating open cut or conventional auger bore crossings of Snitz Creek, have been eliminated from further consideration.

Conclusion

Based on the analysis of all alternative construction methods discussed above, SPLP concluded the HDD construction method remains the best option for this location.

Specifically, the completion of the 3,050-foot-long, 16-inch-diameter HDD is technically feasible and the most practicable of the alternatives considered and discussed above for several important reasons. The re-evaluation, re-design, and previously and additionally proposed mitigation measures (including but not limited to relief wells, real-time tracking of fluid volumes, proactive dam-and-flume stream containment) will minimize the likelihood of further IRs and IR occurrences outside of containment so as to adequately protect public health, safety, and the environment. In addition, completion of this HDD construction method is anticipated to require three (3) weeks upon restart of drilling, whereas all other alternatives (detailed design, easement acquisition, and major modification permitting processes aside) would essentially start from scratch and require from 3 to 7 months to construct; thus completion of the HDD minimizes the duration of construction activities, including in proximity to residential properties. This method also results in the least direct surface impacts to wetlands, waterbodies, and other environmental resources (i.e., floodplains, riparian buffers, forests, residential areas), and avoids significant impacts on environmental and human environment resources. Therefore, completion of the HDD is considered the most practicable alternative that also results in the least impact on aquatic, other environmental, and human environment resources, and thereby is selected by SPLP as the preferred alternative.

ATTACHMENT 4
Sunoco Zinn's Mill Road Single Pass Reaming Discussion

MICHELS®

Sunoco (ETC)
Zinns Mill Road Crossing
16-inch Steel Pipe
Advantages of Single Pass Reaming and Reaming Direction Explanation

Explanation and Advantages of a Single Ream Pass

Michels HDD drilling rigs and ancillary equipment are the premier drill rigs in the HDD industry with optimum and superior capabilities. Working in tandem with the rigs and ancillary equipment, Michels utilizes hole openers (26" in this circumstance) designed to take full advantage of such capabilities. Michels has successfully performed hundreds of 26" and larger ream passes immediately following a minimum pilot hole size of 9 7/8" diameter with no evidence of additional HDD or environmental risk. In fact, past experience has shown to Michels that typically performing one larger, single ream pass reduces IR and environmental risk.

Michels began using a 27" hole opener as the first ream pass in rock formations on larger diameter HDD's 19 years ago. Working with the manufacturers, a 27" hole opener, designed to follow a minimum 9 7/8" pilot has been commercially available to the entire HDD maxi-rig market since early 2003. Taking advantage of technology and equipment capabilities, that initial ream pass from a pilot hole, in rock, has increased to 30" in 2006, and to a 34" ream pass over 10 years ago in larger product installations. Approximately 6 years ago, again taking full advantage of increased equipment capabilities and technologies, the maxi-rig market has actually began using a 36" initial ream pass in rock formation, where warranted, following a minimum 10 5/8" pilot hole. When reaming unconsolidated soil formations, Michels has regularly performed an initial 54" ream pass from the 12 1/4" pilot for the installation of 42" steel product pipe and has typically had appropriate drilling fluid returns to the entry/exit pits.

Some of the reasons and advantages of performing a single 26" ream pass in comparison to a series of individual passes include:

1. Larger annulus for easing fluid and cuttings flow and reduced annular pressure. This requires adequately sized equipment to introduce the correct amount of drilling fluid to match the ROP (rate of penetration) and clean the hole properly. Michels has the capabilities of cleaning and pumping upwards of 750 gpm. Michels more recent fluid systems are based on 1500 gpm however both rigs on the Zinns Mill Road crossing location have 1000 gpm capacity systems although we are targeting a 750 gpm pump rate.

2. More robust tooling with larger bearings in the cutters, reducing downhole failure and unnecessary drilling and circulating times to replace tooling. In the formation encountered on the Zinns Mill crossing, if a piece of a reamer were to break off, as in a lost cutter, retrieving the broken part would likely prove difficult, if not impossible, leading to a redrill of some, or possibly all of the crossing from the pilot phase.

3. A reamed hole that closely resembles the geometry of the pilot hole (multiple passes have shown to deviate from the original pilot hole with the reamer "walking" or "keyholing" around the harder formations following softer seams). The soil formations encountered on the Zinns Mill Road HDD have been very inconsistent and suggests wandering would occur, performing multiple ream passes, likely causing difficulties installing or damage to the product pipe.

4. Pilot hole annulus in front of the hole opener is smaller (12 1/4”) in comparison to the 7 5/8” drill stem, which would be more likely to restrict fluid flow in front of reamer and keep majority of fluid returns behind the reamer to entry/exit pit, or in this case the relief well.

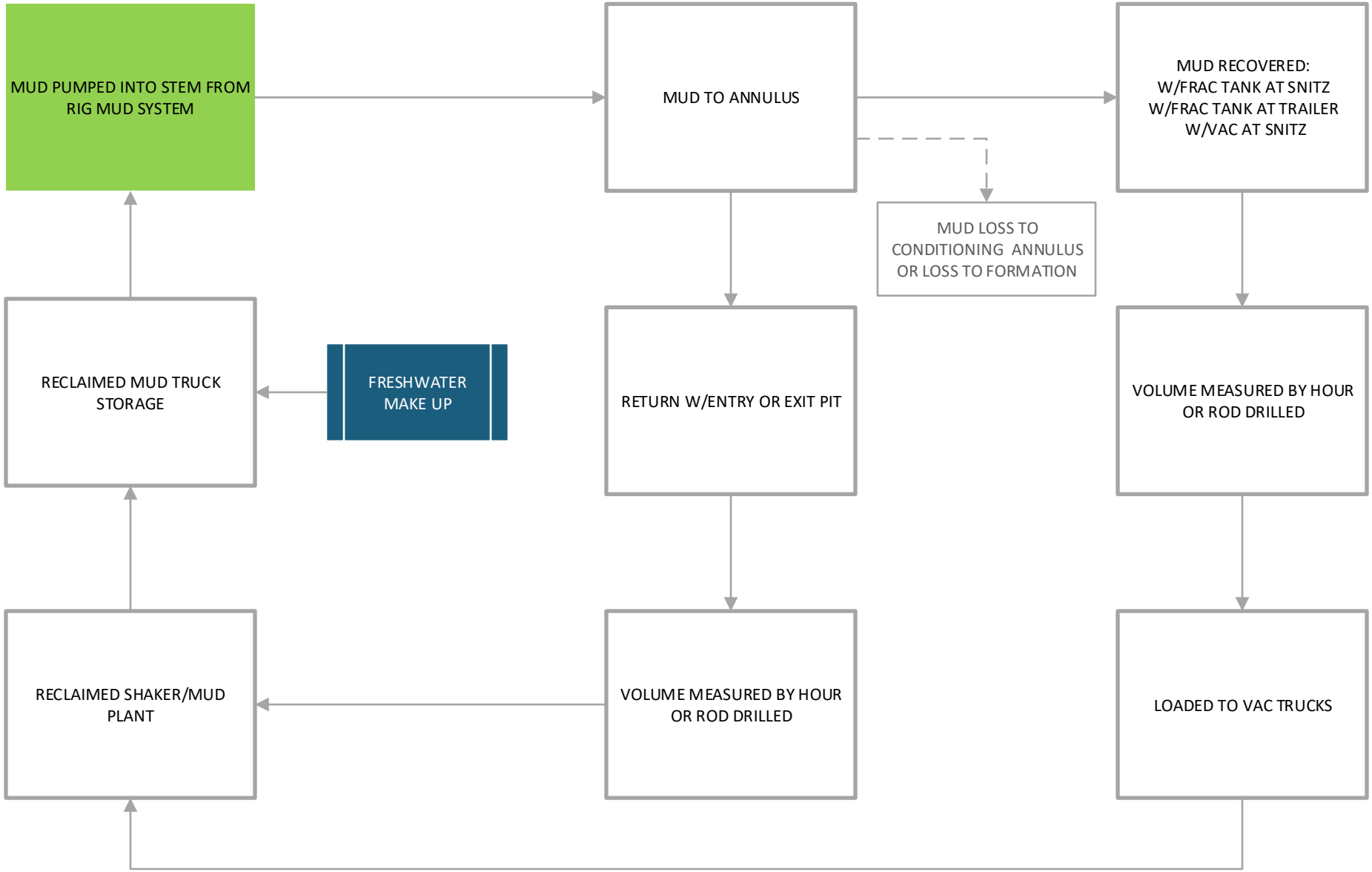
5. 52 crossings were successfully completed by Michels on the Sunoco Mariner East II project with medium to maxi rig sized equipment and successfully utilized a single ream pass. 7 crossings performed by Michels on the project utilized a stepped or multiple ream pass approach due to the use of smaller drilling equipment and a 7 1/2” or smaller pilot hole. Michels drilled a 12-1/4” pilot hole at Zinns Mill Road and is utilizing 2 maxi-rigs, so a single ream pass would follow the standard proven single ream pass procedure. In addition, Michels has successfully completed hundreds of crossings across the world using a 26” or larger initial ream pass.

In conclusion, with the experience and knowledge that Michels has gained on this subject over the past 32 years lessons learned have shown that the “Best Management Practice” of performing a larger initial ream pass is advantageous. The single ream pass is simply a better methodology when the right HDD equipment and tooling is used, within the constraints of such equipment, along with proper drilling fluid flow rates and rates of penetration. The larger annulus of the reamed hole generally keeps drilling fluid returns flowing to the entry/exit returns pits to proactively minimize and avoid most environmental and constructability concerns.

Michels proposes to continue the 26” ream pass direction from east to west. The logic for this decision is taking into the consideration the reamed hole elevation (elev. ~382’) at approximate station 11+33 on the drawing in relation to the proper placement of the proposed relief wells. The proposed relief wells intend to intersect the bore path at approximate stations of 9+75 (elev. 402’), 11+00 (elev. 386’) and 11+60 (elev. 380). The low point of the crossing is elevation ~365’. The current end of the 441’ of 26” reamed hole from the west end (exit side) at station ~26+16 is elevation ~434’. Based on experience, Michels is confident that returns flows would be recovered from the cluster of proposed relief wells for the remaining 1483’ to be reamed. Michels is also confident the 3 existing reliefs wells from the pilot hole stage, along with the 4th proposed relief wells near the 3rd previously installed well would reactivate and act as a contingency plan prior to fluid surfacing in an undesirable location.

ATTACHMENT 5
Mud Flow Diagram

MUD FLOW DIAGRAM
JANUARY 22, 2021

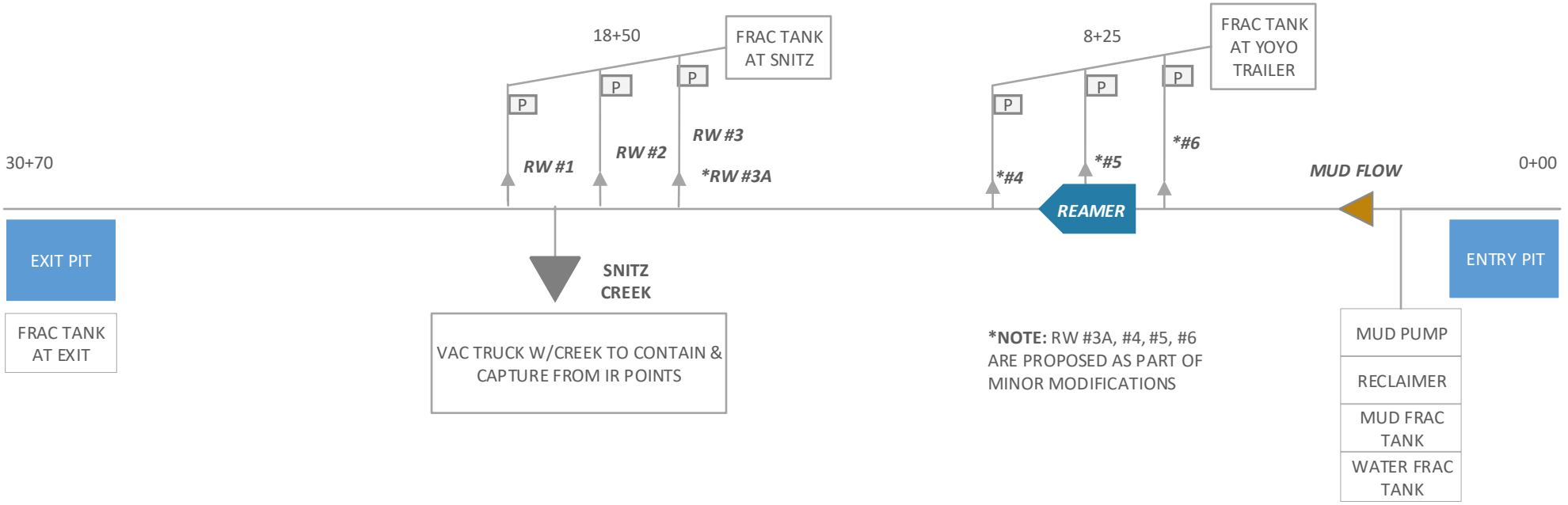


MUD FLOW DIAGRAM
JANUARY 22, 2021

WEST PIT
RIG PULL REAM

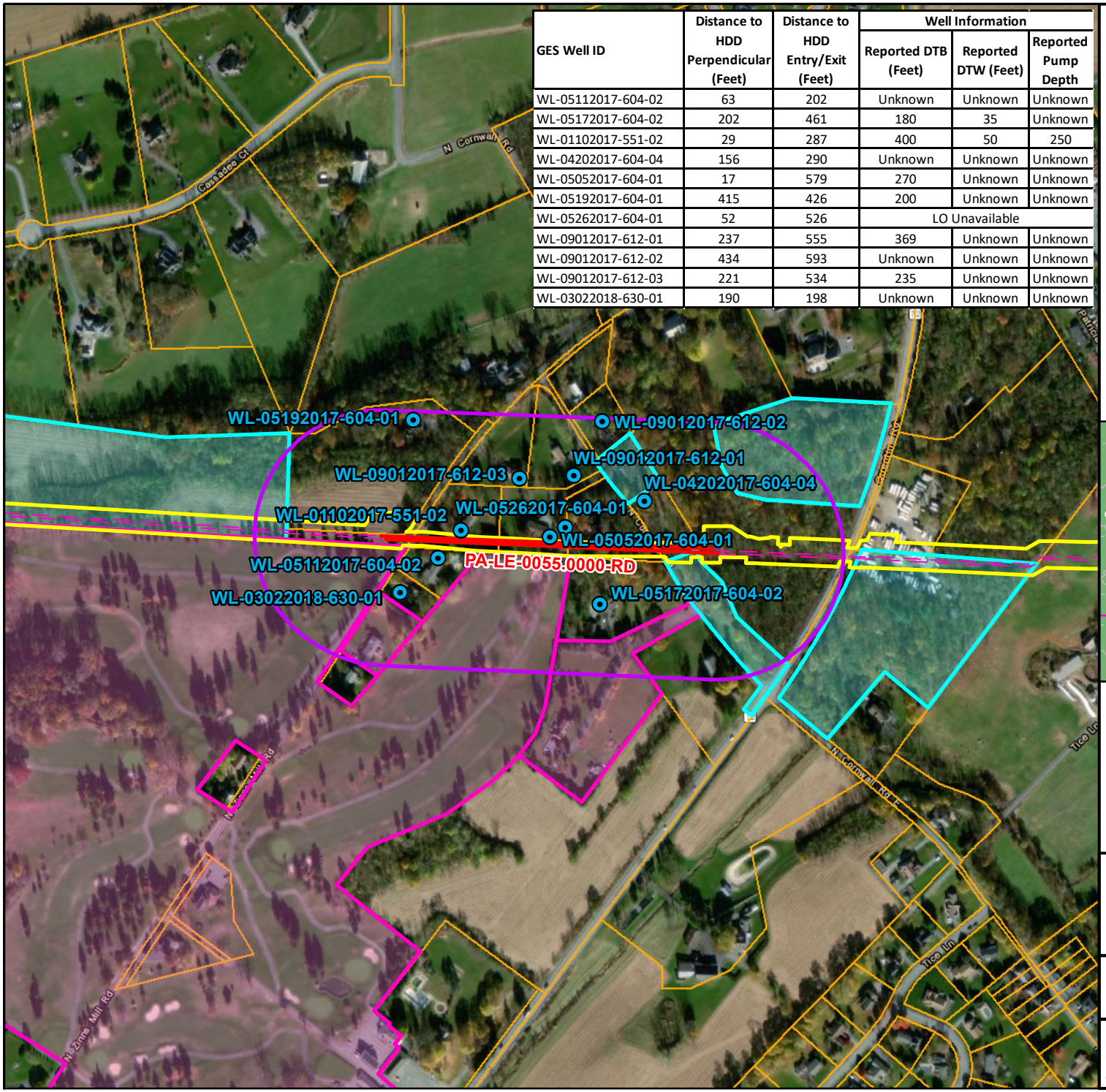
EAST PIT
RIG PUSH REAM

APPROXIMATELY
3,070LF



***NOTE:** RW #3A, #4, #5, #6 ARE PROPOSED AS PART OF MINOR MODIFICATIONS

ATTACHMENT 6
Residential Well Location (within 450') - Map



GES Well ID	Distance to HDD Perpendicular (Feet)	Distance to HDD Entry/Exit (Feet)	Well Information		
			Reported DTB (Feet)	Reported DTW (Feet)	Reported Pump Depth
WL-05112017-604-02	63	202	Unknown	Unknown	Unknown
WL-05172017-604-02	202	461	180	35	Unknown
WL-01102017-551-02	29	287	400	50	250
WL-04202017-604-04	156	290	Unknown	Unknown	Unknown
WL-05052017-604-01	17	579	270	Unknown	Unknown
WL-05192017-604-01	415	426	200	Unknown	Unknown
WL-05262017-604-01	52	526	LO Unavailable		
WL-09012017-612-01	237	555	369	Unknown	Unknown
WL-09012017-612-02	434	593	Unknown	Unknown	Unknown
WL-09012017-612-03	221	534	235	Unknown	Unknown
WL-03022018-630-01	190	198	Unknown	Unknown	Unknown

Legend

- LOD
- Parcel
- PPP Centerline
- HDD
- 450 foot buffer of HDD alignment
- Public Water Supply/Landowner Confirmed No Well
- Testing Refused

****Testing locations current as of 08/20/2018**

- GES Testing Location

Location

0 250 500 Feet

Well Location Map
HDD# PA-LE-0055.0000-RD
Lebanon County, PA.

Prepared By: TETRA TECH

Date: 1/27/2021

Base Map;
ESRI World Imagery, 09/24/2015

Coordinate System: NAD 83 Stateplane, PA South, Feet

P:\GIS\projects\T2\0\0938-PPP\MXD\WellLocations\PA_WellLocations\ThursdayWellLocation_PA_LE_0055_0000_RR.mxd LN

RETTEW
We answer to you.
3020 Columbia Avenue, Lancaster, PA 17603 Phone: (800) 738-8395
E-mail: rettew@rettew.com ● Web site: rettew.com

MEMORANDUM

TO: Nicholas Bryan, PLS, Energy Transfer (ET)

FROM: David Reusswig, PG and David Anderson, PG, RETTEW

CC: Matt Bruckner, PG, RETTEW

DATE: January 28, 2021, **Revised February 5, 2021**

PROJECT NAME: Sunoco Pipeline LP Mariner East 2 Pennslyvania Pipeline - Spread 5 **PROJECT NO.:** 096302010

SUBJECT: Restart Report – S3-0101-16 / North Zinn's Mill Road HDD, West Cornwall Township, Lebanon County, PA

Introduction and Background

This restart report presents site details and an evaluation of the inadvertent return (IR) that occurred during efforts to advance the 26-inch diameter reamer from the east end of Sunoco Pipeline LP's (SPLP) S3-0101-16, North Zinn's Mill Road horizontal directional drill (HDD) on October 19, 2020 in West Cornwall Township, Lebanon County, Pennsylvania. This report includes an updated timeline of site activity that has occurred since the Pennsylvania Department of Environmental Protection (PA DEP) approved the restart of drilling on September 23, 2020.

Pilot drilling for the 16-inch pipe was initiated from the east end of the profile on May 20, 2020, and from the west end of the profile on July 29, 2020. Drilling activities have been conducted by Michels Corporation (Michels). On August 31, 2020, two IRs occurred outside of established containment within Snitz Creek (S-A17). Following restart at the west drilling rig on September 23, 2020, an IR occurred within Snitz Creek (S-A17) just outside of the expanded containment. The containment was further expanded to capture the September 23rd IR location and drilling was halted at the east drilling rig. Drilling at the east drilling rig resumed with recirculation conducted within the further expanded permitted containment structure and the pilot hole was completed on October 5, 2020. The 26-inch reaming phase was initiated by Michels on October 6, 2020. Following the IRs on October 19, 2020, both drilling rigs at the site were shut down and are currently awaiting PA DEP restart approval following approval of this report. Currently, approximately 441 feet of 26-inch reaming has been completed from the west, and approximately 1,133 feet of 26-inch reaming has been completed from the east, for a total of 1,574 feet of 26-inch reaming completed to date. The total length of the HDD is 3,057 feet and there are 1,483 feet remaining to complete the 26-inch ream.

Overview of the HDD Activities

The following is a summary and discussion of drilling activity and other events which occurred during the HDD activities for the 16-inch pipe since September 23, 2020:

- **September 23, 2020:** Michels resumed drilling operations from the west entry pad following PA DEP approval of the restart addendum submitted on September 21, 2020. Approximately 17 feet of drilling had been completed, to a trajectory length of approximately 1,381 feet, when an IR occurred within Snitz Creek (S-A17) just outside of containment in place at the time. The new September 23rd IR location was at (N40.290110°, W76.427301°), which was within the permitted extent of the containment structures within Snitz Creek. Accordingly, to contain the IR, Precision Pipeline, LLC (Precision) extended the

approved containment structures within Snitz Creek to their permitted extents within the pipeline right-of-way (ROW). Operations continued after extension of the containment structures for a short time, with the west drilling rig completing another 14 feet of drilling for the day. At that point, SPLP shut down operations at the west drilling rig. The east drilling rig had also resumed operations this day following extension of the containment structures and completed approximately 32 feet of drilling for the day.

- **September 24, 2020:** The east drilling rig completed approximately 95 additional feet of pilot hole drilling for a total trajectory length of 1,463.54 feet from the east end. Reactivation of drilling fluids occurred at the permitted containment structures and the relief well near Route 72, but no additional IRs occurred. SPLP shut down operations at the east drilling rig pending submittal of a restart report and approval to restart the west drilling rig.
- **September 25, 2020:** Michels drilling on the east and west entry pads remained on standby awaiting PA DEP approval following the September 23, 2020 IR to advance the pilot hole. Michels injected 39 cubic yards of pressure grout downhole. Michels tripped out the grout piping.
- **September 26, 2020:** Michels tripped in 47 rods on the east side, lost circulation on Rod #47, and then tripped out all the rods.
- **September 28, 2020:** Sunoco/ETP submitted a restart report to the PA DEP for the September 23, 2020 IR. Michels injected 40 cubic yards of pressure grout downhole on the east side, then tripped out the grout piping, and then tripped in the drilling rods to the grout in preparation for drilling out the grout.
- **September 29, 2020:** Michels completed trip-in on the east side with no returns. The sensor was determined to be off-alignment approximately 4 degrees. HDD crew remained on standby.
- **September 30, 2020:** Sunoco/ETP received restart approval from PA DEP. Michels received approval to trip out drilling pipe and trip in grout pipe for grouting on 10/1/2020.
- **October 1, 2020:** Michels Injected 18.3 cubic yards of pressure grout, then tripped out the grout pipes and added the downhole assembly to the rig.
- **October 2, 2020:** Michels tripped rods back into the bedrock face and drilled 63.64 feet of new bedrock to a total trajectory of 1,527.18 feet from the east end.
- **October 3, 2020:** Michels continued drilling the pilot hole. Michels completed drilling Rods #50-54 for 160.9 feet for the day and a total trajectory length of 1,688.17 feet from the east end.
- **October 5, 2020:** Michels completed the intersection of the east and west pilot holes and the pilot hole was completed.
- **October 6, 2020:** Michels started the 26-inch ream from west to east.
- **October 9, 2020:** Michels continued the 26-inch ream from west to east and reached a trajectory length of 441 feet from west to east.
- **October 10, 2020:** Michels moved the reamer to the east entry and began reaming from east to west. Michels completed 4 rods of reaming for a total trajectory length of 125.92 feet from the east end.
- **October 12-17, 2020:** Michels continued the 26-inch ream for a total trajectory length of 1,007.74 feet from the east end.
- **October 19, 2020:** Michels continued the 26-inch reaming from east to west. An IR (approximately 150-200 gallons) occurred in Snitz Creek outside of the permitted containment BMP. The IR consisted of 20 separate and isolated discharge points within an approximately 75-foot long span within the creek starting from the southernmost discharge point located directly underneath the Route 72 bridge (STATION 12303+52; N40°17’21.51202”, W-76°25’35.17628”) to the northernmost discharge point located downstream approximately 75 feet from the Route 72 bridge (STATION 12302+00; N40°17’22.26161”,

W-76°25'36.44426"). At the time of the IR, the reaming bit was located approximately 1,133 feet from the east end and at an approximate depth of 120 feet below ground surface. Michels immediately ceased HDD operations and Precision constructed temporary containments around the discharge locations within Snitz Creek. Michels has remained on standby since the 10/19/2020 IR awaiting PA DEP approval of this restart report.

