HDD Inadvertent Release, Monitoring and Remediation Plan

22 Johnston Way
Stow, Massachusetts
Map R-22 / Parcel 1B-2, Map U-11 / Parcel 13-1B-3, Map U-11 / Parcel 10A-A1

Date: May 13th, 2021

Prepared By: Dillis & Roy Civil Design Group, Inc.
1 Main Street – Suite #1
Lunenburg, Massachusetts 01462

Prepared For: Stow Elderly Housing Corp.
22 Johnston Way
Stow, MA 01775

TABLE OF CONTENTS

Sections:

1.0 Project Description

The Applicant proposes to construct a new Public Water Supply facility complete with access drive, wells, pump house, and water service between the pump house and existing facilities. The water service consists of the installation of 290 linear feet of two (2) 3-inch diameter HDPE directionally drilled (HDD) pipe under the adjacent wetlands and Potash Brook.

2.0 Surface and Groundwater Protection Plans

Dillis & Roy (Engineer) have developed Notice of Intent site plans to document measures taken to mitigate construction impacts within the project area. Additionally, this Plan outlines the measures to be taken to prevent impact and the plan to be implemented if an impact were to occur due to HDD activities.

3.0 Inadvertent Return Plan

This plan presents methodologies to control and minimize the impacts to sensitive environmental resources from inadvertent returns of drilling fluids associated with the proposed HDD crossing during the construction of the project.

4.0 HDD Overview

HDD is a steerable trenchless method of installing underground pipe, conduit, or cable in a shallow arc along a prescribed bore path. HDDs are typically utilized when conventional trenching techniques are not desirable or practicable. It is suitable for a variety of soil and geologic conditions and primarily intended for obstacle avoidance including, but not limited to, river crossings, roads, and environmental features.

HDD Fluids

The principal functions of drilling fluid in HDD pipeline installation are listed below:

- Drilled spoil, consisting of excavated soil or rock cuttings, is suspended in the fluid and carried to the surface via a fluid stream flowing through the drill annulus between the bore hole and the drill rig.
- Build-up of drilled spoils on bit or reamer cutters is removed by high velocity fluid streams directed at the cutters. Cutters are also cooled by the fluid.
- Friction between the pipe and the bore wall is reduced by lubricating properties of the drilling fluid.
- Stabilization of the drilled hole is accomplished by the drilling fluid building up a “wall” cake” which seals pores and holds soil particles in place, which is critical for HDD pipeline installation.
- Power required to turn a bit and mechanically drill a hole is transmitted to a downhole motor by the drilling fluid.
- Soil is excavated by erosion from high velocity fluid streams directed from jet nozzles on bits or reaming tools.

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

The major component of drilling fluid used in HDD pipeline installation is fresh water. To increase the hydraulic properties of the water, it is generally necessary to modify it by adding a viscosifier. The viscosifier used almost exclusively in HDD drilling is naturally occurring bentonite clay. It is not a listed hazardous material/substance as defined by the US Environmental Protection Agency's (USEPA) Emergency Planning and Community Right-to-Know Act (EPCRA) or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulatory criteria. Bentonite is non-toxic and commonly used in farming practices, but has the potential to impact aquatic habitats and wildlife if discharged to waterways in significant quantities.

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

Drilling fluid expended downhole will flow in the path of least resistance. In the drilled annulus, the path of least resistance may be an existing fracture or fissure in the soil or rock substrate, or a manmade structure. When this happens, circulation can be lost or reduced. This is a common occurrence in the HDD process that can be effectively managed/controlled and does not prevent completion of the HDD. However, the environment may be impacted if the drilling fluid inadvertently returns to the surface of the ground at a location on a waterway's banks, within a waterway or wetland, or in the vicinity of other potential receptors. When this occurs, it is called an inadvertent return or release. An inadvertent return is an unauthorized discharge of drilling fluids to the ground surface or surface waters, including wetlands, associated with HDD or other trenchless construction methodologies.

5.0 Inadvertent Return (IR) Minimization Methodologies

While rare, inadvertent returns of drilling fluids can occur for various reasons. The following sections detail methodologies to be implemented for the Project with the intent of eliminating or minimizing inadvertent returns based on a sound understanding of the reasons that cause returns.

