



August 6, 2020

VIA ELECTRONIC & OVERNIGHT DELIVERY

Dianne Dow, Director
Division of Land Resource Protection
Department of Environmental Protection
Mail Code 501-02A
P.O. Box 420
Trenton, NJ 08625-0420

RE: Suspension Letter – Freshwater Wetlands General Permit #2
File and Activity No.: 0000-15-0007.1 FWW15001
Applicant: New Jersey Natural Gas (NJNG)
Project: NJNG Southern Reliability Link (SRL)
Municipality: Chesterfield Twp., North Hanover Twp., Burlington County
Plumsted Twp., Jackson Twp., Manchester Twp., Ocean County
Upper freehold Twp., Monmouth County

Dear Ms. Dow:

New Jersey Natural Gas (NJNG) hereby submits to the New Jersey Department of Environmental Protection (NJDEP) its written strategy to prevent and/or reduce future inadvertent returns (IR) for the Southern Reliability Link (SRL) project's remaining horizontal directional drilling (HDD) activities, as required by the permit suspension letter noted below and by N.J.A.C. 7:7A-20.8(d).

This risk mitigation strategy was developed in response to the two Notices of Violation (NOVs) issued by the NJDEP on June 25, 2020 and the Freshwater Wetlands General Permit #2 - NJDEP Suspension Letter issued on July 8, 2020. The NOVs and suspension letter resulted from IR events that occurred on April 9-15, 2020 and June 16-19, 2020.

The most recent IR incident on June 19, 2020, occurred as an NJNG subcontractor was performing HDD activity on Province Line Road, Upper Freehold, Monmouth County to cross under a Burlington County culvert structure. As a result of the IR, drilling mud travelled underground, entered the basement of a house, damaged its foundation and discharged to an adjacent stream. The drilling operation was halted immediately when an IR was suspected, and our incident response plan was immediately put into action.

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Both NOVs require the submittal of “an explanation of measures to be taken to prevent and/or reduce the chances for additional inadvertent returns” and “a best management practices plan to eliminate future inadvertent returns.” The subsequent Freshwater Wetlands suspension letter requires NJNG “to submit to the NJDEP a written strategy” to remedy the inadvertent returns and comply with all environmental permit requirements.

To satisfy these requirements, NJNG engaged two expert firms to inform its strategy and ensure that appropriate protocols are employed to mitigate the risk of IRs moving forward:

1. NJNG engaged CCI & Associates (“CCI”), an international engineering firm specializing in trenchless construction technologies such as HDD, to review and analyze the HDD along Province Line Road that resulted in the June 19 incident. As described in greater detail below, CCI also will be evaluating the five remaining HDDs to confirm that all possible precautions will be taken during these remaining activities.
2. NV5, an engineering and consulting services company, was also retained by NJNG to conduct an independent review and analysis of the IR events that occurred in connection with HDD performed during installation of the SRL. The NV5 report includes a review of the technical work conducted prior to commencing SRL HDD activities and the best management practices incorporated into the project design. NV5 also outlined probable causes for the IR events that are the subject of the NOVs and permit suspension. NV5 reviewed NJNG’s response to the IR events, including the environmental reports prepared and submitted to the Department following each event. Finally, NV5 also reviewed the consistency of CCI’s remedial plan with industry best management practices for HDD.

In consultation with CCI and NV5, NJNG is employing the following strategy to mitigate the IR risk for the remaining HDD activities:

CCI has created an alternative HDD design for the Province Line Road site that was halted due to the IR on June 19. The redesign (detailed in the CCI report) includes a modification to the HDD drill path with a 50' offset from the previous entry and exit point as well a 10' vertical offset from the abandoned drill path;

CCI is conducting a full evaluation of all current HDD designs for the remaining five locations. This evaluation includes a review of the existing construction drawings, available geotechnical data, and survey and regional geological information. A constructability review report will be submitted to NJNG for each of the remaining locations that recommends design changes to limit risk and identifies site-specific HDD parameters to reduce/mitigate construction complications;

An additional geotechnical investigation (detailed in the CCI report) is being conducted for each of the remaining HDD alignments to which NJNG did not previously have access due to road opening permit issues. This analysis will ensure that valuable subsurface data is obtained for use in each HDD design;

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Performance of a full HDD stress analysis. This analysis will ensure that all operating and bending stresses imposed on the pipe will remain within expected limits during HDD installation;

Performance of an annular pressure analysis specific to each remaining HDD to simulate the downhole pressure during the pilot hole drilling and compare it with the overburden fracture pressure of the geological formations above the drill path;

Implementation of a downhole annular pressure monitoring tool to provide real-time pressure data so the contractor can proactively re-evaluate drilling fluid parameters based on field conditions;

Additional tooling modifications to enhance fluid management, such as utilizing smaller diameter drill pipe along with a larger drill head during pilot hole in order to increase annular space and decrease expected drilling pressures;

Additional mechanical cleaning, or “trip outs,” of the bore hole at certain points during the drill to clean the hole and maintain proper downhole pressure;

CCI to perform an HDD risk analysis with NJNG and the onsite contractors specific to each remaining HDD just prior to commencing construction;

The HDD contractor will provide a qualified mud engineer on site for the duration of each drill to monitor the drilling fluid system, its properties and operation. The HDD contractor will restrict the use of additives to those certified by NSF 60 as directed by the NJDEP; and

Development of a bore hole abandonment plan as suggested by the Department.

In addition to the technical assessments and recommendations listed above, CCI will provide for each of the remaining HDDs a qualified HDD inspector on site for the duration of each HDD to review our HDD contractor’s execution plan, drilling fluid program, tooling, and ensure compliance with all requirements. They will also assist with assessment and resolution of on-site issues should they develop.

This inspector, along with the onsite mud engineer, will ensure that the HDD contractor follows the additional protocols that have been and will be developed to ensure that the drilling fluid and downhole pressures remain within design parameters during operation.

A copy of CCI’s HDD Mitigation Plan outlining these additional best practices and execution measures is attached. Also attached is their technical review plan for the HDD on Province Line Road that precipitated the NOVs and permit suspension. The third attached document is the summary report prepared by NV5, which provides a comprehensive review of HDD activities from the planning phase of SRL to the current strategy moving forward.

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At the recommendation of the NJDEP, NJNG will also evaluate the use of drones over areas under construction as an additional means to monitor site conditions during drilling operations.

While the measures outlined above are not typically required for HDDs such as those planned for the SRL, NJNG believes that these measures will significantly minimize the potential for IRs on the remaining HDDs required to complete the project.

How the Strategy will Remedy the Cause(s) of the Suspension (N.J.A.C. 7:7A-20.8(d)(1))

As you are aware, IRs are incidents where the bentonite clay/water drilling mud mixture breaks out of the drilling borehole and, in some instances, unintentionally reaches the ground surface through subsurface fractures, fissures and zones of higher permeability that may be naturally occurring or due to human activity - essentially following the path of least resistance.

The strategies outlined above greatly mitigate the risk of an IR by managing and monitoring drilling pressures through enhanced protocols, thus allowing for the safe use of HDD to minimize surface disturbances and avoid impacts to wetlands, transition areas and streams. By taking the additional precautions outlined in NJNG's strategy, the potential impact to regulated waters will be significantly reduced and/or eliminated.

As noted above, these protocols include: employing the use of site-specific drill designs informed by additional pressure modeling and analyses of geological conditions; utilizing enhanced technologies to provide real-time data to allow drilling operations to be adjusted in response to site conditions; incorporating enhanced cleaning protocols of the borehole to maintain proper pressures; and increased oversight of field conditions with onsite experts.

These strategies reflect proven best management practices and enhanced operational measures for HDDs of this scope, to reduce or eliminate the risk of an IR, as attested by both CCI and NV5 as part of their respective independent reviews.

A demonstration that the strategy will bring the project into compliance (N.J.A.C. 7:7A-20.8(d)(2))

The additional protocols and best management practices recommended and validated by our two expert firms address the potential for future IRs and will maintain our HDD program in compliance with our February 24, 2017 Freshwater Wetlands General Permit #2. These protocols include:

- Conducting an annular pressure analysis for each remaining HDD to simulate downhole pressures and overburden fracture pressures in order to identify optimal operating parameters and thus avoid IRs;
- Using a downhole pressure monitoring tool to accurately evaluate real-time pressure conditions within the borehole, which will allow the drill operator to adjust drilling

- operations, as needed, to maintain appropriate drilling pressures;
- Using smaller diameter drill rods to allow for better circulation of drilling mud;
 - Increasing the frequency of “trip outs” to clean the borehole of obstructions and maintain good circulation and lower drilling pressures;
 - Engaging a “mud engineer” to closely monitor mud viscosity and circulation rates to maintain low drilling pressures and detect subtle changes in drilling conditions, thereby allowing adjustments to be quickly made to further reduce the potential for an IR;
 - Restricting the use of additives to those certified by NSF 60 as directed by the NJDEP; and
 - Developing an abandonment plan as directed by the NJDEP.

A proposed time frame within which the permittee will execute the strategy (N.J.A.C. 7:7A-20.8(d)(3))

NJNG is prepared to implement the enhanced operational strategy immediately. Additional geotechnical information is scheduled for collection for the remaining 5 HDD locations in Burlington County and an evaluation is being conducted of the existing HDD construction drawings, available geotechnical data, and regional geological information. Once completed, site-specific HDD parameters will be identified to reduce the potential risk for IRs that will ensure the successful completion of the SRL project.

NJNG appreciates this opportunity to work with the Department to ensure that future work remains in compliance with applicable rules and permit requirements.

We value the open line of communication between NJNG and the Department and will address any questions or concerns the Department may have in a timely manner.

Sincerely,

NEW JERSEY NATURAL GAS



Craig A. Lynch

Senior Vice President Energy Delivery

cc: Peter Keledy, NJDEP, Bureau of Coastal and Land Use Enforcement (via email)
Andrew Edelhauser, NJDEP, Bureau of Coastal and Land Use Enforcement (via email)
Bryan Barrett, NJDEP, Bureau of Water Compliance and Enforcement (via email)



August 6, 2020

Dennis J. Krumholz Esq.
Riker Danzig Scherer Hyland & Perretti LLP Headquarters Plaza
One Speedwell Avenue
Morristown, NJ 07962-1981

Subject: NJNG: Southern Reliability Link Project

Dear Mr. Krumholz:

Please find attached the NV5 report associated with New Jersey Natural Gas Southern Reliability Link natural gas pipeline project dated August 6, 2020.

Sincerely,

A handwritten signature in blue ink that reads "Ed Gonzales".

