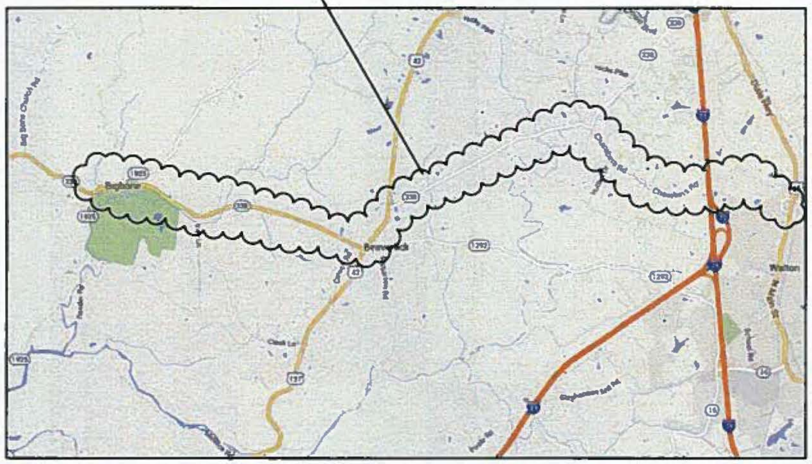
CONFIDENTIAL PROPRIETARY TRADE SECRET

DUKE ENERGY

GAS DEPARTMENT
DUKE ENERGY
ERLANGER DISTRICT N.T.S.

CONTACT GAS SYSTEMS OPERATIONS SUPERVISOR PRIOR TO STARTING JOB TO VERIFY GAS FLOW

AREA OF WORK



VICINITY MAP
N.T.S.

LEGEND

- EX. GAS
- CONT. GAS
- PROP. GAS
- ELECTRIC
- WATER
- SEWER
- CENTERLINE
- E.O.P.
- R/W
- EASEMENT
- PARCEL

IFI
MAR 8, 2016
DRAWINGS

WELDING PROCEDURE(S) REQUIRED	
100% XRAY	SPEC. #501-4
% XRAY	SPEC. #
% XRAY	SPEC. #
% XRAY	SPEC. #
% XRAY	SPEC. #

PIPE INSTALLED ON JOB

SIZE	KIND	WALL THICKNESS	EST. QUANTITIES	ACTUAL QUANTITIES
12"	SPCW X52	0.375"	XXXXXX'	
12"	SPCW X52 (POWERCRETE)	0.375"	981'	

TOTAL ACTUAL INSTALLED ______

PERMIT(S) REQUIRED
BOONE COUNTY
CSX
KYTC HIGHWAY

UTILITY LOCATION CONTACTS

TELEPHONE:	1-800-752-6007
ELECTRIC:	1-800-752-6007
SAN. SEWER:	1-800-752-6007
STORM SEWER:	1-800-752-6007
WATER:	1-800-752-6007
CABLE T.V.:	1-800-752-6007
MUNICIPALITY:	
WARREN COUNTY:	1-859-334-3600

GAS CONTACTS
CONSTRUCTION:
MICHAEL FRANZEN
513-287-2588

ENGINEERING SPONSOR:
JOHN PERKINS
(W) 513-287-1276
(C) 513-315-8338

SYSTEM OPERATION SUPERVISOR VALVES AND NUMBERS REVIEWED
REVIEWED BY ______
DATE

VALVES THAT HAVE BEEN ABANDONED AND BOX REMOVED

DESIGN REVIEW OF COMPLETED CONSTRUCTION JOB
SPONSOR ______ DATE ______
FIELD CHANGE REQUEST DOCUMENT REQUIRED: YES ☐ NO ☐
TRANSMISSION DESIGN DOCUMENT REQUIRED: YES ☐ NO ☐

CORROSION ENGINEERING
APPR. BY: ______
COATING TYPE ______
INSPECTION: VISUAL ☐ JEEP ☐
TYPE PATCH MATERIAL
CONDITION OF PIPE COATING WHEN DELIVERED TO JOB: GOOD ☐ FAIR ☐ POOR ☐
INSULATION CHECKED ☐
NO. CHECKED

TEST CONN. PER STANDARD 7.7.1
NO. PROPOSED ______
NO. INSTALLED ______
NO. TESTED OK P/S INDICATOR ______
PLASTIC SEPARATIONS INSTALLED ☐
CONTINUITY OF COUPLINGS CHECKED ☐
CASING CHECKED FOR SHORT ☐

FIELD PRESSURE TEST
ALL PIPELINES REQUIRED TESTING BEFORE PLACING INTO SERVICE. PRESSURE CHARTS AND FORMS SHOULD BE FORWARDED TO GAS ENGINEERING AND PLANNING.
REQUIRED TEST PRESSURE RANGE:
MIN. ______ PSIG TO MAX ______ PSIG
HOURS ______ MEDIUM ______
TESTED BY ______ DATE ______

SUPERVISOR BLOCK
SUPERVISOR OR CONTRACTOR ______
RECORDED BY ______
DATE STARTED ______ DATE PLACED IN SERVICE ______
DATE COMPLETED ______ PERMIT NO. ______

HYDRO PRESSURE TEST
ALL PIPELINES REQUIRE TESTING BEFORE PLACING INTO SERVICE. PRESSURE CHARTS AND FORMS SHOULD BE FORWARDED TO GAS ENGINEERING AND PLANNING.
REQUIRED TEST PRESSURE RANGE:
MIN. ______ PSIG TO MAX. ______ PSIG
HOURS ______ MEDIUM ______
TESTED BY ______ DATE ______

FIELD SERVICES	ENG. SERVICES	TRANSMISSION OR FEEDER DISTRIBUTION MAINS HYDROSTATIC TEST WATER DISCHARGE
		SEE STANDARDS:
N/A		PERMIT REQUIRED FOR DISCHARGE (CONTACT LEAD) KENTUCKY ☐ 45 DAY NOTICE INDIANA ☐ 60 DAY NOTICE
		CONTACT GAS OPERATION REGULATORY COMPLIANCE TO ARRANGE FOR SAMPLING AND TESTING OF DISCHARGE.
		DISCHARGE PERMITS AND SAMPLING ARE NOT REQUIRED IF THE DISCHARGE IS TO A SANITARY SEWER.
N/A		IN KENTUCKY, A WITHDRAW PERMIT IS REQUIRED IF 10,000 GALLONS OF WATER IS TAKEN FROM ANY LAKE OR STREAM.

