GENERAL HORIZONTAL DIRECTIONAL DRILLING SPECIFICATION

1.01 DESCRIPTION
The work specified in this section consists of furnishing and installing underground utilities using the horizontal directional drilling (HDD) method of installation, also commonly referred to as directional boring or guided horizontal boring.

1.02 REFERENCES
Specifications for High Density Polyethylene DR9 PE3408, 200 PSI pressure-rating Piping shall be used as a reference.

1.03 QUALITY ASSURANCE
The Contractor's attention is hereby directed to this document specify a wide range of procedural precautions necessary to insure that the very basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this specification. Adherence to the specifications contained herein, or the Contracting Officer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

1.04 SUBMITTALS
A. Work Plan:
Prior to beginning work, the Contractor must submit to the Owner's representative a general work plan outlining the procedure and schedule to be used to execute the project. Plan should document the thoughtful planning of equipment, materials and personnel required to successfully complete the project.

B. Equipment:
Contractor will submit specifications on directional drilling equipment and materials to be used to ensure that the equipment will be adequate to complete the project.

C. Boring Plan:
Prior to beginning work the Contractor must submit a Boring Plan to the Owner's representative. The Boring Plan shall include the length of rods, distance from the center of the drilling fluid specifications, depth below grade and horizontal and vertical orientation in tabular format. A sketch of the bore path shall also be provided.

D. As-Built Record:
The Contractor shall submit a plan, profile and tabular record of the position of the HEF supply line. The record data shall be similar to that shown on the boring plan.

PART 2.00 PRODUCTS
2.01 EQUIPMENT
The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a drilling fluid mixing and delivery system of sufficient capacity to successfully complete the crossing, a guidance system to accurately guide boring operations and trained and competent personnel to operate the system. All equipment shall be in good, safe operation condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

2.02 DRILLING SYSTEM
A. Drilling Rig:
The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering pressurized fluid mixture to a guidable drill (bore) head. The machine shall have the capacity to pull the prefabricated pipeline with a steady tensile pressure required to complete the crossing. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.

B. Drill Head:
The drill head shall be steerable by changing its rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

C. Mud Motors (if required):
Mud motors shall be of adequate power to turn the required drilling tools.

D. Drill Pipe:
Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

2.03 GUIDANCE SYSTEM
The Guidance System shall be of a proven type and shall be set up and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

2.04 DRILLING FLUID (MUD) SYSTEM
A. A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry power to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be sized for adequate storage of the mud. Mixing system shall continually agitate the drilling fluid during drilling operations.
B. Drilling Fluids:
Drilling fluids shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 ß 10 and/or as per mixing requirements of the manufacturer. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate of equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.
C. Delivery System:
The mud pumping system shall have a minimum capacity to supply mud in sufficient volume to the drilling operation and maintain the required pressure. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, minimum of 12" high, shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum trucks(s) of sufficient capacity shall be in place to convey excess drilling fluid from containment areas to storage facilities.