Current Conditions Report

There has been no drilling activity at this HDD site since October 19, 2020. Copies of the most recent IR reports, prepared by Tetra Tech, have been submitted to the PA DEP. A copy of the most recent Current Conditions Report, prepared by Tetra Tech, will be submitted separately.

Analysis of Cause of IR and Assessment of Strata Where IR Occurred

The bedrock underlying the site consists of the Cambrian-age Snitz Creek Formation. Geyer and Wilshusen (1982) describe this formation as a gray, medium to coarsely crystalline oolitic dolomite with limestone, sandstone, and shale interbeds. This formation is well bedded and thick to massive. Fracturing consists of joints which have a blocky pattern. The joints are moderately well developed, moderately to highly abundant, are regularly spaced with a moderate distance between fractures, and are open and steeply dipping. The Snitz Creek Formation is moderately resistant to weathering; slightly to moderately weathered to a shallow depth; irregularly shaped; and the interface between bedrock and mantle is characterized by pinnacles in most places. This carbonate (karst) formation has good subsurface drainage but little surface drainage. The porosity of the weathered portion of this formation is of moderate to high magnitude, resulting in moderate to high permeability. The ease of excavation (and drilling) is classified as generally easy (fast) in the limestone but is somewhat more difficult (slowed) in the dolomite due to the presence of numerous sandstone interbeds.

Groundwater movement within these rocks is primarily through a network of interconnected secondary openings (e.g., fractures, joints, and faults) that were developed by external forces following deposition of the beds. Geotechnical rock core observations confirm that the local bedrock ranges from fractured and very broken to massive interbedded dolomite, limestone, and shale comprised of well-developed thick to massive steeply dipping joint and bedding planes. Importantly, solutioning of these structural features observed during the geotechnical investigations and HDD operations are indicative of a complex karst fracture system

The October 19, 2020 IR totaled approximately 150-200 gallons of diluted drilling fluid and occurred outside of containment within Snitz Creek (S-A17). The IR consisted of 20 isolated discharge locations within an area of Snitz Creek starting from directly underneath the Route 72 bridge to approximately 75 feet northwest of the Route 72 bridge. The northernmost discharge was located at N40° 17' 22.2161"; W-76° 25' 36.44426" at STATION 12302+00. The southernmost discharge was located at N40° 17' 21.51202"; W-76° 25' 35.17628" at STATION 12303+52. Prior to the IR occurring, recirculation of approximately 108,000 gallons of drilling fluid from within the containment was conducted at the August 17th, 2020 and the September 23, 2020 IR locations (see Revision 3 of the Erosion & Sedimentation Control & Site Restoration Plan). The IR occurred with the 26-inch reaming bit at approximately 1,133 feet from the east end of the HDD path and at a depth of approximately 120 feet.

Based on published geologic and hydrogeologic information, geotechnical borings, field observations and geophysical surveys, the October 19, 2020 IR appears to have resulted from a combination of the presence of secondary openings and relatively greater dissolution of bedrock along bedding planes, joints, faults, and fractures that are characteristic of karstic settings.

Depth and Alignment of the Drill Bit at the Time of the October 19, 2020 IR

Currently, the approximate depth of cover over the 26-inch reamed borehole at 1,133 feet from the east end and 441 feet from the west end is approximately 120 feet and 100 feet below ground surface, respectively, for a total trajectory length to date of 1,574 feet. The total length of the HDD is 3,057 feet and there are 1,483 feet remaining to complete the 26-inch ream.

Profile of the Drill Path as Constructed Overlain on the Permitted Profile

A plan of the drill path as constructed and overlain on the permitted profile is included as **Attachment 1.**

Analysis of Potential Mitigation Measures

Alternative considerations were evaluated and implemented as follows:

1. Alternative entry and/or exit points: As discussed in the HDD Revaluation Report - "Horizontal Directional Drill Analysis North Zinn's Mill Road Crossing" dated February 4, 2019 and approved by the PA DEP on May 1, 2020, the HDD entry/exit points were previously reevaluated and revised. The original profile for the HDD was redesigned to make the profile a total of 1,870 foot longer, such that the entry and exit points are in new locations.
2. Alternative entry and/or exit angles: As discussed in the February 4, 2019 HDD Revaluation Report, the entry and exit angles were previously increased from 12-14 degrees to 16 degrees, which allowed for a sharper and quicker entry into and exit out of competent rock.
3. Alternative profile depth: As discussed in the February 4, 2019 HDD Revaluation Report, the depth of cover was increased by 47 feet at the maximum depth. The revised profile radius is also 107 feet deeper below the crossing of Snitz Creek
4. Reduced drilling fluid pressures: Due to the presence of interconnected horizontal and vertical fractures and dissolution features in the karstic bedrock, SPLP will continue to monitor and minimize drilling fluid pressures to the maximum extent practicable to avoid over pressuring the borehole.
5. Thickened drill mud and/or the use of pre-approved LCMs: Michels has used and will continue to use LCMs as needed following IR and/or LOC events to help regain circulation and reduce the risk of IRs and LOC events.
6. The use of pre-approved loss-control materials (LCM): As specified in the Re-evaluation Report dated February 4, 2019 and approved by the PA DEP on May 1, 2020, Michels used LCMs to help regain circulation and reduce the risk of further IRs and LOC during the pilot phase. During the reaming limited use of LCM will be evaluated depending on downhole conditions and current fluid flow at the relief wells. There is a potential that LCMs may plug completely or reduce the effectiveness of the relief wells.
7. Borehole casing: The IR occurred at a boring length of approximately 1,133 feet and a depth of approximately 120 feet, which is beyond the point where casing could be installed at this site.
8. Relief wells: Three relief wells (1, 2 & 3) have been completed and are being utilized at the site. Two wells are located in close proximity to Snitz Creek (S-A17), see Revisions 9 & 10 of the Erosion & Sedimentation Control & Site Restoration Plan. The third relief well is located along the alignment, approximately 1,337 feet west of the east entry location (near Route 72). To address the 10/19/2020 IR, a cluster of three additional relief wells (4, 5 & 6) is proposed for the area around the current reamer location. These wells are to relieve the pressure in the bore hole. A fourth additional relief well (3A) is proposed adjacent to the existing relief well near Route 72. This well (3A) is to provide additional capacity at this location and allow for one well to be in

operation while the other well is cleaned. The locations of the relief wells are shown on the E&S sheets included in **Attachment 2**. Relief wells 4, 5 and 6 have been sited around the reamer location and will be directly over top of the HDD bore. These wells will be drilled into the bore hole and are intended to capture fluid at the point where the loss of circulation originated. Relief well 3A will be offset to the south from the HDD bore by approximately 5 feet. The offset is a required safety factor due to the proximity of the 20-inch pipeline at this location. All of the relief wells will be cased to within a few feet of the HDD bore. The relief well locations were selected based on results from existing relief wells and currently available information. Drilling fluid will be recovered from the relief wells by connecting a pump directly to the top of the well casing. The pumping rate will be adjusted based on the HDD rig fluid pumping rate and observations made in the field. Depending on field conditions, observations of fluid loss, and position of the reamer in the HDD bore, all the relief wells may not be in operation at any one time. As the proposed relief wells are installed and new information is collected as the drill progresses, additional relief well locations will be evaluated. Any relief wells installed would remain operational for the duration of the HDD installation. The relief wells would be plugged and abandon after completion of the HDD.

9. Conversion of the crossing type from HDD to other trenchless technologies and open-cut; and relocation of the pipeline that will minimize the likelihood of further IRs so as to adequately protect public health, safety, and the environment: An evaluation of alternative crossing types was conducted and alternative crossings were not feasible or practicable at this location as was discussed in the HDD Revaluation Report dated February 4, 2019 and approved by the PA DEP May 1, 2020. A supplemental alternatives analysis of crossing types for this location was prepared by Tetra Tech and is included as **Attachment 3**.

10. Consideration should be given to installing a dam and flume stream containment as a proactive measure before the HDD is restarted. As such, SPLP has evaluated the installation of a dam and flume to isolate the section of Snitz Creek where previous inadvertent return events have occurred. Subsequently, SPLP submitted a Ch. 102 and Ch. 105 permit modification request on January 28, 2021, prepared by Tetra Tech, Inc., which proposes the installation of a corrugated pipe bypass to collect water flow upstream and discharge downstream of previous IR locations to enable the completion of the HDD while minimizing potential impacts to the creek. In addition, supplemental information was provided via email to the Department on February 5, 2021 which outlines site specific protocols to be followed in the event of an IR within the isolated stream section including notification(s), containment, cleanup, restoration and resumption

11. An evaluation of a stepped-ream approach using three HDD passes (pilot, intermediate, and final ream), as opposed to the two HDD passes (pilot and final ream) which is the method currently underway at this HDD location was completed by Michels Directional Crossings, and a summary of that evaluation is included as **Attachment 4**.

Drilling Tracking and Reporting

Upon the restart of HDD operations, the following procedure will be utilized to measure/calculate the drilling fluid used during active HDD operations on the shorter of 1-hour or 1-rod intervals. The qualified team of individuals responsible for tracking/reporting drilling fluid usage during the active HDD operations are as follows:

<u>Mud Engineer</u>

- Responsible for tracking drilling fluid usage (on a per rod or hourly basis, whichever comes first) and tracking any fluid recovered and transferred to the frac tanks for reuse/recirculation

- Responsible for completing the daily drilling fluid tracking report
- Responsible for communicating to the driller/drill foreman and to ET any BMP recommendations to restore full circulation, as appropriate, in the event of a LOC.

HDD Contractor Superintendent

- Responsible for overseeing and directing the drill crew on the ground. Will communicate directly with the driller and/or drill foreman and the Mud Engineer regarding specific drilling information for the purposes of determining LOC volumes. The drilling Superintendent will provide internal verbal notifications to the field team as needed.

Lead Environmental Inspector (LEI)

In addition to the responsibilities described in the IR PPC plan the LEI will have the following site-specific responsibilities:

- Continuously monitor Snitz Creek for reactivation of IRs and continuously inspect for new IRs
- Notify the ET field team via text message of any pertinent findings. This includes reactivation of IRs within Snitz Creek, occurrence of a new IR within or in the vicinity of Snitz Creek, or initiation of pumping from a relief well.

Chief Environmental Inspector (CEI)

- Responsible for lead supervision/direction of EI and LEI
- Responsible for assisting ET in the preparation of reports submitted to the PA DEP.

Professional Geologist (PG) and/or Lead PG

In addition to the responsibilities described in the IR PPC plan the PG will have the following site-specific responsibilities:

- Visual inspection and documentation of drilling fluid returns in the pit and notifying the Mud Engineer of any observed loss of returns in the pit
- Assist the Mud Engineer as needed in taking meter readings after the completion of each rod or after each hour (whichever comes first)
- Responsible for internal text message notification to the ET Team if a LOC threshold has been exceeded as determined by the Mud Engineer of if an IR occurs
- Preparation of the PG Daily Inspection Report and submission to ET.

ET Project Manager

- Responsible for overseeing/directing the construction team
- Reports updates to ET Project team.

Construction Manager

- Responsible for overseeing/directing field construction team
- Reports to ET Project Manager.

ET Environmental Project Manager

- Responsible for oversight/direction of Environmental Inspection team
- Responsible for daily submission of Daily Fluid Tracking report and PG Daily Inspection Reports to the PA DEP. These reports will be submitted by noon of the following day
- Responsible for submissions of Restart Reports, LOC Notifications, Loss Prevention Reports, and Landowner Notifications to the PA DEP as necessary.

The procedure for real time tracking of fluid volumes is as follows:

- The onsite Mud Engineer will work and communicate directly with the driller and drill foreman to obtain the necessary information to calculate the estimated the fluid usage immediately after each rod is drilled or after one hour.
- The Mud Engineer will record the estimated volume of drilling fluid used during the drilling of the 31-foot rod or during the last hour. If any of the containments or relief wells have been activated during this time and drilling fluid is being recovered from any of the containment BMPs or the relief wells, the driller will gauge the liquid levels in the frac tanks to determine the estimated volume of fluid recovered and notify the Mud Engineer so he can determine the net fluid loss.
  - The amount of fluid consumed will be calculated as follows:
    - Where:
      - Operational fluid use = Fluid added to mud plant – Fluid recovered
      - Fluid recovered = Total volume of fluid recovered at the relief wells, Snitz Creek recirculation BMP and the mud pit on the opposite end of bore from drilling rig
      - Hole volume estimate calculation:

$$\text{Hole volume} = \left((27.53 \frac{\text{gal}}{\text{ft}} * \text{X ft}) * 1.15 \right)$$

        - *27.53 gallons = per foot volume for a 26-inch diameter hole*
        - *X = length of boring completed in past hour or rod length*
        - *1.15 = 15 % allowance for conditioning the bore hole.*
- The fluid tracking worksheet will be submitted to the PA DEP daily via email.
- A flow diagram showing the fluid circulation at the site is included in **Attachment 5**.

Drilling Fluid Viscosity

The normal drilling fluid viscosity range is 140 to 160 (sec/qt). Based on downhole conditions, the fluid viscosity may be adjusted to achieve efficient cuttings removal. At sites where an influx of groundwater is impacting downhole fluid viscosity, a higher viscosity range is used. Fluid viscosity in the mud tank will vary based on current stage the plant operator is at in adjusting the viscosity. If the operator has just added more water, viscosity is low and if the operator just added bentonite, viscosity will be high. The operator is routinely checking viscosity and any individual sample may not represent the actual final target range of fluid pumped down hole. The PGs have been obtaining one or two viscosity readings a day from the operator. The variation in the readings reported on the Form Bs in the PG daily report indicate the viscosity at a single point in time and do not reflect the target range utilized during drilling. Going forward the PGs will consult, at the end of the day, with the drilling superintendent regarding the fluid viscosity and the viscosity range of the fluid used that day will be reported on the Form B.

Annular Pressure Monitoring

In HDD projects, annular pressure monitoring can be conducted during the pilot phase but is very rarely conducted during the ream phase. Industry experience from pressure monitoring during ream phases has been that little to no downhole pressure in excess of naturally occurring hydrostatic pressure is generated. The pressure monitors typically have required a wire connection. No wire connection with the drilling tools is used during the ream which was one of the reasons why monitoring is not typically performed during reaming. While wireless pressure monitors are now available, the wireless monitors are specifically designed for use during piloting, not during the reaming phase. Further, the currently available wireless monitors are not sturdy enough to sustain the impacts of normal drilling operations during the reaming phase. As a result, the lifespan of the wireless monitors is estimated to be as short as an hour during a normal reaming process. Based on industry experience, pressure monitoring during the Zinns Mill ream phase, using either a wired monitor (which is not possible), or a wireless monitor (which will not sustain the reaming process), is not available or otherwise expected to provide useful information, and therefore is not planned at this time.

Residential Water Supply Wells

As described in the "Water Supply Assessment, Preparedness, Prevention and Contingency Plan" (Plan), revised August 8, 2017, private water supplies within 450 feet of the HDD profile have been routinely sampled and monitored during the project. There are 11 wells within 450-foot radius that have been identified and sampled within the radius. A map showing the locations of the identified and sampled water supply wells is included as **Attachment 6.** A summary table of all the analytical results for all samples collected from these wells has been submitted to the PADEP separately. Per the requirements of the Plan, all the well owners have previously been offered a connection to a temporary water supply "water buffalo" or provided with a regular delivery of bottled water. Prior to restart of HDD operations, all the well owners will be re-contacted by SPLP's land agents to confirm that the landowners have contact information to notify SPLP of any concerns regarding their water supplies, and will also repeat and renew the offer of a water buffalo or bottled water delivery. SPLP will also offer to provide daily communications to the well owners (or as often or in the manner that the well owner dictates) and during drilling, an SPLP representative will be available 24/7 to respond to any concerns or complaints from the well owners.

Borehole Geophysical Logging

Borehole logging of a single boring is planned for the week of February 1, 2021. The borehole will be installed approximately 10 feet south of the HDD profile near the reamer location at the time the October 19, 2020 IR occurred. The borehole will be drilled to a depth 10 feet below the HDD profile. The exact location of the borehole will be determined in the field based on utility clearances and site access for a drilling rig. The expected suite of techniques to be completed includes natural gamma (ng), fluid conductivity, fluid temperature, 3-arm caliper (borehole diameter), along with acoustic and optical televiewer imaging. The results will be provided to the PA DEP as soon as the data analysis is completed.

Analysis of Risk of Additional IRs and Recommendations

The October 19, 2020 IR occurred during 26-inch diameter reaming from east to west following recirculation of drilling fluids within the expanded containment at the September 17th and September 23rd IR locations (see Revision 3 of the Erosion & Sedimentation Control & Site Restoration Plan). SPLP installed additional containment(s) around the October 19, 2020 IR/discharge locations. SPLP will utilize the two HDD relief points along the drill path on each side of Snitz Creek within the approved LOD, the third relief point along the east entry borehole near Route 72 where a second relief well will be installed for additional capacity, and a cluster of three new wells at a proposed relief point along Snitz Creek near the October 19, 2020 IR/discharge locations (described above). The four proposed new relief wells will make for a total of seven (7) relief wells at the site. All relief points

are intended to reduce the pressure in the borehole and redirect the IR discharges to locations outside of the stream where they can be better controlled. Drilling fluid collected from the relief wells has been and will continue to be returned to the mud pit for re-use.

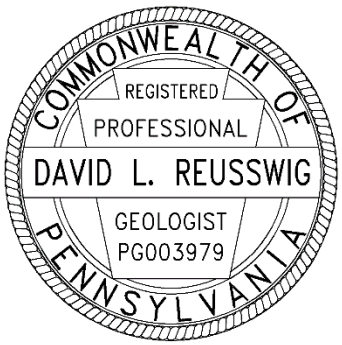
Based on information provided by, and the expertise of the HDD team, as well as our experience with the relevant hydrogeology and geology, RETTEW agrees with the approach to utilize previously approved and expanded containment BMPs, as well as the recent containments surrounding the October 19, 2020 IR/discharge locations and the four proposed relief wells once approved by the PA DEP. In addition, RETTEW believes that the application of LCM measures and further conditioning of other locations along the borehole will prevent or minimize the risk of new IRs in other locations along this HDD. Consistent with the IR PPC Plan, if a new IR were to occur outside of the currently authorized containments the procedure from Section 5.1.5 "Monitoring Protocol for Condition 3 – Inadvertent Returns" in the "HDD Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan", prepared by Tetra Tech, Inc. and revised April 2018, will be implemented. Materials and equipment for containing and controlling IRs are immediately available on-site, as required by permit, during all drilling activities. As mentioned above, a dam and flume stream containment should also be considered prior to the resumption of drilling activities.

Proposed Schedule for Recommencement of HDD Operations & Anticipated Duration of the HDD Operations
SPLP proposes to perform the aforementioned recommended measures upon restart approval from the PA DEP. The anticipated duration to complete HDD operations for the 16-inch pipe is three weeks from restart of drilling, following restart approval.

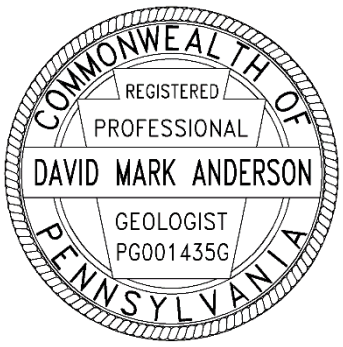
Based on information provided by, and the expertise of, the HDD team, as well as our experience with the relevant hydrogeology and geology, RETTEW believes that the implementation of the measures outlined above will minimize the risk of a new IR in another location on this HDD and minimize the likelihood that further drilling will result in an impact to the environment. Furthermore, based on such information, expertise and experience, RETTEW believes that these measures represent the practicable means, as identified in the April 2018 IR PPC Plan, that can be taken to minimize impacts to any private water supplies. In the unlikely event of an impact to a private water supply, SPLP will implement the procedures of the IR PPC Plan.

Certification
This report was prepared in collaboration with the horizontal directional drilling team, relying on information gathered and prepared by others. By affixing my seal to this document, I am certifying that the hydrogeologic and geologic information contained herein is true and correct, to my knowledge and belief. I further certify that I am licensed to practice in the Commonwealth of Pennsylvania.

David L. Reusswig, PG
License No. PG003979



David M. Anderson, PG
License No. PG001435G

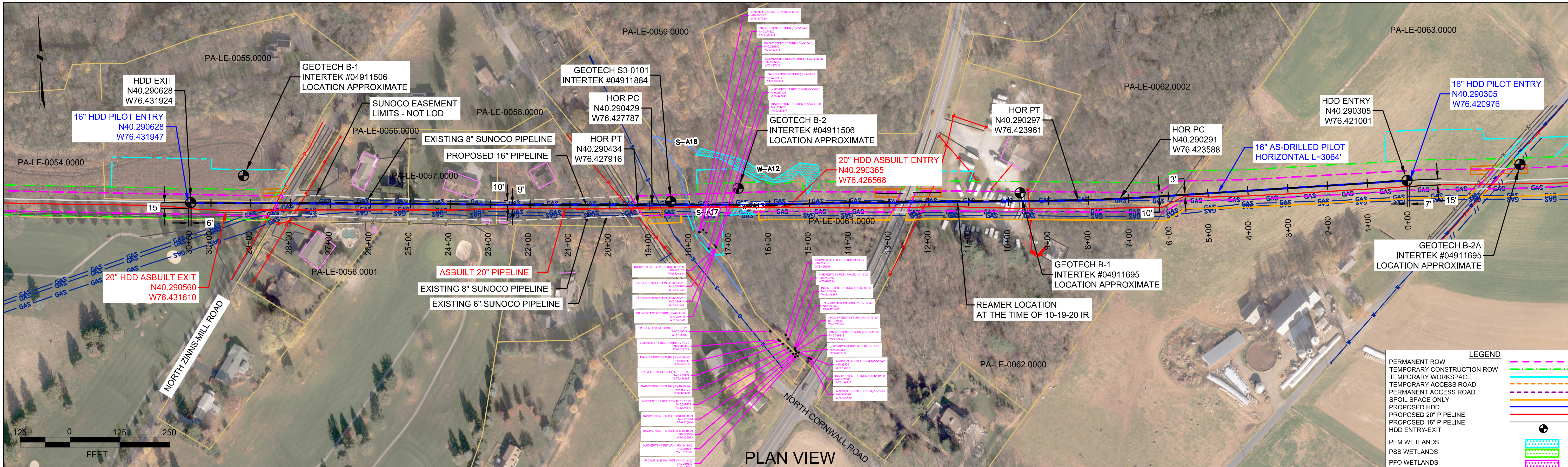


Enclosure

Attachment 1 – PA-LE-0055.Rd-16-IR-Overlay: As-Drilled Pilot Overlay
Attachment 2 – Relief Well Locations (5958ES001–Rev 4 Layout 1, .32-IR-Rev 16 Layout 1, .32 IR.b-Rev 16-Layout1)
Attachment 3 – Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)
Attachment 4 – Sunoco Zinn's Mill Road Single Pass Reaming Discussion
Attachment 5 – Mud Flow Diagram
Attachment 6 – Residential Well Location (within 450') – Map