ALL WELDS MUST BE IN ACCORDANCE WITH COMPANY SPECIFICATION 501.

MAOP VERIFICATION
PIPE INSTALLED

	SIZE	WALL THICKNESS	GRADE
1.	12"	.375"	X52
2.			
3.			
4.			
5.			

DESIGN MAOP of Line: ______ psig OPERATING MAOP of Line: ______ psig
______ % SMYS
Signed ______ Date ______

S05W04-46	S05W03-39	S05W02-22
S05W04-54	S05W03-40	S05W02-23
S05W04-62	S05W03-46	S05W02-30
S05W04-63	S05W03-47	S05W02-31
S05W03-07	S05W03-54	S05W02-38
S05W03-15	S05W03-61	S05W02-39
S05W03-23	S05W02-05	S05W02-47
S05W03-31	S05W02-13	
S05W03-32	S05W02-14	

	PROJECT	ACTIVITY
INSTALLATION	R2190	I

BIG BONE
F/L MAIN EXTENSION
BOONE CO., KENTUCKY

DRAWN	ENE	03-08-16
CHECKED	ADK	03-08-16
APPROVED		
CLOSED BY		
EST. FOOTAGE	XXXXXX'	

MAP NO. S05W02-47
DRAWING NO. 8205804

REVISIONS

CONFIDENTIAL PROPRIETARY TRADE SECRET

GAS DEPARTMENT
DUKE ENERGY
ERLANGER DISTRICT N.T.S.

2
XX

CONSTRUCTION NOTES

1. TARGET START DATE: 03-01-17
   TARGET FINISH DATE: 11-30-17

2. THE WINNING BIDDER MUST INSTALL THE MAIN IN ACCORDANCE WITH THE SPECIFIED BID INSTALLATION METHOD UNLESS AN ALTERNATIVE METHOD IS SUBMITTED TO AND APPROVED BY THE DUKE ENERGY DESIGN ENGINEER. ANY CHANGES IN INSTALLATION METHOD SHALL NOT INCREASE THE COST OF THE PROJECT TO DUKE. NOR SHALL PAYMENT BE MADE FOR RESTORATION NOT PERFORMED.

3. RESTRICTED HOURS, TRAFFIC CONTROL OR OTHER RESTRICTIONS IMPOSED BY THE PERMITTING AGENCY ARE THE SOLE RESPONSIBILITY OF THE BIDDERS AND NO EXTRAS WILL BE PAID BY DUKE ENERGY.

4. EXTRA DEPTH WILL BE PAID FOR DIRECT BURY INSTALLATIONS WHEN EXCAVATIONS ARE GREATER THAN 6-FEET TOTAL DEPTH AND DEPTH IS GREATER THAN 2-FEET OVER THE PLANNED EXCAVATION DEPTH.

5. ROCK EXCAVATION WILL BE PAID PER GD-150. THE DUKE ENERGY INSPECTOR AND THE CONTRACTOR MUST AGREE ON THE ACTUAL AMOUNT OF ROCK BEFORE BACKFILLING THE TRENCH IN DIRECT BURY INSTALLATIONS. NO ROCK EXCAVATION WILL BE PAID FOR DIRECTIONAL DRILLING INSTALLATIONS.

6. TIE-IN WORK WILL BE GIVEN TO THE WINNING CONTRACTOR AT THE DISCRETION OF DUKE ENERGY. DUKE ENERGY RETAINS THE RIGHT TO HAVE DUKE ENERGY CREWS PERFORM TIE-IN WORK.

7. ALL WORK MUST BE DONE IN ACCORDANCE WITH THE 'SPECIFICATIONS FOR THE 2010 GAS MAIN REPLACEMENT, RELOCATION, AND EXTENSION PROJECTS' AND THE MOST CURRENT VERSION OF GD-150.

8. TIE-IN MAINS MUST BE ADEQUATELY EXPOSED FOR PROPER LINE-UP.

9. OFFSETS WILL BE PAID IF TWO (2) UNPLANNED ELBOWS ARE USED FOR THE AVOIDANCE OF AN UNFORESEEN OBSTACLE IN EITHER THE HORIZONTAL OR VERTICAL DIRECTION.

10. OUT OF BALANCED BIDS WILL BE REJECTED AND NOT CONSIDERED BY DUKE ENERGY.

11. _____

_____

_____

REVISIONS

MARCH 8, 2016

GAS DEPARTMENT
DUKE ENERGY

ERLANGER DISTRICT N.T.S.

3
XX

BOM SHEET

REVISIONS

MARCH 8, 2016

CONFIDENTIAL PROPRIETARY TRADE SECRET

GAS DEPARTMENT
DUKE ENERGY

ERLANGER DISTRICT N.T.S.