5.1 HDD Site Feasibility Analysis and Design

Provided below are the methodologies employed to eliminate/minimize inadvertent returns.

5.1.1 Site Feasibility Analysis & IR Risk Assessment

The following criteria represent constructability areas of review:

- Physical/technical constrains (angle, required depths >5 feet at streams and >4 feet at wetlands)
- Practicality constraints
- Geological constraints

5.1.2 Drilling Fluid Control

The most effective way to minimize environmental impact associated with HDD installations and specifically with drilling fluids is to maintain drilling fluid recirculation. Maintenance of fluid circulation is the responsibility of the HDD contractor. Monitoring of drilling mud volumes, pressures, and pump rates/returns will assist in determining if significant drill mud loss occurs signaling a possible inadvertent return. The following requirements shall be placed upon each HDD contractor with respect to drilling fluid control:

- Instrumentation – The contractor shall provide and maintain instrumentation which accurately locates the pilot hole, measures drill string axial and torsional loads, and measures drilling fluid discharge rate and annular pressure during the pilot hole phase. A log of all recorded readings shall be maintained and will become a part of the "As-built" information supplied by the contractor to the Engineer.
- Composition – The composition of all drilling fluids proposed for use shall be submitted to the Engineer for approval.
- Recirculation – The contractor shall maximize recirculation of drilling fluid to the bore pit. The contractor shall provide solids control and fluid cleaning equipment of a capacity and configuration that can process drilling fluids to the bore pit that produce drilling fluids suitable for reuse.
- Loss of Circulation – The Contractor shall employ its best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at locations other than the entry and exit points shall be minimized. In the event that annular circulation is lost or significantly diminished, the contractor shall take one or more of the following steps to restore circulation:
    - Size the hole frequently by advancing and retracting the drill string in order to keep the annulus clean and unobstructed.
    - Minimize annular pressures by minimizing fluid density consistent with hole cleaning and stabilization requirements.
    - Viscosity will be adjusted as necessary to reduce annular pressures consistent with hole cleaning and stabilization requirements.

- Gel strength will be adjusted as necessary to reduce annular pressures.
- Control of the balling of material on bits, reaming tools, and pipe in order to prevent a plunger effect from occurring.
- Control penetration rates and travel speeds in order to prevent a plunger effect from occurring.
- Seal a zone of lost circulation using a high viscosity bentonite plug, loss control materials, or grouting. Drilling activities will be suspended as long as necessary to allow plugs, loss of control materials, or grout to cure.
- When drilling fluid flow has been suspended, re-establish circulation slowly and before advancing.

5.1.3 HDD Alignment Monitoring and IR Controls

Persistent monitoring of the HDD alignment for an IR is an integral component in minimizing adverse environmental impacts. The intensity of this monitoring will vary depending on the following drilling fluid operational conditions:

- Condition 1: Full Circulation
- Condition 2: Loss of Circulation
- Condition 3: Inadvertent returns in waters/wetlands

<u>Monitoring for Condition 1 – Full Circulation</u>

When HDD operations are in progress and full drilling fluid circulation is being maintained at one or both of the HDD endpoints, the following monitoring protocol will be implemented.

- The presence of drilling fluid returns at one or both of the HDD endpoints will be periodically documented by the contractor.
- Land-based portions of the drilled alignment will be periodically walked and visually inspected for signs of inadvertent drilling fluid returns as well as surface heaving and settlement. Waterways and wetlands will be visually inspected from the banks for a visible drilling fluid plume.
- Drilling fluid products present at the jobsite will be documented.

If inadvertent drilling fluid return enters waters or wetlands, the monitoring protocol associated with Condition 3 will immediately be implemented. If an inadvertent return enters uplands only, the procedures associated with section 6.2 of this plan will immediately be implemented.

<u>Monitoring for Condition 2 – Loss of Circulation</u>

When HDD operations are in progress and drilling fluid circulation to the HDD endpoints is either lost from the annulus or is significantly diminished (“loss of circulation”), the following monitoring protocol will be implemented.