Ed Gonzales
Sr. Vice President NV5

NEW JERSEY NATURAL GAS – SOUTHERN RELIABILITY LINK PROJECT INADVERTENT RETURN EVENTS

August 6, 2020

Prepared For:

Riker Danzig Scherer Hyland & Perretti LLP Headquarters Plaza
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1.0 INTRODUCTION

NV5, LLC (NV5) has been retained by New Jersey Natural Gas Company (NJNG), in connection with the installation of the Southern Reliability Link natural gas pipeline (“SRL”). Construction of the SRL to date includes 28 of 34 planned horizontal directional drills (HDD). Of the 28 completed HDDs there were instances of inadvertent returns (IR) during the HDD process on January 29, 2019, February 4, 7, 8 and 19, 2019, April 4-15, 2020 and June 16 & 19, 2020. NV5 has focused an independent review and analysis on the IR’s associated with the Notice of Violations issued on June 25, 2020 by NJDEP’s Central Bureau of Water Compliance and Enforcement and Bureau of Coastal and Land Use Compliance & Enforcement. These IR events are noted below and were associated with HDDs performed on Province Line Road.

- HDD No. 8: IR’s occurred on April 4 - April 15, 2020
- HDD No. 7: IR’s occurred on June 16, 2020 and June 19, 2020

NV5 has prepared a comprehensive summary report to provide a general narrative of how NJNG planned for SRL construction, what happened during the IR events, the probable cause of the IR events, the response to the IR events, the steps taken since the events with regard to future HDD activities and a review of the proposed IR mitigation plan prepared for the balance of HDDs going forward on the SRL Project.

This report has been prepared by the following NV5 representatives:

- Ed Gonzales, Sr. Vice President
- Jay Fleming, Director of Gas Operations

The HDD process is a minimal impact trenchless method of installing underground utilities such as pipe, conduit, or cables in a relatively shallow arc or radius along a prescribed underground path using a surface-launched drilling rig. HDDs offer significant environmental advantages over traditional cut and cover pipeline/utility installations. The technique is routinely used when conventional trenching or excavating is not practical or when minimal surface disturbance is required.

The HDD process was introduced in the early 1970’s to install pipelines, and today, HDDs are heavily relied upon for the primary method for crossings of watercourses, wetlands, utility corridors, road, railroads, shorelines, environmental sensitive areas, and urban areas.

In general terms, the process starts with the receiving pit and entrance pits. These pits will allow the drilling fluid to be collected and reclaimed to prevent waste. The first stage drills a pilot hole on the designed path, and the second stage (reaming) enlarges the hole by passing a larger cutting tool known as reamer. The reamer’s diameter depends on the size of the product pipe to be pulled back through the bore hole. The driller increases the diameter according to the outer diameter of the product pipe being installed and to achieve optimal production (typically the hole is reamed to 1.5 times the diameter of product pipe). The third stage places the product pipe in the enlarged hole by way of the drill stem pipe; it is typically pulled behind a reamer to allow centering of the pipe in the newly reamed path.

HDDs are executed with the help of a viscous fluid known as drilling fluid or drilling mud. It is a mixture of water and typically bentonite clay that continuously pumps to the cutting head or drill bit to facilitate the removal of cuttings, stabilize the bore hole, cool the cutting head, and lubricate the passage of the product pipe. The drilling fluid is sent into a machine called a reclaimer which removes the drill cuttings and maintains the proper viscosity of the fluid. Drilling fluid holds the cuttings in suspension to prevent them from clogging the bore.

HDDs have been widely used for decades in the oil and gas industry and pipeline transmission lines. In addition, the usage has grown to include gas distribution lines in urban and suburban areas, as well for municipal water and telecommunication cable crossings. Federal permitting agencies such as the Federal Energy Regulatory Commission (FERC), Army Corp of Engineers (ACOE) as well as municipalities have welcomed the use of HDDs to crossing sensitive areas (wetlands, waterbodies, etc.), obstructions (utilities, culverts, etc.), and crossings underneath roadways which to maintain the integrity of the road without the disruption of road traffic. HDDs do have risks in the form of IR's or subsurface conditions that may not be conducive to perform a HDD crossing. In this instance, the HDD may need to be abandoned, and alternate methods explored for the crossing or alignment.

During the course of our careers the authors have been involved with the successful execution of hundreds of HDDs throughout the US and Atlantic Canada when crossing the noted features. We have worked with the FERC, ACOE as well as local municipalities and other permitting agencies.

2.0 OVERVIEW OF PREPARATIONS FOR THE HDD WORK

As a best management practice (BMP), prior to a project commencing design and construction, a pre-construction planning stage is completed which involves collecting pertinent data to determine the feasibility and constructability of a project. This includes identifying any potential risks so the project execution team can develop a plan going forward. NV5 has reviewed the following documents associated with the HDDs and summarized the findings of each:

1. AECOM Geotechnical Investigation Report SRL Project Dated August 2017 -

NJNG procured the services of AECOM to perform the design of the entire pipeline which included trenchless crossings and foundation design for valve sites. The geotechnical investigation was performed to support this work on the SRL Project. The first AECOM Geotechnical Investigation Report was prepared in August 2017. This report is comprehensive in addressing site conditions, geologic conditions, subsurface exploration, subsurface conditions, conclusions/recommendations, limitations and reference material. In total, seventy-three (73) geotechnical soil borings were taken and laboratory testing was completed to characterize the physical properties of the soils to assist in the engineering evaluation and design of the trenchless crossing design and foundations.

2. AECOM Borehole Stability Analysis for Typical Conditions Along HDD Bore Path Burlington County, New Jersey Dated December 19, 2017 -

A second report was prepared by AECOM concerning borehole stability for HDD No. 1 and No. 2 in Burlington County. Due to earlier permitting delays and ROW access, the initial soil boring samples taken (AECOM August 2017 report) were only in the general proximity of the HDDs in Burlington County. In addition, it is our understanding that this supplemental report was prepared to familiarize Burlington County with the factors NJNG takes into consideration during the HDD design process. Per the report, these HDDs were selected for further analysis due to subsurface conditions and specific risk factors that are representative to the five (5) HDDs to be performed in Burlington County. Per the report, "the borehole stability analysis is the evaluation of estimated conditions affecting heave and collapse of the HDD borehole. The analysis considers alignment geometry (depth, length, curves), borehole diameter, ground conditions, drilling behavior, and drilling fluid design to accommodate the ground conditions. Borehole stability results can provide an indicator of potential inadvertent returns (with risk of hydro-fracture, heave or loss of fluids) and borehole collapse."

The report provides a comprehensive analysis and findings based upon the collected data. As part of the report, AECOM provided conclusions and recommendations on how to proceed with these crossings as well as noting on the HDD plan and profile drawings “areas of increased inadvertent returns risk”. This type of analysis was performed for each drill design, however, the results were not formalized as shown in this report.

3. NJNG Construction Specifications for the SRL Project- Section 1 Section 8A Directional Drilling -

NV5 reviewed the NJNG HDD specification and it is our understanding that this specification was incorporated into the SRL Construction Contract for the contractor to use as a guideline. The specification includes the following sections:

A. NJNG HDD Specification

Part 1 of the specification (pages 1 - 15) is thorough and includes the following sections for adherence when the contractor is preparing and executing a HDD:

1. Scope
2. Codes and Standards
3. Materials
4. General Requirements
5. Drilling Fluids and Water
6. HDD Instrumentation
7. Drill Path Geometry
8. Safety
9. Pre-construction
10. Construction
11. Drilling Parameters
12. Disposal and Clean-up
13. Reporting
14. Inspections

B. NJNG HDD IR's Specification

Part 2 of the specification Contingency Plan for Handling IRs of Drilling Mud (pages 15 - 27) is thorough and includes the following sections:

1. Introduction (plan scope/approach and HDD process overview)
2. Prevention, Monitoring and Response to IRs (prevention, monitoring, and response measures; terrestrial (upland), surface water and wetland releases)
3. Restoration and Post-Construction Monitoring
4. Typical Failure Conditions and Response Measures

The introduction of the section indicates "*This example plan establishes the minimum design, monitoring and mitigation activities that shall be implemented by the selected Drilling Contractor during HDD installation of the proposed pipeline at all project locations*". NV5 finds the specification to be comprehensive and provides sufficient detail and the appropriate guidance and requirements to the HDD contractor.

3.0 INCIDENTS

3.1 INCIDENT DETAILS

The following information details the HDD location, date, and IR location for each reportable incident that occurred on the SRL Project on Province Line Road. All information was derived from letters sent from DuBois & Associates ("DuBois") to NJDEP:

1. April 9 - 15, 2020 - HDD No. 8 IR along Province Line Road in Upper Freehold Township

The IR's occurred periodically in the past five (5) days (April 9 – April 15, 2020) at Province Line Road, along the tributary to Deep Run, in Upper Freehold Township, Monmouth County.

2. June 16, 2020 - HDD No. 7 IR along Province Line Road in Upper Freehold Township

The IR occurred June 16, 2020 at approximately 4:00pm at 209 Province Line Road, along the tributary to Deep Run, in Upper Freehold Township, Monmouth County.

3. June 19, 2020 - HDD No. 7 IR along Province Line Road in Upper Freehold Township

The IR occurred June 19, 2020 at approximately 10:48am at 39 Hutchinson Road, along the tributary to Deep Run, in Upper Freehold Township, Monmouth County.

3.2 PROBABLE CAUSE

It can be very difficult to pinpoint the probable circumstances that caused the IR events noted above. However, based upon NV5's prior experience, a review of the material provided, and discussions with NJNG team, the following scenarios could be one or more causes for the IR events:

1. Higher down hole pressure than the overburden could contain
2. Seepage into cracks and pores in the soil
3. Artesian water flow
4. Following the path of underground utilities (abandoned, active, or inactive)

NV5 reviewed the HDD drilling logs for HDD No. 7, which noted that the HDD contractor experienced an IR at the end of the day on June 16, 2020 and tripped back 5 joints. The morning of June 19, 2020 the HDD contractor began tripping back to the bottom of the hole and utilized an additive called Magma Fiber to plug the previous IR. Magma Fiber, a NSF 60 certified additive, is a standard Lost Circulation Material (LCM) and is used for plugging off voids and other permeable formations. The drilling log reflects the following: "Used 12 bags of Magna Fiber. 9:08am back on bottom. Still no flow."

Drilling operations ceased at 10:48am due to IR in basement. Due to the unique circumstances that occurred at this crossing, we understand NJNG has abandoned and properly sealed the pilot hole and will be developing a new design for this crossing should HDDs be utilized going forward.