4 / XX

DIRECT FIELD PRESSURE TEST

ALL PIPELINES REQUIRE TESTING BEFORE PLACING INTO SERVICE. PRESSURE CHARTS AND FORMS SHOULD BE FORWARDED TO GAS ENGINEERING AND PLANNING

ALL JOINTS MUST BE SOAP TESTED PER STD 2.18.52:

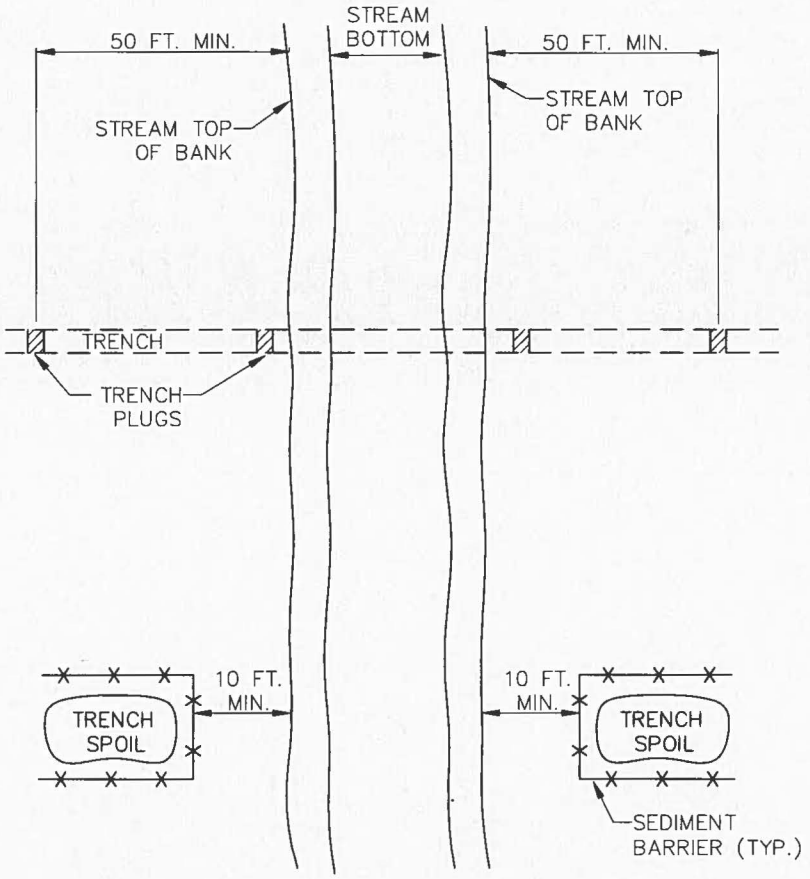
REQUIRED TEST PRESSURE RANGE:
MIN.____ PSIG TO MAX ____ PSIG
HOURS ____ MEDIUM ____
TESTED BY ____ DATE ____
STREET ____
FROM ____ TO ____

DIRECT FIELD PRESSURE TEST
ALL PIPELINES REQUIRE TESTING BEFORE PLACING INTO SERVICE. PRESSURE CHARTS AND FORMS SHOULD BE FORWARDED TO GAS ENGINEERING AND PLANNING
ALL JOINTS MUST BE SOAP TESTED PER STD 2.18.52:
REQUIRED TEST PRESSURE RANGE:
MIN.____ PSIG TO MAX ____ PSIG
HOURS ____ MEDIUM ____
TESTED BY ____ DATE ____
STREET ____
FROM ____ TO ____
(same form repeated 19 more times)

REVISIONS

MARCH 8, 2016

EXHIBIT 2(d) PUBLIC PAGES 328 THROUGH 364 ARE BEING FILED UNDER SEAL



NOTES:

GRUBBING SHALL NOT TAKE PLACE WITHIN 50 FEET OF TOP-OF-BANK UNTIL ALL MATERIALS REQUIRED TO COMPLETE CROSSING ARE ON SITE AND PIPE IS READY FOR INSTALLATION.

TRENCH PLUGS SHALL BE INSTALLED WITHIN THE TRENCH ON BOTH SIDES OF THE STREAM CHANNEL.

WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO A PUMPED WATER FILTER BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY SURFACE WATER.

HAZARDOUS OR POLLUTANT MATERIAL STORAGE AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM THE TOP OF STREAMBANK.

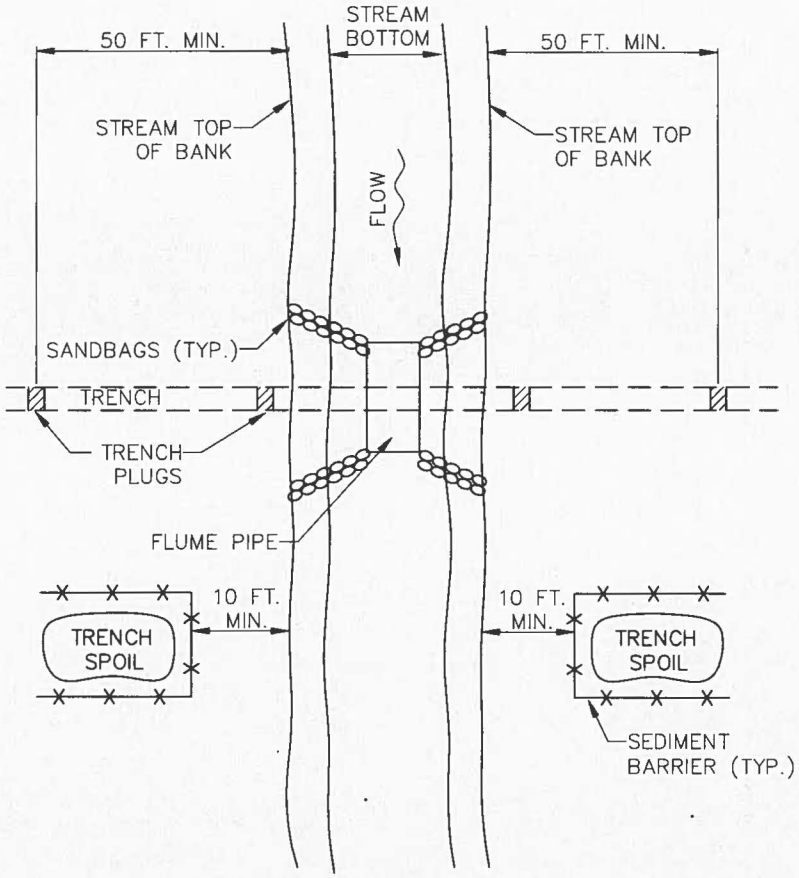
ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.