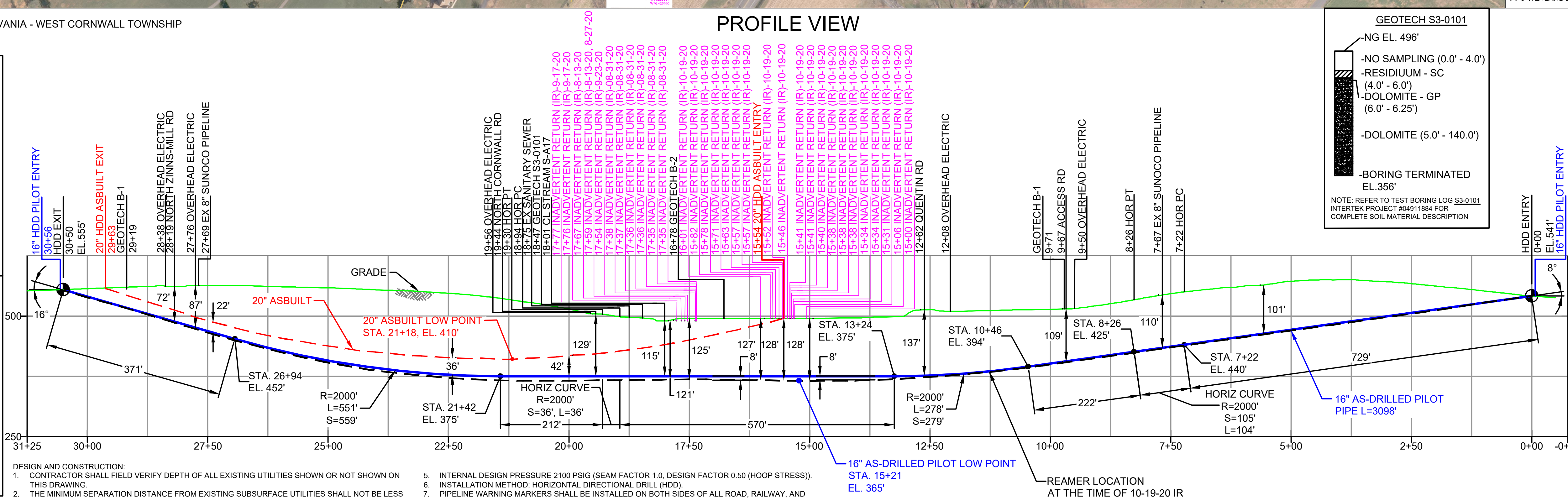
Z:\Shared\Projects\09630\096302010 - Spread 5\GS\Restart Reports & Incident Assessments\S3-0101-16 North Zinns Mill Road\2020-10-20 Restart Addendum 4\COA response\S3-0101 N Zinns Mill Rd_Final Restart Report_Revised 2021-02-05.docx

ATTACHMENT 1
PA-LE-0055.Rd-16-IR-Overlay: As-Drilled Pilot Overlay



LEBANON COUNTY, PENNSYLVANIA - WEST CORNWALL TOWNSHIP
S3-0101-16

PROFILE VIEW



GEOTECH B-1

- NG EL. 556'
- RESIDIUUM-CLAY CL (0.0' - 5.0')
- GROUNDWATER (43.0')
- DOLOMITE/LIMESTONE /SHALE (5.0' - 170.0')
- BORING TERMINATED EL.386'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911506 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-2

- NG EL. 495'
- FILL ML (0.0' - 3.5')
- GROUNDWATER (2.9')
- FILL MH (3.5' - 8.5')
- DOLOMITE/LIMESTONE (8.5' - 105.0')
- BORING TERMINATED EL.390'

NOTE: REFER TO TEST BORING LOG B-2 INTERTEK PROJECT #04911506 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH S3-0101

- NG EL. 496'
- NO SAMPLING (0.0' - 4.0')
- RESIDIUUM - SC (4.0' - 6.0')
- DOLOMITE - GP (6.0' - 6.25')
- DOLOMITE (5.0' - 140.0')
- BORING TERMINATED EL.356'

NOTE: REFER TO TEST BORING LOG S3-0101 INTERTEK PROJECT #04911884 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-1

- NG EL. 515'
- NO SAMPLING (0.0' - 5.0')
- FILL GP-GM (5.0' - 15.0')
- GROUNDWATER (24.0')
- LIMESTONE/DOLOMITE (15.0' - 152.0')
- BORING TERMINATED EL.363'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911695 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-2A

- NG EL. 543'
- NO SAMPLING (0.0' - 9.5')
- GROUNDWATER (27.0')
- LIMESTONE/DOLOMITE (9.5' - 153.0')
- BORING TERMINATED EL.390'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911695 FOR COMPLETE SOIL MATERIAL DESCRIPTION

DESIGN AND CONSTRUCTION:

1. CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
2. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HORZ. LENGTH (L=): 3050'
   HDD PIPE LENGTH (S=): 3083'
   16" x 0.438" W.T., X-70, API5L, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 2100 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 2625 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
12. SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
13. SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

HDD IR OVERLAY

NOTES

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

REF. DRAWING

DWG NO		DWG NO	DESCRIPTION
ES-5.32	TO	ES-5.32	EROSION & SEDIMENT PLAN
SHEET 18	TO	SHEET 18	AERIAL SITE PLAN

REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
EP12	ADDED 10-19-20 IR AND REAMER LOCATION INFORMATION	MRS	10/20/20	RMB	10/20/20	AMC	10/20/20
EP11	ADDED 9-23-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	09/25/20	RMB	09/25/20	AMC	09/25/20
EP10	ADDED 9-17-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	09/21/20	RMB	09/21/20	AMC	09/21/20
EP9	ADDED 8-27-20 IR INFORMATION	MRS	08/27/20	RMB	08/27/20	AMC	08/27/20
EP8	ADDED 8-13-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	08/18/20	RMB	08/18/20	AMC	08/18/20
EP7	ADDED GEOTECH INFORMATION	MRS	02/25/20	RMB	02/25/20	AMC	02/25/20

Sunoco Logistics Partners L.P.

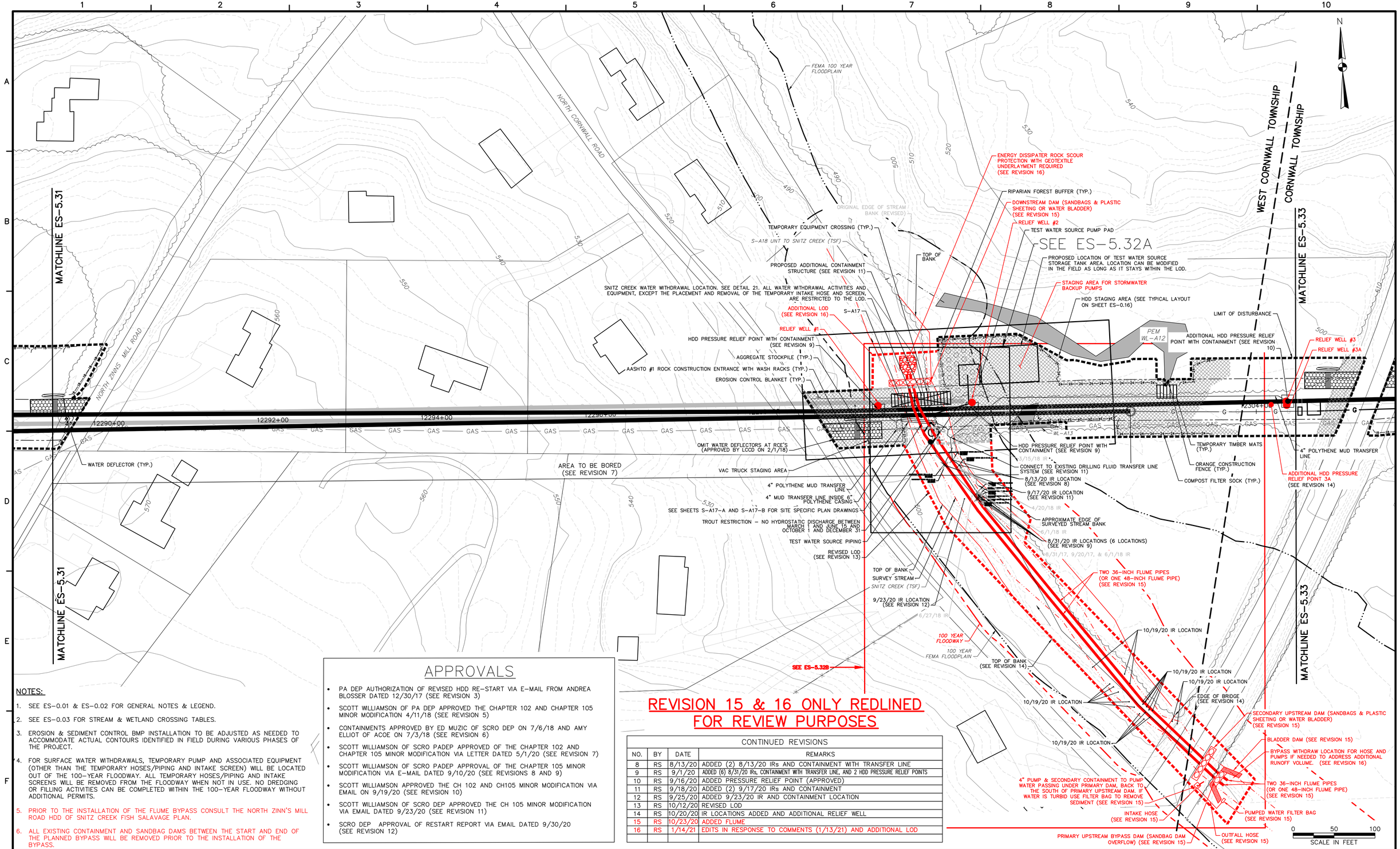
TETRA TECH ROONEY (303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
N ZINNS MILL ROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=250' DWG. NO. PA-LE-0055.0000-RD-16

ATTACHMENT 2
Relief well locations (5958ES001–Rev 4 Layout 1, .32-IR-Rev 16 Layout 1, .32 IR.b-Rev 16-Layout 1)



NOTES:

1. SEE ES–0.01 & ES–0.02 FOR GENERAL NOTES & LEGEND.
2. SEE ES–0.03 FOR STREAM & WETLAND CROSSING TABLES.
3. EROSION & SEDIMENT CONTROL BMP INSTALLATION TO BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONTOURS IDENTIFIED IN FIELD DURING VARIOUS PHASES OF THE PROJECT.
4. FOR SURFACE WATER WITHDRAWALS, TEMPORARY PUMP AND ASSOCIATED EQUIPMENT (OTHER THAN THE TEMPORARY HOSES/PIPING AND INTAKE SCREEN) WILL BE LOCATED OUT OF THE 100–YEAR FLOODWAY. ALL TEMPORARY HOSES/PIPING AND INTAKE SCREENS WILL BE REMOVED FROM THE FLOODWAY WHEN NOT IN USE. NO DREDGING OR FILLING ACTIVITIES CAN BE COMPLETED WITHIN THE 100–YEAR FLOODWAY WITHOUT ADDITIONAL PERMITS.
5. PRIOR TO THE INSTALLATION OF THE FLUME BYPASS CONSULT THE NORTH ZINN'S MILL ROAD HDD OF SNITZ CREEK FISH SALAVAGE PLAN.
6. ALL EXISTING CONTAINMENT AND SANDBAG DAMS BETWEEN THE START AND END OF THE PLANNED BYPASS WILL BE REMOVED PRIOR TO THE INSTALLATION OF THE BYPASS.

APPROVALS

- PA DEP AUTHORIZATION OF REVISED HDD RE–START VIA E–MAIL FROM ANDREA BLOSSER DATED 12/30/17 (SEE REVISION 3)
- SCOTT WILLIAMSON OF PA DEP APPROVED THE CHAPTER 102 AND CHAPTER 105 MINOR MODIFICATION 4/11/18 (SEE REVISION 5)
- CONTAINMENTS APPROVED BY ED MUZIC OF SCRO DEP ON 7/6/18 AND AMY ELLIOT OF ACOE ON 7/3/18 (SEE REVISION 6)
- SCOTT WILLIAMSON OF SCRO PADEP APPROVED OF THE CHAPTER 102 AND CHAPTER 105 MINOR MODIFICATION VIA LETTER DATED 5/1/20 (SEE REVISION 7)
- SCOTT WILLIAMSON OF SCRO PADEP APPROVAL OF THE CHAPTER 105 MINOR MODIFICATION VIA E–MAIL DATED 9/10/20 (SEE REVISIONS 8 AND 9)
- SCOTT WILLIAMSON APPROVED THE CH 102 AND CH105 MINOR MODIFICATION VIA EMAIL ON 9/19/20 (SEE REVISION 10)
- SCOTT WILLIAMSON OF SCRO DEP APPROVED THE CH 105 MINOR MODIFICATION VIA EMAIL DATED 9/23/20 (SEE REVISION 11)
- SCRO DEP APPROVAL OF RESTART REPORT VIA EMAIL DATED 9/30/20 (SEE REVISION 12)

REVISION 15 & 16 ONLY REDLINED FOR REVIEW PURPOSES

CONTINUED REVISIONS

NO.	BY	DATE	REMARKS
8	RS	8/13/20	ADDED (2) 8/13/20 IRs AND CONTAINMENT WITH TRANSFER LINE
9	RS	9/1/20	ADDED (6) 8/31/20 IRs, CONTAINMENT WITH TRANSFER LINE, AND 2 HDD PRESSURE RELIEF POINTS
10	RS	9/16/20	ADDED PRESSURE RELIEF POINT (APPROVED)
11	RS	9/18/20	ADDED (2) 9/17/20 IRs AND CONTAINMENT
12	RS	9/25/20	ADDED 9/23/20 IR AND CONTAINMENT LOCATION
13	RS	10/12/20	REVISED LOD
14	RS	10/20/20	IR LOCATIONS ADDED AND ADDITIONAL RELIEF WELL
15	RS	10/23/20	ADDED FLUME
16	RS	1/14/21	EDITS IN RESPONSE TO COMMENTS (1/13/21) AND ADDITIONAL LOD

TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921–7090 | F: (412) 921–4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	3/28/17	INCORPORATED THE SPECIAL CONDITIONS SET FORTH IN DEP'S CHAPTER 102 AND CHAPTER 105 PERMITS
2	RS	5/25/17	DRAWINGS PROVIDED TO FIELD
3	RS	12/15/17	REVISED HDD
4	RS	2/8/18	EROSION/SEDIMENT CONTROL MODIFICATION FOR RCE
5	RS	3/29/18	ATWS FOR INADVERTENT RETURN RESPONSE AND INSERT
6	RS	6/28/18	ATWS FOR 2ND IR CONTAINMENT (ON 6/6/18), & ADD. CONTAINMENTS
7	RS	12/10/18	REVISED 16" HDD

COMMONWEALTH OF PENNSYLVANIA – REGISTERED PROFESSIONAL ENGINEER – ROBERT F. SIMCIK – ENGINEER PE084455-E

SUNOCO PIPELINE LP
SINKING SPRING, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT CONSTRUCTION SPREAD 4

1–20" & 1–16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

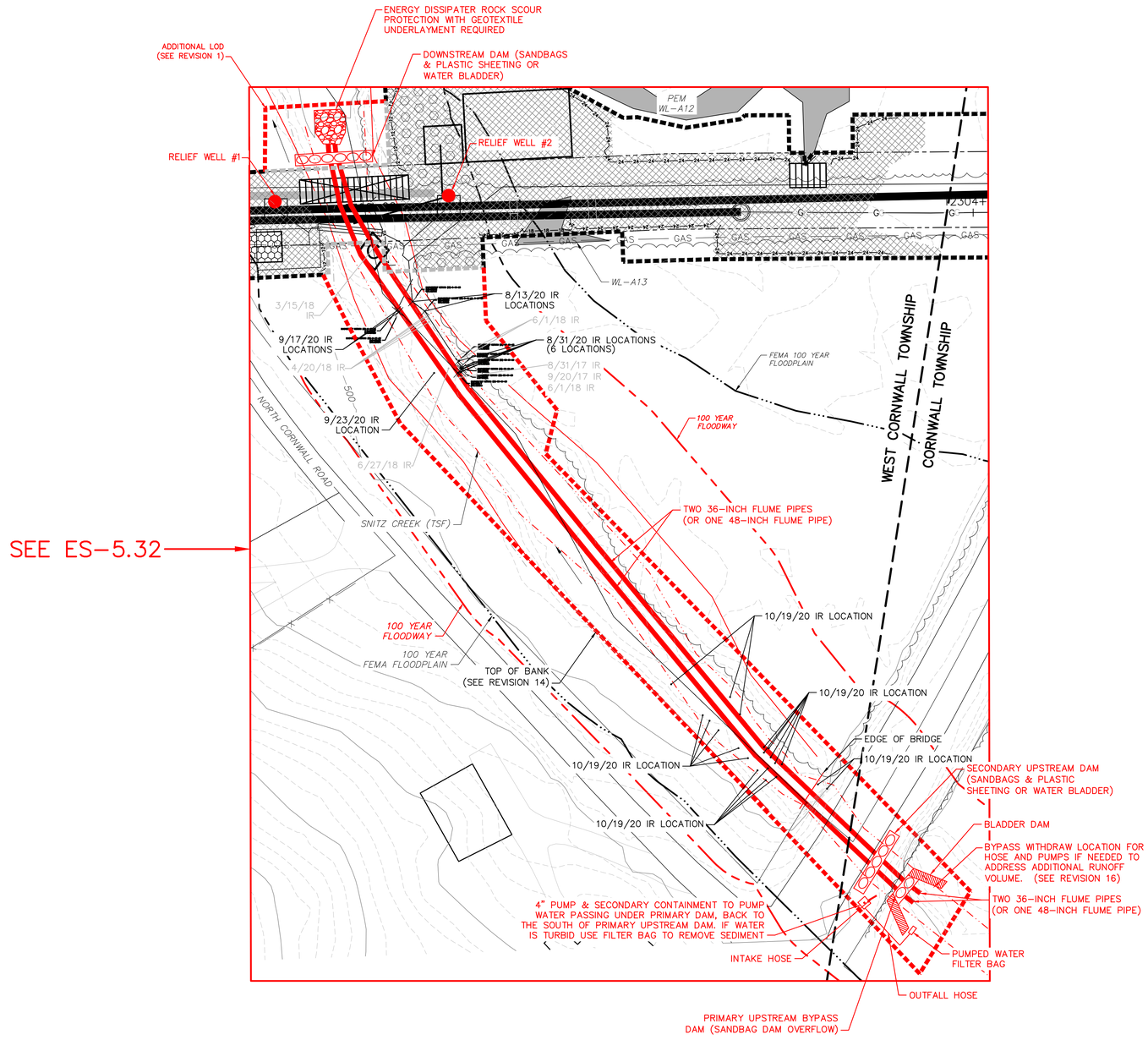
LEBANON COUNTY CONSERVATION DISTRICT EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN

SHEET 32 OF 69

DATE:	2/8/2017
PROJECT NO.:	112IC05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES–5.32
SHEET 5.32 OF 127

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.32–IR – REV 16.dwg PIT NIKKI.DILLA 1/28/2021 8:05:19 AM



TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	1/14/21	REVISED LOD AND BYPASS WITHDRAW LOCATION FOR ADDITIONAL RUNOFF

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROBERT F. SIMCIK ENGINEER 073644-E

SUNOCO PIPELINE LP
SINKING SPRING, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT
CONSTRUCTION SPREAD 4

1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

LEBANON COUNTY CONSERVATION DISTRICT
EROSION & SEDIMENT CONTROL &
SITE RESTORATION PLAN
SHEET 32 OF 69

DATE:	2/8/2017
PROJECT NO.:	112IC05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES-5.32B
SHEET 5.32 OF 127

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.32-IR.b – REV 16..dwg PIT NIKKI.DILLA 1/28/2021 7:26:51 AM

MATCHLINE ES-5.32

MATCHLINE ES-5.34

WOODED AREA

QUENTIN ROAD

TICE LANE

ADDITIONAL TEMPORARY WORK SPACE FOR CONVENTIONAL BORE CROSSING (SEE TYPICAL LAYOUT ON SHEET ES-0.17)

AGGREGATE STOCKPILE (TYP.)

AASHTO #1 ROCK CONSTRUCTION ENTRANCE WITH WASH RACKS (TYP.)

LIMIT OF DISTURBANCE

EROSION CONTROL BLANKET (TYP.)

TEMPORARY UPSLOPE DIVERSION BERM (TYP.)

TEMPORARY SLOPE PIPE (TYP.)

RELIEF WELL #3

RELIEF WELL #3A

RELIEF WELL #4

RELIEF WELL #5

RELIEF WELL #6

PROPOSED LOCATIONS FOR RELIEF WELLS (SEE REVISION 4)

20-INCH AREA TO BE BORED

16-INCH AREA TO BE BORED

AREA TO BE BORED

BORE PIT (TYP.)

PERMANENT WATER BAR (TYP.)

COMPOST FILTER SOCK (TYP.)

TRENCH PLUGS (TYP.)

TEMPORARY WATER BAR (TYP.)

REVISED 16" HDD ENTRY/EXIT LOCATION

FEMA 100 YEAR FLOODPLAIN

12304+00 12306+00 12308+00 12310+00 12312+00 12314+00 12316+00 12318+00

NOTES:

1. SEE ES-0.01 & ES-0.02 FOR GENERAL NOTES & LEGEND.
2. SEE ES-0.03 FOR STREAM & WETLAND CROSSING TABLES.
3. EROSION & SEDIMENT CONTROL BMP INSTALLATION TO BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONTOURS IDENTIFIED IN FIELD DURING VARIOUS PHASES OF THE PROJECT.

APPROVALS

- SCOTT WILLIAMSON OF SCRO PADEP APPROVAL OF THE CHAPTER 102 AND 105 MINOR MODIFICATION VIA LETTER DATED 5/1/20 (SEE REVISION 3)

REVISION 4 ONLY REDLINED FOR REVIEW PURPOSES

0 50 100
SCALE IN FEET

TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	3/28/17	INCORPORATED THE SPECIAL CONDITIONS SET FORTH IN DEP'S CHAPTER 102 AND CHAPTER 105 PERMITS
2	RS	5/25/17	DRAWINGS PROVIDED TO FIELD
3	RS	1/14/18	REVISED 16" HDD AND ATWS ADDITION
4	RS	10/20/20	ADDED PROPOSED LOCATIONS FOR RELIEF WELLS

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER ROBERT F. SIMCIK PE084435-E

SUNOCO PIPELINE LP
PHILADELPHIA, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT CONSTRUCTION SPREAD 5

1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

LEBANON COUNTY CONSERVATION DISTRICT EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN SHEET 33 OF 69

DATE:	2/6/17
PROJECT NO.:	112C05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES-5.33
SHEET 5.33 OF 95

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.33 – REV 4.dwg PIT NIKKI.DILLA 1/26/2021 4:53:20 PM

ATTACHMENT 3
Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)

TETRA TECH

Memorandum

Prepared by:	Stephen A. Compton, Senior Program Director, Tetra Tech, Inc.
Prepared for:	Energy Transfer
cc:	Brad Schaeffer, Project Manager, Tetra Tech, Inc.
Date:	January 27, 2021
Subject:	Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)

SUPPLEMENTAL ALTERNATIVES ANALYSIS
North Zinns Mill Road Crossing
SPLP HDD-S3-0101-16

Original Project-Wide Alternatives Analysis – Original Proposed "Reduced Length" HDD

As part of the 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. The baseline route provided for the pipeline construction was to cross every wetland and stream on the project by open cut construction procedures. The Alternatives Analysis submitted to PADEP conceptually analyzed the potential feasibility of any alternative to baseline route trenched resource crossings (e.g., reroute, conventional bore, HDD). The decision-making processes for selection of the HDD instead of an open cut crossing methodology is discussed thoroughly in the submitted alternatives analysis and was an important part of the overall PADEP approval of HDD plans as originally permitted.

The original proposed 16-inch-diameter HDD (HDD-S3-0101-16) mirrored the original proposed and installed 20-inch-diameter HDD (HDD-S3-0101-20), both located in West Cornwall Township, Lebanon County, Pennsylvania. The original proposed 16-inch-diameter HDD was designed with a horizontal length of 1,180 feet, entry/exit angle of 12-14 degrees, maximum depth of cover of 90 feet, depth below Snitz Creek of 8 feet, and pipe design radius of 1,600 feet. The original HDD (from west to east) began at the western exit site located approximately 144 feet to the west of North Zinns Mill Road, traversed (in addition to numerous buried and overhead utilities) beneath North Zinns Mill Road, residential lands and associated infrastructure, North Cornwall Road, and Snitz Creek (Stream A17) and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway, and terminated at the eastern entry site located approximately 247 feet east of the centerline of Snitz Creek; the eastern entry site workspace also encompassed palustrine emergent (PEM) Wetland A13.

Accordingly, the original proposed HDD comprised a "reduced length" (1,180 feet) HDD alternative compared to the currently proposed HDD (3,050 feet), as further discussed below. Due to inadvertent returns (IRs) that occurred during the installation of the 20-inch-diameter HDD, this "reduced length" 16-inch-diameter HDD plan was re-evaluated in accordance with Condition No. 3 of the Stipulated Order issued under Environmental Hearing Board Docket No. 2017-009-L, and thereby revised with an "increased length" to avoid or minimize the potential for future IRs. As a result, the "reduced length" HDD alternative was eliminated from further consideration and replaced with the proposed re-evaluated and "increased length" HDD.