4.0 RESPONSE TO INCIDENT

NV5 reviewed the following letters prepared by DuBois concerning the notice requirements to NJDEP when an IR occurs:

- Letter dated April 16, 2020: IR: Province Line Road: Periodically occurring between April 9 - April 15, 2020: HDD No. 8
- Letter dated April 28, 2020: IR: Province Line Road: Follow-up to prior letter (noted above): HDD No. 8
- Letter dated June 17, 2020: IR: 209 Province Line Road: Occurred June 16, 2020: HDD No. 7
- Letter dated June 17, 2020 (Amended June 27, 2020): IR: 209 Province Line Road: occurred June 16, 2020: HDD No. 7
- Letter dated June 20, 2020: IR: 39 Hutchinson Road: occurred June 19, 2020: HDD No. 7

The letters to NJDEP convey a detailed timeline concerning the IR events and action taken to resolve these events. As noted in several of the letters, DuBois reflects the following: "It is determination of DuBois that due to the expedited clean up within 24 –hours of the event, there were no permanent impact to wetlands or waterways". In addition, DuBois is continuing to monitor the locations to document continued restoration conditions and regrowth of the areas. The response actions implemented by NJNG are BMP's. As we understand, based on verbal discussions with NJNG, ongoing discussions are occurring with the Homeowner at 39 Hutchinson Road to address the IR that occurred in the basement.

It is important to note that NJNG and the HDD contractor were able to get the IR to seal on HDD No. 8 along Province Line Road and they were able to successfully complete this crossing without any further incident. In addition, the HDD contractor was able to successfully complete HDD No. 6 & No. 9 on Province Line Road.

5.0 REPORT OF FINDINGS

In summary, based upon our review of the information provided by NJNG and discussions with the NJNG team, our findings are as follows:

- Pre-Construction: NJNG performed sound pre-construction activities with the utilization of AECOM to collect the appropriate data to analyze and assess the subsurface conditions for performing the proposed trenchless crossings. In addition, AECOM designed the HDD crossings taking into account the subsurface conditions and also provided conclusions and recommendations for NJNG to consider and also pointed out areas of increased IR risk for the remaining five (5) crossings in Burlington County. In addition, the successful HDD contractor was provided a robust HDD and IR specification to use when executing the work and preparing the IR Plan. It is NV5's understanding that during the execution of the crossings NJNG determined which recommendations of the AECOM reports would be implemented and also made modifications to their specification. It is not unusual for an owner/operator to modify their specifications to meet specific project conditions.

- NV5 reviewed a letter from ULS Corporation (ULS), the prime contractor on the SRL Project. ULS proactively began looking at HDD No. 8 to develop contingency plans to mitigate IR's at this location. The following were the items presented:
 - Installation of hay berms.
 - Location of sandbag berms should a pump around be required in the creek bed if an IR occurred.
 - Changes to the drill path to have greater separation between the drill path and an existing 60" reinforced concrete pipe.

Per our discussion with NJNG they implemented all recommended mitigation measures. Additionally, they installed hay bales and silt fence around the stream in advance of construction so as to prevent any upland IRs from flowing into the stream.

- IR's: Unfortunately, IR's occurred during the drilling of the pilot holes on HDD No.7 and No.8. As noted above, NJNG and the HDD contractor acted very quickly to control the IR's, by cleaning-up and restoring the site immediately. In addition, ongoing monitoring is being performed at the sites. Utilization of BMP's as outlined in the IR Plan was successful in limiting any permanent impacts to the surrounding wetlands, riparian zones and waterbodies.

Implementation of the IR Plan within 24-hours was successful in limiting any permanent impacts to wetlands and waterbodies per several of the letters to NJDEP from DuBois.

On July 8, 2020 NJDEP issued a suspension letter to NJNG on the SRL Project due to the IR's that occurred on April 9 - April 15, 2020, June 16, 2020 and June 19, 2020.

6.0 REVIEW AND ANALYSIS OF HDD PLANS MOVING FORWARD

As part of NV5's assessment, we have reviewed several initiatives that NJNG is considering to implement concerning the remaining six (6) HDDs (No. 1 - 5 in Burlington County and No. 7 in Monmouth County). The following assessment of the documents has been conducted:

1. CCI & Associates Inc. (CCI) developed two reports for NJNG for performance of the remaining HDDs on the SRL Project. The following is summary of these documents:
 - Southern Reliability Project – 30" HDD7 Review- August 5, 2020 -
 - NJNG secured services of CCI “to provide go-forward recommendations to ensure environmental protection during the completion of the HDD7 Horizontal Directional Drill (HDD)”.
 - In addition, CCI provided guidance concerning the HDD stress analysis associated with the pullback of the product pipe for consideration. CCI has also provided recommendations for continuance of the HDD No.7 as reflected below:
 - A redesign of the HDD drill path with a 50' offset from the previous entry and exit point as well a 10' vertical offset from the abandoned drill path.
 - Increasing the annular space between the drill pipe and jetting assembly for the pilot hole. Recommending 4 1/2" drill pipe and 12 1/4" jetting assembly.
 - Maintaining full returns to entry pit and defining tolerances for drilling fluid density, jetting methodology, drill production rate and trips downhole to mechanically clean the pilot hole.
 - Developed a downhole pressure curve for the HDD and notes the following; “Based on the pressure chart above, there is a low risk of fracture for most of the drilling path, with a moderate-low risk of fracture within the middle 400 ft. of the drill”. To mitigate the risk of potential IR's, CCI recommends annular pressure be monitored.
 - Close monitoring of the drilling fluid system and properties.

- Have a Mud Engineer on site full time during the pilot hole operations.
- Additional trips down hole to keep the hole clean within the area of concern (400 ft. mid-point of HDD).
- Open line of communication between NJNG and HDD contractor to correct identified issues during the drilling process.
- Have a qualified inspector on site during all stages of the drill to ensure plans are implemented and on site when contingency plans need to be addressed due to on-site drilling issues or concerns.

All of the above items that are noted in the CCI report are sound recommendations and have been successfully implemented on numerous HDDs that NV5 have been associated with.

- o NJNG Southern Reliability Link's HDD Mitigation Plan: Dated August 5, 2020 -
 - NJNG secured the services of CCI to help ensure that all appropriate precautions are assessed to help prevent IR's for the remainder of the HDDs on the SRL Project. As noted in the CCI report "*Due to the nature of the formations present, these lower pressures may reduce potential environmental impacts, however, the existence of preferential paths such as fissures and fractures in the formation are rarely located in the geotechnical investigation, even with numerous borings along the HDD path*". With that said, CCI offered several General Guidelines for additional BMP's and execution measures for NJNG to consider going forward. These include -
 - Detailed Design Review: Perform a detailed design review as well as a review of geotechnical data collected and regional information. CCI would provide NJNG a memorandum identifying HDD parameters to reduce/mitigate construction complications and recommend design changes to limit risk.
 - Geotechnical Investigation: CCI describes a site specific geotechnical investigation that NJNG did not have access to previously that they will be undertaking. They go on to describe the extensive review and analysis that will be performed of this data.
 - Annular Pressure Analysis: Indicates modelling will be performed to simulate the downhole pressure during the pilot hole. This analysis and calculations will assist the HDD contractor in understanding their limitations of downhole pressure to mitigate the risk of IR's.
 - Contractor Mitigation: CCI recommends that the HDD contractor prepare an Engineered Drilling Fluids Program, as annular drilling fluid pressures can change significantly with the changes of drilling fluid properties. They also recommend annular pressure measurement during the HDD installation.
 - Construction Inspection and Oversight: CCI recommends daily oversight of the HDD contractor to help with assessment and resolution of drilling issues as they occur.
 - HDD Abandonment: Should abandonment of a borehole be required, CCI provides reference material for consideration on how to perform the work.
 - Training: CCI recommends that the HDD contractor is properly trained and proficient in industry established management practices.

The general HDD guidance that CCI has provided in this report is very sound and hits the critical areas of concerns that NV5 would have. As CCI also has noted, HDDs have been successful in crossing environmentally sensitive areas and obstructions where conventional cut and cover techniques would not be viable or permitted. However, it does come with risk in the form of IR's, or subsurface conditions are such that a HDD is just not viable. With that said CCI presented several recommendations, as noted above, for all the remaining HDDs and as with the first report, these have been successfully implemented on numerous HDDs that the authors of this report have been associated with.

NV5 recommends the following additional items for consideration:

- All HDD construction drawings going forward should be prepared by NJNG's design firm rather than by the HDD contractor. This will add control and will ensure proper vetting with all team members before implementing a change.
 - Evaluation of the pros and cons of performing an intersect method (drilling the pilot from the entry and exit point and intersecting along the drill path) for the pilot hole. This could help address downhole pressure issues and further mitigate IR's.
 - If additives are going to be considered, they should all be addressed with the team, as well as when they would be utilized.
2. Additional Geotechnical Reports -
- Earth Engineering Incorporated - July 8, 2020:
 - A supplemental soil boring was taken near the alignment of the current drill path for HDD No. 7, as we understand it. This additional soil boring will be beneficial as NJNG explores a new HDD path and/or the possibility of using other construction methods.
 - Per our discussions with the NJNG team on July 24, 2020, they indicated that they will be performing two (2) soil boring samples at each of the five (5) HDDs remaining in Burlington County. These additional soil borings are a proactive approach as NJNG determines the path forward for these crossings to minimize, or mitigate, any accidental IR's.
3. Additional Evaluation of the Remaining Six (6) HDDs -
- NJNG indicated they will be undertaking an extensive evaluation of the remaining six (6) HDD crossings. This will include the recommendations noted in the CCI reports.
 - Now that access has been granted by Burlington County, geotechnical borings can be completed for the five (5) remaining HDDs in County roadways.
 - In addition to the geotechnical data being collected as noted above, we understand NJNG will also undertake a review of the HDD and IR Specification, current HDD design and IR Release Plan. The extensive reassessment is a very proactive approach to evaluate the execution of the remaining six (6) HDDs and mitigation measures for potential IR's.

As noted above in Section 6, CCI's report provides some excellent recommendations associated with the continuance of HDD No. 7. In addition, their report associated with general HDD guidance for design and construction, reflects some comprehensive guidance for all remaining HDDs on the project.

NJNG is undertaking several initiatives to explore the best options going forward as well as gathering appropriate expertise to develop the best path for success. From NV5's perspective, one of the most important recommendations noted by CCI is the pause and reassessment of the existing geotechnical data and assessment of new data for planned future soil borings; this is the foundation for making sound decisions on the options for a path forward and contingency planning for the crossings. CCI recommends using a team of HDD experts, professional geotechnical engineers and geologists which NV5 agrees is critical in the successful execution of HDD crossings.

When executing HDDs in the past, the authors of this report have experienced some similar situations that NJNG is currently facing, and they took a similar approach to assess all options and develop a successful execution plan to complete those HDDs.