ALL DISTURBED AREAS WITHIN 50 FEET OF TOP-OF-BANK SHALL BE BLANKETED OR MATTED WITHIN 24 HOURS OF INITIAL DISTURBANCE FOR MINOR STREAMS OR 48 HOURS OF INITIAL DISTURBANCE FOR MAJOR STREAMS UNLESS OTHERWISE AUTHORIZED.

APPROPRIATE STREAMBANK PROTECTION SHALL BE PROVIDED WITHIN THE CHANNEL.

TYPICAL UTILITY LINE DRY STREAM CROSSING

NOT TO SCALE



NOTES:

GRUBBING SHALL NOT TAKE PLACE WITHIN 50 FEET OF TOP-OF-BANK UNTIL ALL MATERIALS REQUIRED TO COMPLETE CROSSING ARE ON SITE AND PIPE IS READY FOR INSTALLATION.

TRENCH PLUGS SHALL BE INSTALLED WITHIN THE TRENCH ON BOTH SIDES OF THE STREAM CHANNEL.

WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO A PUMPED WATER FILTER BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY SURFACE WATER.

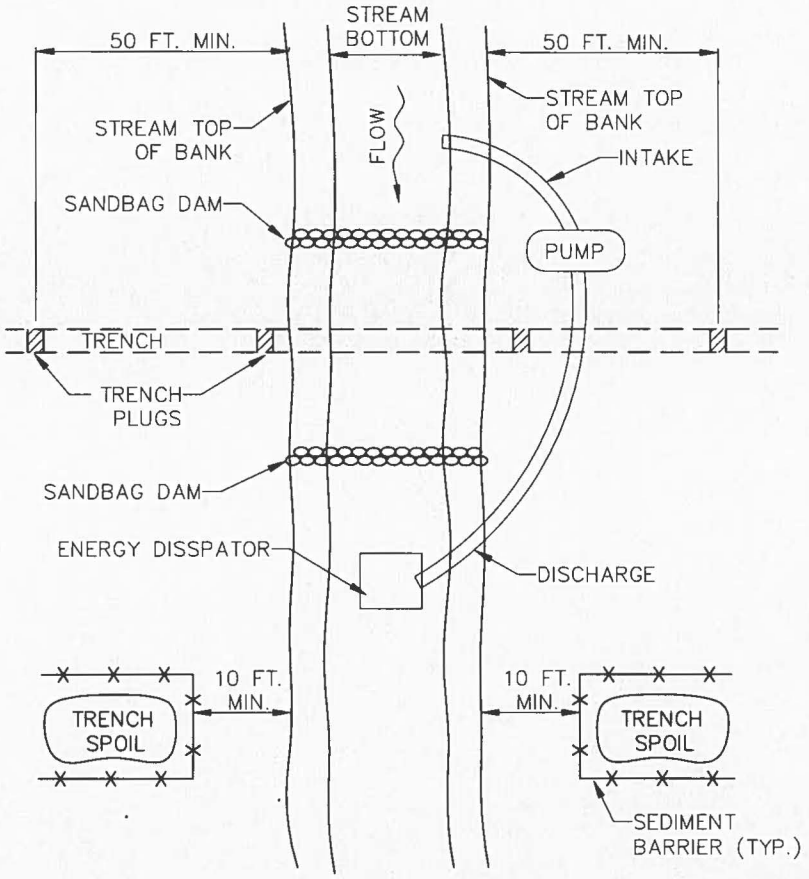
HAZARDOUS OR POLLUTANT MATERIAL STORAGE AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM THE TOP OF STREAMBANK.

ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.

ALL DISTURBED AREAS WITHIN 50 FEET OF TOP-OF-BANK SHALL BE BLANKETED OR MATTED WITHIN 24 HOURS OF INITIAL DISTURBANCE FOR MINOR STREAMS OR 48 HOURS OF INITIAL DISTURBANCE FOR MAJOR STREAMS UNLESS OTHERWISE AUTHORIZED. APPROPRIATE STREAMBANK PROTECTION SHALL BE PROVIDED WITHIN THE CHANNEL.

TYPICAL FLUMED UTILITY LINE STREAM CROSSING

NOT TO SCALE



NOTES:

GRUBBING SHALL NOT TAKE PLACE WITHIN 50 FEET OF TOP-OF-BANK UNTIL ALL MATERIALS REQUIRED TO COMPLETE CROSSING ARE ON SITE AND PIPE IS READY FOR INSTALLATION.

BYPASS PUMP INTAKE SHALL BE MAINTAINED A SUFFICIENT DISTANCE FROM THE BOTTOM TO PREVENT PUMPING OF CHANNEL BOTTOM MATERIALS.

TRENCH PLUGS SHALL BE INSTALLED WITHIN THE TRENCH ON BOTH SIDES OF THE STREAM CHANNEL.

WATER ACCUMULATING WITHIN THE WORK AREA SHALL BE PUMPED TO A PUMPED WATER FILTER BAG OR SEDIMENT TRAP PRIOR TO DISCHARGING INTO ANY SURFACE WATER.

HAZARDOUS OR POLLUTANT MATERIAL STORAGE AREAS SHALL BE LOCATED AT LEAST 100 FEET BACK FROM THE TOP OF STREAMBANK.

ALL EXCESS EXCAVATED MATERIAL SHALL BE IMMEDIATELY REMOVED FROM THE STREAM CROSSING AREA.