Proposed (Reevaluated or "Increased Length") HDD

The re-evaluated ("Increased Length") 16-inch-diameter HDD was presented in the Horizontal Directional Drill Analysis (or "Reevaluation Report") for HDD-S3-0101-16 submitted to the Department on February 4, 2019. This re-evaluated 16-inch-diameter HDD has been further revised based on supplemental filings, including additional information presented herein, including relocation of the entry and exits sites and lengthening of the HDD to include crossing of Route 72/Quentin Road (for which an open cut crossing is not allowed) and to accommodate adequate open space for the longer pull back string. As part of this redesign, SPLP has considered and adopted a

TETRA TECH
301 Ellicott Street, Buffalo, New York 14203
Tel 716.849.9419 Fax 716.849.9420 tetratech.com

number of additional mitigation measures to further avoid or minimize the potential for IRs (see Analysis of Potential Mitigation Measures in this Restart Report). These mitigation measures include, but are not limited to, relocation of the of the entry and exit sites; increasing the length (by 1,870 feet), entry/exit angle (from 12-14 up to 16 degrees), depth of cover along the bore path (by 47 feet at maximum depth), and depth of cover beneath Snitz Creek (by 107 feet) and its associated floodplain. Specifically, as currently proposed, the re-evaluated HDD is designed with a horizontal length of 3,050 feet, entry/exit angle of 8-16 degrees, maximum depth of cover of 137 feet, depth below Snitz Creek of 115 feet, and pipe design radius of 2,000 feet. The currently proposed HDD (from west to east) begins at the western exit site was located approximately 231 feet west of North Zinns Mill Road, traverses (in addition to numerous buried and overhead utilities) beneath North Zinns Mill Road, residential lands and associated infrastructure, North Cornwall Road, Snitz Creek (Stream A17) and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway, PEM Wetland A13, Route 72/Quentin Road, and additional residences and associated infrastructure, and terminates at the eastern entry site in an open field located approximately 1,262 feet east of Route 72/Quentin Road.

SPLP presented an overall alternatives analysis of HDD-S3-0101-16 in its Reevaluation Report submitted to the Department on February 4, 2019. As presented therein, as required by the Order, the reanalysis of HDD S3-0101-16 included an evaluation of open cut alternatives and a re-route analysis. In addition, as requested by the Department, SPLP presented additional alternatives analyses in its Letter Response to DEP Response (Information Request) to Hydrogeological HDD Re-Evaluation Report, dated August 29, 2019. As described in this submittal, SPLP evaluated Flexbor and Direct Pipe Bore, as well as conventional auger bore, alternatives along the HDD alignment. Based on the analyses of each of these alternative analyses, SPLP confirmed the conclusions reached in the previously submitted Alternatives Analysis that completion of the HDD construction method – which is anticipated to require three (3) weeks to complete from restart of drilling – will cause the least amount of direct impact to the environment and remains the best option for this location.

As further requested by the Department, the following presents a summary of previous, as well as supplemental, analyses of alternatives to the currently proposed HDD-S3-0101-16.

Open Cut – Entire HDD Alignment and Snitz Creek Crossing

As presented in its submittal to the Department dated February 4, 2019, SPLP evaluated the use of the open cut construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment described above. SPLP specifications require a minimum of 48-inches of cover over the installed pipelines, and the Pennsylvania Department of Transportation (PADOT) requires 60-inches of cover under public roadways.

Although an open cut installation of the pipeline is potentially technically feasible along portions of the HDD alignment, several important factors result in use of this method being either not technically feasible or not practicable regarding logistics and existing technology.

Use of the open cut construction method to cross Route 72/Quentin Road is not allowed by PADOT and thereby requires a trenchless crossing. Therefore, use of this method across the entire length of the HDD alignment is not technically feasible. The following discussion addresses the potential use of the open cut construction method across the remainder of the HDD alignment.

The logistics associated with this method would significantly increase the length of time the affected properties would be subject to construction disturbance and would directly affect adjacent residential home sites due to the workspace requirements to accommodate the open trench method while constructing between two existing in-service pipelines.

The HDD alignment crosses one (1) minor perennial stream crossing (Snitz Creek, Stream A17) and one (1) PEM wetland (Wetland A13). Although this stream is not listed as high quality or exceptional value, use of the open cut construction method would result in a direct increase in the physical disturbance to Wetland A13 as well as Snitz Creek and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway. Open cut impacts to these resources would be minimal but would require modification of the state and federal permits. In addition, an open cut crossing would require the temporary and permanent clearing of forested riparian buffer areas on each side of

Snitz Creek and within its associated floodplains, and upland forested areas and potentially individual trees immediately adjacent to residential properties.

Furthermore, any produced groundwater in the open excavations would be pumped to a discharge filtration structure. The current feasible filtration ability, however, does not exceed 50 microns. Therefore, cloudy water (from suspended fine clay and silt particles) would be discharged downstream regardless of all control methods employed for the entire duration of the use of open cut construction techniques.

Moreover, based on additional experience and observations gained via the completed installation of the 20-inch-diameter HDD, construction activities for 16-inch-diameter HDDs, IRs, and supplemental geotechnical investigations, an open cut construction method crossing of Snitz Creek (Stream A17) would likely not be technically feasible. Specifically, due to the presence of a shallow groundwater table associated with this perennial stream, a dry open cut excavation through Snitz Creek would be extremely difficult to maintain, requiring a robust groundwater management system including constant pumping of groundwater from the excavated trench, conveyance around the construction area, filtration (as discussed above), and discharge. Due to the volume of groundwater anticipated, it is likely that establishing and maintaining dry trench conditions would not be technically feasible.

Based on this analysis, use of the open cut construction method, either along the currently proposed 3,050-foot-long HDD alignment or only across Snitz Creek, is likely not technically feasible, and therefore is eliminated from further consideration.

Conventional Auger Bore – Entire HDD Alignment

As presented in its submittal to the Department dated February 4, 2019, SPLP evaluated the use of the conventional auger bore construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment described above. A conventional auger bore is generally limited to 200 linear feet at a time, varying by the underlying substrate. Due to the spacing of constraints at the HDD location and changes in elevation at the resources to be bored beneath, there are no subset of locations within this length of area to feasibly employ this type of installation method. Therefore, use of the conventional auger bore method along the entire HDD alignment is eliminated from further consideration.

Conventional Auger Bore – Snitz Creek

SPLP considered the use of the conventional auger bore construction method to install the 16-inch-diameter pipeline at the crossing of Snitz Creek (Stream A17) and determined it is likely not technically feasible solely due to the shallow groundwater table, and furthermore several important factors result in use of this method being not technically feasible regarding logistics and existing technology, as discussed below.

First, use of the conventional auger bore construction method requires the excavation, stabilization, maintenance, and safe use of bore pits on both sides of the crossing for the duration of the construction process. Due to the shallow groundwater table at Snitz Creek, the bore pits should be setback a minimum of 50 feet from the top of banks of Snitz Creek to minimize the potential for groundwater intrusion. However, this or greater setback distances still would place the bore pits within the floodplain of Snitz Creek. Groundwater intrusion into bore pits not only requires extensive management (pumping, conveyance, filtering, discharge) for the duration of the construction process, but moreover presents significant safety concerns for construction equipment, materials, and personnel, working in saturated and unstable soil conditions. Despite a 50-foot setback, it is likely bore pits would experience extensive groundwater intrusion, resulting in suboptimal (at the least) bore pit conditions.

Second, potentially available workspace on the west side of the Snitz Creek crossing area is very constrained with a maximum of approximately 115 feet between the eastern edge of North Cornwall Road and the western top of bank of Snitz Creek. Assuming the best case scenario use of a typical exit bore pit (instead of the larger entry bore pit) in this area (to support conventional auger bore crossings of both North Cornwall Road and Snitz Creek), such an exit bore pit would be a minimum of 56 feet long, setback from the road by a minimum of 50 feet, and setback from Snitz Creek by 50 feet to maximize potential of avoiding its shallow groundwater table; thereby requiring a typical minimum total of approximately 156 feet. Therefore, available workspace is not available to accommodate the typical minimum conventional auger bore construction method setup, even assuming use of the

smaller exit bore pit, between North Cornwall Road and Snitz Creek, such that use of this method is not technically feasible.

Finally, use of the conventional auger bore construction method requires the excavation, stabilization, maintenance, and safe use of bore pits on both sides of the crossing for the duration of the construction process. In addition, SPLP specifications require a minimum of 60-inches (5 feet) of cover over the installed pipeline beneath streams. Assuming flat topography across the crossing profile including the stream, the bore pit depth is a minimum of 8 feet given the base of the boring machine sits approximately 3 feet below the auger. In practice, bore pit depths are deeper to accommodate typical undulating topography and the degree to which the stream bed is incised across the crossing profile, with typical bore pit depths on the order of 10 to 12 feet. However, based on the existing topographic rise from the Snitz Creek stream bed west toward North Cornwall Road, and the highly incised profile of the Snitz Creek banks and stream bed, use of the minimum conventional auger exit bore pit lengths and setbacks (see above) would result in the west exit pit being a minimum of 15 – 20 feet (east – west faces) deep, thereby presenting significant safety concerns for construction equipment, materials, and personnel, as pit walls would require extensive and engineered shoring and diligent monitoring to prevent failure or collapse during the lengthy boring process. These safety concerns are exacerbated by the presence of a shallow groundwater table at Snitz Creek as discussed above. In addition, the shallow groundwater table also presents a substantive risk of collapse of the stream bed along the bore path.

In addition, conventional auger bore crossings of Snitz Creek and North Cornwall Road would also require the temporary and permanent clearing of forested riparian buffer areas on each side of Snitz Creek and within its associated floodplain, and upland forested areas and potentially individual trees adjacent to residential properties. As a result, the conventional auger bore method is not the most practicable alternative that results in the least impact on wetlands, waterbodies, and other environmental resources at this location.

Based on this analysis, use of the conventional auger bore construction method to cross Snitz Creek is not technically feasible, and therefore is eliminated from further consideration.

Combination Open Cut-Conventional Auger Bore

As discussed above, use of either the open cut or conventional auger bore construction methods to cross Snitz Creek is considered not technically feasible. Therefore, use of a combination of open cut and conventional auger bore construction methods along the currently proposed 3,050-foot-long HDD alignment, including the crossing of Snitz Creek, is eliminated from further consideration.

Direct Pipe Bore – Entire HDD Alignment

As presented in its submittal to the Department dated August 29, 2019, SPLP evaluated the use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment (due to, but not limited to, the requirement to cross Route 72/Quentin Road by trenchless construction method) described above. 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 annular 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 feet in extent on the Mariner II East Project. However, the length of the Snitz Creek/North Zinns Mill Road HDD is 3,050 ft, which exceeds the limits of Direct Pipe Bore technology. Therefore, use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline along entire length of the currently proposed 3,050-foot-long HDD alignment is not technically feasible, and therefore has been eliminated from further consideration.

Direct Pipe Bore – Reduced Length Alignment

As presented in its submittal to the Department dated August 29, 2019, SPLP evaluated the use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline for shorter lengths along the currently proposed 3,050-foot-long HDD alignment described above. However, due to the presence of surface developments, multiple adjacent utility lines, natural resources, and variation in surface elevations, there are no feasible entry-exit points at the crossing of Snitz Creek to employ this technology, including use of the Direct Pipe Bore construction method along the original proposed 1,180-foot-long, 16-inch-diameter HDD alignment described above. This construction method could be employed to avoid surface impacts in the residential area west of Snitz Creek; however, that would then require use of the open cut or conventional auger bore construction methods to cross Snitz Creek and the adjacent lands. As discussed above, use of either the open cut or conventional auger bore construction methods to cross Snitz Creek is considered not technically feasible. Therefore, the use of Direct Pipe Bore construction method for reduced length alignments, either including a Direct Pipe Bore crossing of Snitz Creek or alternatively incorporating open cut or conventional auger bore crossings of Snitz Creek, have been eliminated from further consideration.

Conclusion

Based on the analysis of all alternative construction methods discussed above, SPLP concluded the HDD construction method remains the best option for this location.

Specifically, the completion of the 3,050-foot-long, 16-inch-diameter HDD is technically feasible and the most practicable of the alternatives considered and discussed above for several important reasons. The re-evaluation, re-design, and previously and additionally proposed mitigation measures (including but not limited to relief wells, real-time tracking of fluid volumes, proactive dam-and-flume stream containment) will minimize the likelihood of further IRs and IR occurrences outside of containment so as to adequately protect public health, safety, and the environment. In addition, completion of this HDD construction method is anticipated to require three (3) weeks upon restart of drilling, whereas all other alternatives (detailed design, easement acquisition, and major modification permitting processes aside) would essentially start from scratch and require from 3 to 7 months to construct; thus completion of the HDD minimizes the duration of construction activities, including in proximity to residential properties. This method also results in the least direct surface impacts to wetlands, waterbodies, and other environmental resources (i.e., floodplains, riparian buffers, forests, residential areas), and avoids significant impacts on environmental and human environment resources. Therefore, completion of the HDD is considered the most practicable alternative that also results in the least impact on aquatic, other environmental, and human environment resources, and thereby is selected by SPLP as the preferred alternative.

ATTACHMENT 4
Sunoco Zinn's Mill Road Single Pass Reaming Discussion

MICHELS®

Sunoco (ETC)
Zinns Mill Road Crossing
16-inch Steel Pipe
Advantages of Single Pass Reaming and Reaming Direction Explanation

Explanation and Advantages of a Single Ream Pass

Michels HDD drilling rigs and ancillary equipment are the premier drill rigs in the HDD industry with optimum and superior capabilities. Working in tandem with the rigs and ancillary equipment, Michels utilizes hole openers (26" in this circumstance) designed to take full advantage of such capabilities. Michels has successfully performed hundreds of 26" and larger ream passes immediately following a minimum pilot hole size of 9 7/8" diameter with no evidence of additional HDD or environmental risk. In fact, past experience has shown to Michels that typically performing one larger, single ream pass reduces IR and environmental risk.

Michels began using a 27" hole opener as the first ream pass in rock formations on larger diameter HDD's 19 years ago. Working with the manufacturers, a 27" hole opener, designed to follow a minimum 9 7/8" pilot has been commercially available to the entire HDD maxi-rig market since early 2003. Taking advantage of technology and equipment capabilities, that initial ream pass from a pilot hole, in rock, has increased to 30" in 2006, and to a 34" ream pass over 10 years ago in larger product installations. Approximately 6 years ago, again taking full advantage of increased equipment capabilities and technologies, the maxi-rig market has actually began using a 36" initial ream pass in rock formation, where warranted, following a minimum 10 5/8" pilot hole. When reaming unconsolidated soil formations, Michels has regularly performed an initial 54" ream pass from the 12 1/4" pilot for the installation of 42" steel product pipe and has typically had appropriate drilling fluid returns to the entry/exit pits.

Some of the reasons and advantages of performing a single 26" ream pass in comparison to a series of individual passes include:

1. Larger annulus for easing fluid and cuttings flow and reduced annular pressure. This requires adequately sized equipment to introduce the correct amount of drilling fluid to match the ROP (rate of penetration) and clean the hole properly. Michels has the capabilities of cleaning and pumping upwards of 750 gpm. Michels more recent fluid systems are based on 1500 gpm however both rigs on the Zinns Mill Road crossing location have 1000 gpm capacity systems although we are targeting a 750 gpm pump rate.

2. More robust tooling with larger bearings in the cutters, reducing downhole failure and unnecessary drilling and circulating times to replace tooling. In the formation encountered on the Zinns Mill crossing, if a piece of a reamer were to break off, as in a lost cutter, retrieving the broken part would likely prove difficult, if not impossible, leading to a redrill of some, or possibly all of the crossing from the pilot phase.

3. A reamed hole that closely resembles the geometry of the pilot hole (multiple passes have shown to deviate from the original pilot hole with the reamer "walking" or "keyholing" around the harder formations following softer seams). The soil formations encountered on the Zinns Mill Road HDD have been very inconsistent and suggests wandering would occur, performing multiple ream passes, likely causing difficulties installing or damage to the product pipe.

4. Pilot hole annulus in front of the hole opener is smaller (12 1/4”) in comparison to the 7 5/8” drill stem, which would be more likely to restrict fluid flow in front of reamer and keep majority of fluid returns behind the reamer to entry/exit pit, or in this case the relief well.

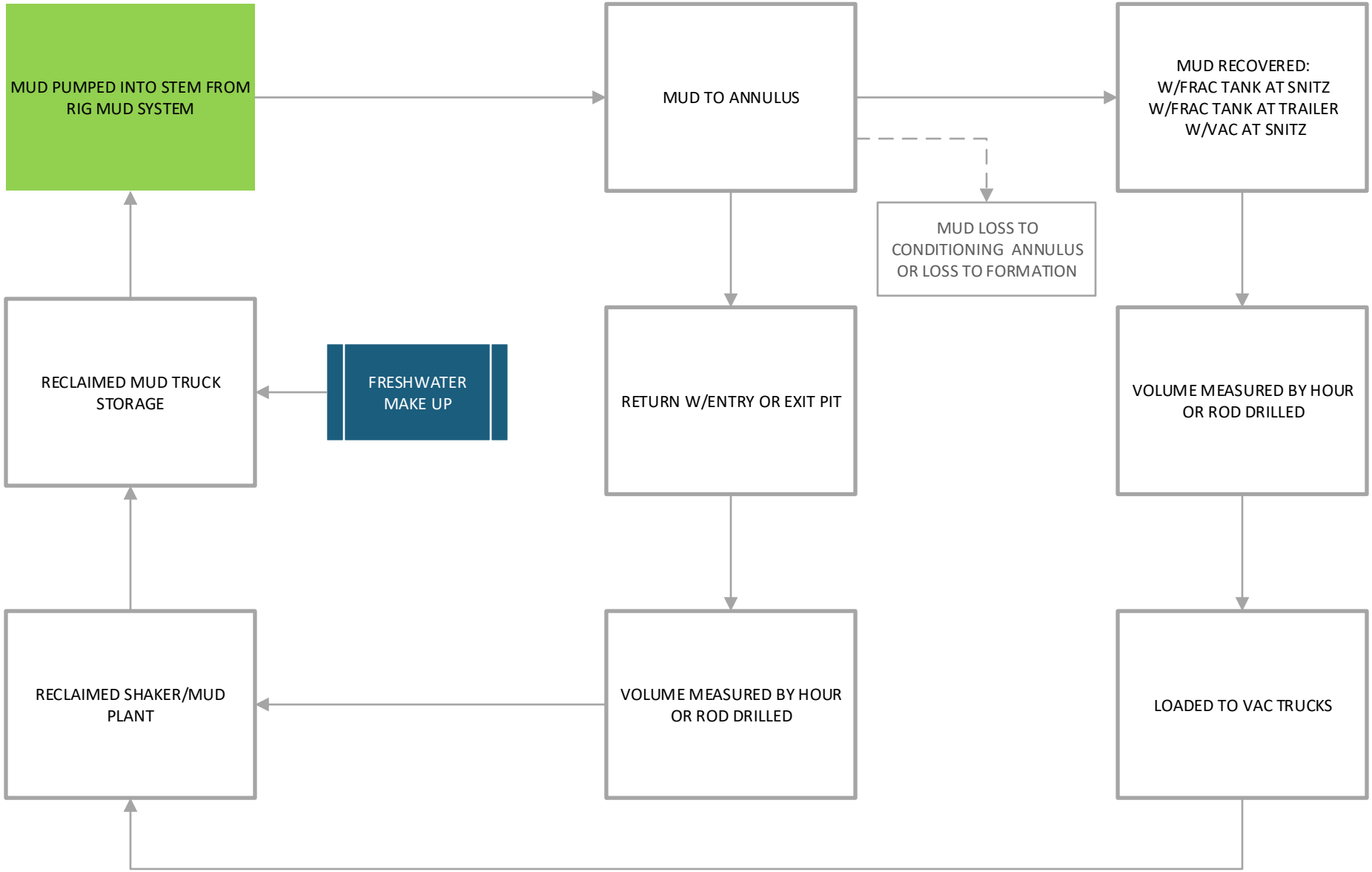
5. 52 crossings were successfully completed by Michels on the Sunoco Mariner East II project with medium to maxi rig sized equipment and successfully utilized a single ream pass. 7 crossings performed by Michels on the project utilized a stepped or multiple ream pass approach due to the use of smaller drilling equipment and a 7 1/2” or smaller pilot hole. Michels drilled a 12-1/4” pilot hole at Zinns Mill Road and is utilizing 2 maxi-rigs, so a single ream pass would follow the standard proven single ream pass procedure. In addition, Michels has successfully completed hundreds of crossings across the world using a 26” or larger initial ream pass.

In conclusion, with the experience and knowledge that Michels has gained on this subject over the past 32 years lessons learned have shown that the “Best Management Practice” of performing a larger initial ream pass is advantageous. The single ream pass is simply a better methodology when the right HDD equipment and tooling is used, within the constraints of such equipment, along with proper drilling fluid flow rates and rates of penetration. The larger annulus of the reamed hole generally keeps drilling fluid returns flowing to the entry/exit returns pits to proactively minimize and avoid most environmental and constructability concerns.

Michels proposes to continue the 26” ream pass direction from east to west. The logic for this decision is taking into the consideration the reamed hole elevation (elev. ~382’) at approximate station 11+33 on the drawing in relation to the proper placement of the proposed relief wells. The proposed relief wells intend to intersect the bore path at approximate stations of 9+75 (elev. 402’), 11+00 (elev. 386’) and 11+60 (elev. 380). The low point of the crossing is elevation ~365’. The current end of the 441’ of 26” reamed hole from the west end (exit side) at station ~26+16 is elevation ~434’. Based on experience, Michels is confident that returns flows would be recovered from the cluster of proposed relief wells for the remaining 1483’ to be reamed. Michels is also confident the 3 existing reliefs wells from the pilot hole stage, along with the 4th proposed relief wells near the 3rd previously installed well would reactivate and act as a contingency plan prior to fluid surfacing in an undesirable location.

