SUNOCO PIPELINE
An ENERGY TRANSFER Company

535 Fritztown Road
Sinking Spring, PA 19608

October 31, 2018

Via Electronic Mail
Mr. John Hohenstein, P.E.
Chief, Dams and Waterway Section
Pennsylvania Department of Environmental Protection
2 East Main Street
Norristown, PA 19401

Re: Supplemental Information
Hydrogeological Reevaluation Report
Valley Road Crossing HDD (S3-0591)
DEP Permit Nos. E23-524
Middletown Township, Delaware County, Pennsylvania

Dear Mr. Hohenstein:

In compliance with the Corrected Stipulated Order dated August 10, 2017 (the "Order"), on May 21, 2018, Sunoco Pipeline, L. P. (SPLP) submitted a response to comments received from the Department in a letter dated March 13, 2018, concerning the Reevaluation Report on the above referenced horizontal directional drill ("HDD"). Please accept this letter as supplemental information to the May 21st letter from SPLP to assist in your review. SPLP proposes to utilize the data and methods below during this HDD to minimize the risk of Inadvertent Returns (IRs) and impacts to public and private water supplies during the construction phases of the HDD.

1. Geophysics Analysis

SPLP agrees to perform a geophysics analysis over the profile for the S3-0591 HDD. The geophysics contractor will review the location of the HDD, geology, and surrounding surface conditions and provide a recommendation on the exact analysis to be employed with the analysis options to include: 3D electrical resistivity (ERI), microgravity, and multi-channel analysis of surface waves (MASW) geophysical methods.

The results of this analysis will be used to identify locations of potential weakness in the subsurface geology, in combination with the use of active HDD data, to identify zones, or locations within the HDD annulus, for proactive sealing or stabilization as described in Item 3 below.

2. Proactive Measures to Prevent Inadvertent Returns and Annulus Subsidence

Items "a", "b", and "c" below discuss the active drilling data that SPLP's directional drilling contractors, professional geologists (PGs) and Inspectors will utilize to identify zones, or

locations within the HDD annulus, for proactive sealing or stabilization. The potential methods of sealing or stabilization are described in Item 3 below.

a. Tool Face Pressure

As the pilot drilling mud motor advances forward, the hydraulic pressure applied to the tool face cutting through the geology is continually monitored and recorded. This information will be used to identify specific locations, or zones, of geologic weakness within the annulus as potential locations for proactive treatment by grout injections to minimize the movement of drilling fluids outside of the borehole annulus, or stabilization of the annulus wall to minimize collapse of the surrounding geologic materials into the annulus.

b. Annular Pressure Monitoring

The annular pressure monitor (APM) is an instrument internal to the drilling rod stem that records the drilling fluid pressures within the annulus of the HDD as the pilot tool advances. The APM is located behind the drilling tool (mud motor), generally 18-30 feet (ft) behind the actual tool face varying by model of the pilot drilling tool. When pilot drilling at entry starts, the APM records the pressure as the pilot tool proceeds through the entry radius down to the maximum depth of profile and then through the exit radius and return to the land surface at the exit point. Generally, there is a normal steady increase in annular pressure (AP) until maximum depth is achieved, and so long as the annulus remains clear, the pressure is generally steady across the horizontal run of the HDD and then will slightly decrease as the pilot tool advance proceeds through to the exit point due a decrease in elevation below ground. Abrupt decreases in AP are indicative of drilling through a fracture, and are typically accompanied by a Loss of Circulation. Declining AP while progressing forward is indicative of formation weakness and loss of fluids to the surrounding formation.

c. Tracking of Cuttings Removal

During both the pilot phase and reaming phase of an HDD, the returns to the HDD are pumped to and recycled through a cleaning unit to remove the cut materials and return the “cleaned fluids” back to the HDD unit for continued use. The volume of materials recovered by the recycler is tracked. SPLP will use this data to verify that the cut and removed materials are consistent with a stable annulus. Some loss of geologic materials surrounding the annulus is normal; however, should the volume of cuttings removed exceed 120% of the calculated annulus volume, then SPLP’s drillers and Inspectors will note this data in combination with tool pressures and AP to identify a location or zone of a potential unstable annulus that may require proactive treatment by grout injections.

3. Proactive Treatment by Annulus Grouting

Generally the use of Loss Control Materials (LCMs) are less effective below 70 ft of the ground surface. The AP below that depth can exceed the effective stabilization capability of LCMs. Many of SPLP’s HDD profiles are below 70 ft of depth for the horizontal length of the profile.

Accordingly, corrective action to address the presence of fractures or unstable geology at greater depths below ground requires grouting of the HDD annulus. Two types of grouting will be utilized for corrective actions to seal fractures and stabilize zones of weak geology. These are: 1) grouting using "neat cement"; and 2) grouting using a sand/cement mix. Neat cement grout is a slurry of Portland cement and water. The sand/cement grout mix is a slurry of mostly sand with a small percentage of Portland cement and activators that after setup results in a material having the competency of a friable sandstone or mortar. Both grouting actions require tripping out the drilling tool, and then tripping in with an open-ended drill stem to apply or inject the grout mixes.

The neat cement grout is highly reactive to the bentonite/water drilling fluid mix and is used during pilot phase drilling to stabilize the movement of fluids within the geologic formation where multiple fractures exist in relative proximity to each other in a stable geologic formation. When a neat cement grout is pumped into the annulus it is chased by a pumped volume of sand/cement grout to "squeeze" or push the neat cement into the fractures surrounding the annulus and then is allowed to setup for a minimum of 24 hours. When this type of corrective action is taken, the sand/cement grout blend that squeezes the neat cement slurry is calculated to result in a material after setup that is still weaker than the surrounding geology to prevent deflection of the drilling tool when it returns to this location in the HDD profile.

The sand/cement grout corrective action is used for the filling of voids encountered while pilot drilling or reaming, or can be used to re-establish an intact annulus wall where the HDD is passing through weak geologic zones or where excessive loss of geologic materials into the annulus has occurred. As previously discussed, the sand/cement grout blend pumped into the annulus is calculated to result in a material after setup that is still weaker than the surrounding geology to prevent deflection of the drilling tool when it returns to this location in the HDD profile.

SPLP submits that we have been, and are, in compliance with the terms and requirements of analysis of the Order, as agreed to by the Department, and that no further analysis is required for the Department to consent to the start of this HDD. SPLP therefore requests that the Department approve the Reevaluation Report for Valley Road Crossing (HDD S3-0591) as soon as possible.

Sincerely,

Larry J. Gremminger, CWB
Geotechnical Evaluation Leader
Mariner II Pipeline Project