- The HDD contractor will immediately notify the Site Superintendent and the Engineer.
- The Site Superintendent and/or Engineer will immediately notify the Town Conservation Agent of the loss of circulation.
- The Site Superintendent and/or Engineer will increase the frequency of visual inspections along the HDD alignment and outside the limits of disturbance on public areas and where authorized without trespassing, and conduct enhanced monitoring of sensitive environmental resources within 100 feet of the HDD alignment. Additionally, the Site Superintendent and/or Engineer will document periods of contractor downtime and the contractor's drilling fluid pumping rate to estimate lost circulation volumes.
- Drilling operations will be suspended and the Engineer will submit to the Conservation Commission (1) a loss prevention report, which describes the measure(s) that will be implemented to prevent, to the maximum extent practicable, the likely hood of additional losses of circulation; and (2) proof that every public water supplier within 450 feet of the HDD alignment and every landowner with a private water supply within 450 feet of the HDD alignment has been notified. Drilling operations shall not resume until all required information has been submitted.
- In addition, the Engineer shall document steps taken by the HDD contractor to (1) restore circulation to the entry/exit and (2) reduce annular pressure down hole.
- In addition, the HDD contractor shall take one or more of the following actions to restore full circulation:
    - Minimize annular pressures by minimizing drilling fluid density consistent with hole cleaning and stabilization requirements.
    - Viscosity will be adjusted as necessary to reduce annular pressures consistent with hole cleaning and stabilization requirements.
    - Gel strength will be adjusted as necessary to reduce annular pressure.
    - Control the balling of material on bits, reaming tools, and pipe in order to prevent a plunger effect from occurring.
    - Control penetration rates and travel speeds in order to prevent a plunger effect from occurring.
    - Reduce drilling fluid pumping pressures to the minimum necessary to maintain hole cleaning requirements.
    - Size the hole frequency by advancing and retracting the drill string in order to keep the annulus clean and unobstructed.
    - Seal a zone of lost circulation using a high velocity bentonite plug, loss control materials, or grouting.

    - Drilling activities will be suspended as long as necessary to allow plugs, loss control materials, or grout to cure.
    - If drilling fluid flow has been suspended, re-establish circulation slowly before advancing.
- If circulation is regained, and there is no IR or other loss of circulation within 48 hours, monitoring protocol associated with Condition 1 may be resumed.
- If circulation is not re-established, the Site Superintendent and/or Engineer shall increase the frequency of visual inspection along the drilled path alignment and outside the limits of disturbance on public areas and where authorized without trespassing. Additionally, the Site Superintendent and/or Engineer will document periods of contractor downtime and the contractor's drilling fluid pumping rate to estimate lost circulation volumes.

<u>Monitoring for Condition 3 – Inadvertent Returns in Waters/Wetlands</u>

If an inadvertent return of drilling fluids is detected in waters/wetlands, the following monitoring and operational protocol will be implemented. Inadvertent returns impacting uplands only will be addressed in accordance with Section 6.2.

- The HDD contractor will immediately notify the Site Superintendent and the Engineer.
- The Site Superintendent and the Engineer shall document the location, magnitude, and potential impact of the return.
- If the inadvertent return is confirmed to be less than 50 gallons and is the first inadvertent return at a HDD location, HDD operations may continue after (1) containment is achieved, (2) cleanup of the inadvertent return has been completed, and (3) the Engineer submits written notice and documentation that the inadvertent return has been contained and the cleanup has been completed and the Conservation Commission has approved restart of HDD operations, which shall occur no later than 72 hours after the Engineer has submitted the required written documentation and notice to the Conservation Commission, at which time the HDD contractor may resume trenchless construction unless the Conservation Commission disapproves restart.
- If the inadvertent return is confirmed to be (i) more than 50 gallons, (ii) of unknown quantity, or (iii) is a second or subsequent inadvertent return at an HDD location, drilling operations will be suspended until the Conservation Commission Agent inspects the site , and subsequently approves the restart report provided by the Engineer. The restart report must contain an overview of the HDD activities, an assessment of the strata where the IR occurred, depth and alignment of the drill bit at time of IR, profile of the drill path as constructed overlain on the

permitted drill profile, and analysis of the risk of additional inadvertent returns to waters/wetlands, and recommendations on measures that will minimize likelihood that further drilling will result in harm to the environment, or impact any private or public water supplies. The HDD contractor may recommence HDD operations after the Conservation Commission provides written approval to restart. Additionally, the Site Superintendent and/or Engineer will document periods of contractor downtime and the contractor's drilling fluid pumping rate to estimate inadvertent return volumes.