ALL DISTURBED AREAS WITHIN 50 FEET OF TOP-OF-BANK SHALL BE BLANKETED OR MATTED WITHIN 24 HOURS OF INITIAL DISTURBANCE FOR MINOR STREAMS OR 48 HOURS OF INITIAL DISTURBANCE FOR MAJOR STREAMS UNLESS OTHERWISE AUTHORIZED.

APPROPRIATE STREAMBANK PROTECTION SHALL BE PROVIDED WITHIN THE CHANNEL.

TYPICAL UTILITY LINE STREAM CROSSING WITH PUMP BYPASS

NOT TO SCALE

Horizontal Directional Drill Work Plan and Contingency Plan

Duke Energy
Walton-Big Bone Natural Gas Pipeline Project
Boone County, Kentucky

April 2016

Submitted By: Duke Energy, Inc.
139 East Fourth Street
Cincinnati, Ohio 45202

DUKE ENERGY®

1.0 INTRODUCTION

Horizontal Directional Drill (HDD) is a widely-used, trenchless construction method which accomplishes the installation of pipelines and buried utilities with minimal impact to the obstacle being crossed; however, the HDD installation method involves the risk of failure when certain adverse subsurface conditions are encountered. Duke Energy will perform a geotechnical investigation to assess subsurface conditions which will be the design basis for the HDD borings to minimize the potential for inadvertent releases of drilling fluids.

The purpose of this document is to present a Work Plan and Contingency Plans that may be implemented in the event that problems develop during HDD operations in order to complete the crossings successfully while minimizing any associated impacts.

1.1 BACKGROUND

The components of a horizontal drilling rig used for pipeline construction are similar to those of an oil well drilling rig with the major exception that a horizontal drilling rig is equipped with an inclined ramp as opposed to a vertical mast. HDD pilot-hole operations are similar to those involved in drilling a directional oil well. Drill pipe and downhole tools are generally interchangeable and drilling fluid is used throughout the operation to transport drilled soil/rock (spoil), reduce friction, stabilize the hole, etc.

Installation of a pipeline by HDD is generally accomplished in three stages. The first stage consists of directionally drilling a small diameter pilot-hole along a designed directional path. The second stage involves enlarging this pilot-hole to a diameter suitable for installation of the pipeline. The third stage consists of pulling a prefabricated pipeline segment into the enlarged hole.

The table below lists the preliminary planned HDD locations at the Walton-Big Bone Natural Gas Pipeline Project and the associated minimum estimated boring lengths and depths below stream bed. These bores will be further detailed once the final engineering HDD designs are completed.

Location	Minimum Boring Length (feet)	Minimum Depth Below Stream Bed (feet)
Big Bone Creek	600	10
Gum Branch	500	6
Mud Lick Creek	600	6

2.0 EXISTING CONDITIONS

2.1 TEMPORARY CONSTRUCTION ROW WIDTH

The typical construction ROW width required for the pipeline is approximately 50 feet. The construction space is primarily constrained by the adjacent public highway.

2.2 EXTRA WORKSPACE AREAS

Temporary construction work areas associated with the HDD's s will be located within the ROW of the adjacent public road or on adjacent private lands as necessary. Temporary workspaces associated with the HDD's will be restored as appropriate once the bores are complete.

2.3 AGENCY CLEARANCES

A Nationwide Permit No. 12 Pre-Construction Notification was submitted to the U.S. Army Corps of Engineers, Louisville District for approval of the stream crossings construction activities that will take place near the streams to be crossed by HDD as well as open trenching.

The proposed HDD areas have been reviewed for habitat that may be suitable for threatened and endangered species as well as cultural resources. No potential habitat for these species and no cultural resources of significance were identified within the construction ROW.

3.0 HDD DESCRIPTION

The HDD process involves use of a drilling fluid (also referred to as drilling mud) made up primarily of water and bentonite. Bentonite is a naturally occurring, non-toxic, inert clay substance that is frequently used for drilling potable water wells.

The primary purpose of drilling fluid is to remove cuttings from the borehole, stabilize the borehole, and act as a coolant and lubricant during the drilling process. Drilling fluid is first prepared in a mixing tank and then is pumped through the center of the drill pipe to the cutters. Drilling fluid returns flow through the annulus created between the wall of the boring and the drill pipe. The drilling fluid is cleaned and recycled before it is returned to the mixing tank and pumps for reuse in the borehole. Cuttings and bentonite mud (clay) that is not left in situ around the bore will be recovered and properly disposed of by the drilling contractor.

The HDD method has the potential for loss or seepage of drilling fluid into the geologic formation through which the drill passes. In some instances, drilling fluid may be forced to the surface, resulting in what is commonly referred to as an inadvertent release. Inadvertent releases can occur if the drill hole is pressurized beyond the containment capability of the overburden soil material.

Providing adequate depth of cover for the installation is a design consideration intended to mitigate this potential. Duke Energy has designed the HDD borings such that the drill path will be positioned a minimum of eight (8) feet below the streambed elevation for any stream crossing (refer to Section 4.0 for details). The depth of the HDD under the stream beds will mitigate much of the risk associated with a potential inadvertent release.

3.1 CONSTRUCTION METHODOLOGY

3.1.1 Silt Fence or other Sediment Control Practices

The construction will start with the installation of appropriate erosion control devices where the HDD rig will be setup to bore the crossings. There is a potential for extra work space (EWS) within the road ROW adjacent to both the proposed bore entry and exit locations, these areas will be managed with appropriate best management practices to control sedimentation and erosion potential.

3.1.2 Timber Mats

After installation of appropriate erosion control devices, timber mats may be placed within the work space to set up the rig and required support equipment.

3.1.3 Rig Setup

After the timber mats have been installed, as necessary, the rig ramp would be positioned and dead man installed as required along with the power unit/control center and drill pipe. Necessary supporting equipment will be contained within the proposed construction workspace within the ROW.