ATTACHMENT 5
Mud Flow Diagram

MUD FLOW DIAGRAM
JANUARY 22, 2021

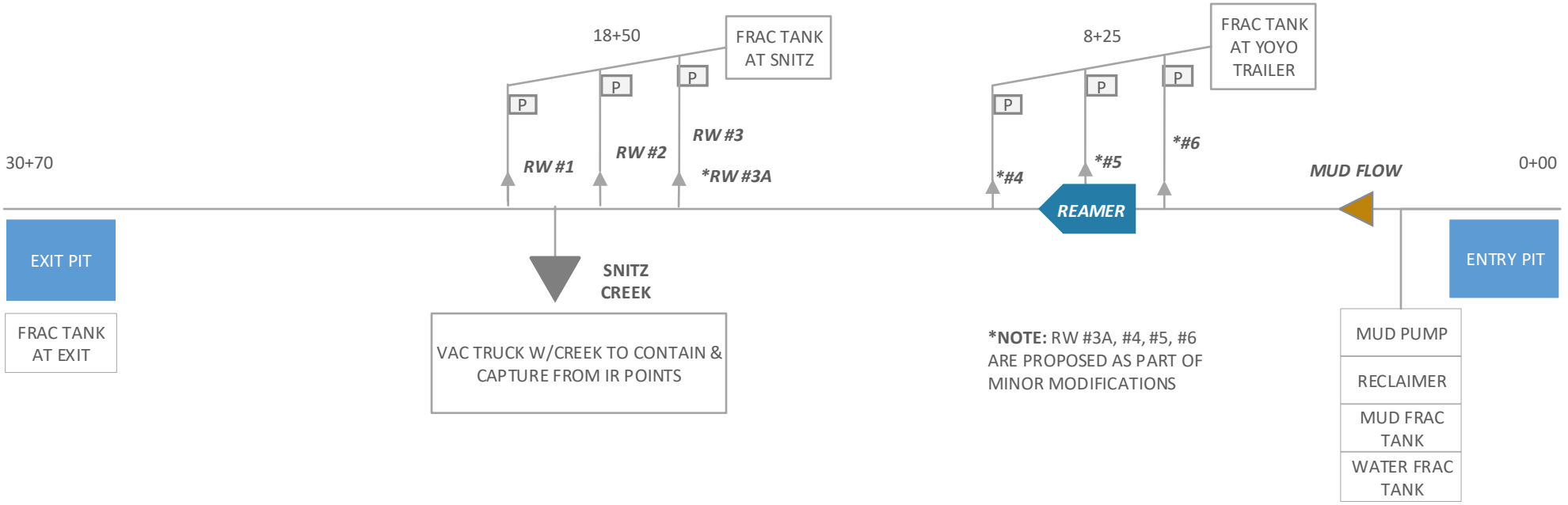


MUD FLOW DIAGRAM
JANUARY 22, 2021

WEST PIT
RIG PULL REAM

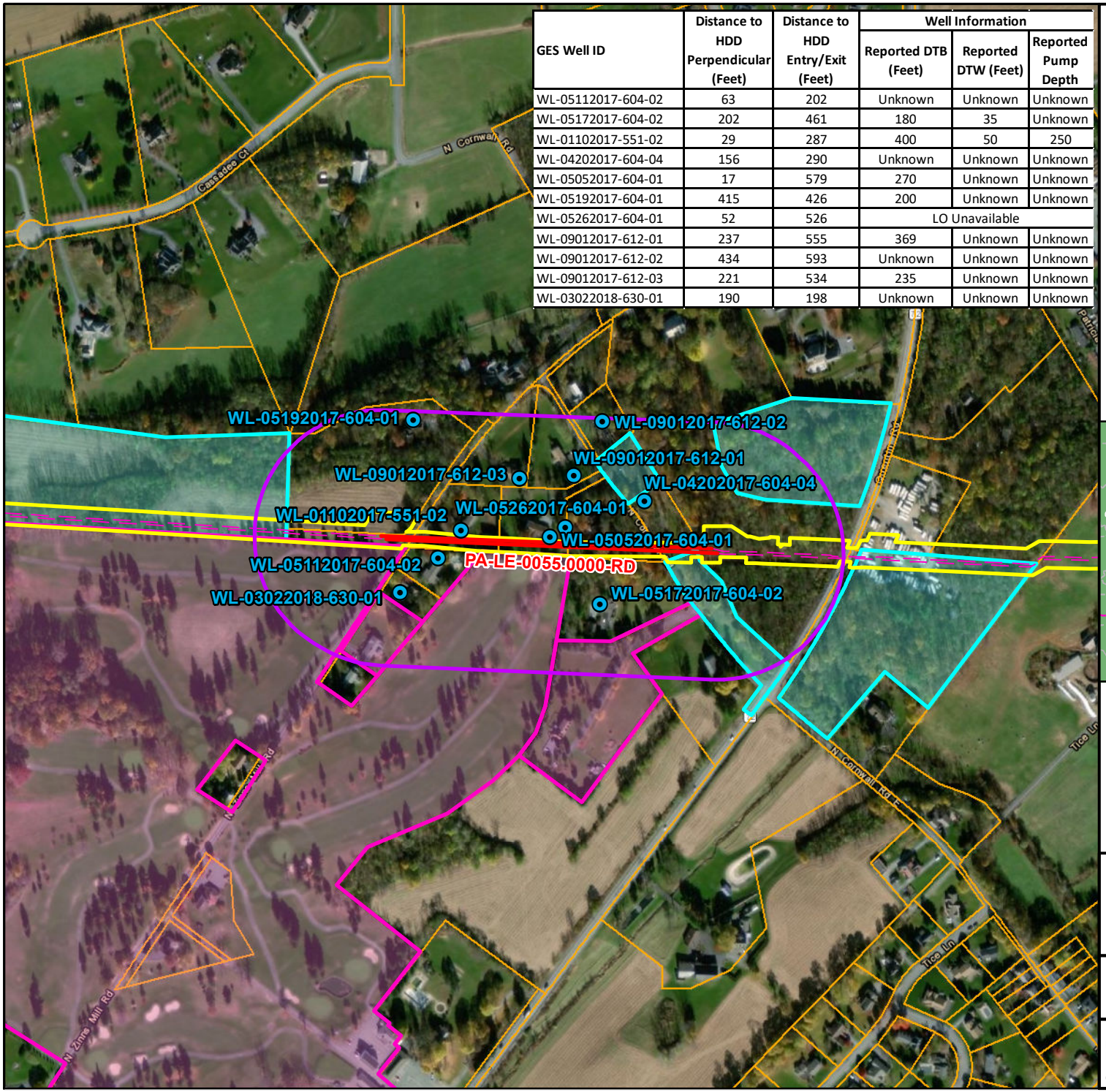
EAST PIT
RIG PUSH REAM

APPROXIMATELY
3,070LF



***NOTE:** RW #3A, #4, #5, #6 ARE PROPOSED AS PART OF MINOR MODIFICATIONS

ATTACHMENT 6
Residential Well Location (within 450') - Map



GES Well ID	Distance to HDD Perpendicular (Feet)	Distance to HDD Entry/Exit (Feet)	Well Information		
			Reported DTB (Feet)	Reported DTW (Feet)	Reported Pump Depth
WL-05112017-604-02	63	202	Unknown	Unknown	Unknown
WL-05172017-604-02	202	461	180	35	Unknown
WL-01102017-551-02	29	287	400	50	250
WL-04202017-604-04	156	290	Unknown	Unknown	Unknown
WL-05052017-604-01	17	579	270	Unknown	Unknown
WL-05192017-604-01	415	426	200	Unknown	Unknown
WL-05262017-604-01	52	526	LO Unavailable		
WL-09012017-612-01	237	555	369	Unknown	Unknown
WL-09012017-612-02	434	593	Unknown	Unknown	Unknown
WL-09012017-612-03	221	534	235	Unknown	Unknown
WL-03022018-630-01	190	198	Unknown	Unknown	Unknown

Legend

- LOD
- Parcel
- PPP Centerline
- HDD
- 450 foot buffer of HDD alignment
- Public Water Supply/Landowner Confirmed No Well
- Testing Refused

****Testing locations current as of 08/20/2018**

- GES Testing Location

Location

0 250 500 Feet

Well Location Map
HDD# PA-LE-0055.0000-RD
Lebanon County, PA.

Prepared By: TETRA TECH

Date: 1/27/2021

Base Map;
ESRI World Imagery, 09/24/2015

Coordinate System: NAD 83 Stateplane, PA South, Feet

P:\GIS\projects\T2\0\0938-PPP\MXD\WellLocations\PA_WellLocations\ThursdayWellLocation_PA_LE_0055_0000_RR.mxd LN

RETTEW
We answer to you.
3020 Columbia Avenue, Lancaster, PA 17603 Phone: (800) 738-8395
E-mail: rettew@rettew.com ● Web site: rettew.com

MEMORANDUM

TO: Nicholas Bryan, PLS, Energy Transfer (ET)

FROM: David Reusswig, PG and David Anderson, PG, RETTEW

CC: Matt Bruckner, PG, RETTEW

DATE: February 5, 2021**, Revised February 11, 2021**

PROJECT NAME: Sunoco Pipeline LP Mariner East 2 Pennslyvania Pipeline - Spread 5 **PROJECT NO.:** 096302010

SUBJECT: Restart Report – S3-0101-16 / North Zinn's Mill Road HDD, West Cornwall Township, Lebanon County, PA

Introduction and Background

This restart report presents site details and an evaluation of the inadvertent return (IR) that occurred during efforts to advance the 26-inch diameter reamer from the east end of Sunoco Pipeline LP's (SPLP) S3-0101-16, North Zinn's Mill Road horizontal directional drill (HDD) on October 19, 2020 in West Cornwall Township, Lebanon County, Pennsylvania. This report includes an updated timeline of site activity that has occurred since the Pennsylvania Department of Environmental Protection (PA DEP) approved the restart of drilling on September 23, 2020.

Pilot drilling for the 16-inch pipe was initiated from the east end of the profile on May 20, 2020, and from the west end of the profile on July 29, 2020. Drilling activities have been conducted by Michels Corporation (Michels). On August 31, 2020, two IRs occurred outside of established containment within Snitz Creek (S-A17). Following restart at the west drilling rig on September 23, 2020, an IR occurred within Snitz Creek (S-A17) just outside of the expanded containment. The containment was further expanded to capture the September 23rd IR location and drilling was halted at the east drilling rig. Drilling at the east drilling rig resumed with recirculation conducted within the further expanded permitted containment structure and the pilot hole was completed on October 5, 2020. The 26-inch reaming phase was initiated by Michels on October 6, 2020. Following the IRs on October 19, 2020, both drilling rigs at the site were shut down and are currently awaiting PA DEP restart approval following approval of this report. Currently, approximately 441 feet of 26-inch reaming has been completed from the west, and approximately 1,133 feet of 26-inch reaming has been completed from the east, for a total of 1,574 feet of 26-inch reaming completed to date. The total length of the HDD is 3,057 feet and there are 1,483 feet remaining to complete the 26-inch ream.

Overview of the HDD Activities

The following is a summary and discussion of drilling activity and other events which occurred during the HDD activities for the 16-inch pipe since September 23, 2020:

- **September 23, 2020:** Michels resumed drilling operations from the west entry pad following PA DEP approval of the restart addendum submitted on September 21, 2020. Approximately 17 feet of drilling had been completed, to a trajectory length of approximately 1,381 feet, when an IR occurred within Snitz Creek (S-A17) just outside of containment in place at the time. The new September 23rd IR location was at (N40.290110°, W76.427301°), which was within the permitted extent of the containment structures within Snitz Creek. Accordingly, to contain the IR, Precision Pipeline, LLC (Precision) extended the

approved containment structures within Snitz Creek to their permitted extents within the pipeline right-of-way (ROW). Operations continued after extension of the containment structures for a short time, with the west drilling rig completing another 14 feet of drilling for the day. At that point, SPLP shut down operations at the west drilling rig. The east drilling rig had also resumed operations this day following extension of the containment structures and completed approximately 32 feet of drilling for the day.

- **September 24, 2020:** The east drilling rig completed approximately 95 additional feet of pilot hole drilling for a total trajectory length of 1,463.54 feet from the east end. Reactivation of drilling fluids occurred at the permitted containment structures and the relief well near Route 72, but no additional IRs occurred. SPLP shut down operations at the east drilling rig pending submittal of a restart report and approval to restart the west drilling rig.
- **September 25, 2020:** Michels drilling on the east and west entry pads remained on standby awaiting PA DEP approval following the September 23, 2020 IR to advance the pilot hole. Michels injected 39 cubic yards of pressure grout downhole. Michels tripped out the grout piping.
- **September 26, 2020:** Michels tripped in 47 rods on the east side, lost circulation on Rod #47, and then tripped out all the rods.
- **September 28, 2020:** Sunoco/ETP submitted a restart report to the PA DEP for the September 23, 2020 IR. Michels injected 40 cubic yards of pressure grout downhole on the east side, then tripped out the grout piping, and then tripped in the drilling rods to the grout in preparation for drilling out the grout.
- **September 29, 2020:** Michels completed trip-in on the east side with no returns. The sensor was determined to be off-alignment approximately 4 degrees. HDD crew remained on standby.
- **September 30, 2020:** Sunoco/ETP received restart approval from PA DEP. Michels received approval to trip out drilling pipe and trip in grout pipe for grouting on 10/1/2020.
- **October 1, 2020:** Michels Injected 18.3 cubic yards of pressure grout, then tripped out the grout pipes and added the downhole assembly to the rig.
- **October 2, 2020:** Michels tripped rods back into the bedrock face and drilled 63.64 feet of new bedrock to a total trajectory of 1,527.18 feet from the east end.
- **October 3, 2020:** Michels continued drilling the pilot hole. Michels completed drilling Rods #50-54 for 160.9 feet for the day and a total trajectory length of 1,688.17 feet from the east end.
- **October 5, 2020:** Michels completed the intersection of the east and west pilot holes and the pilot hole was completed.
- **October 6, 2020:** Michels started the 26-inch ream from west to east.
- **October 9, 2020:** Michels continued the 26-inch ream from west to east and reached a trajectory length of 441 feet from west to east.
- **October 10, 2020:** Michels moved the reamer to the east entry and began reaming from east to west. Michels completed 4 rods of reaming for a total trajectory length of 125.92 feet from the east end.
- **October 12-17, 2020:** Michels continued the 26-inch ream for a total trajectory length of 1,007.74 feet from the east end.
- **October 19, 2020:** Michels continued the 26-inch reaming from east to west. An IR (approximately 150-200 gallons) occurred in Snitz Creek outside of the permitted containment BMP. The IR consisted of 20 separate and isolated discharge points within an approximately 75-foot long span within the creek starting from the southernmost discharge point located directly underneath the Route 72 bridge (STATION 12303+52; N40°17’21.51202”, W-76°25’35.17628”) to the northernmost discharge point located downstream approximately 75 feet from the Route 72 bridge (STATION 12302+00; N40°17’22.26161”,

W-76°25'36.44426"). At the time of the IR, the reaming bit was located approximately 1,133 feet from the east end and at an approximate depth of 120 feet below ground surface. Michels immediately ceased HDD operations and Precision constructed temporary containments around the discharge locations within Snitz Creek. Michels has remained on standby since the 10/19/2020 IR awaiting PA DEP approval of this restart report.

Current Conditions Report

There has been no drilling activity at this HDD site since October 19, 2020. Copies of the most recent IR reports, prepared by Tetra Tech, have been submitted to the PA DEP. A copy of the most recent Current Conditions Report, prepared by Tetra Tech, will be submitted separately.

Analysis of Cause of IR and Assessment of Strata Where IR Occurred

The bedrock underlying the site consists of the Cambrian-age Snitz Creek Formation. Geyer and Wilshusen (1982) describe this formation as a gray, medium to coarsely crystalline oolitic dolomite with limestone, sandstone, and shale interbeds. This formation is well bedded and thick to massive. Fracturing consists of joints which have a blocky pattern. The joints are moderately well developed, moderately to highly abundant, are regularly spaced with a moderate distance between fractures, and are open and steeply dipping. The Snitz Creek Formation is moderately resistant to weathering; slightly to moderately weathered to a shallow depth; irregularly shaped; and the interface between bedrock and mantle is characterized by pinnacles in most places. This carbonate (karst) formation has good subsurface drainage but little surface drainage. The porosity of the weathered portion of this formation is of moderate to high magnitude, resulting in moderate to high permeability. The ease of excavation (and drilling) is classified as generally easy (fast) in the limestone but is somewhat more difficult (slowed) in the dolomite due to the presence of numerous sandstone interbeds.

Groundwater movement within these rocks is primarily through a network of interconnected secondary openings (e.g., fractures, joints, and faults) that were developed by external forces following deposition of the beds. Geotechnical rock core observations confirm that the local bedrock ranges from fractured and very broken to massive interbedded dolomite, limestone, and shale comprised of well-developed thick to massive steeply dipping joint and bedding planes. Importantly, solutioning of these structural features observed during the geotechnical investigations and HDD operations are indicative of a complex karst fracture system

The October 19, 2020 IR totaled approximately 150-200 gallons of diluted drilling fluid and occurred outside of containment within Snitz Creek (S-A17). The IR consisted of 20 isolated discharge locations within an area of Snitz Creek starting from directly underneath the Route 72 bridge to approximately 75 feet northwest of the Route 72 bridge. The northernmost discharge was located at N40° 17' 22.2161"; W-76° 25' 36.44426" at STATION 12302+00. The southernmost discharge was located at N40° 17' 21.51202"; W-76° 25' 35.17628" at STATION 12303+52. Prior to the IR occurring, recirculation of approximately 108,000 gallons of drilling fluid from within the containment was conducted at the August 17th, 2020 and the September 23, 2020 IR locations (see Revision 3 of the Erosion & Sedimentation Control & Site Restoration Plan). The IR occurred with the 26-inch reaming bit at approximately 1,133 feet from the east end of the HDD path and at a depth of approximately 120 feet.

Based on published geologic and hydrogeologic information, geotechnical borings, field observations and geophysical surveys, the October 19, 2020 IR appears to have resulted from a combination of the presence of secondary openings and relatively greater dissolution of bedrock along bedding planes, joints, faults, and fractures that are characteristic of karstic settings.

Depth and Alignment of the Drill Bit at the Time of the October 19, 2020 IR

Currently, the approximate depth of cover over the 26-inch reamed borehole at 1,133 feet from the east end and 441 feet from the west end is approximately 120 feet and 100 feet below ground surface, respectively, for a total trajectory length to date of 1,574 feet. The total length of the HDD is 3,057 feet and there are 1,483 feet remaining to complete the 26-inch ream.

Profile of the Drill Path as Constructed Overlain on the Permitted Profile

A plan of the drill path as constructed and overlain on the permitted profile is included as **Attachment 1.**

Analysis of Potential Mitigation Measures

Alternative considerations were evaluated and implemented as follows:

1. Alternative entry and/or exit points: As discussed in the HDD Revaluation Report - "Horizontal Directional Drill Analysis North Zinn's Mill Road Crossing" dated February 4, 2019 and approved by the PA DEP on May 1, 2020, the HDD entry/exit points were previously reevaluated and revised. The original profile for the HDD was redesigned to make the profile a total of 1,870 foot longer, such that the entry and exit points are in new locations.
2. Alternative entry and/or exit angles: As discussed in the February 4, 2019 HDD Revaluation Report, the entry and exit angles were previously increased from 12-14 degrees to 16 degrees, which allowed for a sharper and quicker entry into and exit out of competent rock.
3. Alternative profile depth: As discussed in the February 4, 2019 HDD Revaluation Report, the depth of cover was increased by 47 feet at the maximum depth. The revised profile radius is also 107 feet deeper below the crossing of Snitz Creek
4. Reduced drilling fluid pressures: Due to the presence of interconnected horizontal and vertical fractures and dissolution features in the karstic bedrock, SPLP will continue to monitor and minimize drilling fluid pressures to the maximum extent practicable to avoid over pressuring the borehole.
5. Thickened drill mud and/or the use of pre-approved LCMs: Michels has used and will continue to use LCMs as needed following IR and/or LOC events to help regain circulation and reduce the risk of IRs and LOC events.
6. The use of pre-approved loss-control materials (LCM): As specified in the Re-evaluation Report dated February 4, 2019 and approved by the PA DEP on May 1, 2020, Michels used LCMs to help regain circulation and reduce the risk of further IRs and LOC during the pilot phase. During the reaming limited use of LCM will be evaluated depending on downhole conditions and current fluid flow at the relief wells. There is a potential that LCMs may plug completely or reduce the effectiveness of the relief wells.
7. Borehole casing: The IR occurred at a boring length of approximately 1,133 feet and a depth of approximately 120 feet, which is beyond the point where casing could be installed at this site.
8. Relief wells: Three relief wells (1, 2 & 3) have been completed and are being utilized at the site. Two wells are located in close proximity to Snitz Creek (S-A17), see Revisions 9 & 10 of the Erosion & Sedimentation Control & Site Restoration Plan. The third relief well is located along the alignment, approximately 1,337 feet west of the east entry location (near Route 72). To address the 10/19/2020 IR, a cluster of three additional relief wells (4, 5 & 6) is proposed for the area around the current reamer location. These wells are to relieve the pressure in the bore hole. A fourth additional relief well (3A) is proposed adjacent to the existing relief well near Route 72. This well (3A) is to provide additional capacity at this location and allow for one well to be in

operation while the other well is cleaned. The locations of the relief wells are shown on the E&S sheets included in **Attachment 2**. Relief wells 4, 5 and 6 have been sited around the reamer location and will be directly over top of the HDD bore. These wells will be drilled into the bore hole and are intended to capture fluid at the point where the loss of circulation originated. Relief well 3A will be offset to the south from the HDD bore by approximately 5 feet. The offset is a required safety factor due to the proximity of the 20-inch pipeline at this location. All of the relief wells will be cased to within a few feet of the HDD bore. The relief well locations were selected based on results from existing relief wells and currently available information. Drilling fluid will be recovered from the relief wells by connecting a pump directly to the top of the well casing. The relief wells will be pumped with a 74 horsepower, 6-inch centrifugal pump which has sufficient capacity to lower the water level in the well casing below the creek bed elevation. The pumping rate will be adjusted based on the HDD rig fluid pumping rate and observations made in the field. Depending on field conditions, observations of fluid loss, and position of the reamer in the HDD bore, all the relief wells may not be in operation at any one time. As the proposed relief wells are installed and new information is collected as the drill progresses, additional relief well locations will be evaluated. Any relief wells installed would remain operational for the duration of the HDD installation. The relief wells would be plugged and abandon after completion of the HDD.

9. Conversion of the crossing type from HDD to other trenchless technologies and open-cut; and relocation of the pipeline that will minimize the likelihood of further IRs so as to adequately protect public health, safety, and the environment: An evaluation of alternative crossing types was conducted and alternative crossings were not feasible or practicable at this location as was discussed in the HDD Revaluation Report dated February 4, 2019 and approved by the PA DEP May 1, 2020. A supplemental alternatives analysis of crossing types for this location was prepared by Tetra Tech and is included as **Attachment 3**.

10. Consideration should be given to installing a dam and flume stream containment as a proactive measure before the HDD is restarted. As such, SPLP has evaluated the installation of a dam and flume to isolate the section of Snitz Creek where previous inadvertent return events have occurred. Subsequently, SPLP submitted a Ch. 102 and Ch. 105 permit modification request on January 28, 2021, prepared by Tetra Tech, Inc., which proposes the installation of a corrugated pipe bypass to collect water flow upstream and discharge downstream of previous IR locations to enable the completion of the HDD while minimizing potential impacts to the creek. In addition, supplemental information was provided via email to the Department on February 5, 2021 which outlines site specific protocols to be followed in the event of an IR within the isolated stream section including notification(s), containment, cleanup, restoration and resumption. Pre-approved and site-specific protocols, as discussed in the February 5, 2021 submittal, would be followed in the event of an IR occuring within the bypassed stream section. Upon IR occurrence, the HDD operation would be shut down and the immediate area of the IR would be contained, and drilling fluid remediated in accordance with the HDD Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan, April 2018 (IR Plan). All appropriate notifications would be made in accordance with the IR Plan for an IR occurring in an aquatic resource. Due to the anticipated restart approval being based on use of the bypass area as a contained area where IRs could be expected to return, SPLP would supplement the approved restart report with submittal of a redline of the current E&S Plans. The redline would identify the location and size of the installed containment and would request the use of the installed containment as an unconventional relief point where upon restart reemergence of drilling fluid would be contained and pumped to vacuum trucks or tanks for reuse or proper disposal. Restart

of the HDD may occur upon providing the PA DEP a redlined plan and receipt of verbal and/or email confirmation from the PA DEP that drilling may resume.

11. An evaluation of a stepped-ream approach using three HDD passes (pilot, intermediate, and final ream), as opposed to the two HDD passes (pilot and final ream) which is the method currently underway at this HDD location was completed by Michels Directional Crossings, and a summary of that evaluation is included as **Attachment 4**.

Drilling Tracking and Reporting

Upon the restart of HDD operations, the following procedure will be utilized to measure/calculate the drilling fluid used during active HDD operations on the shorter of 1-hour or 1-rod intervals. The qualified team of individuals responsible for tracking/reporting drilling fluid usage during the active HDD operations are as follows:

Mud Engineer

- Responsible for tracking drilling fluid usage (on a per rod or hourly basis, whichever comes first) and tracking any fluid recovered and transferred to the frac tanks for reuse/recirculation
- Responsible for completing the daily drilling fluid tracking report
- Responsible for communicating to the driller/drill foreman and to ET any BMP recommendations to restore full circulation, as appropriate, in the event of a LOC.

HDD Contractor Superintendent

- Responsible for overseeing and directing the drill crew on the ground. Will communicate directly with the driller and/or drill foreman and the Mud Engineer regarding specific drilling information for the purposes of determining LOC volumes. The drilling Superintendent will provide internal verbal notifications to the field team as needed.

Lead Environmental Inspector (LEI)

In addition to the responsibilities described in the IR PPC plan the LEI will have the following site-specific responsibilities:

- Continuously monitor Snitz Creek for reactivation of IRs and continuously inspect for new IRs
- Notify the ET field team via text message of any pertinent findings. This includes reactivation of IRs within Snitz Creek, occurrence of a new IR within or in the vicinity of Snitz Creek, or initiation of pumping from a relief well.

Chief Environmental Inspector (CEI)

- Responsible for lead supervision/direction of EI and LEI
- Responsible for assisting ET in the preparation of reports submitted to the PA DEP.

Professional Geologist (PG) and/or Lead PG

In addition to the responsibilities described in the IR PPC plan the PG will have the following site-specific responsibilities:

- Visual inspection and documentation of drilling fluid returns in the pit and notifying the Mud Engineer of any observed loss of returns in the pit

- Assist the Mud Engineer as needed in taking meter readings after the completion of each rod or after each hour (whichever comes first)
- Responsible for internal text message notification to the ET Team if a LOC threshold has been exceeded as determined by the Mud Engineer of if an IR occurs
- Preparation of the PG Daily Inspection Report and submission to ET.

ET Project Manager

- Responsible for overseeing/directing the construction team
- Reports updates to ET Project team.

Construction Manager

- Responsible for overseeing/directing field construction team
- Reports to ET Project Manager.

ET Environmental Project Manager

- Responsible for oversight/direction of Environmental Inspection team
- Responsible for daily submission of Daily Fluid Tracking report and PG Daily Inspection Reports to the PA DEP. These reports will be submitted by noon of the following day
- Responsible for submissions of Restart Reports, LOC Notifications, Loss Prevention Reports, and Landowner Notifications to the PA DEP as necessary.