7.0 APPENDICES

7.1 DOCUMENTATION RECEIVED AND REVIEWED

- See attached table prepared and provided by NJNG

7.2 NJNG INTERVIEWS

On July 22, 2020 and July 24, 2020, the authors of this report had the opportunity to interview multiple NJNG engineering representatives to discuss the various items reflected in this report.

7.3 NV5 PROJECT TEAM

1. *Ed Gonzales, Sr. Vice President*

- a. See attached CV
- b. HDD experience summary –

Over 40+ years of experience executing energy projects. Throughout career, has been directly responsible for or provided oversight for the layout, geotechnical analysis, design and execution of over a hundred HDDs. In addition, has been involved with several hundred HDDs during route section and feasibility stages of projects in the US as well as Atlantic Canada. Involved with several State of Art HDD crossings: land to water, water to water, and record HDD crossing lengths at the time of the installation. Several landmark HDDs were successfully completed in 2012 and 2013 on the NJ/NY project, executed on behalf of Spectra Energy including the Kill Van Kull, Hudson River with landfall in Manhattan (Gansevoort Peninsula), 18th street and multiple in Jersey City. Certified by the National Energy Board in Canada to provide testimony as a technical expert for HDDs on a proposed natural gas pipeline in Atlantic Canada.

2. *Jay Fleming, Director of Gas Operations*

- a. See attached CV
- b. HDD experience summary –

Over 10+ years of construction experience in the oil and gas industry having managed and successfully completed over 100 HDDs and other trenchless method installations. Project experience spanned all over the United States in both urban and rural areas. Co-owner of a pipeline construction company that specializes in HDD and Jack & Bore installation, serving clients such as Kinder Morgan, TransCanada, SoCal Gas, SDG&E, Washington Gas, Xcel Energy, and PG&E. Roles and responsibilities range from supporting pipeline design, constructability, and execution of HDD projects.

The logo consists of three vertical bars of equal height. The first bar contains the letter 'N', the second bar contains the letter 'V', and the third bar contains the number '5'.

N|V|5 Delivering Solutions
Improving Lives

DOCUMENTS PROVIDED BY NJNG SUMMARY SHEET

DATED	DOCUMENT
6/2002	US Army Corps of Engineers, Engineer Research and Development Center Guidelines for Installation of Utilities Beneath Corps of Engineers Levees Using Horizontal Directional Drilling
7/27/15	AECOM Figure 9 Boring Location Overview Map, Sheet 3 of 6; Log of Boring N. BH 7A-1; Log of Boring N. BH 7A-2; Summary of Laboratory Test Results, Project: NJNG Section 2 HDDs 5-10, Project No. 20000603; Appendix C – Laboratory Test Results; Particle Size Distribution, Project Number 60416786, October 2015, Figure 8
11/26/2016	Letter from Barry Baker of AECOM to Janice L. Arnett, Div. of Land Use Regulation, NJDEP, responding to comments received in a letter dated 11/3/16 from NJDEP addressing comments raised during public hearings on 10/19 and 10/20/16: Attachment A: 2015-CPA-0158-NJ Natural Gas 1716 – 12/31/15 Two Way Memorandum; Attachment B: 2015-CPA-0158 NJ Natural Gas 41116 – 4/8/16 Two Way Memorandum; Attachment C: Supplemental Bog Turtle Results E-mail dated 7/5/16; Attachment D: Inadvertent Return Plan – 3/24/15 AECOM HDD Contingency Plan for Handling Inadvertent Releases of Drilling Mud
2/24/2017	NJDEP Permits: 0000-15-0007.1 CAF150001 – CAFRA Individual Permit; and 0000-15-0007.10FWW15001 – Water Quality Certificate
5/31/2017 Revision	AECOM HDD 06 Province Line Road #1 Culvert Crossing; AECOM HDD 07 Province Line Road #2 Culvert Crossing; HDD 08 Province Line Road #3 Culvert Crossing; HDD 09 Province Line Road # 4 Stream Crossing
08/2017	AECOM Geotechnical Investigation Report
12/19/2017	AECOM Project Memorandum re: SRL Project: Borehole Stability Analysis for Typical Conditions Along HDD Borepaths – Burlington County, NJ attaching Burlington County Geotechnical Data
2/12/2019	Email from Keith Sturn to Ernest Deman enclosing: January 31, 2019 Eastern Inspection Inadvertent Return Documentation Report, re: 1/29/19 IR; February 5, 2019 Eastern Inspection Inadvertent Return Documentation Report, re: 2/4/19 IR; February 8, 2019 Eastern Inspection Inadvertent Return Documentation Report, re: 2/7/19 IR; February 11, 2019 Eastern Inspection Inadvertent Return Documentation Report, re: 2/8/19 IR.
10/2019	Federal Energy Regulatory Commission, Office of Energy Projects Guidance for Horizontal Directional Drill Monitoring, Inadvertent Return Response, and Contingency Plans
2/7/2020	Carson Corporation “Contingency Plan for Potential Problems – SRL – Phase 1, Horizontal Directional Drilling”
Undated	NJNG Construction Specifications for SRL Project – Section 1 – Section 8A Directional Drilling pages 1-27
2/7/2020	Carson Corporation “Inadvertent Release Plan” NJNG SRL – Phase 1 Horizontal Directional Drilling
3/2/2020	Carson Corporation Plan & Profile Drawing # HDD7
3/20/2020	Carson Corporation Proposed Plan and Profile, Drawing # HDD8
3/25/2020	Email from Thomas Rehrig of ULS, to Marc Panaccione, et al., re: Proactive IR Plan for HDD8 which included a map laying out potential IRs for HDD8 and recommendation of the proposed Carson design
4/7/2020 Revision	AECOM Road Opening Plans (ROP) Sheets 60 and 61 of 62
4/7/2020 Revision	AECOM drawing 61908945-ROP-DET1
4/8/2020	NJNG Engineering Construction Report form for HDD 08
4/9/2020	Carson Corporation Pilot Hole Report (HDD 8) – Drillers Log
4/14/2020	NJNG Engineering Construction Report form for HDD 08
4/14/2020	NJNG Engineering Construction Report form for Province Line Rd. HDD 08
4/15/2020	Carson Corporation 30” Ream Report HDD8 – Drillers Log

DOCUMENTS PROVIDED BY NJNG SUMMARY SHEET

DATED	DOCUMENT
4/29/2020	Carson Corporation As-Built (HDD 8), Drawing # AB-8
6/16/2020	NJNG Engineering Construction Report form for HDD 07
6/19/2020	Carson Corporation Pilot Hole Report (HDD 7) – Daily Drill Log
6/16/2020	NJNG Engineering Construction Report form for HDD 07
6/19/2020	NJNG Engineering Construction Report form for HDD 07
6/22/2020	Carson Pilot Hole Progress drawing #PH-7 depicting progress vs. proposed alignment (for HDD 7)
6/25/2020	NJDEP Notices of Violation 6/25/20 - CLUE File 0000-15-0007.1; and NJPDES File 815079 - Upper Freehold discharge incidents
6/26/2020	G. Nicholas email summarizing his discussion with Amy Jones of DuBois
6/26/2020	Letter from Counsel for PPA and the Sierra Club to NJDEP requesting DEP suspend NJNG's permits and stay construction of SRL
6/26/2020	G. Nicholas email to D. Lockward and A. Edelhauser at DEP acknowledging receipt of the Notice of Violation
6/30/2020	Certification of John Wyckoff, P.E., In Support of NJNG's Opposition to PPA & Sierra Club Motions to Stay and the Request for Suspension and/or a Stay of Permits to the Pinelands Commission and the Board of Public Utilities
6/30/2020	G. Nicholas email to A. Edelhauser DEP attaching 7 documents re: NJNG's response to 6/25/20 NOVs; <ul style="list-style-type: none"> • 6/30/20 Letter from NJNG to A. Edelhauser outlining NJNG's response; • 4/16/20 DuBois notice to DEP of Inadvertent Return Notice; • 4/28/20 DuBois Inadvertent Return Restoration Report – Province Line Road; • 4/30/20 email from A. Edelhauser DEP to Amy Jones re: restoration completed successfully; • 6/17/20 DuBois Inadvertent Return Notice to DEP (6/16/20 at 4:00 pm 209 Province Line Road); • 6/20/20 DuBois Inadvertent Return Notice to DEP (39 Hutchinson Road); • 6/27/20 DuBois amendment to 6/17/20 report to DEP re: Inadvertent Return – 209 Province Line Road
7/1/2020	NJNG Opposition to Request by the PPA and Sierra Club for a Suspension and/or Stay of Permits for Construction (to C. McCabe)
7/1/2020	G. Nicholas email summarizing call with P. Keledy, DEP
7/2/2020	G. Nicholas email to P. Keledy at DEP responding to additional info requested in 7/2/20 DEP email – attaching: <ul style="list-style-type: none"> • SRL Route Map; • IR Plan for ULS.pdf • SRL – NJDEP CAFRA and Wetlands permit
7/7/2020	Letter from PPA and Sierra Club Counsel to the NJDEP responding to NJNG's July 1, 2020 Opposition to their Motions for Stay of Construction and Withdrawal of Permits and enclosing Princeton Hydro letter
7/7/2020	Letter from DEP to K. Sturn, NJNG suspending permits
7/9/2020	G. Nicholas email & letter to Diane Dow of DEP re: 7/8/20 DEP Permit Suspension
7/9/2020	Earth Engineering Inc., Geotechnical Engineers & Geologists letter to Mark Taylor at Kiely Civil re: July 8 test boring at 284 Ellisdale Arneytown Road with boring profile & log
7/10/2020	G. Nicholas email attaching Amy Jones' review of PPA Sierra Club Princeton Hydro Report; and The Princeton Hydro Report
7/16/2020	G. Nicholas email to D. Lockward, DEP, encl response to issues raised in 7/14/20 teleconference and attaching 3/11/2019 Eastern Inspection IR Environmental Report and 2/20/2019 Eastern Inspection IR Documentation Report
7/16/20 (filed 7/17/20)	Sierra Club Motion to Supplement the Record and for a Stay in Appellate Division Appeal of Pinelands Commission along with Certification of Daniel A. Greenhouse, Esq., In Support
7/17/2020	G. Nicholas email summarizing discussion with Amy Jones re: impact of rescission of permit by rule PBR 36 and being required to obtain a Flood Hazard Individual Permit
8/6/2020	CCI & Associates reports re: Southern Reliability Project – 30" HDD7 Review CCI #2866-01-Continuance Plan-HDD7 and Southern Reliability Link's HDD Mitigation Plan CCI # 2866-01-General HDD Guidelines for Design and Construction-04

EDUCATION

B.S., Civil Engineering Technology

EXPERIENCE

40 years

INDUSTRY AWARDS AND RECOGNITIONS:

2-time winner of Platt's Global Construction Project of the Year for NJ/NY Project and Sabal Trail Project

Letter of recognition from the Governor of Maine on the completion of the Maritimes & Northeast Pipeline

EDWARD (ED) GONZALES**Senior Vice President**

Accomplished Consultant with more than 40 years of experience in executing major and mega pipeline related projects with a strong emphasis on project management. His broad range of experience has provided him with a unique set of skills including cost estimating, technical and financial analysis, feasibility assessments, contract negotiation, scheduling, and development and implementation of detailed processes and procedures. A goal-oriented, organized and highly motivated problem solver with the ability to direct complex projects from concept to completion. He possesses strong leadership skills which enable him to develop highly motivated teams to execute projects that meet his high standards and expectations. He has a proven ability to work collaboratively with client representatives, engineering firms, construction contractors, vendors, and field personnel and to interface professionally with federal, state and local agencies, particularly the Federal Energy Regulatory Commission (FERC). He has demonstrated success in delivering high-level, quality projects while maintaining a safe environment and highly satisfied clients.