3.1.4 Drilling

Upon successful completion of the rig setup, drilling of the pilot-hole would commence. While the drilling is in progress, the ROW will be continually monitored for any evidence of inadvertent drilling fluid releases. Once the pilot-hole is completed, the drill head will be retrieved and, if necessary, a reaming head placed on the drill pipe with the hole reaming and clean-out.

3.1.5 Tracking

During drilling operations, the directional drilling contractor will continually monitor the location of the drill head by use of a tracking system specific to the drilling equipment used. Between the HDD entry and exit points, the tracking system will require no additional clearing.

3.1.6 Excavation

The exit pits will be excavated when the drill head exits the ground. The excavations will be large enough to allow for a smooth transition for the pullback operations.

3.1.7 Welding, X-Ray, and Coating

Powercrete® applied over fusion-bonded, epoxy-coated pipe will be used to ensure the pipeline is protected during pullback operations. The welding, x-ray, and coating of the pipe joints for the pull back strings will be completed within the work space near the proposed exit pits. After completion of the welding and coating of the joints, the pipe strings will be placed on rollers for the pullback operations as needed.

3.1.8 Pullback

After the pipe strings are welded and coated and the reaming of the bore is completed, a swivel and pull head will be attached to the drill pipe and connected to the first pipe string. Pull back operations will commence until the length of the first pipe string is in the ground with the end in the appropriate location for the next string to be welded, x-rayed, and coated prior to pull back operation resuming. This sequence will continue until all pipe strings are pulled back.

3.1.9 Hydrostatic Testing

Prior to installation of this section of pipeline, a HDD hydrostatic test will be conducted to verify that the pipeline will withstand the proposed operating pressures.

3.1.10 Backfill of Pits

After the pipeline is in its final position, the entry and exit pits will be backfilled with select materials to pad the pipe and the remaining spoil piles will be properly disposed of or used as backfill in the trench used for the remainder of the pipeline.

3.1.11 Cleanup

After the backfill is completed, the ROW will be seeded and mulched or otherwise restored as appropriate.

4.0 DRILLING PROCEDURES AND FLUID HANDLING

All stages of HDD involve circulating drilling fluid from equipment on the surface, through a drill pipe to a downhole bit or reamer, and back to the surface through the annular space between the pipe and the wall of the hole. Drilling fluid returns collected at the entry and exit points are stored in steel tanks and processed through a solids control system which removes spoil from the drilling fluid allowing the fluid to be reused. The basic method used by the solids control system is mechanical separation using shakers, as well as possibly desanders and desilters. Excess spoil and drilling fluid are transported to, and disposed of, at an approved disposal site.

Under ideal circumstances, drilling fluid exhausted at the bit or reamer will flow back to the entry or exit point through the drilled annulus. In practice, sometimes this happens inconsistently. Drilling fluid expended downhole will flow in the path of least resistance. In the drilled annulus, this path may be an existing fracture or fissure in the soil. This can result in dispersal of drilling fluid into the surrounding soils (lost circulation) or discharge to the surface at some random location (inadvertent returns). Lost circulation and inadvertent releases during installations do not necessarily prevent completion; however, impacts may be realized if drilling fluid inadvertently returns to the surface at a location on a waterway's banks or within a waterway. Drilling parameters may be adjusted to maximize circulation and minimize the risk of an inadvertent release; however, the potential for or a release cannot be completely eliminated.

A summary table of the HDD crossing locations is shown in the table below. A significant portion of the three boring lengths will be beneath soil having high clay content and/or consistency of consolidated materials, greatly reducing the risk of an inadvertent release from occurring.

4.1 DRILLING FLUID FUNCTIONS

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

- Transmission of Hydraulic Power: On crossings through harder soils or rock, power required to turn a bit and mechanically drill a hole is transmitted to a downhole motor by the drilling fluid.

- Transportation of Spoil: Drilled spoil, consisting of excavated soil or rock cuttings, is suspended in the fluid and carried to the surface by the fluid stream flowing in the annulus between the pipe and the wall of the hole.

- Bore Stabilization: Stabilization of the bore is accomplished by the drilling fluid building up a "wall cake" which seals pores and holds soil particles in place. This is critical in HDD pipeline installation as bores are often through unconsolidated formations and are uncased.

- Cooling and Cleaning of Cutters: Drilled spoil build-up on bit or reamer cutters is removed by high velocity fluid streams directed at the cutters. Cutters are also cooled by the fluid.

- Reduction of Friction: Friction between the pipe and the wall of the hole is reduced by the lubricating properties of the drilling fluid.

- Modification of Soil Properties: 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 it.

4.2 DRILLING FLUID COMPOSITION

The major component of drilling fluid used in HDD pipeline installation is fresh water. In order for water to perform the required functions, it is generally necessary to modify its properties by adding a viscosifier. The viscosifier used almost exclusively in HDD drilling fluids is naturally occurring bentonite clay typically mined by "open pit" methods from locations in Wyoming and South Dakota. Bentonite is soft clay, formed by the weathering of volcanic ash, with the unique characteristic of swelling to several times its original volume when in contact with water. It is not a hazardous material as defined by the United States Environmental Protection Agency's regulations. It is also used to seal earth structures such as ponds or dams, abandoning ground water wells.

4.3 DISPOSAL OF EXCESS DRILLING FLUID

Excess drilling muds will be recovered and disposed of properly by the drilling contractor.

4.4 MINIMIZING ENVIRONMENTAL IMPACTS

The most effective way to minimize environmental impact associated with HDD drilling fluids is to maintain drilling fluid circulation to the extent practical; however, resources spent in an effort to maintain circulation should be weighed against the potential benefits achieved through full circulation. It should be recognized that in subsurface conditions which are not conducive to annular flow, restoration of circulation may not be practical or possible. In such cases, environmental impact can often be minimized most effectively by completing HDD operations in the shortest possible amount of time.