The procedure for real time tracking of fluid volumes is as follows:

- The onsite Mud Engineer will work and communicate directly with the driller and drill foreman to obtain the necessary information to calculate the estimated the fluid usage immediately after each rod is drilled or after one hour.
- The Mud Engineer will record the estimated volume of drilling fluid used during the drilling of the 31-foot rod or during the last hour. If any of the containments or relief wells have been activated during this time and drilling fluid is being recovered from any of the containment BMPs or the relief wells, the driller will gauge the liquid levels in the frac tanks to determine the estimated volume of fluid recovered and notify the Mud Engineer so he can determine the net fluid loss.
    - The amount of fluid consumed will be calculated as follows:
        - Where:
            - Operational fluid use = Fluid added to mud plant – Fluid recovered
            - Fluid recovered = Total volume of fluid recovered at the relief wells, Snitz Creek recirculation BMP and the mud pit on the opposite end of bore from drilling rig
            - Hole volume estimate calculation:

$$\text{Hole volume} = \left((27.53 \frac{\text{gal}}{\text{ft}} * \text{X ft}) * 1.15 \right)$$

                - *27.53 gallons = per foot volume for a 26-inch diameter hole*
                - *X = length of boring completed in past hour or rod length*
                - *1.15 = 15 % allowance for conditioning the bore hole.*

- The fluid tracking worksheet will be submitted to the PA DEP daily via email.
- A flow diagram showing the fluid circulation at the site is included in **Attachment 5**.

Drilling Fluid Viscosity

The normal drilling fluid viscosity range is 140 to 160 (sec/qt). Based on downhole conditions, the fluid viscosity may be adjusted to achieve efficient cuttings removal. At sites where an influx of groundwater is impacting downhole fluid viscosity, a higher viscosity range is used. Fluid viscosity in the mud tank will vary based on current stage the plant operator is at in adjusting the viscosity. If the operator has just added more water, viscosity is low and if the operator just added bentonite, viscosity will be high. The operator is routinely checking viscosity and any individual sample may not represent the actual final target range of fluid pumped down hole. The PGs have been obtaining one or two viscosity readings a day from the operator. The variation in the readings reported on the Form Bs in the PG daily report indicate the viscosity at a single point in time and do not reflect the target range utilized during drilling. Going forward the PGs will consult, at the end of the day, with the drilling superintendent regarding the fluid viscosity and the viscosity range of the fluid used that day will be reported on the Form B.

Annular Pressure Monitoring

In HDD projects, annular pressure monitoring can be conducted during the pilot phase but is very rarely conducted during the ream phase. Industry experience from pressure monitoring during ream phases has been that little to no downhole pressure in excess of naturally occurring hydrostatic pressure is generated. The pressure monitors typically have required a wire connection. No wire connection with the drilling tools is used during the ream which was one of the reasons why monitoring is not typically performed during reaming. While wireless pressure monitors are now available, the wireless monitors are specifically designed for use during piloting, not during the reaming phase. Further, the currently available wireless monitors are not sturdy enough to sustain the impacts of normal drilling operations during the reaming phase. As a result, the lifespan of the wireless monitors is estimated to be as short as an hour during a normal reaming process. Based on industry experience, pressure monitoring during the Zinns Mill ream phase, using either a wired monitor (which is not possible), or a wireless monitor (which will not sustain the reaming process), is not available or otherwise expected to provide useful information, and therefore is not planned at this time.

Residential Water Supply Wells

As described in the "Water Supply Assessment, Preparedness, Prevention and Contingency Plan" (Plan), revised August 8, 2017, private water supplies within 450 feet of the HDD profile have been routinely sampled and monitored during the project. There are 11 wells within 450-foot radius that have been identified and sampled within the radius. A map showing the locations of the identified and sampled water supply wells is included as **Attachment 6.** A summary table of all the analytical results for all samples collected from these wells has been submitted to the PADEP separately. Per the requirements of the Plan, all the well owners have previously been offered a connection to a temporary water supply "water buffalo" or provided with a regular delivery of bottled water. Prior to restart of HDD operations, all the well owners will be re-contacted by SPLP's land agents to confirm that the landowners have contact information to notify SPLP of any concerns regarding their water supplies, and will also repeat and renew the offer of a water buffalo or bottled water delivery. SPLP will also offer to provide daily communications to the well owners (or as often or in the manner that the well owner dictates) and during drilling, an SPLP representative will be available 24/7 to respond to any concerns or complaints from the well owners.

Borehole Geophysical Logging

Borehole logging of a single boring is planned for the week of February 1, 2021. The borehole will be installed approximately 10 feet south of the HDD profile near the reamer location at the time the October 19, 2020 IR occurred. The borehole will be drilled to a depth 10 feet below the HDD profile. The exact location of the borehole will be determined in the field based on utility clearances and site access for a drilling rig. The expected suite of techniques to be completed includes natural gamma (ng), fluid conductivity, fluid temperature, 3-arm caliper (borehole diameter), along with acoustic and optical televiewer imaging. The results will be provided to the PA DEP as soon as the data analysis is completed. Subsequent borehole logging will also be conducted for each relief well and the results will be provided to the Department within 24 hours of completion of the evaluations and data analyses.

Analysis of Risk of Additional IRs and Recommendations

The October 19, 2020 IR occurred during 26-inch diameter reaming from east to west following recirculation of drilling fluids within the expanded containment at the September 17th and September 23rd IR locations (see Revision 3 of the Erosion & Sedimentation Control & Site Restoration Plan). SPLP installed additional containment(s) around the October 19, 2020 IR/discharge locations. SPLP will utilize the two HDD relief points along the drill path on each side of Snitz Creek within the approved LOD, the third relief point along the east entry borehole near Route 72 where a second relief well will be installed for additional capacity, and a cluster of three new wells at a proposed relief point along Snitz Creek near the October 19, 2020 IR/discharge locations (described above). The four proposed new relief wells will make for a total of seven (7) relief wells at the site. All relief points are intended to reduce the pressure in the borehole and redirect the IR discharges to locations outside of the stream where they can be better controlled. Drilling fluid collected from the relief wells has been and will continue to be returned to the mud pit for re-use.

Based on information provided by, and the expertise of the HDD team, as well as our experience with the relevant hydrogeology and geology, RETTEW agrees with the approach to utilize previously approved and expanded containment BMPs, as well as the recent containments surrounding the October 19, 2020 IR/discharge locations and the four proposed relief wells once approved by the PA DEP. In addition, RETTEW believes that the application of LCM measures and further conditioning of other locations along the borehole will prevent or minimize the risk of new IRs in other locations along this HDD. Consistent with the IR PPC Plan, if a new IR were to occur outside of the currently authorized containments the procedure from Section 5.1.5 “Monitoring Protocol for Condition 3 – Inadvertent Returns” in the “HDD Inadvertent Return Assessment, Preparedness, Prevention and Contingency Plan”, prepared by Tetra Tech, Inc. and revised April 2018, will be implemented. Materials and equipment for containing and controlling IRs are immediately available on-site, as required by permit, during all drilling activities. As mentioned above, a dam and flume stream containment should also be considered prior to the resumption of drilling activities.

Proposed Schedule for Recommencement of HDD Operations & Anticipated Duration of the HDD Operations

SPLP proposes to perform the aforementioned recommended measures upon restart approval from the PA DEP. The anticipated duration to complete HDD operations for the 16-inch pipe is three weeks from restart of drilling, following restart approval.

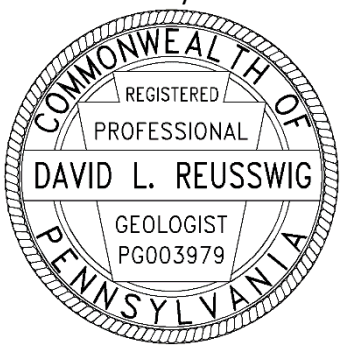
Based on information provided by, and the expertise of, the HDD team, as well as our experience with the relevant hydrogeology and geology, RETTEW believes that the implementation of the measures outlined above will minimize the risk of a new IR in another location on this HDD and minimize the likelihood that further drilling will result in an impact to the environment. Furthermore, based on such information, expertise and experience, RETTEW believes that these measures represent the practicable means, as identified in the April 2018 IR PPC Plan,

that can be taken to minimize impacts to any private water supplies. In the unlikely event of an impact to a private water supply, SPLP will implement the procedures of the IR PPC Plan.

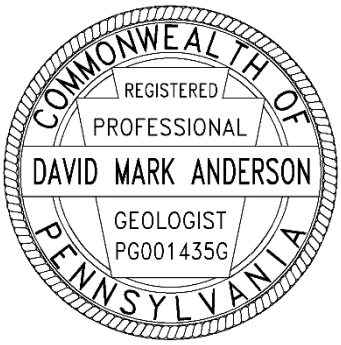
Certification

This report was prepared in collaboration with the horizontal directional drilling team, relying on information gathered and prepared by others. By affixing my seal to this document, I am certifying that the hydrogeologic and geologic information contained herein is true and correct, to my knowledge and belief. I further certify that I am licensed to practice in the Commonwealth of Pennsylvania.

David L. Reusswig, PG
License No. PG003979



David M. Anderson, PG
License No. PG001435G

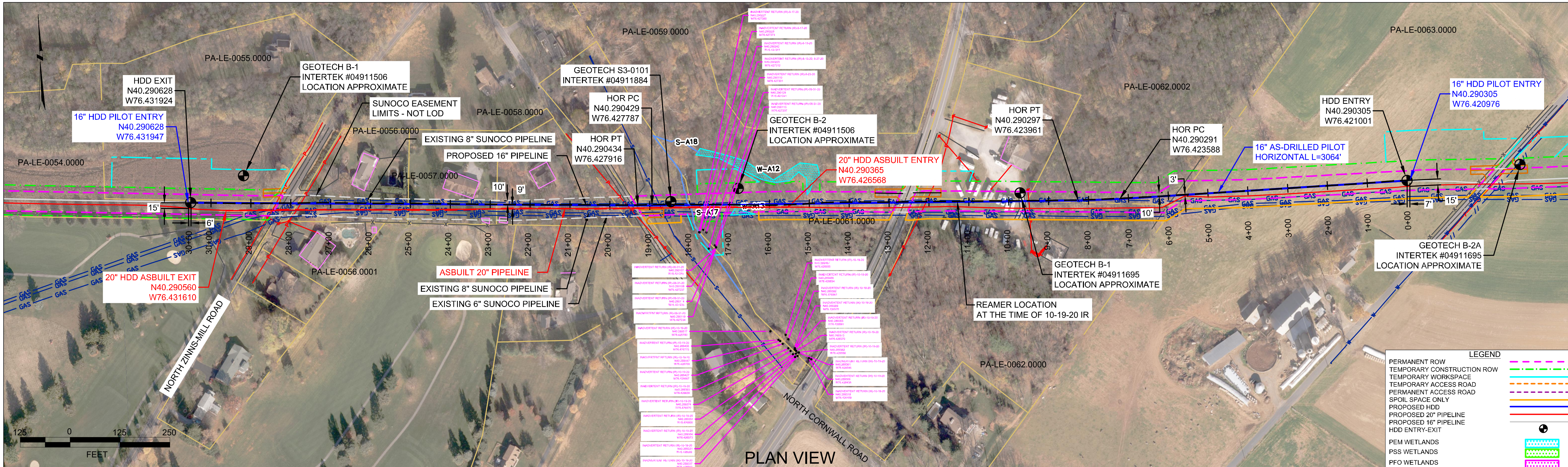


Enclosure

Attachment 1 – PA-LE-0055.Rd-16-IR-Overlay: As-Drilled Pilot Overlay
Attachment 2 – Relief Well Locations (5958ES001–Rev 4 Layout 1, .32-IR-Rev 16 Layout 1, .32 IR.b-Rev 16-Layout1)
Attachment 3 – Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)
Attachment 4 – Sunoco Zinn's Mill Road Single Pass Reaming Discussion
Attachment 5 – Mud Flow Diagram
Attachment 6 – Residential Well Location (within 450') – Map

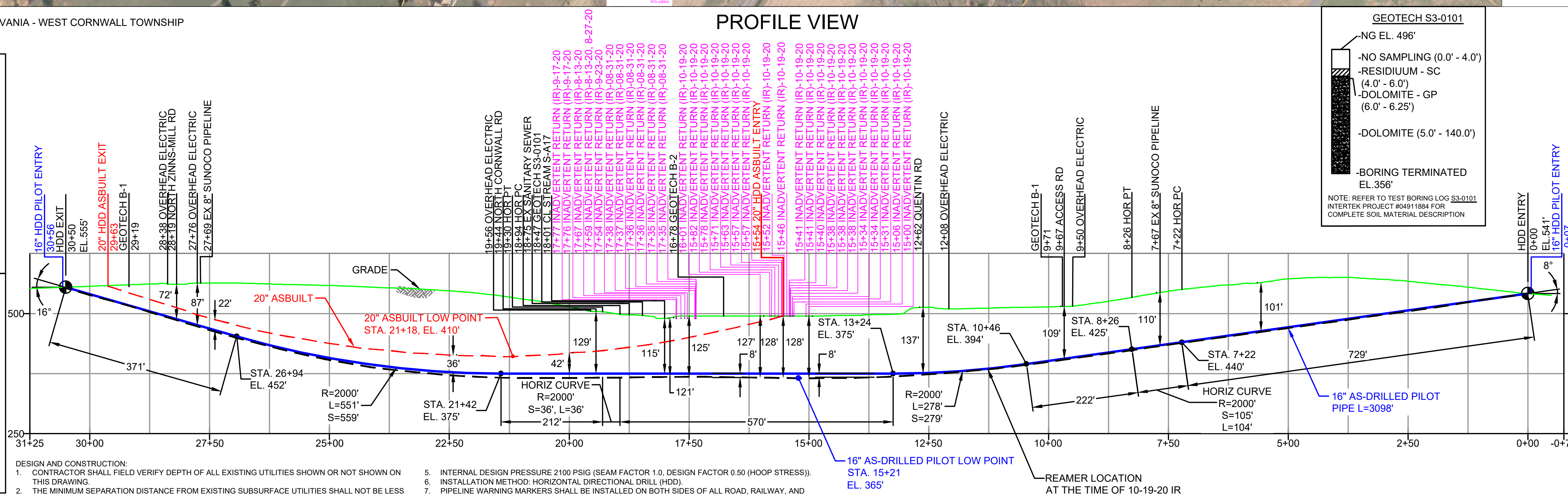
Z:\Shared\Projects\09630\096302010 - Spread 5\GS\Restart Reports & Incident Assessments\S3-0101-16 North Zinns Mill Road\2020-10-20 Restart Addendum 4\COA response\S3-0101 N Zinns Mill Rd_Final Restart Report_Revised 2021-02-11.docx

ATTACHMENT 1
PA-LE-0055.Rd-16-IR-Overlay: As-Drilled Pilot Overlay



LEBANON COUNTY, PENNSYLVANIA - WEST CORNWALL TOWNSHIP
S3-0101-16

PROFILE VIEW



GEOTECH B-1

- NG EL. 556'
- RESIDIUUM-CLAY CL (0.0' - 5.0')
- GROUNDWATER (43.0')
- DOLOMITE/LIMESTONE /SHALE (5.0' - 170.0')
- BORING TERMINATED EL.386'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911506 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-2

- NG EL. 495'
- FILL ML (0.0' - 3.5')
- GROUNDWATER (2.9')
- FILL MH (3.5' - 8.5')
- DOLOMITE/LIMESTONE (8.5' - 105.0')
- BORING TERMINATED EL.390'

NOTE: REFER TO TEST BORING LOG B-2 INTERTEK PROJECT #04911506 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH S3-0101

- NG EL. 496'
- NO SAMPLING (0.0' - 4.0')
- RESIDIUUM - SC (4.0' - 6.0')
- DOLOMITE - GP (6.0' - 6.25')
- DOLOMITE (5.0' - 140.0')
- BORING TERMINATED EL.356'

NOTE: REFER TO TEST BORING LOG S3-0101 INTERTEK PROJECT #04911884 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-1

- NG EL. 515'
- NO SAMPLING (0.0' - 5.0')
- FILL GP-GM (5.0' - 15.0')
- GROUNDWATER (24.0')
- LIMESTONE/DOLOMITE (15.0' - 152.0')
- BORING TERMINATED EL.363'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911695 FOR COMPLETE SOIL MATERIAL DESCRIPTION

GEOTECH B-2A

- NG EL. 543'
- NO SAMPLING (0.0' - 9.5')
- GROUNDWATER (27.0')
- LIMESTONE/DOLOMITE (9.5' - 153.0')
- BORING TERMINATED EL.390'

NOTE: REFER TO TEST BORING LOG B-1 INTERTEK PROJECT #04911695 FOR COMPLETE SOIL MATERIAL DESCRIPTION

DESIGN AND CONSTRUCTION:

1. CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
2. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
3. DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
4. CROSSING PIPE SPECIFICATION:
   HDD HORZ. LENGTH (L=): 3050'
   HDD PIPE LENGTH (S=): 3083'
   16" x 0.438" W.T., X-70, API5L, PSL2, ERW, BFW
   COATING: 14-16 MILS FBE WITH 40 MILS MIN. ARO (POWERCRETE R95)
5. INTERNAL DESIGN PRESSURE 2100 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50 (HOOP STRESS)).
6. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
7. PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
8. CARRIER PIPE NOT ENCASED.
9. PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
10. CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 2625 PSIG.
11. SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
12. SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
13. SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

HDD IR OVERLAY

NOTES

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

REF. DRAWING

DWG NO		DWG NO	DESCRIPTION
ES-5.32	TO	ES-5.32	EROSION & SEDIMENT PLAN
SHEET 18	TO	SHEET 18	AERIAL SITE PLAN

REVISIONS

NO.	DESCRIPTION	BY	DATE	CHK	DATE	APP	DATE
EP12	ADDED 10-19-20 IR AND REAMER LOCATION INFORMATION	MRS	10/20/20	RMB	10/20/20	AMC	10/20/20
EP11	ADDED 9-23-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	09/25/20	RMB	09/25/20	AMC	09/25/20
EP10	ADDED 9-17-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	09/21/20	RMB	09/21/20	AMC	09/21/20
EP9	ADDED 8-27-20 IR INFORMATION	MRS	08/27/20	RMB	08/27/20	AMC	08/27/20
EP8	ADDED 8-13-20 IR AND AS-DRILLED PILOT INFORMATION	MRS	08/18/20	RMB	08/18/20	AMC	08/18/20
EP7	ADDED GEOTECH INFORMATION	MRS	02/25/20	RMB	02/25/20	AMC	02/25/20

Sunoco Logistics Partners L.P.

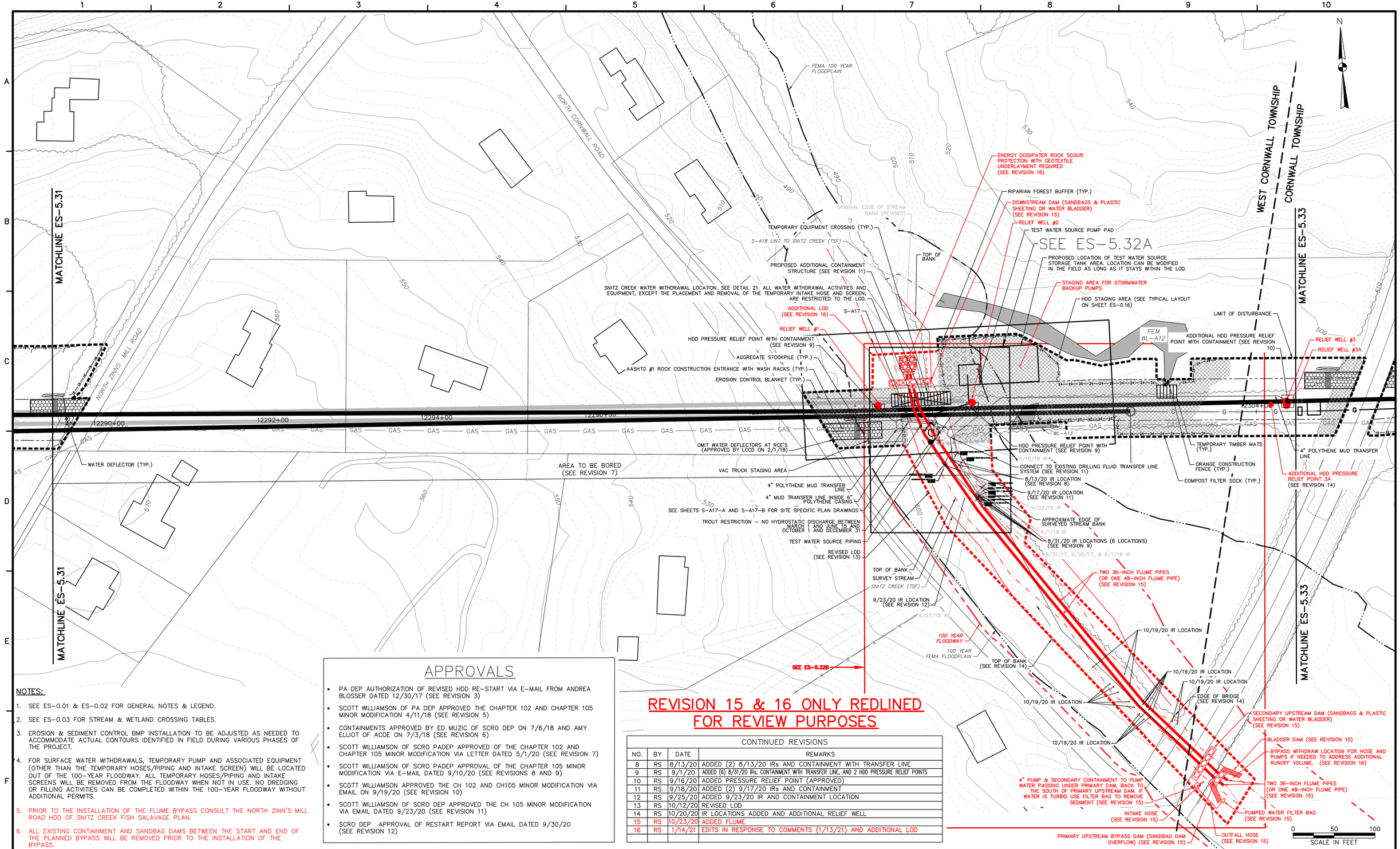
TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

HORIZONTAL DIRECTIONAL DRILL
N ZINNS MILL ROAD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=250' | DWG. NO. PA-LE-0055.0000-RD-16

ATTACHMENT 2
Relief well locations (5958ES001–Rev 4 Layout 1, .32-IR-Rev 16 Layout 1, .32 IR.b-Rev 16-Layout 1)



NOTES:

1. SEE ES–0.01 & ES–0.02 FOR GENERAL NOTES & LEGEND.
2. SEE ES–0.03 FOR STREAM & WETLAND CROSSING TABLES.
3. EROSION & SEDIMENT CONTROL BMP INSTALLATION TO BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONTOURS IDENTIFIED IN FIELD DURING VARIOUS PHASES OF THE PROJECT.
4. FOR SURFACE WATER WITHDRAWALS, TEMPORARY PUMP AND ASSOCIATED EQUIPMENT (OTHER THAN THE TEMPORARY HOSES/PIPING AND INTAKE SCREEN) WILL BE LOCATED OUT OF THE 100–YEAR FLOODWAY. ALL TEMPORARY HOSES/PIPING AND INTAKE SCREENS WILL BE REMOVED FROM THE FLOODWAY WHEN NOT IN USE. NO DREDGING OR FILLING ACTIVITIES CAN BE COMPLETED WITHIN THE 100–YEAR FLOODWAY WITHOUT ADDITIONAL PERMITS.
5. PRIOR TO THE INSTALLATION OF THE FLUME BYPASS CONSULT THE NORTH ZINN'S MILL ROAD HDD OF SNITZ CREEK FISH SALAVAGE PLAN.
6. ALL EXISTING CONTAINMENT AND SANDBAG DAMS BETWEEN THE START AND END OF THE PLANNED BYPASS WILL BE REMOVED PRIOR TO THE INSTALLATION OF THE BYPASS.