Project Experience**SENIOR VICE PRESIDENT****NV5 AND AK ENVIRONMENTAL (ACQUIRED BY NV5 IN 2014)**

Provides strategic counsel, senior level management support and professional direction for major energy projects. Primary responsibilities include managing key capital expansion projects for Fortune 100 energy clients. Example projects include:

Duke Energy: Atlantic Coast Pipeline (ACP)

Serves as an Owner's Representative for the client in the overall execution of this \$7.8B project; a joint venture between Dominion and Duke Energy to construct approximately 600 miles of large diameter interstate natural gas pipeline through West Virginia, Virginia and North Carolina. The project involves several compression facilities and M&R stations. Manage a dedicated team of project control staff to provide the client an independent view of project execution, project schedule, cost and risk analysis to complete the remainder of the project.

CONFIDENTIAL CLIENTS (Intrastate, Midstream, LDC and JV Partnerships)

Performed Due Diligence on various projects (ranging from major to mega projects). These projects were in various stages of the Project Life Cycle. Based upon our extensive project execution experience with large and small scale interstate and intrastate pipeline projects and depth of knowledge of best practices, NV5 professionals, in collaboration with the clients, presented an unbiased and realistic perspective on the project's current "health" status with a strong emphasis placed on cost, schedule, risks, and gap analysis. NV5 also identified the areas where "best in class" practices are being deployed by the Project Team such that those practices would remain in place. In addition, NV5 introduced various project execution and control practices for the Project Team's consideration. The adoption of the practices would allow the

Project Experience

Project Team to monitor and manage the project proactively, communicate changes in a timely manner, pursue mitigation measures, implement contingency planning, and ultimately enhance the probability of delivering the project safely, in compliance, on-time and on budget

CONFIDENTIAL CLIENT (Midstream)

Served as subject matter expert (SME). Conducted a comprehensive post construction and commissioning analysis of a pipeline project and related facilities to identify potential project execution/technical gaps, performed a root causes analysis of issues associated with commissioning the facilities and recommended remedial measures for future projects.

SABAL TRAIL TRANSMISSION PROJECT

Served as Project Director for the client in the overall development and execution of this \$3.2B project; a joint venture between Enbridge, Duke Energy, and NextEra to construct approximately 500 miles of large diameter interstate natural gas pipeline through Alabama, Georgia, and Florida. The project involved several compression facilities and laterals to service new and existing power plants. Managed a dedicated team responsible for route selection, feasibility study, Monte Carlo evaluation, cost estimating, public open houses, field surveys, FERC application, contracting strategies, and construction oversight. Held accountable by client for the complete outcome of the project related to safety, compliance, scope control, cost, and schedule.

SPECTRA ENERGY, NJ-NY EXPANSION PROJECT

Served as Project Director for the client in the overall development and execution of a \$1.2B project, delivering natural gas to Manhattan. The project included pipeline and related facilities located in densely populated and urban areas of New Jersey and New York. Directed a dedicated team that managed all project activities including route selection, feasibility study, Monte Carlo evaluation, cost estimating, public open houses, field surveys, FERC application, contracting strategies, and construction oversight. Held accountable by client for the complete outcome of the project related to safety, compliance, scope control, cost, and schedule.

SPECTRA ENERGY, EAST 2 WEST PROJECT

Provided project management advice, oversight and technical counsel to the Client's Project Manager in development of a feasibility study, preparing cost estimates, overseeing field surveys, attending public open houses, developing construction strategies, and assessing feasibility of proposed horizontal directional drills.

DUKE ENERGY / MID-CONTINENT CROSSING PIPELINE (MCX)

Managed the development of a 750-mile, 42-inch natural gas pipeline with associated facilities. Responsible for overall management of the project, which included oversight of the project, preparation of the feasibility study, cost estimating, preparation of project schedule, and development of construction contracting strategy.

MARITIMES AND NORTHEAST (M&N) PIPELINE, PHASE IV

Supported the M&N management with project cost estimating, agency permitting, public open house participation, coordination of field surveys, development of contracting strategies, and assessment of twelve horizontal directional drills. Additional responsibilities included providing technical expertise to address federal and state permitting issues and filing permits with the National Energy Board in Canada.

SPECTRA ENERGY, ISLANDER EAST PIPELINE

Provided technical support to Project Manager which included assisting in overall management of project including project costing, agency permitting, public open house participation, coordination of field surveys, development of contracting strategy, assessment of horizontal directional drill (land-to-water and land-to-land), development of construction strategy, and provided technical expertise to address federal and state permitting issues.

DUKE ENERGY, NORTHEAST GATEWAY PIPELINE.

Provided technical expertise for the siting of an offshore LNG facility in Massachusetts Bay and marine pipeline routing to connect to the existing HubLine pipeline. Participated in high-level meetings with key stakeholders, permitting agencies, and state and

Project Experience

local representatives. Assisted client in addressing agency issues as it related to proposed construction techniques and overall construction schedule. Participated in preliminary contractor meetings and provided recommendations on construction contracting strategies for marine lay.

DUKE ENERGY/TECHNICAL EXPERTISE.

Provided technical expertise to legal counsel on pending arbitration cases for onshore pipeline construction project. Reviewed project documents, schedules, and day-to-day project activities to provide expert testimony on construction contractor's performance and execution of project permit conditions and construction schedule.

PETCO INTERNATIONAL.

Provided technical expertise, assembled a pipeline construction team from the US and bid on the first Israeli natural gas pipeline. Participated in various meetings with Israeli officials to discuss the project and qualification requirements.

SALTEC INTERNATIONAL, INC.

Provided technical expertise associated with siting of a storage field facility and take-away pipelines for interconnect to various interstate natural gas pipelines. Developed project schedule and high level cost estimate associated with pipeline facilities.

CONFIDENTIAL CLIENT.

Developed a feasibility study for a proposed LNG facility. The study included the siting of the LNG facility and pipeline alignment for interconnect to various interstate natural gas pipelines. Also prepared feasibility cost estimate and schedule for pipeline facilities.

CONFIDENTIAL CLIENT.

Performed due diligence for the purchase of a natural gas pipeline and associated facilities to determine book value of facilities.

EL PASO ENERGY.

Performed various feasibility assessment and cost estimates for the siting of a proposed natural gas pipeline.

DIRECTOR & MANAGER

DUKE ENERGY (NATURAL GAS PIPELINE DIVISION), PAN ENERGY, TEXAS EASTERN PIPELINE COMPANY, 1979 – 2004. PROJECT DIRECTOR NORTHEAST TEAM, 1996 – 2004.

Responsible for natural gas market expansion projects in the Northeast and Eastern Canada from inception through commissioning of facilities for the Engineering and Construction Department. Responsibilities ranged from directing initial feasibility assessments, siting of facilities, cost estimates; directing field work, environmental surveys, permit applications and right-of-way acquisition; engineering, material procurement, construction management, public and government relations, legal support and commissioning of facilities. Projects included HubLine Project, Islander East, Maritimes & Northeast Pipeline Phases I, II and III and various marketing expansion projects in Pennsylvania and New Jersey. Project budgets ranged from \$10M to approximately \$1B. Several of these projects required review of state-of-the-art horizontal directional drills.

DIRECTOR, 1995 – 1996, ENVIRONMENTAL PROTECTION AND COMPLIANCE.

Directed environmental projects associated with the construction and operation of natural gas pipelines and gas compression facilities for 27,000 miles of interstate natural gas pipeline system operated by parent company and subsidiaries; forecasted and managed \$10.3M departmental O&M budget, established departmental goals, trained and supervised two project managers and 30 staff. Prepared and filed documents for state and federal regulatory agencies; reviewed permits for air emissions, stream and wetland crossings, cultural resources, and endangered species register determinations; monitored compliance and permits, toxic and hazardous materials committee; reported to CEO and Board of Directors at PanEnergy on environmental issues affecting daily operations and long-term liability.

Project Experience

DIRECTOR, 1990 – 1994, CONSTRUCTION DIVISION.

Directed and managed an annual construction budget of \$750M for 27,000-mile interstate natural gas pipeline system operated by parent company and subsidiaries. Managed all phases of contract process; estimated costs and documented construction processes used in FERC and other permitting agencies filing procedures; qualified contractors and presided over bid analysis and award; selected appropriate contract documents, verified accuracy of engineering exhibits; negotiated special conditions and contract changes; determined payment schedules; directed release of retainers; established and maintained administrative procedures, including technical specifications; and guidelines including division office area managers and more than 300 contract employees. Consolidated seven construction offices to three, achieving an annual savings of \$0.65M. Participated in a task force that evaluated engineering processes and made recommendations to PanEnergy's executive committee resulting in streamlined decision-making, faster turnaround and substantial cost savings. Implemented PanEnergy's first partnering arrangement with station contractor to assist with development of gas compressor station, collaboration realized \$3M savings through the design phase.

MANAGER OF CONSTRUCTION AND REGIONAL CONSTRUCTION MANAGER, 1988 – 1989.

Managed a \$300M budget and all phases of contract administration for the construction of natural gas facilities. Supervised seven technical staff and two field-office area managers.

REGIONAL CONSTRUCTION MANAGER, 1983– 1988.

Managed all field and construction activities of natural gas facilities in the Northeast region; managed the construction of over 400 miles of natural gas pipeline facilities and several new mainline compressor stations associated with market expansion projects.

ENGINEER, 1979 – 1983.

Coordinated construction of natural gas gathering facilities. Responsibilities included scheduling material delivery, contract preparation, bid award, cost reporting and record review for gathering facilities and mainline expansion projects with budgets ranging from \$50k to \$30M. Managed route selection, field surveys, contract administration and permitting in Texas, New Mexico and Oklahoma.