5.1.4 Hydrologic Impacts

The HDD contractor is able to monitor annulus pressure of returns during the HDD pilot hole phase of HDD using an annual pressure monitor. If the pressure spikes significantly and unexpectedly and all other drilling parameters are otherwise unchanged, this may signify a potential influx of groundwater. If this occurs, an inspection of the HDD alignment and adjacent areas for returns would be conducted. The surfacing of groundwater over the HDD profile as a result of HDD activities, could be indicative of an ongoing IR. Notifications relating to the surfacing of groundwater are addressed in Section 6.5.

During the pilot hole phase or reaming phase of an HDD, a sudden increase in drilling fluid returns, the appearance of clear water mixed with drilling fluids, or clear water only returning to the HDD entry point indicates that the HDD has progressed into or intercepted a zone of groundwater with a hydrostatic pressure greater than the annular pressure of the HDD phase in progress. That could be naturally occurring groundwater. If this occurs, the HDD contractor, Site Superintendent, and/or Engineer will notify the Conservation Commission Agent.

If the volume of produced water is minimal or does not exceed the volumes being used for the HDD phase in progress, then this water should be pumped with the returning fluids and cuttings and recycled into the HDD process.

If the volume of produced water exceeds the water demand for continued drilling, the contractor will capture and haul away all produced water for treatment until test results show that the water can be safely discharged at a suitable location at the HDD site.

If the produced groundwater returns persist after installation of the pipeline, the HDD contractor will develop and implement a plan to establish a seal to stop groundwater flows as to avoid impacts to environment and public and private water supplies.

6.0 Response to Inadvertent Returns

If an IR is observed, the HDD contractor will take measures to eliminate, reduce, or control the return. The actions to be taken will depend on the location and time of the return, site specific conditions, and the volume of the return.

6.1 General Conditions

- This Plan must be present onsite during drilling operations and made available to the Conservation Commission.
- The Conservation Commission is to be notified at least 24 hours prior to the beginning of each HDD, or any type of bore, under waters/wetlands.
- All required permits and MSDS sheets must be onsite and made available to the Conservation Commission Agent.
- Drilling fluid additives other than bentonite and water shall be approved by the Conservation Commission prior to use.
- When an inadvertent return or loss of circulation is discovered, the inadvertent return or loss of circulation will be immediately reported to the Conservation Commission in accordance with Section 6.5; and
- Any water supply complaints received by the Engineer will be reported to the Conservation Commission in accordance with Section 6.5.

6.2 Inadvertent Returns in Uplands

If a return is identified within or nearby the HDD alignment, within the adjacent uplands (an "upland IR"), then notification, containment, and cleanup will be carried out as specified in this Section. Upland IRs include "punch out returns", which are defined as releases of drilling fluids in uplands that occur within the HDD staging area as depicted in the approved plans. Punch out returns may occur when the HDD nears the exit point during pilot hole drilling as a result of reductions in the depth of the drill and unconsolidated soil conditions near the exit point.

The HDD contractor will immediately suspend drilling operations following an upland IR, except if the upland IR is a punch-out return where the drilling fluid is contained within the permitted limit of disturbance and does not enter a water/wetland or impact a water supply well. The Engineer must quantify the upland IR, document its location, photograph the return, determine the proximity of the return to any resource(s), assess the potential to impact any resource(s), and report the incident to the Client. The HDD contractor will take appropriate actions to contain, reduce, eliminate, or control the return. These actions may include, as appropriate:

- Constructing a small pit or sandbag coffer around the return point, installing a section of silt fence and/or straw bales to trap as much drilling fluid as possible, and placing a pump hose in the pit to pump the drilling fluid back to the bore site or temporary holding area vessels;
- Reducing drilling fluid pressures;
- Adjusting the properties of the drilling fluid mixture; and/or

- Adding pre-approved loss circulation material to the fluid mixture.

Drilling fluid may be recovered , recycled, and reused to the extent practical.

When HDD operations have been suspended pursuant to this section following an upland IR, HDD operations may resume after (1) containment of the upland IR is achieved, (2) cleanup of the upland, and (3) the Conservation Commission receives written notice and documentation that the inadvertent return has been contained and the cleanup completed.