APPROVALS

- PA DEP AUTHORIZATION OF REVISED HDD RE–START VIA E–MAIL FROM ANDREA BLOSSER DATED 12/30/17 (SEE REVISION 3)
- SCOTT WILLIAMSON OF PA DEP APPROVED THE CHAPTER 102 AND CHAPTER 105 MINOR MODIFICATION 4/11/18 (SEE REVISION 5)
- CONTAINMENTS APPROVED BY ED MUZIC OF SCRO DEP ON 7/6/18 AND AMY ELLIOT OF ACOE ON 7/3/18 (SEE REVISION 6)
- SCOTT WILLIAMSON OF SCRO PADEP APPROVED OF THE CHAPTER 102 AND CHAPTER 105 MINOR MODIFICATION VIA LETTER DATED 5/1/20 (SEE REVISION 7)
- SCOTT WILLIAMSON OF SCRO PADEP APPROVAL OF THE CHAPTER 105 MINOR MODIFICATION VIA E–MAIL DATED 9/10/20 (SEE REVISIONS 8 AND 9)
- SCOTT WILLIAMSON APPROVED THE CH 102 AND CH105 MINOR MODIFICATION VIA EMAIL ON 9/19/20 (SEE REVISION 10)
- SCOTT WILLIAMSON OF SCRO DEP APPROVED THE CH 105 MINOR MODIFICATION VIA EMAIL DATED 9/23/20 (SEE REVISION 11)
- SCRO DEP APPROVAL OF RESTART REPORT VIA EMAIL DATED 9/30/20 (SEE REVISION 12)

REVISION 15 & 16 ONLY REDLINED FOR REVIEW PURPOSES

CONTINUED REVISIONS

NO.	BY	DATE	REMARKS
8	RS	8/13/20	ADDED (2) 8/13/20 IRs AND CONTAINMENT WITH TRANSFER LINE
9	RS	9/1/20	ADDED (6) 8/31/20 IRs, CONTAINMENT WITH TRANSFER LINE, AND 2 HDD PRESSURE RELIEF POINTS
10	RS	9/16/20	ADDED PRESSURE RELIEF POINT (APPROVED)
11	RS	9/18/20	ADDED (2) 9/17/20 IRs AND CONTAINMENT
12	RS	9/25/20	ADDED 9/23/20 IR AND CONTAINMENT LOCATION
13	RS	10/12/20	REVISED LOD
14	RS	10/20/20	IR LOCATIONS ADDED AND ADDITIONAL RELIEF WELL
15	RS	10/23/20	ADDED FLUME
16	RS	1/14/21	EDITS IN RESPONSE TO COMMENTS (1/13/21) AND ADDITIONAL LOD

TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921–7090 | F: (412) 921–4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	3/28/17	INCORPORATED THE SPECIAL CONDITIONS SET FORTH IN DEP'S CHAPTER 102 AND CHAPTER 105 PERMITS
2	RS	5/25/17	DRAWINGS PROVIDED TO FIELD
3	RS	12/15/17	REVISED HDD
4	RS	2/8/18	EROSION/SEDIMENT CONTROL MODIFICATION FOR RCE
5	RS	3/29/18	ATWS FOR INADVERTENT RETURN RESPONSE AND INSERT
6	RS	6/28/18	ATWS FOR 2ND IR CONTAINMENT (ON 6/6/18), & ADD. CONTAINMENTS
7	RS	12/10/18	REVISED 16" HDD

COMMONWEALTH OF PENNSYLVANIA – REGISTERED PROFESSIONAL ENGINEER – ROBERT F. SIMCIK – ENGINEER PE084455-E

SUNOCO PIPELINE LP
SINKING SPRING, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT CONSTRUCTION SPREAD 4

1–20" & 1–16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

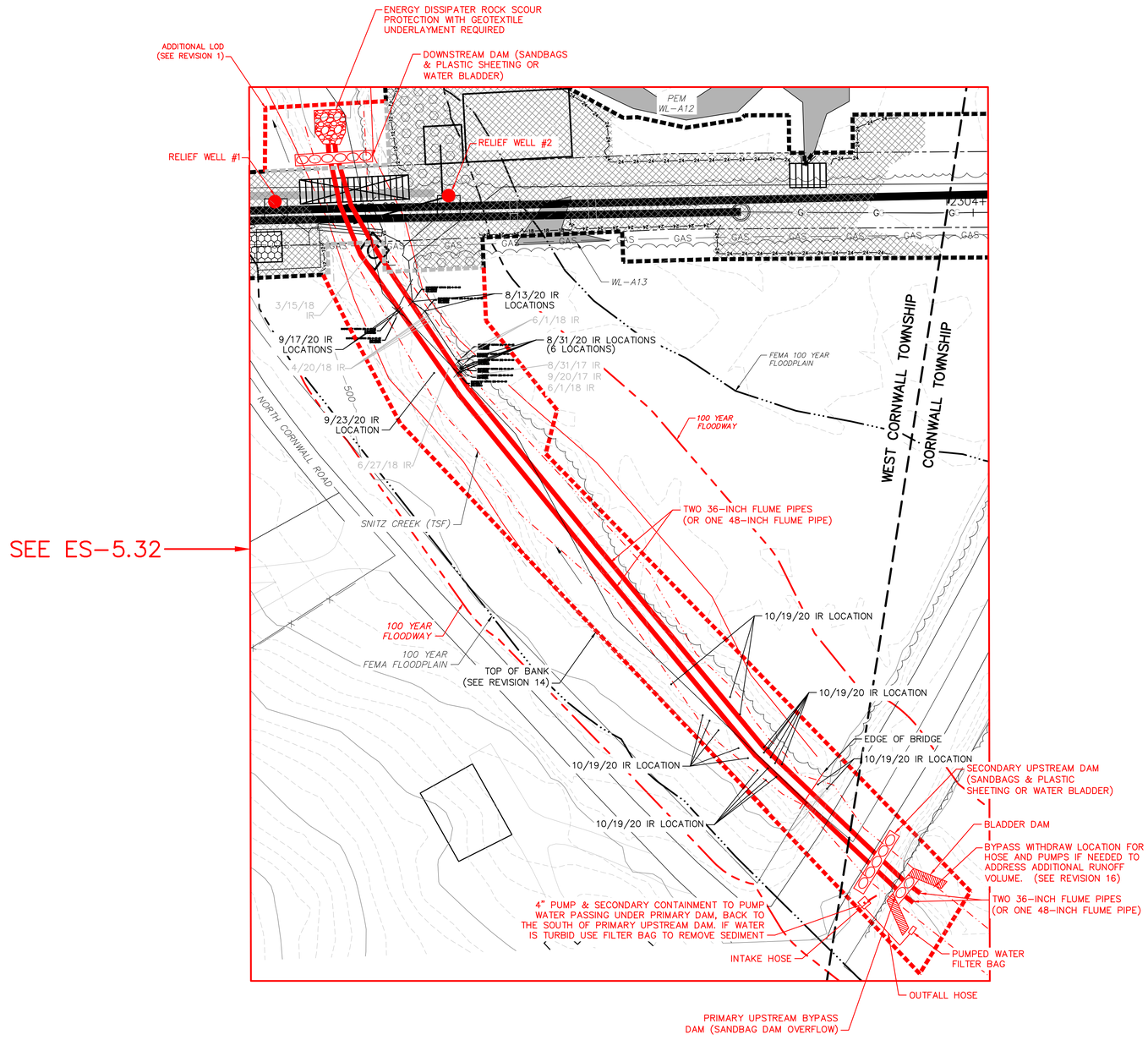
LEBANON COUNTY CONSERVATION DISTRICT EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN

SHEET 32 OF 69

DATE:	2/8/2017
PROJECT NO.:	112IC05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES–5.32
SHEET 5.32 OF 127

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.32–IR – REV 16.dwg PIT NIKKI.DILLA 1/28/2021 8:05:19 AM



TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	1/14/21	REVISED LOD AND BYPASS WITHDRAW LOCATION FOR ADDITIONAL RUNOFF

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ROBERT F. SIMCIK ENGINEER 073644-E

SUNOCO PIPELINE LP
SINKING SPRING, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT
CONSTRUCTION SPREAD 4

1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

LEBANON COUNTY CONSERVATION DISTRICT
EROSION & SEDIMENT CONTROL &
SITE RESTORATION PLAN
SHEET 32 OF 69

DATE:	2/8/2017
PROJECT NO.:	112IC05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES-5.32B
SHEET 5.32 OF 127

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.32-IR.b – REV 16..dwg PIT NIKKI.DILLA 1/28/2021 7:26:51 AM

MATCHLINE ES-5.32

MATCHLINE ES-5.34

WOODED AREA

QUENTIN ROAD

TICE LANE

ADDITIONAL TEMPORARY WORK SPACE FOR CONVENTIONAL BORE CROSSING (SEE TYPICAL LAYOUT ON SHEET ES-0.17)

AGGREGATE STOCKPILE (TYP.)

AASHTO #1 ROCK CONSTRUCTION ENTRANCE WITH WASH RACKS (TYP.)

LIMIT OF DISTURBANCE

EROSION CONTROL BLANKET (TYP.)

TEMPORARY UPSLOPE DIVERSION BERM (TYP.)

TEMPORARY SLOPE PIPE (TYP.)

RELIEF WELL #3

RELIEF WELL #3A

RELIEF WELL #4

RELIEF WELL #5

RELIEF WELL #6

PROPOSED LOCATIONS FOR RELIEF WELLS (SEE REVISION 4)

20-INCH AREA TO BE BORED

16-INCH AREA TO BE BORED

AREA TO BE BORED

BORE PIT (TYP.)

PERMANENT WATER BAR (TYP.)

COMPOST FILTER SOCK (TYP.)

TRENCH PLUGS (TYP.)

TEMPORARY WATER BAR (TYP.)

REVISED 16" HDD ENTRY/EXIT LOCATION

FEMA 100 YEAR FLOODPLAIN

12304+00 12306+00 12308+00 12310+00 12312+00 12314+00 12316+00 12318+00

NOTES:

1. SEE ES-0.01 & ES-0.02 FOR GENERAL NOTES & LEGEND.
2. SEE ES-0.03 FOR STREAM & WETLAND CROSSING TABLES.
3. EROSION & SEDIMENT CONTROL BMP INSTALLATION TO BE ADJUSTED AS NEEDED TO ACCOMMODATE ACTUAL CONTOURS IDENTIFIED IN FIELD DURING VARIOUS PHASES OF THE PROJECT.

APPROVALS

- SCOTT WILLIAMSON OF SCRO PADEP APPROVAL OF THE CHAPTER 102 AND 105 MINOR MODIFICATION VIA LETTER DATED 5/1/20 (SEE REVISION 3)

REVISION 4 ONLY REDLINED FOR REVIEW PURPOSES

0 50 100
SCALE IN FEET

TETRA TECH
www.tetratech.com
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

REVISIONS

NO.	BY	DATE	REMARKS
1	RS	3/28/17	INCORPORATED THE SPECIAL CONDITIONS SET FORTH IN DEP'S CHAPTER 102 AND CHAPTER 105 PERMITS
2	RS	5/25/17	DRAWINGS PROVIDED TO FIELD
3	RS	1/14/18	REVISED 16" HDD AND ATWS ADDITION
4	RS	10/20/20	ADDED PROPOSED LOCATIONS FOR RELIEF WELLS

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL ENGINEER ROBERT F. SIMCIK PE084435-E

SUNOCO PIPELINE LP
PHILADELPHIA, PENNSYLVANIA

PENNSYLVANIA PIPELINE PROJECT CONSTRUCTION SPREAD 5

1-20" & 1-16" PROPOSED WELDED STEEL NATURAL GAS LIQUIDS PIPELINES

LEBANON COUNTY CONSERVATION DISTRICT EROSION & SEDIMENT CONTROL & SITE RESTORATION PLAN SHEET 33 OF 69

DATE:	2/6/17
PROJECT NO.:	112C05958
DESIGNED BY:	JB
DRAWN BY:	GR
CHECKED BY:	RS

ES-5.33
SHEET 5.33 OF 95

R:_Marcellus Shale Projects\Sunoco\5958 – Penn Pipeline Project\14 – Lebanon\E&S\5958ES001.33 – REV 4.dwg PIT NIKKI.DILLA 1/26/2021 4:53:20 PM

ATTACHMENT 3
Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)

TETRA TECH

Memorandum

Prepared by:	Stephen A. Compton, Senior Program Director, Tetra Tech, Inc.
Prepared for:	Energy Transfer
cc:	Brad Schaeffer, Project Manager, Tetra Tech, Inc.
Date:	January 27, 2021 – revised February 11, 2021
Subject:	Supplemental Alternatives Analysis – North Zinns Mill Road Crossing (HDD-S3-0101-16)

SUPPLEMENTAL ALTERNATIVES ANALYSIS
North Zinns Mill Road Crossing
SPLP HDD-S3-0101-16

Original Project-Wide Alternatives Analysis – Original Proposed "Reduced Length" HDD

As part of the 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. The baseline route provided for the pipeline construction was to cross every wetland and stream on the project by open cut construction procedures. The Alternatives Analysis submitted to PADEP conceptually analyzed the potential feasibility of any alternative to baseline route trenched resource crossings (e.g., reroute, conventional bore, HDD). The decision-making processes for selection of the HDD instead of an open cut crossing methodology is discussed thoroughly in the submitted alternatives analysis and was an important part of the overall PADEP approval of HDD plans as originally permitted.

The original proposed 16-inch-diameter HDD (HDD-S3-0101-16) mirrored the original proposed and installed 20-inch-diameter HDD (HDD-S3-0101-20), both located in West Cornwall Township, Lebanon County, Pennsylvania. The original proposed 16-inch-diameter HDD was designed with a horizontal length of 1,180 feet, entry/exit angle of 12-14 degrees, maximum depth of cover of 90 feet, depth below Snitz Creek of 8 feet, and pipe design radius of 1,600 feet. The original HDD (from west to east) began at the western exit site located approximately 144 feet to the west of North Zinns Mill Road, traversed (in addition to numerous buried and overhead utilities) beneath North Zinns Mill Road, residential lands and associated infrastructure, North Cornwall Road, and Snitz Creek (Stream A17) and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway, and terminated at the eastern entry site located approximately 247 feet east of the centerline of Snitz Creek; the eastern entry site workspace also encompassed palustrine emergent (PEM) Wetland A13.

Accordingly, the original proposed HDD comprised a "reduced length" (1,180 feet) HDD alternative compared to the currently proposed HDD (3,050 feet), as further discussed below. Due to inadvertent returns (IRs) that occurred during the installation of the 20-inch-diameter HDD, this "reduced length" 16-inch-diameter HDD plan was re-evaluated in accordance with Condition No. 3 of the Stipulated Order issued under Environmental Hearing Board Docket No. 2017-009-L, and thereby revised with an "increased length" to avoid or minimize the potential for future IRs. As a result, the "reduced length" HDD alternative was eliminated from further consideration and replaced with the proposed re-evaluated and "increased length" HDD.

Additional Reduced Length HDD Alternatives

On February 11, 2021, the Department requested that SPLP evaluate an additional reduced length HDD alternative for HDD-S3-0101-16 that is shorter than the currently proposed HDD (see below) but longer than the original HDD (see above). SPLP developed and evaluated a further reduced length HDD alternative configuration along the original and proposed HDD alignments. The primary considerations in the development of this alternative configuration included, but were not limited to:

TETRA TECH
301 Ellicott Street, Buffalo, New York 14203
Tel 716.849.9419 Fax 716.849.9420 tetratech.com

- best engineering design practices, including but not limited to pipe radius toleranaces, boring and pipe pullback operations, and associated risks and requirements related to pipeline integrity;
- requirements to use the horizontal directional drill (or at least an alternative trenchless) construction method to install the 16-inch-diameter pipeline beneath North Zinns Mill Road and Route 72/Quentin Road;
- maintaining use of the original and proposed HDD exit site, located approximately 231 west of North Zinns Mill Road, to accommodate adequate HDD workspace and suitable (open land) pullback string workspace aligned directly behind the drill path;
- known areal extent and classification of existing PADEP-regulated wetlands, waterbodies, and floodplains/floodways, and objective to avoid or minimize surface disturbance to these resources and associated riparian vegetation buffers;
- specifically, crossings by HDD of Snitz Creek and its regulated floodplain, given use of the open cut or conventional auger bore construction methods to cross this stream were determined to be not technically feasible (see below);
- achieving an HDD bore path with a minimum depth of 115 feet below Snitz Creek (the same depth as the currently proposed HDD) to avoid or minimize the potential for future loss of circulation (LOC) of drilling fluids and IRs;
- known areal extent and protection requirements of existing agency-regulated significant land use, cultural, and human environment resources, and objective to avoid or minimize surface disturbance to these resources;
- specifically, crossing by HDD three residiential properties and associated infrastructure located between North Zinns Mill Road and North Cornwall Road to avoid open cut construction immediately adjacent these human environment resources, as well as due to significant workspace constraints associated with construction immediately adjacent to three existing SPLP buried pipelines within the same permanent right-of-way;
- known existing topographic, geologic, and hydrogeologic conditions and constraints at and below the ground surface along and adjacent to the original and proposed HDD crossing alignments based on the Horizontal Directional Drill Analysis (or “Reevaluation Report”) for HDD-S3-0101-16 submitted to the Department on February 4, 2019 and supplemental investigations; and
- given these conditions and constraints, the objective to use the minimum linear extent of the HDD construction method practicable.

Therefore, this theoretical alternative represents the best engineering design configuration that meets the above-listed objectives based on existing technology, logistics, and cost.

Based primarily on best engineering design practices and constraints related to achieving adequate pipeline depth below Snitz Creek to avoid or minimize the potential for future LOC of drilling fluids and IRs, placement of the HDD entry site at any location west of Route 72/Quentin Road (and east of Snitz Creek by necessity) was determined to be not technically feasible. Therefore, SPLP only considered reduced length HDD entry site locations ranging from immediately east of Route 72/ Quentin Road eastward to the currently proposed HDD entry site located immediately west of Tice Lane.

Based on the above considerations, SPLP developed and evaluated a reduced length HDD alternative configuration for HDD-S3-0101-16 that is designed with a horizontal length of 1,970 feet, entry/exit angles of 16 degrees, maximum depth of cover of 180 feet, depth below Snitz Creek of 129 feet, and pipe design radius of 2,000 feet. This HDD alternative configuration (from west to east) begins at the western HDD exit site located approximately 231 feet west of North Zinns Mill Road; traverses (in addition to numerous buried and overhead utilities) beneath North Zinns Mill Road, residential lands (three residences) and associated infrastructure, North Cornwall Road, Snitz Creek (Stream A17) and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway, PEM Wetland A13, Route 72/Quentin Road, and a portion of a recreational vehicle repair business; and terminates at a new HDD entry site located approximately 163 feet east of Route 72/Quentin Road.

Although this HDD alternative configuration has a shorter (by 1,080 feet) horizontal length than the currently proposed HDD alignment, the maximum depth below Snitz Crek (7 feet deeper based on as-built pilot hole) is essentially the same as the currently proposed HDD alignment. Therefore, this reduced length HDD alternative

configuration would not result in further avoiding or minimizing the potential for LOC of drilling fluids or IRs compared to the currently proposed HDD alignment, and thereby offers no substantial benefit to reducing potential impacts to PADEP-regulated wetlands, waterbodies, and associated floodplains. In addition, based on SPLP's experience on other HDD construction in this area, creation of a new bore path from the pilot hole stage has the potential to result in new LOC or IR locations or issues. Furthermore, this HDD alternative configuration would result in increased surface disturbance and impacts to environmental and human environment resources associated with the new HDD entry site workspace and use of the open cut construction method for the remaining 1,080 feet of the pipeline alignment from the new HDD entry site eastward to the currently proposed HDD entry site located immediately west of Tice Road. Specifically, this alternative would involve temporary HDD entry site and open cut construction disturbance to a recreational vehicle repair business located immediately east of Route 72/Quentin Road, requiring temporary removal of vehicles and disturbance to business operations for the duration of construction, and temporary open cut construction disturbance to maintained open land and agricultural land pipeline right-of-way. Moreover, use of this HDD alternative configuration would require substantial time and further delay associated with "starting from scratch," including but not limited to detailed design, easement acquisition, major modification permitting processes, acquisition of modified state and federal permits, and construction, as well as the irretrievable loss of resources already committed to the construction of the currently proposed HDD alignment.

Based on this analysis, use of this conceptual reduced length HDD alternative configuration does not offer any substantial benefit and results in increased impacts to environmental and human environment resources compared to the currently proposed HDD alignment, and therefore is eliminated from further consideration.

Proposed (Reevaluated or "Increased Length") HDD

The re-evaluated ("Increased Length") 16-inch-diameter HDD was presented in the Horizontal Directional Drill Analysis (or "Reevaluation Report") for HDD-S3-0101-16 submitted to the Department on February 4, 2019. This re-evaluated 16-inch-diameter HDD has been further revised based on supplemental filings, including additional information presented herein, including relocation of the entry and exits sites and lengthening of the HDD to include crossing of Route 72/Quentin Road (for which an open cut crossing is not allowed) and to accommodate adequate open space for the longer pull back string. As part of this redesign, SPLP has considered and adopted a number of additional mitigation measures to further avoid or minimize the potential for IRs (see Analysis of Potential Mitigation Measures in this Restart Report). These mitigation measures include, but are not limited to, relocation of the of the entry and exit sites; increasing the length (by 1,870 feet), entry/exit angle (from 12-14 up to 16 degrees), depth of cover along the bore path (by 47 feet at maximum depth), and depth of cover beneath Snitz Creek (by 107 feet) and its associated floodplain. Specifically, as currently proposed, the re-evaluated HDD is designed with a horizontal length of 3,050 feet, entry/exit angle of 8-16 degrees, maximum depth of cover of 137 feet, depth below Snitz Creek of 115 feet, and pipe design radius of 2,000 feet. The currently proposed HDD (from west to east) begins at the western exit site was located approximately 231 feet west of North Zinns Mill Road, traverses (in addition to numerous buried and overhead utilities) beneath North Zinns Mill Road, residential lands and associated infrastructure, North Cornwall Road, Snitz Creek (Stream A17) and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway, PEM Wetland A13, Route 72/Quentin Road, and additional residences and associated infrastructure, and terminates at the eastern entry site in an open field located approximately 1,262 feet east of Route 72/Quentin Road.

SPLP presented an overall alternatives analysis of HDD-S3-0101-16 in its Reevaluation Report submitted to the Department on February 4, 2019. As presented therein, as required by the Order, the reanalysis of HDD S3-0101-16 included an evaluation of open cut alternatives and a re-route analysis. In addition, as requested by the Department, SPLP presented additional alternatives analyses in its Letter Response to DEP Response (Information Request) to Hydrogeological HDD Re-Evaluation Report, dated August 29, 2019. As described in this submittal, SPLP evaluated Flexbor and Direct Pipe Bore, as well as conventional auger bore, alternatives along the HDD alignment. Based on the analyses of each of these alternative analyses, SPLP confirmed the conclusions reached in the previously submitted Alternatives Analysis that completion of the HDD construction method – which is anticipated to require three (3) weeks to complete from restart of drilling – will cause the least amount of direct impact to the environment and remains the best option for this location.

As further requested by the Department, the following presents a summary of previous, as well as supplemental, analyses of alternatives to the currently proposed HDD-S3-0101-16.

Open Cut – Entire HDD Alignment and Snitz Creek Crossing

As presented in its submittal to the Department dated February 4, 2019, SPLP evaluated the use of the open cut construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment described above. SPLP specifications require a minimum of 48-inches of cover over the installed pipelines, and the Pennsylvania Department of Transportation (PADOT) requires 60-inches of cover under public roadways.

Although an open cut installation of the pipeline is potentially technically feasible along portions of the HDD alignment, several important factors result in use of this method being either not technically feasible or not practicable regarding logistics and existing technology.

Use of the open cut construction method to cross Route 72/Quentin Road is not allowed by PADOT and thereby requires a trenchless crossing. Therefore, use of this method across the entire length of the HDD alignment is not technically feasible. The following discussion addresses the potential use of the open cut construction method across the remainder of the HDD alignment.

The logistics associated with this method would significantly increase the length of time the affected properties would be subject to construction disturbance and would directly affect adjacent residential home sites due to the workspace requirements to accommodate the open trench method while constructing between two existing in-service pipelines.

The HDD alignment crosses one (1) minor perennial stream crossing (Snitz Creek, Stream A17) and one (1) PEM wetland (Wetland A13). Although this stream is not listed as high quality or exceptional value, use of the open cut construction method would result in a direct increase in the physical disturbance to Wetland A13 as well as Snitz Creek and portions of its Chapter 106 Floodplain Fringe and Chapter 105 Floodway. Open cut impacts to these resources would be minimal but would require modification of the state and federal permits. In addition, an open cut crossing would require the temporary and permanent clearing of forested riparian buffer areas on each side of Snitz Creek and within its associated floodplains, and upland forested areas and potentially individual trees immediately adjacent to residential properties.

Furthermore, any produced groundwater in the open excavations would be pumped to a discharge filtration structure. The current feasible filtration ability, however, does not exceed 50 microns. Therefore, cloudy water (from suspended fine clay and silt particles) would be discharged downstream regardless of all control methods employed for the entire duration of the use of open cut construction techniques.

Moreover, based on additional experience and observations gained via the completed installation of the 20-inch-diameter HDD, construction activities for 16-inch-diameter HDDs, IRs, and supplemental geotechnical investigations, an open cut construction method crossing of Snitz Creek (Stream A17) would likely not be technically feasible. Specifically, due to the presence of a shallow groundwater table associated with this perennial stream, a dry open cut excavation through Snitz Creek would be extremely difficult to maintain, requiring a robust groundwater management system including constant pumping of groundwater from the excavated trench, conveyance around the construction area, filtration (as discussed above), and discharge. Due to the volume of groundwater anticipated, it is likely that establishing and maintaining dry trench conditions would not be technically feasible.

Based on this analysis, use of the open cut construction method, either along the currently proposed 3,050-foot-long HDD alignment or only across Snitz Creek, is likely not technically feasible, and therefore is eliminated from further consideration.