EDUCATION

B.S Construction Management

EXPERIENCE

Over 10 years

CERTIFICATIONS

Certified Construction Manager-
CCM

PMP Certified Project Manager

Certified Professional Contract
Manager-CPCM

Certified NACE Level III Inspector:
#41725

AWS/CWI Inspector

OSHA 10, and OSHA 30

HAZ-MAT 40

JAY FLEMING**Director – Gas Operations**

Construction, Project, and Engineering Management leader with a focus in Utility, Oil & Gas industry and leading with 10+ years of expertise in all facets of construction management, project management, engineering management, financial management, project oversight, contracts & negotiations, overall operations and driving significant revenue within respected organizations. Skilled in collaborating with all members of the organization to achieve business and financial objectives. Instrumental in streamlining and improving processes, enhancing productivity, and implementing problem resolution, providing solutions. Offer strength in collaborative communication with all levels, partners and members of the organization.

- Managed portfolio of \$400M, as part of a \$2B program, which consisted of aligning area and regional goals with expectations regarding construction management philosophy and overall area performance and providing cost recovery testimony to CPUC rate case hearings with a success rate of 98% recovery.
- Onsite Construction Manager for two of SoCal Gas (SCG) Pipeline Safety Enhancement Project (PSEP) largest replacement projects in Urban Los Angeles with a project value of over \$150M Project included 3 HDD's of 24" pipe crossing under the 110 and 405 Freeways.
- Provided cost saving solutions and developed processes for client resulting in over \$35M of change orders being prevented while recovering an additional \$50M in credits back from both construction and engineering contractors on behalf of the client as well as additional \$35M in savings through negotiations.
- A consistent history of organizational team building, adaptable, and decisive leadership, driving change and progress in established organizations. Over 10 years of multi-functional accomplishments in business operations, project management, construction management marketing, strategic planning, and diversified organizational development.

Project Experience**NV5****SAN DIEGO, CA**

Director-Gas Operation, 2019 – Present. Responsible for the daily management and guidance of all Gas staff supporting public and private utility providers. Duties include, but not limited to, daily monitoring of activities of staff supporting clients to include third party support service vendors, track progress of the projects to confirm all task and documents are completed in accordance with standards and specifications while ensuring a quality product, responsible for coordinating and pursuing all business development opportunities and RFP's and for developing alliances and strategic partnership with industry partners.

E2 Consulting Engineering Inc.

LOS ANGELES, CA

Director - Operations, 2017–2018. Served as the Director of Construction Operations and PMO representative under contract with SCG/SDGE, (PSEP) projects throughout Southern California with a direct report to the Sr. Director of PSEP. Duties to include, but not limited to, daily monitoring of activities within construction management, construction inspection, and all 3rd party support service vendors, track progress of the project to confirm all task and documents are completed in accordance with standards and specifications to be turned over to client and negotiate all RFI/Change Orders for program.

- Provided Construction leadership to all field construction activities, while interfacing with appropriate SCG/SDGE counterparts and stakeholders.
- Assisted in the development and management of priority planning and scheduling of construction activities.
- Assisted in the development, planning, execution, management, and oversight of all HDD and Jack and Bore projects for the SCG/SDG&E (PSEP) Pipeline Safety, Enhancement, Program.
- Monitored all construction management and inspection operation to ensure compliance with design documents and client standards.
- Manage all RFI/Change orders for the PSEP Program.
- Conduct project job walks, provide constructability reviews and guidance and assist PM with development of scope of work, estimate labor cost, schedule baseline, track and report project progress.
- Manage bid projects review and selection.
- Expanded E2's presence and scope of work within SCG/SDG&E within 6 weeks of joining firm.
- Increased revenue from \$10M to over \$20M in one year due to expanded scope and increase of staff for inspection, engineering, CM/PM, and PMO team.
- Successfully expanded the E2 M2M software throughout SCG/SDGE resulting in a Sempra Utilities MSA across business lines and division of Sempra and subsidiaries.

Jacobs Engineering Inc.

LAS ANGELES, CA

Sr. Construction Manager, 2014-2017. As PMO representative under contract with SCG/SDGE, (PSEP) projects throughout Southern California with a direct report to the SoCal Gas Team Lead Anthony Stevenson, responsible for the largest projects to be executed in PSEP at the time. Working with CTL I was able to provide guidance and implement construction management procedures that have been adopted and standardized throughout the PSEP program.

- Provided Construction leadership to all field construction activities, while interfacing with appropriate SCG/SDGE counterparts and stakeholders.
- Assisted in the development and management of priority planning and scheduling of construction activities.
- Monitored and inspected construction operation to ensure compliance with design documents and client standards.
- Manage all construction RFI/Change orders for Program.
- Conducted project job walks, provide constructability reviews and guidance and assist PM with development of scope of work, estimate labor cost, schedule baseline, track and report project progress.
- Assisted in the development, planning, execution, management, and oversight of all HDD and Jack and Bore projects for the SCG/SDG&E (PSEP) Pipeline Safety, Enhancement, Program.
- Manage bid projects review, selection, execution, and negotiation with support of Supply Management team.
- Provided oversight to all third party construction services.
- Represent PSEP construction during internal reviews in work paper preparation and rate case testimony preparation.

TULSA INSPECTION RESOURCES (TIR)

TULSA, OK

Sr. Construction Manager, 2013 - 2014. Worked as Sr. Construction Manager on contract with PG&E, (PSEP) projects throughout Northern California and Central Coast oversaw the selection and day-to-day oversight of contractor and third party support services on the PSEP program. Acted on behalf of client with contract negotiations and cost management of construction activities.

- Successfully supported the implementation of the PSEP program in collaboration with PG&E and PMO firms contracted to innate program development.
- Developed and implemented standards for construction management and contract management in accordance to new regulatory requirements set by CPUC.
- Accelerated construction schedules and project kickoff to minimize project overrun and extended construction durations resulting in a cost reduction of over \$3M in a one-year period.

CHESAPEAKE MIDSTREAM PARTNERS

BIG FLATS, NY

Sr. Construction Manager, 2011-2013. Oversaw the initiation, route development, engineering and construction of 130+ miles of new natural gas gathering pipelines in the Marcellus portion of north central PA with total project budgets more than \$300M. Managed life cycle of 150+ projects simultaneously from initiation through project closeout.

- Successfully acquired constructible pipeline routes and obtaining regulatory approval/permitting of proposed pipeline corridors in accordance with Chesapeake's aggressive drilling and production schedule.
- Developed and implemented standards for engineering and construction including bidding specifications and contract documents.
- Advanced construction activities (cutting lead times from 10-12 weeks to under a week) and reducing costs by over 50% and located, set-up, managed and coordinated welding shop and warehousing facilities for fabrication of pipeline components.

DOMINION ENERGY GROUP

CLARKSBURG, WV

Construction Manager, 2008 - 2011. Spearheaded operational guidance and management of capital projects for natural gas compressor stations, transmission pipelines and storage fields in northern Pennsylvania and New York.

- Developed and successfully implemented a multi-year phased replacement plan to replace all aged piping in an underground storage field.
- Successfully maximized budget dollars allowing additional work items to be completed without additional O&M or capital expenditures.
- Supervised upgrades and replacement of reciprocating and turbine compressors in natural gas pumping stations and storage fields in northern PA and Upstate NY.
- Managed construction of new compressor stations, metering and regulating stations, and related facilities for natural gas transmission and storage facility capacity upgrades.

To: **New Jersey Natural Gas**
From: **CCI & Associates Inc.**
Date: **August 6, 2020**
Re: **Southern Reliability Link Project – 30” HDD7 Review**
CCI # **2866-01-CONTINUANCE PLAN-HDD7-07**

Project Overview & Background Information:

CCI has been retained by New Jersey Natural Gas Company (NJNG) to provide go-forward recommendations to ensure environmental protection during the completion of the HDD7 Horizontal Directional Drill (HDD). This review includes options for continuance including design, methodology, and execution modifications. The current HDD has been abandoned with a bentonite mixture as of June 25, 2020.

Geotechnical Information:

To form a basis to evaluate the subsurface conditions, CCI reviewed AECOM Report No. 60416786 entitled “Geotechnical Investigation Report - Southern Reliability Link Project – Burlington, Monmouth, and Ocean Counties, New Jersey”, dated August 2017. Information contained in the report referenced Boreholes BH7A-1 and BH7A-2, which were drilled and sampled to a depth of 47 ft at the crossing location.

Similar subsurface conditions were encountered in both boreholes, which consisted of silty sand from surface to the terminal depth of investigation. The sand was described as loose to compact containing 24 to 33% fines. Atterberg limits were conducted on the fines; the plastic limits ranged from 26 to 33 and the liquid limits ranged from 38 to 43. Groundwater levels were measured upon completion of drilling and were 22 ft and 10 ft below ground surface in BH 7A1 and 7A2, respectively.

HDD Stress Analysis:

Pipeline Research Council International (PRCI) design guidelines (PR-277-144507-R01) and American Society of Mechanical Engineers (ASME) B31.8-18 (Gas Transmission and Distribution) requirements have been checked for the proposed design. The calculations consider the pipe diameter, wall thickness, grade, depth, and geometric design of the crossing. The analysis was conducted utilizing the design provided. The pipeline specifications, geometry, and operating conditions utilized were as follows:

- Nominal Pipe Size (NPS) 30 (30” O.D.)
- Wall Thickness: 0.5”
- Spec/Grade: API 5L X60
- Design Radius: 2,800 ft
- Minimum Allowable Design Radius (MADR): 2,100 ft (CCI Calculated)
- Entry Angle: 8°
- Exit Angle: 10°
- Borehole Diameter: 42”
- Maximum Operating Pressure: 722 psi
- Maximum Operating Temperature: 60°F
- Minimum Installation Temperature: 23°F

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The analysis of the operating conditions of the designed HDD installation determined that the maximum operating stress imposed upon the pipe within the HDD section is 17,559 psi (65.5% of allowable as per PRCI guidelines) and is therefore acceptable. Table 1 shows the values from the stress analysis for the NPS 30 pipeline.

Table 1 – Stress Analysis

	Stresses	% of Allowable (PRCI)
Maximum Tensile Stress (Installation)	4,713 psi	8.7%
Maximum Bending Stress (Installation)	13,170 psi	33.8%
Maximum Hoop Stress (Installation)	1,093 psi	22.7%
Maximum Operating Stress	17,559 psi	65.0%
Maximum Combined Installation Stress (tensile and bending)	0.42	42%
Maximum Combined Installation Stress (tensile, bending, and hoop)	0.23	23%
Pullforce w/o buoyancy control (incl. 1.5 x S.F.)	328,000 lbs	

CCI recommends that the bending stress imposed on the pipe during pullback not exceed 45% of allowable (as per PRCI allowable bending stress) to ensure that the pipe does not become overstressed due to steering variances that may be present along the drill path. The MADR for this crossing was calculated to be 2,100 ft based on bending stresses.