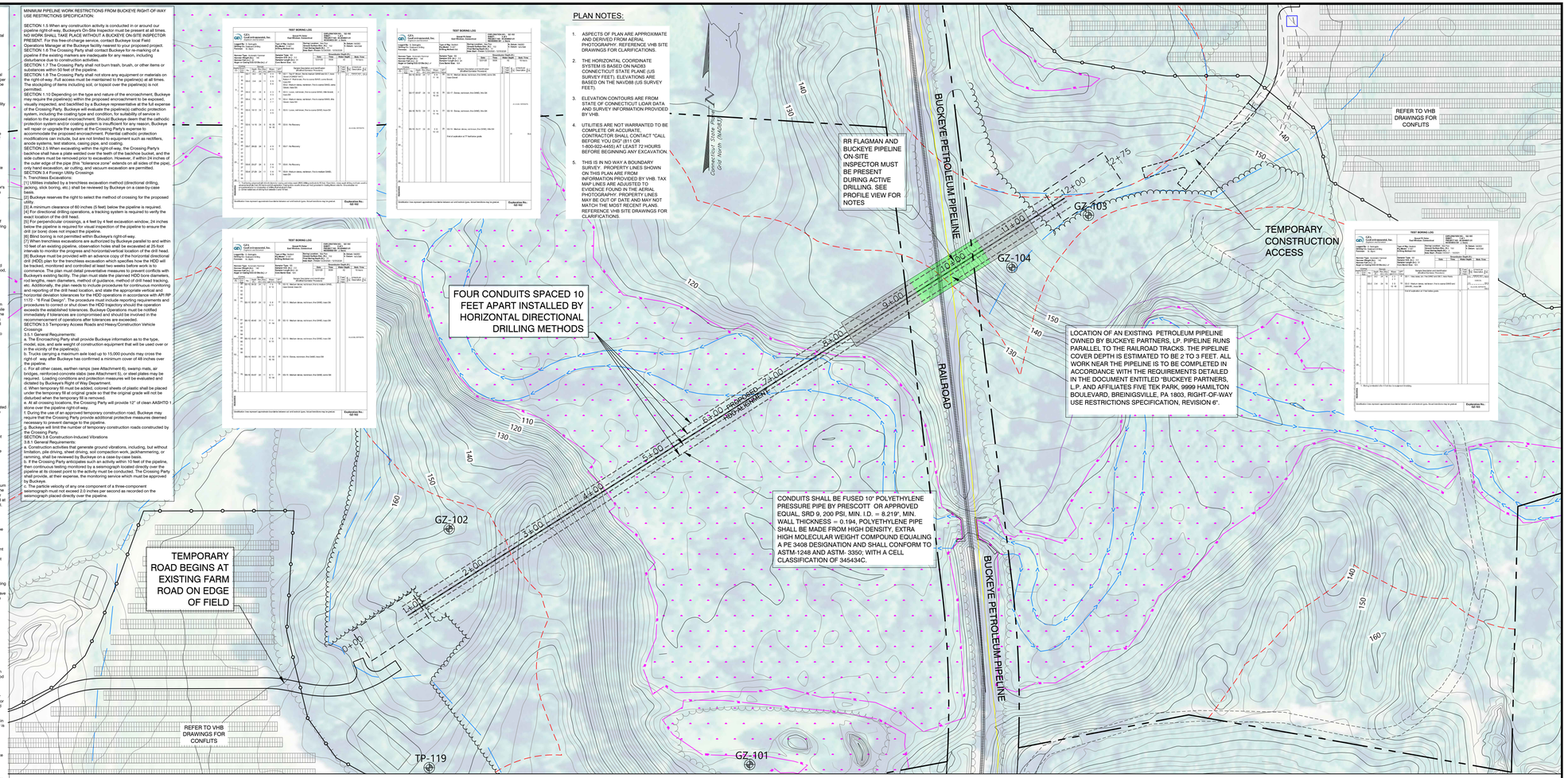
PART 3.00 EXECUTION
3.01 GENERAL
The Owner and Engineer must be notified at least 48 hours in advance of starting work. The directional bore shall not begin until the Owner's representative is present at the job site and agrees that proper preparations for the operation have been made. The Owner representative approval for beginning the installation shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the Contract.

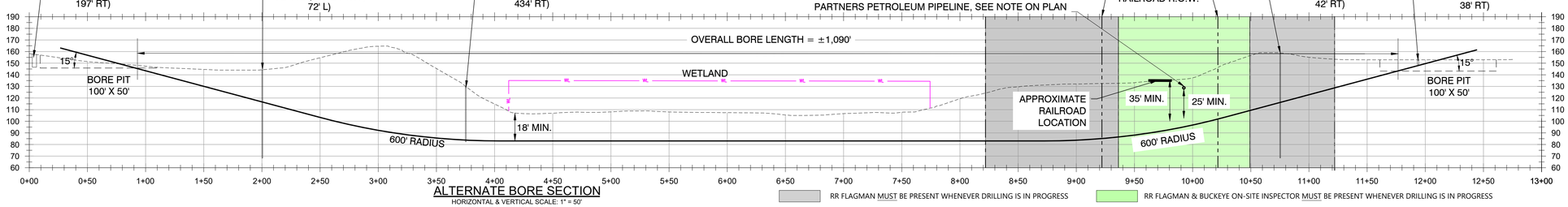
3.02 PERSONNEL REQUIREMENTS
A. Use only experienced installers, equipment operators, supervisors and engineer designers.
B. Contractors with experience shall include:
1) Minimum five years experience in Horizontal Directional Drilling.
2) Upon request, Directional Drill Contractors shall provide references for previous projects completed in the area.