For punch out returns where drilling has not been suspended, the Contractor will contain the drilling fluids and complete the cleanup of the drilling fluids after punchout of the pilot hole is achieved.

6.3 Inadvertent Returns in Waters/Wetlands

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

All inadvertent returns in wetlands, streams, lakes, or any other surface water, regardless of size, are to be reported to the appropriate agencies in accordance with the notification section below.

Containment, cleanup, and restoration activities that would require the installation of construction matting, placement of materials in the wetland or waterway, or the entry of construction vehicles and equipment are not allowed without prior Conservation Commission approval. If, upon reporting of an incident, and under further consultation with the agencies, the return is determined to be significant enough to warrant containment, cleanup, and restoration via mechanical methods, then the following procedures will be followed:

- Draft containment and restoration plan, outlining the limits, types, and duration of disturbances, will be submitted to the Conservation Commission for review and approval.
- Appropriate aquatic resource encroachment permits will be applied for depending on levels and types of disturbances required to cleanup the material.
- Approved activities would only be implemented under the close, full time supervision of the Engineer.
- Drilling operations may only resume once the return is contained and successfully recovered and restart approval is obtained from the Conservation Commission in accordance with Monitoring Protocol for Condition 3 above.

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

causing the pullback section of pipe to be stuck and not able to resume. If a significant risk exists of a release or inadvertent return of drilling fluid during the pipe pullback process, before that process begins, the Engineer will propose a plan to the Conservation Commission Agent to mitigate that risk and will receive the Conservation Commission Agent's approval of the plan before beginning the pipe pullback process.

6.4 Containment & Clean-up Materials and Equipment

The HDD contractor will be required to have the necessary containment and cleanup equipment onsite, at the boring location and readily available for use. At a minimum, a combination of some or all of the following material and equipment should be onsite and in ample supply depending on the extent of sensitive areas:

- Spill sorbent pads and booms
- Straw Wattles
- Straw Bales (certified weed free)
- Wood Stakes
- Sand Bags
- Silt Fence
- Plastic Sheeting
- Corrugated plastic pipe
- Shovels
- Push brooms
- Centrifugal, trash, and sump pumps
- Vacuum truck
- Rubber tired or wide track back hoe
- Bobcat
- Storage Tanks
- Floating Turbidity Curtain
- Timber (sufficient quantity to cross 50% of the wetland width)

6.5 Notifications

- **Commencement of HDD or Bore:** The Conservation Commission and Engineer shall be notified at least 24-hours prior to the beginning of each HDD operation under waters/wetlands.
- **Pullback:** The Conservation Commission and Engineer shall be notified at least 24-hours prior to commencing pullback at any HDD site.
- **Impact to Water Supply:** The HDD contractor, site superintendent, and/or Engineer will provide the Conservation Commission Agent with immediate verbal notification of any citizen complaint received of an impact to a private or public water supply.
- **Inadvertent Returns:** When an inadvertent return is discovered, the HDD contractor shall provide immediate verbal notification to the Engineer. The Engineer shall then

provide the Conservation Commission immediate verbal notification, along with any landowners affected by the return, and to identified public water suppliers with a source located within 450 feet of the HDD alignment and every landowner with a private water supply located within 450 feet of the HDD alignment.

- **Loss of Circulation:** When a loss of circulation is identified, the HDD contractor shall provide immediate verbal notification to the Engineer. The Engineer shall then provide the Conservation Commission immediate verbal notification, along with any landowners affected by the return, and to identified public water suppliers with a source located within 450 feet of the HDD alignment and every landowner with a private water supply located within 450 feet of the HDD alignment.
- **Making Water:** When HDD activities result in the surfacing of groundwater ("making water"), the HDD contractor shall immediately provide verbal notification to the Engineer. The Engineer shall then immediately provide verbal notification to the Conservation Commission, along with any landowners affected by the return, and to identified public water suppliers with a source located within 450 feet of the HDD alignment and every landowner with a private water supply located within 450 feet of the HDD alignment.

7.0 Final Summary Report

A final summary report will be prepared at the end of the project by the Engineer to document the implementation of the drilling method and the IR Plan. Number of drills, duration of drills, number of returns, return characteristics, inspection results and observations, and recommendations will all be discussed within this report.