Based on the pipe specifications and geometry provided, the stress analysis completed shows that the installation and operating stresses will be maintained within allowable limits as per PRCI PR-227-144507 and ASME B31.8-18 specifications and is therefore acceptable.

Potential Option for Continuance (HDD):

CCI has investigated options to minimize the potential for inadvertent returns (IR)'s at the drill location. CCI has created an alternative HDD design that includes the recommendations summarized below. In order to reduce the potential for establishment of fluid communication between the new and abandoned pilot hole, as well as the potential for additional IRs to existing locations, CCI recommends a 50 ft offset of entry/exit locations as well as a 10 ft vertical offset from the abandoned drill path.

Tooling modifications should be implemented to increase annular space and decrease expected drilling pressures. CCI recommends the contractor utilize 4½" drill pipe and a 12¼" jetting assembly for pilot hole activities. CCI also recommends the contractor maintain full returns to entry pit, maintain low drilling fluid densities (in the range of 9 ppg), and ensure jetting methodology (low pump rates [20-40 gpm] and high rate of production [~175 ft per hour]) are followed. Jetting methodology also requires the contractor monitor returns and trip to mechanically clean the hole if the rate of production slows or increased pump rates are required to advance. In order to identify and mitigate climbing pressures, specifically in zones where an IR risk is present, the contractor should use an annular pressure tool and maintain downhole pressures below the calculated soil limiting pressure curve in the event that slower rates of penetration and/or increased pump rates are required. CCI has run annular pressure for the alternative recommended design. If the Contractor cannot maintain pressures within or below the zone of operation shown, below the identified soil limiting pressure, the drill depth should be re-evaluated to provide additional overburden strength and reduce the risk of IR. The drill pipe used during pilot

hole operations should be switched out to 6 5/8" drill pipe upon completion of pilot hole to avoid any potential complications with larger ream sizes including increased rotary torque requirements.

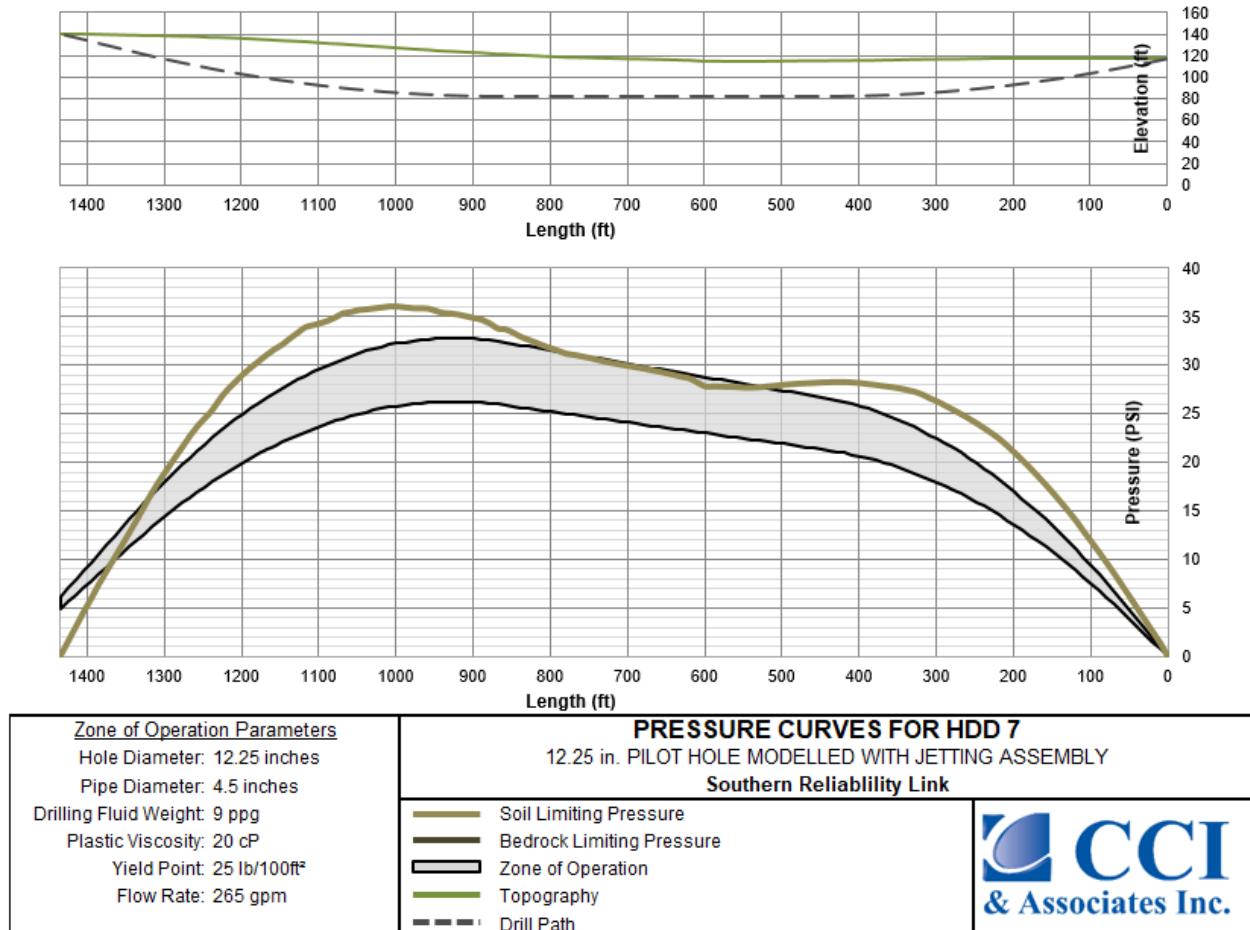


Figure 1 – AP Chart for HDD 7

Based on the pressure chart above, there is a low risk of fracture for most of the drill path, with a moderate-low risk of fracture within the middle 400 ft of the drill. To minimize the risk of fracture to surface, it is highly recommended that annular pressure be monitored. The successful completion of this drill will be contingent on close monitoring of the drilling fluid system and properties. For this reason, it is recommended the contractor have a Mud Engineer on site for the duration of pilot hole activities. Additional trips to clean the hole within the areas of concern are expected to be implemented. It is also expected the contractor will work with NJNG to correct any identified drilling issues, perform optional swab runs, and follow strict adherence to drilling procedures that directly minimize risk. If desired, CCI would be happy to complete a joint risk review with NJNG and the contractor or other stakeholders to ensure all risks are captured and mitigation plans are developed for implementation. This review would also serve to ensure all involved parties are on the same page. Some expectations/recommendations for execution of this option are highlighted below. In order to ensure adherence to the recommendations listed here, it is recommended that a qualified inspector be on site for all stages of the drill to ensure that the drill profile is adhered to, proper drilling techniques and equipment are utilized, and schedule and costs are controlled.

- Annular Pressure Monitoring:
 - Maintaining pressures within the defined zone of operation and below the soil limiting pressure within the zone of concern is paramount to prevent IR events. The purpose of the annular pressure graphs is to ensure the contractor maintains these operational parameters. It is expected that in the event the pressures begin to encroach on the upper limits of the zone of operation, a trip out of the hole would be initiated until pressures are reduced. This may involve a full or partial trip out of the hole as well as circulating a "bottoms-up" (the amount of time it takes for the fluid being pumped from the surface to reach the bottom and return to the entry pit) until cuttings clear up over the shakers before proceeding back to the bottom and advancing the pilot hole further.
 - Sudden annular pressure spikes would also create the conditions that would warrant a trip back until pressures normalize or a full trip out of the hole is implemented in a similar fashion to that described above.
- Circulation and Drilling Fluid
 - In order to maintain circulation at all times throughout construction, the annular pressure monitoring and corrective actions described above will be followed. In addition a drilling fluid program will be implemented to manage the geotechnical conditions at the location in order to facilitate the stabilization of the borehole and movement of drill cuttings.
 - From a drilling fluid perspective, if the contractor encounters the need to trip at an increased frequency, they will investigate and implement measures such as running sweeps to clear out stubborn cuttings or running a bottoms-up every 10 joints to better facilitate cuttings movement and the establishment of increased borehole stability.
- Trip Schedules
 - To ensure a clean borehole, the contractor shall conduct scheduled trips to the surface, whether circulation or annular pressures experienced in the borehole warrant it or not. These scheduled trips do not alleviate the necessity of tripping out of the hole should the conditions or complications previously described dictate otherwise.
 - In addition to the scheduled trips, consideration should be given to completing a trip just prior to the zone of concern. This pre-emptive trip, regardless of conditions, would ensure that best efforts are being taken to maintain an open borehole, prevent the build-up of cuttings, and reduce the potential for annular pressure spikes.



Prepared on behalf of CCI & Associates,

A handwritten signature in black ink that reads "Chelsea Griffiths".

Chelsea Griffiths, P.Eng.
Project Engineer

A handwritten signature in black ink that reads "B. Kerby Primm".

B. Kerby Primm, P.E.
Project Manager



To: **New Jersey Natural Gas**
From: **CCI & Associates Inc.**
Date: **August 6, 2020**
Re: **Southern Reliability Link Project HDD Mitigation Plan**
CCI # **2866-01-General HDD Guidelines for Design and Construction-05**

Introduction

Horizontal Directional Drilling (HDD) is a trenchless method of installing pipelines in the areas where traditional open cut excavations are not feasible or desired for environmental and/or logistical reasons. It is commonly used for the installation of pipelines beneath rivers, highways, railroads and other environmentally sensitive areas, or areas where the topography or site conditions along a proposed alignment compromise conventional cut and cover installation practices. During the HDD process, a pilot hole is first drilled along a predetermined path. The pilot hole is then enlarged in single or multiple steps (reaming) to accommodate the pullback of the carrier pipe into the enlarged hole.

Use of HDD and other trenchless technologies has continued to grow. Trenchless technologies have significant environmental advantages including minimizing ground disturbance, spoil removal, and pavement restoration costs. They are, in many circumstances, more protective of the environment and can reduce public inconvenience. The technology also reduces the impact of pipeline construction in densely populated areas. Business operations can continue to operate, and traffic disruption and delay is minimized. Nevertheless, with all their advantages, there are other factors that need to be considered before employing the trenchless method. Trenchless construction methods can be limited by topography, unfavorable geology, available workspace, and inherent risks associated with use of trenchless construction methods, including extended crossing times and the potential of inadvertent drilling fluid releases or drill failures. These factors must be considered for the successful installation of the product pipe with HDD.