3.03 DRILLING PROCEDURE
A. Site Preparation:
1) Prior to any alterations to worksite, Contractor shall photograph or videotape entire work area, including entry and exit points. One copy of which shall be given to the Owner and one copy to remain with Contractor for a period of one year following the completion of the project. The Contractor shall photograph or video taping the work area and obtain permission before photography or video taping the work area.
2) Worksite as indicated on drawings, with right-of-way, shall be graded or filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.
B. Drill Path Survey:
Drill path shall be staked and accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.
C. Safety:
Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer.
D. Pipe:
Pipe shall be heat welded/fused together in one length, if space permits.
E. Pilot Hole:
1) Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth per a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', Contractor will notify the contracting Owner's representative and the Owner's representative may require Contractor to pull back and re-drill pilot hole at Contractor's expense to correct deviation.
2) In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, Contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or return loss continues, Contractor shall cease operations and notify the Owner's representative. The Contractor shall be responsible for the restoration of any area heaved or damaged by the escape of drilling mud.
F. Reaming:
Upon successful completion of pilot hole, Contractor will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor shall not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.
G. Pull-Back:
1) After successfully reaming borehole to the required diameter, Contractor will pull the pipe and tracer wire through the borehole. In front of the pipe will be a swivel. Once pull-back operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations Contractor shall not apply more than the maximum safe pipe pull pressure at any time.
2) In the event that pipe becomes stuck, Contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, Contractor shall notify the Owner's representative. The contractor shall not be relieved of his responsibility to satisfactory complete the work as authorized under the contract if a stuck pipe can not be pulled.
3) If all other pipe pulling and/or boring methods fail, the contractor officer may request the contractor to complete the electric lines via overhead methods. Payment for the work to that point shall be as dictated by the Contract between the Owner and Contractor. The Contractor shall submit revised pricing for review and approval before proceeding with overhead electric work. No such work shall be commenced before it is confirmed that all necessary permits are in place.

MINIMUM PIPELINE WORK RESTRICTIONS FROM BUCKEYE RIGHT-OF-WAY USE RESTRICTIONS SPECIFICATION:

SECTION 1.5 When any construction activity is conducted in or around our pipeline right-of-way, BUCKEYE ON-SITE INSPECTOR MUST BE PRESENT. NO WORK SHALL TAKE PLACE WITHOUT A BUCKEYE ON-SITE INSPECTOR PRESENT. For the free-of-charge service, contact Buckeye local Field Operations Manager at the Buckeye facility nearest to your proposed project.
SECTION 1.6 The Crossing Party shall contact Buckeye for re-marking of a pipeline if the existing markers are inadequate for any reason, including disturbance due to construction activities.
SECTION 1.7 The Crossing Party shall not burn trash, brush, or other items or substances within 50 feet of the pipeline.
SECTION 1.8 The Crossing Party shall not store any equipment or materials on the right-of-way. Pipe access must be maintained to the pipeline(s) at all times. The stockpiling of items including soil, or topsoil over the pipeline(s) is not permitted.
SECTION 1.10 Depending on the type and nature of the encroachment, Buckeye may require the pipeline(s) within the proposed encroachment to be exposed, visually inspected, and backfilled by a Buckeye representative at the full expense of the Crossing Party. Buckeye will evaluate the pipeline(s) cathodic protection system, including the coating type and condition, for suitability of service in accordance with the encroachment(s). If Buckeye determines that the cathodic protection system and/or coating system is insufficient for any reason, Buckeye will repair or upgrade the system at the Crossing Party's expense to accommodate the proposed encroachment. Potential cathodic protection modifications can include, but are not limited to equipment such as rectifiers, anode systems, test stations, casing pipe, and coating.
SECTION 2.5 When excavating within the right-of-way, the Crossing Party's backhoe shall have a plate welded over the teeth of the backhoe bucket, and the side cutters must be removed prior to excavation. However, within 24 inches of the pipeline, the last 6 inches of material must be removed by hand or by other pipeline only hand excavation, air cutting, and vacuum excavation are permitted.
SECTION 3.4 Foreign Utility Crossings
h. Trenchless Excavations:
[1] Utilities installed by a trenchless excavation method (directional drilling, jacking, slick boring, etc.) shall be reviewed by Buckeye on a case-by-case basis.
[2] Buckeye reserves the right to select the method of crossing for the proposed utility.
[3] A minimum clearance of 60 inches (5 feet) below the pipeline is required.
[4] For directional drilling operations, a tracking system is required to verify the exact location of the drill head.
[5] For perpendicular crossings, a 4 feet by 4 feet excavation window, 24 inches below the pipeline is required for visual inspection of the pipeline to ensure the drill (or bore) does not impact the pipeline.
[6] Blind boring is not permitted within Buckeye's right-of-way.
[7] For parallel installations, observation holes shall be located parallel to and within 10 feet of an existing pipeline, observation holes shall be excavated at 25-foot intervals to monitor the progress and horizontal/vertical location of the drill head.
[8] Buckeye must be provided with an advance copy of the horizontal directional drill (HDD) plan for the trenchless excavation which specifies how the HDD will be tracked, monitored and controlled at least two weeks before work is to commence. The plan must detail preventative measures to prevent conflicts with Buckeye's existing facilities, such as pipelines, cathodic protection systems, AC/DC mitigation facilities, valves and gas meters, method of drill head tracking, etc. Additionally, the plan needs to include procedures for continuous monitoring and reporting of the drill head location, and state the appropriate vertical and horizontal deviation tolerances for the HDD operations in accordance with API RP 1172 - "6 Final Design". The procedure must include reporting requirements and procedures to correct or shut down the HDD trajectory should the operation exceeds the established tolerances. Buckeye Operations must be notified immediately if tolerances are compromised and should be involved in the determination of corrective actions after tolerances are exceeded.
SECTION 3.5 Temporary Access Roads and Heavy/Construction Vehicle Crossings
3.5.1 General Requirements:
a. The Encroaching Party shall provide Buckeye information as to the type, model, size, and axle weight of construction equipment that will be used over or in the vicinity of the pipeline(s).
b. Trucks carrying a maximum axle load up to 15,000 pounds may cross the right-of way after Buckeye has confirmed a minimum cover of 48 inches over the pipeline(s).
c. For all other cases, earthen ramps (see Attachment 6), swamp mats, air bridges, reinforced-concrete slabs (see Attachment 5), or steel plates may be required. Loading conditions and protection measures will be evaluated and dictated by Buckeye's Right of Way Department.
d. When temporary fill must be added, colored sheets of plastic shall be placed under the temporary fill at original grade so that the original grade will not be disturbed and can be easily discovered.
e. At all crossing locations, the Crossing Party will provide 12" of clean AASHTO 1 stone over the pipeline right-of-way.
f. During the use of an approved temporary construction road, Buckeye will require that the Crossing Party provide additional protective measures deemed necessary to prevent damage to the pipeline.
g. Buckeye will limit the number of temporary construction roads constructed by the Crossing Party.
SECTION 3.8 Construction-Induced Vibrations
3.8.1 General Requirements:
a. Construction activities that generate ground vibrations, including, but without limitation, pile driving, sheet driving, soil compaction work, jackhammering, or ramming, shall be reviewed by Buckeye on a case-by-case basis.
b. If the Crossing Party anticipates such an activity within 10 feet of the pipeline, then continuous testing monitored by a seismograph located directly over the pipeline at its closest point to the activity must be conducted. The Crossing Party shall provide, at their expense, the monitoring service which must be approved by Buckeye.
c. The allowable velocity of any one component of a three-component seismograph must not exceed 2.0 inches per second as recorded on the seismograph placed directly over the pipeline.