Steps that may be taken by the contractor to either prevent lost circulation or regain circulation include, but are not limited to, the following:

- Size the hole frequently by advancing and retracting the drill string in order to keep the annulus clean and unobstructed.
- When drilling fluid flow has been suspended, establish circulation slowly and before advancing.
- Minimize annular pressures by minimizing density and flow losses. Viscosity should be minimal consistent with hole cleaning and stabilization requirements.
- Minimize gel strength.
- Control 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.
- Suspend drilling activities for a period of time (e.g. six to eight hours).

If inadvertent surface returns occur on dry land, it will be the responsibility of the HDD contractor to contain, collect, and restore the disturbed area in accordance with the requirements of the this plan. Should an inadvertent release occur within a waterway, Duke Energy will notify appropriate parties and evaluate the potential impact of the returns in order to determine an appropriate course of action.

4.5 REQUIREMENTS OF THE HDD CONTRACTOR

The HDD contractor will be required to comply with this plan, Best Management Practices, and any other items agreed on between Duke Energy and the contractor or as required by permit.

4.6 CONTINGENCY PLAN FOR LOSS OF DRILLING FLUIDS

4.6.1 Introduction

The purpose of this section is to establish monitoring and response criteria that will minimize the environmental effects of the HDD operation. In particular this plan addresses the containment and control of drilling fluids.

4.6.2 Loss or Release of Drilling Fluid

A primary key to containing and controlling an inadvertent return is early detection and quick response by the HDD crew. This plan will identify the activities to be monitored and appropriate response actions to be taken to ensure that any release of drilling fluid is minimized. The plan outlines a process of monitoring the drilling fluid in order to identify a loss-of-returns situation and to determine if there is a release to the surface.

4.6.3 Typical Control Measures Used

Typical measures that are put in place to ensure that a release of drill fluid will be effectively dealt with include the items listed below.

4.6.3.1 Training

Supervisory and other key personnel that will be on-site will have received training with respect to the control and containment of drilling fluid. The training includes:

- the details of this plan;
- the need for environmental protection;
- environmental resources located at or near the site;
- specific permitting conditions and requirements;
- the need to monitor the HDD operation;
- lines of communication;
- lines of authority and responsibility;
- the information the HDD contractor will provide to Duke Energy and other site

representatives;
- contact names and telephone numbers of the appropriate individuals and agencies;
- events that need to be reported and to whom.

4.6.3.2 HDD Monitoring

The contractor's site superintendent has the overall responsibility for monitoring the HDD operations for inadvertent returns. The drill rig operator or driller is the individual who is responsible for monitoring drilling fluid pressures and fluid returns. In the event of a significant drop in down hole fluid pressure or fluid returns the driller will notify the site superintendent. The superintendent, with the assistance of the more senior crewmembers is also responsible for visually monitoring the length of the bore for inadvertent returns.

During the clean-up of spilled drilling fluid, the characteristics of the fluid released, quantities of fluid being cleaned up, the extent of the release and any apparent effects, and general progress of work will be documented in daily reports submitted to Duke Energy and in the driller's log. See Section 5.0 for Duke Energy's monitoring procedure.

4.6.3.3 Response and Notification

The HDD contractor shall immediately notify Duke Energy of any sudden losses in returns or any inadvertent returns. If an inadvertent return to the ground surface or into the stream is observed, the HDD contractor will take certain reasonable actions to eliminate, reduce, or control the release. The actions to be taken will depend on the location and time of release, the geologic conditions there and the volume of the release. This section outlines the response measures that will be implemented for inadvertent returns to the ground surface or into a river bottom. See Section 6.0 for Duke Energy's notification procedure.

Duke Energy in turn will notify the appropriate permitting agencies as required.

4.6.3.4 Inadvertent Return to the Ground Surface

If a release occurs in an upland area, the HDD contractor will take appropriate reasonable actions to reduce, eliminate or control the release. The actions to be taken will depend on the location of the release point and the amount of fluid being released. The actions may include but no be limited to:

- constructing a small pit and/or sandbag coffer around the release point to contain the drilling fluids, installing a section of geotextile filter fabric ("silt fence"), straw bale, and/or rock check dam to trap as much sediment as possible, and placing a pump hose in the pit to pump the drilling fluid back to the bore site as required;
- reducing drilling fluid pressures;
- thickening drilling fluid mixture;

- adding pre-approved LCMs to the fluid mixture; and
- ceasing pumping operations.

Which of these actions will be implemented will depend on the specific boring conditions at the time of the release and the volume of the release. The HDD contractor, in consultation with Duke Energy, will determine which methods are the most appropriate to eliminate, reduce or control the release. Drilling fluid that is recovered will be recycled and reused to the extent that is practical. Duke Energy will document the nature of the release including physical characteristics of the fluid, the location and extent (area, estimated volume and duration), the modified procedures used to reduce the rate of leakage, and the extent to which these measures are successful in controlling or eliminating the release.

4.6.3.5 Inadvertent Return to a Stream Bed

If an in-stream release occurs, the HDD contractor will take appropriate reasonable actions to reduce, eliminate or control the release. The actions to be taken will depend on the location of the release point and the amount of fluid being released. The actions may include but no be limited to:

- containing the drilling fluids in a coffer dam or sand bag enclosure
- reducing drilling fluid pressures;
- thickening drilling fluid mixture;
- ceasing pumping operations

The measures listed above can be used to limit or possibly stop the release of drilling fluid onto the river bottom. Which of these measures will be used will depend on the specific boring conditions at the time of the release and the volume of the release. The HDD contractor, in consultation with Duke Energy, will determine which methods are the most appropriate to eliminate, reduce or control the release. Returns that occur under water in the stream will either be contained (e.g. through use of sand bags) and removed to the extent practical or will be left to dissipate naturally. The HDD contractor will document the nature of the release including physical characteristics of the fluid, the location and extent (area, estimated volume and duration), the modified procedures used to reduce the rate of leakage, and the extent to which these measures are successful in controlling or eliminating the release.