New Jersey Natural Gas (NJNG) wants to ensure that all appropriate measures are being utilized to help prevent inadvertent return for the remainder of the trenchless construction scope of the Southern Reliability Link (SRL) project. Shallower depth drills through softer surficial formations may allow the crossings to be executed with reduced annular pressures and lower drilling fluid volumes. Due to nature of the formation present, these lower pressures may reduce potential environmental impact; however, the existence of preferential paths such as fissures and fractures in the formation are rarely detected in a geotechnical investigation, even with numerous borings along the HDD path. When these anomalies are encountered along the bore path during construction, drilling fluid can escape and migrate until equilibrium of pressure is obtained. Typically, this is to the ground surface; however, if the direction of an inadvertent release moves laterally the drilling fluid can find its way into nearby structures, as it did in the case of the incident and subsequent damage to 39 Hutchinson Road.



General Guidelines

NJNG has requested CCI & Associates, Inc. (CCI) to provide recommendations of general guidelines for additional best practices and execution measures to provide an environmentally protective, and successful path forward for the remaining HDDs on the SRL Project.

- **Detailed Design Review**

A design review of the existing HDD construction drawings, available geotechnical data, survey, and regional geological information will be completed. A constructability review memorandum will be submitted to NJNG that identifies HDD parameters to reduce/mitigate construction complications and recommendations for design changes to limit risk.

- **Geotechnical Investigation**

A site-specific geotechnical investigation has been planned along the remaining HDD alignments where NJNG did not previously have access due to permit issues. Two (2) boreholes, one near the entry and one near the exit location are appropriate for HDD installations of the size and length of those in the SRL Project (645 to 1400 ft). For these lengths, the two (2) borings are typically enough to model a cross-section of the substrata formation. A comprehensive geotechnical study will not only determine the proper tooling and procedures for the HDD contractor to use, but also establish the most suitable soil formation in which to design the bore path profile and maintain the bore within drillable strata. The geotechnical investigation will be completed by HDD experts, including professional geotechnical engineers and geologists, to ensure valuable subsurface data is obtained for use in HDD design. This data includes, but is not limited to, non-cohesive soil grain size, cohesive soil plasticity and shear strength used to calculate the confining pressure of the formation. Any site-specific sub-surface anomalies (such as perched groundwater, or poor drilling conditions, etc.) will be considered in the design recommendations.

- **Annular Pressure Analysis**

The annular pressure will be modelled to simulate the downhole pressure during the pilot hole drilling and compare it with the overburden fracture pressure of the geologic formations above the drill path. The AP simulation would be conducted with CCI's analysis tools which have been developed with industry standard calculation models (Bingham Plastic, General Overburden, and USACE/Delft model) and additional modified safety factors based on our experience from over 15,000 completed HDD crossings.

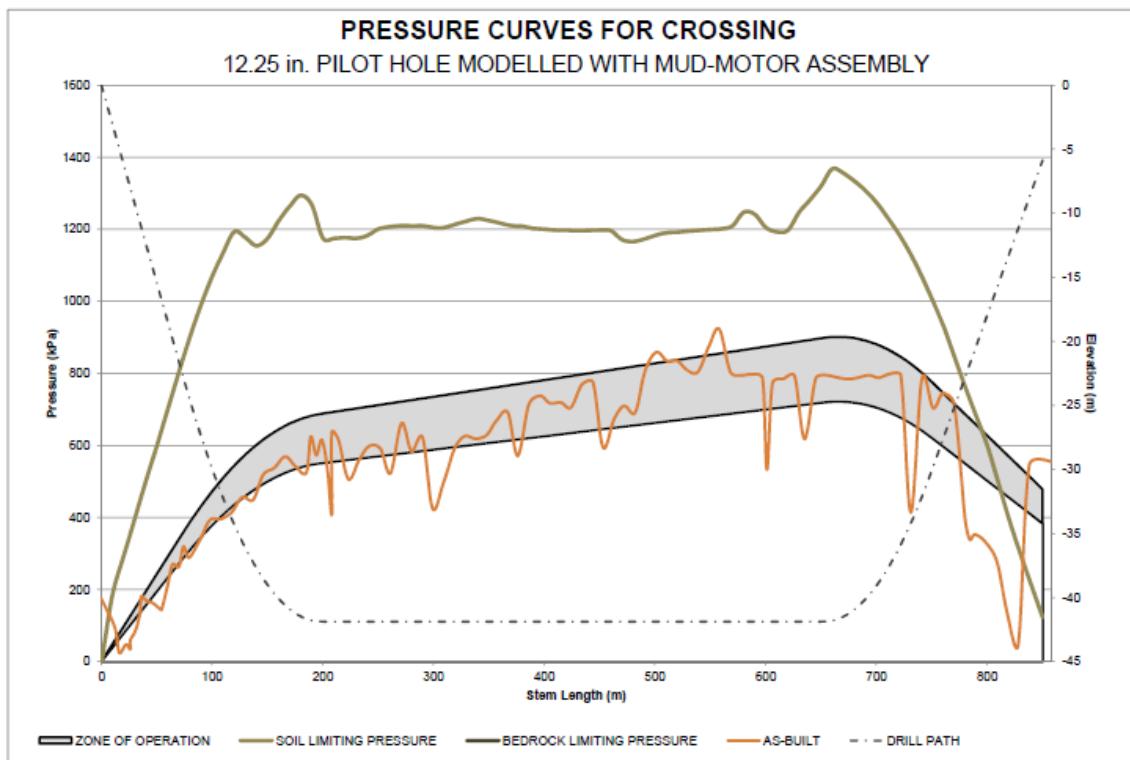
The method of calculating the overburden fracture pressure (confining pressure) of each geologic formation is dependent on its physical properties. These properties include density, angle of internal friction, plasticity, modulus of elasticity, and compressive strength, which will be determined during the geotechnical investigation.

Through the AP analysis, an annular pressure graph will be produced. This graph compares the downhole drilling pressure vs. the calculated overburden fracture pressure of the confining soil. In addition, it shows an Operating Zone (above the baseline pressure), shown as 125% of the expected drilling pressure. CCI recommends the

contractor keep the drilling pressures within the calculated Operating Zone to minimize the risk of IR's.

An example of an annular pressure graph is shown below in Figure 1. The calculated overburden fracture pressure and downhole drilling pressure, with the suggested operating zone, can be seen along the length of the drill. In the example graph, as-built pressure data, obtained with the annular pressure tool (discussed in "Contractor Mitigation") is also modelled.

Figure 1: Annular Pressure Graph

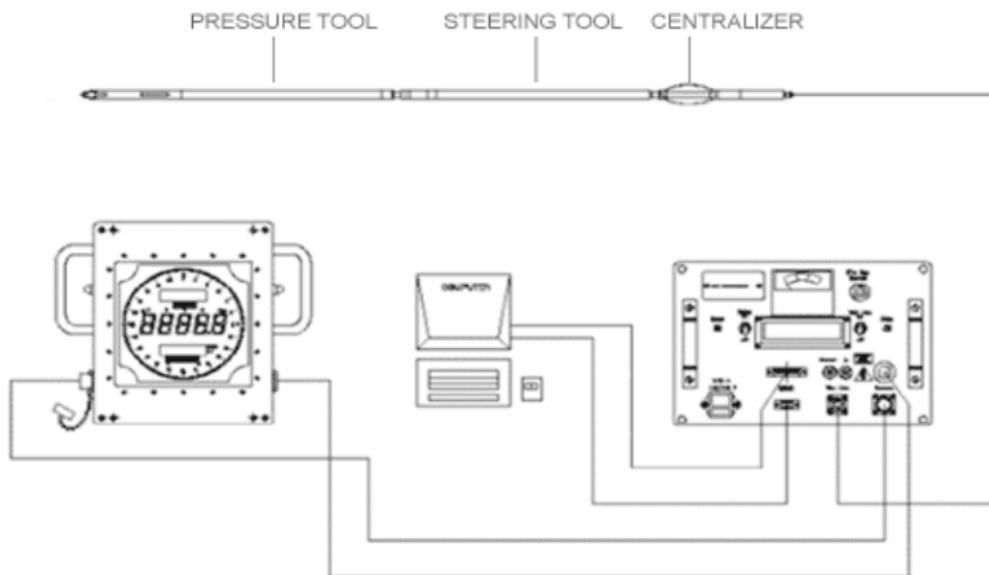


- **Contractor Mitigation**

CCI recommends that the HDD contractor provide an Engineered Drilling Fluids Program (EDFP). Drilling fluid properties are dependent on the intended construction practices of the HDD contractor, field conditions, site specific geotechnical information, and interpretations of the drilling fluid engineer. Annular drilling fluid pressures can significantly change with changes in drilling fluid properties. Therefore, it is important to re-evaluate drilling fluid pressures based on fluid properties during HDD installations and compare them with estimated limiting pressures of the formation. Additionally, CCI recommends the use of an annular pressure measurement tool to monitor annular pressure during the HDD installation. These "real-time" pressure measurements will be compared to the estimated annular and formation limiting pressures along the drill path. Figure 2, below, shows the location of the annular pressure measurement tool within the bottom hole assembly. In the

event of climbing pressures, CCI recommends the contractor to mechanically trip or implement other mitigation measures to reduce the pressures to expected values before continuing.

Figure 2: DataTrax System with Pressure and Steering Tools



- **Construction Inspection and Oversight**

Daily office oversight by an HDD Construction Management Team, or equally qualified personnel, is recommended to help with assessment and resolution of on-site issues as they develop. An onsite liaison will ensure that NJNG project management personnel are kept informed of the project progress, status, and developments. Assistance with the review and approval of the HDD contractor's execution plan, including safety procedures, drilling fluid program, and tooling, will help manage contractor compliance with regulatory and technical requirements throughout the construction process. This will include compliance with NJNG's "Construction Specifications for the Southern Reliability Link Project – Section 8A Directional Drilling".

- **HDD Abandonment**

In the event that the HDD cannot be completed successfully. The HDD borehole will be abandoned and grouted by approved installation methods with pre-approved materials. An abandonment plan will be supplied to the HDD contractor summarizing the minimum requirements to aid in creation of the contractor's grout plan, as required.

The actions needed for successful HDD are not limited to this document. CCI recommends that a qualified HDD contractor who is properly trained and proficient in industry established management plans be utilized for the completion of the remaining HDD's.



Prepared on behalf of CCI & Associates,

A handwritten signature in blue ink that reads "B. Kerby Primm".

B. Kerby Primm, P.E.

Project Manager

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