ALTERNATE BORE SECTION
HORIZONTAL & VERTICAL SCALE: 1" = 50'

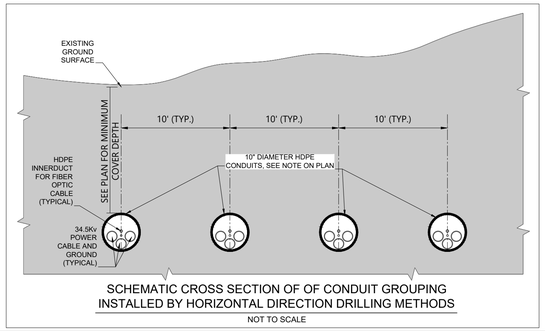
RR FLAGMAN MUST BE PRESENT WHENEVER DRILLING IS IN PROGRESS

RR FLAGMAN & BUCKEYE ON-SITE INSPECTOR MUST BE PRESENT WHENEVER DRILLING IS IN PROGRESS

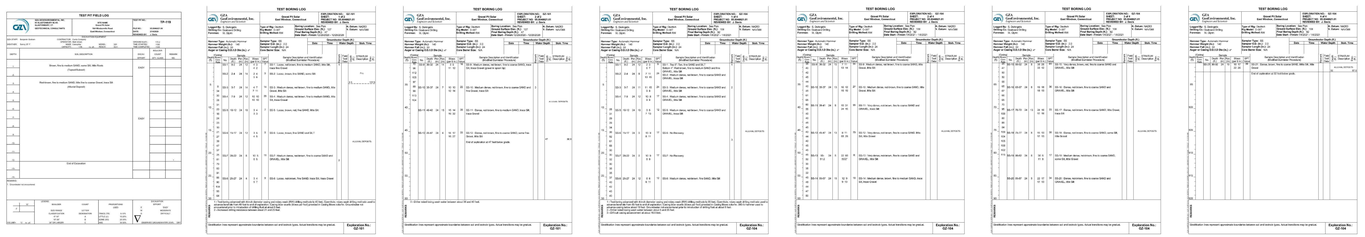
NOTE: CONTRACTOR SHALL MONITOR TRACK ELEVATIONS AT ALL TIMES DURING DRILLING. METHOD OF MONITORING MUST BE PRE-APPROVED BY RR REPRESENTATIVE.

LEGEND

- EXISTING OVERHEAD POWER
- EXISTING GRADE CONTOUR LINES (5 FOOT INTERVALS)
- EXISTING GRADE CONTOUR LINES (1 FOOT INTERVALS)
- EXISTING TREELINE
- APPROXIMATE PROPERTY LINES
- SETBACKS
- DELINEATED WETLANDS
- PROPOSED PERIMETER FENCING
- PROPOSED FIXED SOLAR PANEL RACKING
- PROPOSED GRAVEL ACCESS DRIVE
- PROPOSED LIMIT OF VEGETATION MANAGEMENT ZONE



SCHEMATIC CROSS SECTION OF OF CONDUIT GROUPING INSTALLED BY HORIZONTAL DIRECTION DRILLING METHODS
NOT TO SCALE



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Gravel Pit Solar

Apothecaries Hall Road, Windsorville Road, Wapping Road and Plantation Road
East Windsor, Connecticut

NO.	REVISION	DATE	APPVD.

Drawn by: EJM Checked by: IAJ

Issued for: CTDOT Application Date: January 15, 2021

Not Approved for Construction

PLAN AND PROFILE
HORIZONTAL DIRECTION DRILL
(HDD)

Drawing No.: C-1.04
Sheet Of

Project No.: 20111