Conventional Auger Bore – Entire HDD Alignment

As presented in its submittal to the Department dated February 4, 2019, SPLP evaluated the use of the conventional auger bore construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment described above. A conventional auger bore is generally limited to 200 linear feet at a time, varying by the underlying substrate. Due to the spacing of constraints at the HDD location and changes in elevation at the resources to be bored beneath, there are no subset of locations within this length

of area to feasibly employ this type of installation method. Therefore, use of the conventional auger bore method along the entire HDD alignment is eliminated from further consideration.

Conventional Auger Bore – Snitz Creek

SPLP considered the use of the conventional auger bore construction method to install the 16-inch-diameter pipeline at the crossing of Snitz Creek (Stream A17) and determined it is likely not technically feasible solely due to the shallow groundwater table, and furthermore several important factors result in use of this method being not technically feasible regarding logistics and existing technology, as discussed below.

First, use of the conventional auger bore construction method requires the excavation, stabilization, maintenance, and safe use of bore pits on both sides of the crossing for the duration of the construction process. Due to the shallow groundwater table at Snitz Creek, the bore pits should be setback a minimum of 50 feet from the top of banks of Snitz Creek to minimize the potential for groundwater intrusion. However, this or greater setback distances still would place the bore pits within the floodplain of Snitz Creek. Groundwater intrusion into bore pits not only requires extensive management (pumping, conveyance, filtering, discharge) for the duration of the construction process, but moreover presents significant safety concerns for construction equipment, materials, and personnel, working in saturated and unstable soil conditions. Despite a 50-foot setback, it is likely bore pits would experience extensive groundwater intrusion, resulting in suboptimal (at the least) bore pit conditions.

Second, potentially available workspace on the west side of the Snitz Creek crossing area is very constrained with a maximum of approximately 115 feet between the eastern edge of North Cornwall Road and the western top of bank of Snitz Creek. Assuming the best case scenario use of a typical exit bore pit (instead of the larger entry bore pit) in this area (to support conventional auger bore crossings of both North Cornwall Road and Snitz Creek), such an exit bore pit would be a minimum of 56 feet long, setback from the road by a minimum of 50 feet, and setback from Snitz Creek by 50 feet to maximize potential of avoiding its shallow groundwater table; thereby requiring a typical minimum total of approximately 156 feet. Therefore, available workspace is not available to accommodate the typical minimum conventional auger bore construction method setup, even assuming use of the smaller exit bore pit, between North Cornwall Road and Snitz Creek, such that use of this method is not technically feasible.

Finally, use of the conventional auger bore construction method requires the excavation, stabilization, maintenance, and safe use of bore pits on both sides of the crossing for the duration of the construction process. In addition, SPLP specifications require a minimum of 60-inches (5 feet) of cover over the installed pipeline beneath streams. Assuming flat topography across the crossing profile including the stream, the bore pit depth is a minimum of 8 feet given the base of the boring machine sits approximately 3 feet below the auger. In practice, bore pit depths are deeper to accommodate typical undulating topography and the degree to which the stream bed is incised across the crossing profile, with typical bore pit depths on the order of 10 to 12 feet. However, based on the existing topographic rise from the Snitz Creek stream bed west toward North Cornwall Road, and the highly incised profile of the Snitz Creek banks and stream bed, use of the minimum conventional auger exit bore pit lengths and setbacks (see above) would result in the west exit pit being a minimum of 15 – 20 feet (east – west faces) deep, thereby presenting significant safety concerns for construction equipment, materials, and personnel, as pit walls would require extensive and engineered shoring and diligent monitoring to prevent failure or collapse during the lengthy boring process. These safety concerns are exacerbated by the presence of a shallow groundwater table at Snitz Creek as discussed above. In addition, the shallow groundwater table also presents a substantive risk of collapse of the stream bed along the bore path.

In addition, conventional auger bore crossings of Snitz Creek and North Cornwall Road would also require the temporary and permanent clearing of forested riparian buffer areas on each side of Snitz Creek and within its associated floodplain, and upland forested areas and potentially individual trees adjacent to residential properties. As a result, the conventional auger bore method is not the most practicable alternative that results in the least impact on wetlands, waterbodies, and other environmental resources at this location.

Based on this analysis, use of the conventional auger bore construction method to cross Snitz Creek is not technically feasible, and therefore is eliminated from further consideration.

Combination Open Cut-Conventional Auger Bore

As discussed above, use of either the open cut or conventional auger bore construction methods to cross Snitz Creek is considered not technically feasible. Therefore, use of a combination of open cut and conventional auger bore construction methods along the currently proposed 3,050-foot-long HDD alignment, including the crossing of Snitz Creek, is eliminated from further consideration.

Direct Pipe Bore – Entire HDD Alignment

As presented in its submittal to the Department dated August 29, 2019, SPLP evaluated the use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline along the currently proposed 3,050-foot-long HDD alignment (due to, but not limited to, the requirement to cross Route 72/Quentin Road by trenchless construction method) described above. 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 annular 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 feet in extent on the Mariner II East Project. However, the length of the Snitz Creek/North Zinns Mill Road HDD is 3,050 ft, which exceeds the limits of Direct Pipe Bore technology. Therefore, use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline along entire length of the currently proposed 3,050-foot-long HDD alignment is not technically feasible, and therefore has been eliminated from further consideration.

Direct Pipe Bore – Reduced Length Alignment

As presented in its submittal to the Department dated August 29, 2019, SPLP evaluated the use of the Direct Pipe Bore construction method for installation of the 16-inch-diameter pipeline for shorter lengths along the currently proposed 3,050-foot-long HDD alignment described above. However, due to the presence of surface developments, multiple adjacent utility lines, natural resources, and variation in surface elevations, there are no feasible entry-exit points at the crossing of Snitz Creek to employ this technology, including use of the Direct Pipe Bore construction method along the original proposed 1,180-foot-long, 16-inch-diameter HDD alignment described above. This construction method could be employed to avoid surface impacts in the residential area west of Snitz Creek; however, that would then require use of the open cut or conventional auger bore construction methods to cross Snitz Creek and the adjacent lands. As discussed above, use of either the open cut or conventional auger bore construction methods to cross Snitz Creek is considered not technically feasible. Therefore, the use of Direct Pipe Bore construction method for reduced length alignments, either including a Direct Pipe Bore crossing of Snitz Creek or alternatively incorporating open cut or conventional auger bore crossings of Snitz Creek, have been eliminated from further consideration.

Conclusion

Based on the analysis of all alternative construction methods discussed above, SPLP concluded the HDD construction method remains the best option for this location.

Specifically, the completion of the 3,050-foot-long, 16-inch-diameter HDD is technically feasible and the most practicable of the alternatives considered and discussed above for several important reasons. The re-evaluation, re-design, and previously and additionally proposed mitigation measures (including but not limited to relief wells, real-time tracking of fluid volumes, proactive dam-and-flume stream containment) will minimize the likelihood of further IRs and IR occurrences outside of containment so as to adequately protect public health, safety, and the environment. In addition, completion of this HDD construction method is anticipated to require three (3) weeks upon restart of drilling, whereas all other alternatives (detailed design, easement acquisition, and major

modification permitting processes aside) would essentially start from scratch and require from 3 to 7 months to construct; thus completion of the HDD minimizes the duration of construction activities, including in proximity to residential properties. This method also results in the least direct surface impacts to wetlands, waterbodies, and other environmental resources (i.e., floodplains, riparian buffers, forests, residential areas), and avoids significant impacts on environmental and human environment resources. Therefore, completion of the HDD is considered the most practicable alternative that also results in the least impact on aquatic, other environmental, and human environment resources, and thereby is selected by SPLP as the preferred alternative.

ATTACHMENT 4
Sunoco Zinn's Mill Road Single Pass Reaming Discussion

MICHELS®

Sunoco (ETC)
Zinns Mill Road Crossing
16-inch Steel Pipe
Advantages of Single Pass Reaming and Reaming Direction Explanation

Explanation and Advantages of a Single Ream Pass

Michels HDD drilling rigs and ancillary equipment are the premier drill rigs in the HDD industry with optimum and superior capabilities. Working in tandem with the rigs and ancillary equipment, Michels utilizes hole openers (26" in this circumstance) designed to take full advantage of such capabilities. Michels has successfully performed hundreds of 26" and larger ream passes immediately following a minimum pilot hole size of 9 7/8" diameter with no evidence of additional HDD or environmental risk. In fact, past experience has shown to Michels that typically performing one larger, single ream pass reduces IR and environmental risk.

Michels began using a 27" hole opener as the first ream pass in rock formations on larger diameter HDD's 19 years ago. Working with the manufacturers, a 27" hole opener, designed to follow a minimum 9 7/8" pilot has been commercially available to the entire HDD maxi-rig market since early 2003. Taking advantage of technology and equipment capabilities, that initial ream pass from a pilot hole, in rock, has increased to 30" in 2006, and to a 34" ream pass over 10 years ago in larger product installations. Approximately 6 years ago, again taking full advantage of increased equipment capabilities and technologies, the maxi-rig market has actually began using a 36" initial ream pass in rock formation, where warranted, following a minimum 10 5/8" pilot hole. When reaming unconsolidated soil formations, Michels has regularly performed an initial 54" ream pass from the 12 1/4" pilot for the installation of 42" steel product pipe and has typically had appropriate drilling fluid returns to the entry/exit pits.

Some of the reasons and advantages of performing a single 26" ream pass in comparison to a series of individual passes include:

1. Larger annulus for easing fluid and cuttings flow and reduced annular pressure. This requires adequately sized equipment to introduce the correct amount of drilling fluid to match the ROP (rate of penetration) and clean the hole properly. Michels has the capabilities of cleaning and pumping upwards of 750 gpm. Michels more recent fluid systems are based on 1500 gpm however both rigs on the Zinns Mill Road crossing location have 1000 gpm capacity systems although we are targeting a 750 gpm pump rate.

2. More robust tooling with larger bearings in the cutters, reducing downhole failure and unnecessary drilling and circulating times to replace tooling. In the formation encountered on the Zinns Mill crossing, if a piece of a reamer were to break off, as in a lost cutter, retrieving the broken part would likely prove difficult, if not impossible, leading to a redrill of some, or possibly all of the crossing from the pilot phase.

3. A reamed hole that closely resembles the geometry of the pilot hole (multiple passes have shown to deviate from the original pilot hole with the reamer "walking" or "keyholing" around the harder formations following softer seams). The soil formations encountered on the Zinns Mill Road HDD have been very inconsistent and suggests wandering would occur, performing multiple ream passes, likely causing difficulties installing or damage to the product pipe.

4. Pilot hole annulus in front of the hole opener is smaller (12 1/4”) in comparison to the 7 5/8” drill stem, which would be more likely to restrict fluid flow in front of reamer and keep majority of fluid returns behind the reamer to entry/exit pit, or in this case the relief well.

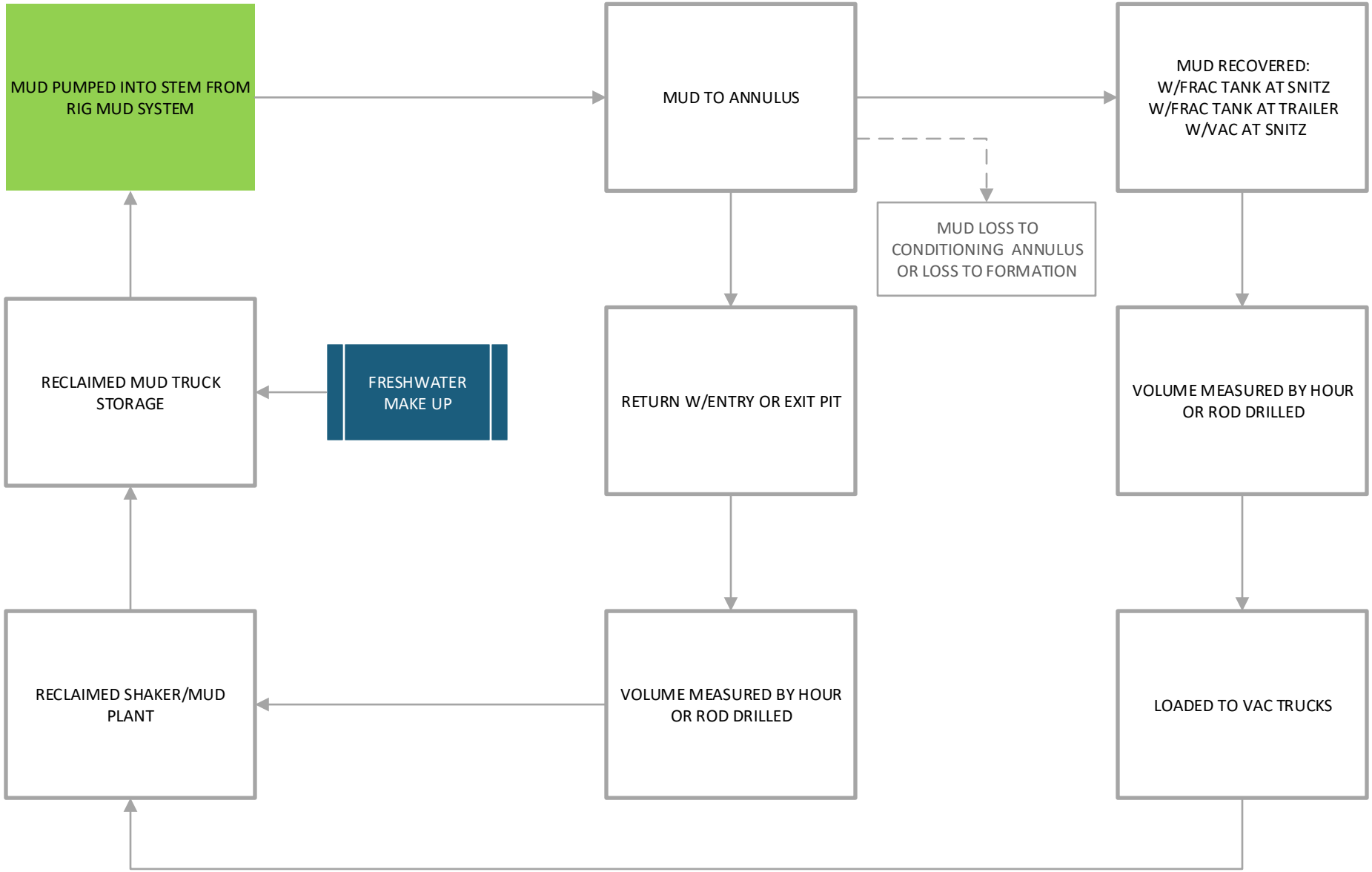
5. 52 crossings were successfully completed by Michels on the Sunoco Mariner East II project with medium to maxi rig sized equipment and successfully utilized a single ream pass. 7 crossings performed by Michels on the project utilized a stepped or multiple ream pass approach due to the use of smaller drilling equipment and a 7 1/2” or smaller pilot hole. Michels drilled a 12-1/4” pilot hole at Zinns Mill Road and is utilizing 2 maxi-rigs, so a single ream pass would follow the standard proven single ream pass procedure. In addition, Michels has successfully completed hundreds of crossings across the world using a 26” or larger initial ream pass.

In conclusion, with the experience and knowledge that Michels has gained on this subject over the past 32 years lessons learned have shown that the “Best Management Practice” of performing a larger initial ream pass is advantageous. The single ream pass is simply a better methodology when the right HDD equipment and tooling is used, within the constraints of such equipment, along with proper drilling fluid flow rates and rates of penetration. The larger annulus of the reamed hole generally keeps drilling fluid returns flowing to the entry/exit returns pits to proactively minimize and avoid most environmental and constructability concerns.

Michels proposes to continue the 26” ream pass direction from east to west. The logic for this decision is taking into the consideration the reamed hole elevation (elev. ~382’) at approximate station 11+33 on the drawing in relation to the proper placement of the proposed relief wells. The proposed relief wells intend to intersect the bore path at approximate stations of 9+75 (elev. 402’), 11+00 (elev. 386’) and 11+60 (elev. 380). The low point of the crossing is elevation ~365’. The current end of the 441’ of 26” reamed hole from the west end (exit side) at station ~26+16 is elevation ~434’. Based on experience, Michels is confident that returns flows would be recovered from the cluster of proposed relief wells for the remaining 1483’ to be reamed. Michels is also confident the 3 existing reliefs wells from the pilot hole stage, along with the 4th proposed relief wells near the 3rd previously installed well would reactivate and act as a contingency plan prior to fluid surfacing in an undesirable location.

ATTACHMENT 5
Mud Flow Diagram

MUD FLOW DIAGRAM
JANUARY 22, 2021

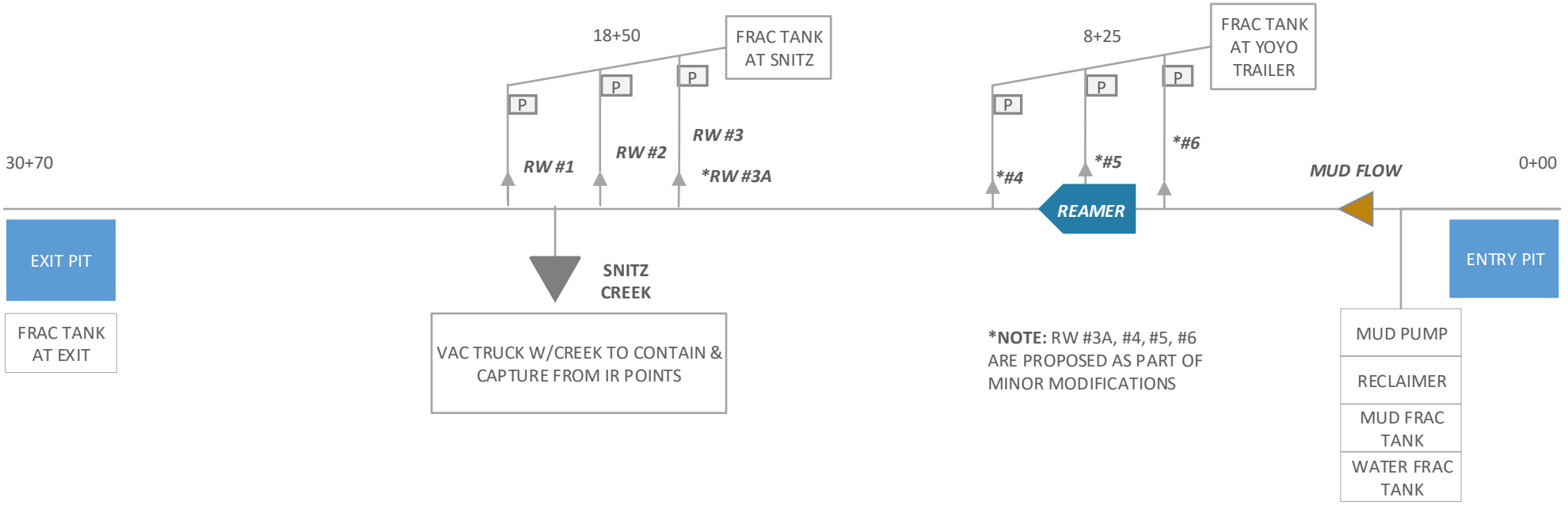


MUD FLOW DIAGRAM
JANUARY 22, 2021

WEST PIT
RIG PULL REAM

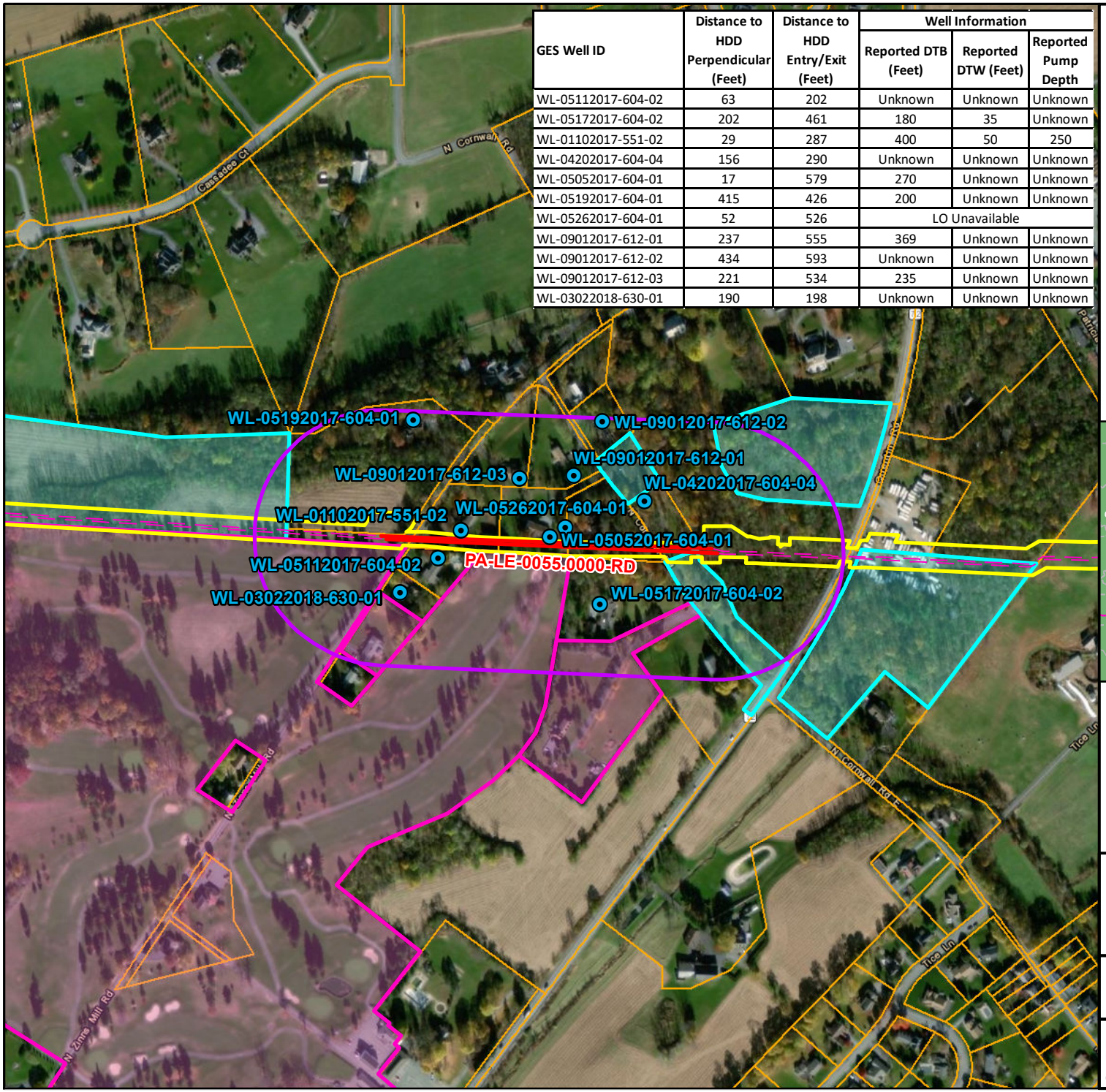
EAST PIT
RIG PUSH REAM

APPROXIMATELY
3,070LF



***NOTE:** RW #3A, #4, #5, #6 ARE PROPOSED AS PART OF MINOR MODIFICATIONS

ATTACHMENT 6
Residential Well Location (within 450') - Map



GES Well ID	Distance to HDD Perpendicular (Feet)	Distance to HDD Entry/Exit (Feet)	Well Information		
			Reported DTB (Feet)	Reported DTW (Feet)	Reported Pump Depth
WL-05112017-604-02	63	202	Unknown	Unknown	Unknown
WL-05172017-604-02	202	461	180	35	Unknown
WL-01102017-551-02	29	287	400	50	250
WL-04202017-604-04	156	290	Unknown	Unknown	Unknown
WL-05052017-604-01	17	579	270	Unknown	Unknown
WL-05192017-604-01	415	426	200	Unknown	Unknown
WL-05262017-604-01	52	526	LO Unavailable		
WL-09012017-612-01	237	555	369	Unknown	Unknown
WL-09012017-612-02	434	593	Unknown	Unknown	Unknown
WL-09012017-612-03	221	534	235	Unknown	Unknown
WL-03022018-630-01	190	198	Unknown	Unknown	Unknown

Legend

- LOD
- Parcel
- PPP Centerline
- HDD
- 450 foot buffer of HDD alignment
- Public Water Supply/Landowner Confirmed No Well
- Testing Refused

****Testing locations current as of 08/20/2018**

- GES Testing Location

Location

0 250 500 Feet

Well Location Map
HDD# PA-LE-0055.0000-RD
Lebanon County, PA.

Prepared By: TETRA TECH

Date: 1/27/2021

Base Map;
ESRI World Imagery, 09/24/2015

Coordinate System: NAD 83 Stateplane, PA South, Feet

P:\GIS\projects\T2\0\0938-PPP\MXD\WellLocations\PA_WellLocations\ThursdayWellLocation_PA_LE_0055_0000_RR.mxd LN