4.6.3.6 Returns to Entry and Exit Points

Measures will be implemented to contain and control the drilling fluid at the HDD crossing entry point and exit point. These measures typically consist of the excavation of a small containment pit around the points. Pumps will be used to remove any fluid that collects in the pit and pump it to either a fluid cleaning system or to a steel storage tank. Drilling fluid that is recovered will be recycled and reused. It is normal that drilling fluid is spilled on the drill rig when threaded connections in the drill string are broken. This fluid will be contained and directed by means of a shallow trench to the entry pit where it will be collected and recycled.

4.6.3.7 Documentation

The daily reports that will be submitted to Duke Energy and the drillers log will contain relevant information pertaining to inadvertent returns and the measures implemented to contain and control them.

4.6.3.8 Cleanup

Immediately following the successful completion of the pipeline pullback, the HDD contractor will clean all affected areas of trash and debris. Excess drilling fluids remaining in pits and tanks will be collected and disposed as discussed above.

4.6.3.9 Hole Abandonment Procedure

Abandoned drill holes penetrating unconsolidated materials or fractured bedrock should be sealed by grouting the entire length of the hole. This is done with a conductor pipe, starting at the end of the drill hole and slowly pulling the conductor pipe toward the entry point at a rate no faster than the grout material fills and displaces water from the hole and until the hole is completely filled. The grout mixture used should be a Portland cement mixed with 2 to 10 percent high solids bentonite clay mixed according to the correct water-to-cement ratio. Commercially available premixed bentonite grout designed for sealing wells may also be used.

4.6.3.10 Project Follow-Up

Post-Project follow-up will only be necessary if a major or sustained release of drilling fluid occurs. The post-Project follow-up will include:

- photographs and/or video taping of the locations where the release occurred;
- determining if environmental impact has occurred; and
- develop remediation actions in conjunction with the appropriate agencies.

5.0 MONITORING

Duke Energy will provide an inspector to monitor the HDD contractor's performance at the jobsite in accordance with established requirements and standard HDD industry practice. The primary functions of Duke Energy's inspector will be to document construction activities, report on the HDD contractor's performance, and notify the Duke Energy Project Manager if the HDD contractor fails to conform to established requirements. Established requirements to which the HDD contractor must conform include, but are not limited to, the construction drawings, technical specifications, permits, easement agreements, and contractor submittals.

The monitoring protocol which will be applied by Duke Energy's inspector relative to drilling fluid related issues is described below in detail.

5.1 DRILLING FLUID MONITORING PROTOCOL

The drilling fluid monitoring protocol to be applied will vary depending upon the following operational conditions.

- Condition 1: Full Circulation;
- Condition 2: Loss of Circulation; or
- Condition 3: Inadvertent Release.

5.1.1 Monitoring Protocol for Condition 1 - Full Circulation

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.
- 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 will be visually inspected from the banks for a visible drilling fluid plume.
- Drilling fluid products present at the jobsite will be documented.

If an inadvertent drilling fluid return is detected during routine monitoring, the monitoring protocol associated with Condition 3 will immediately be implemented.

5.1.2 Monitoring Protocol for Condition 2 - Loss of Circulation

When HDD operations are in progress and drilling fluid circulation to the HDD endpoints is lost or severely diminished, the following monitoring protocol will be implemented.

- Duke Energy's inspector will notify the Project Manager that drilling fluid circulation to the HDD endpoints has been lost or severely diminished.

- Duke Energy's inspector will document steps taken by the HDD contractor to restore circulation. Should the contractor fail to comply with the requirements of the HDD Specification, Duke Energy's inspector will notify the Project Manager so that appropriate actions can be taken.

- If circulation is regained, Duke Energy's inspector will inform the Project Manager and resume the monitoring protocol associated with Condition 1.

  If circulation is not re-established, Duke Energy' inspector will increase the frequency of visual inspection along the drilled path alignment as appropriate.

5.1.3 Monitoring Protocol for Condition 3 - Frac-out

If an inadvertent return of drilling fluids is detected, the following monitoring protocol will be implemented.

- Duke Energy's inspector will inform the Project Manager that an inadvertent drilling fluid return has occurred and provide documentation with respect to the location, magnitude, and potential impact of the return.

- If the inadvertent return occurs on land, Duke Energy's inspector will document steps taken by the HDD contractor to contain and collect the return. Should the contractor fail to comply with the requirements of the HDD Specification, Duke Energy's inspector will notify the Project Manager so that appropriate actions can be taken.

- If the inadvertent return occurs in a waterway, Duke Energy, in consultation with appropriate parties, will determine the impact of the inadvertent return.

- If it is determined that the inadvertent return has minimal impact, HDD operations will continue. Duke Energy's inspector will monitor and document the inadvertent return as well as periods of contractor downtime and the contractor's drilling fluid pumping rate in case it should become necessary to estimate inadvertent return volumes.

- If it is determined that the return creates a significant impact, drilling operations will be suspended until containment measures can be implemented by the contractor. Documentation of any containment measures employed will be provided by Duke Energy's inspector. Once adequate containment measures are in place, the contractor will be permitted to resume drilling operations subject to the condition that drilling operations will again be suspended should the measures fail. Duke Energy's inspector will periodically monitor and document both the inadvertent return and the effectiveness of the containment measures. Upon completion of the HDD installation, Duke Energy will oversee the clean-up of inadvertent drilling fluid returns to the satisfaction of governing agencies and any affected parties.

6.0 NOTIFICATION

In the event of an inadvertent release of drilling fluid within a waterway, Duke Energy will contact applicable agencies by telephone and/or facsimile, detailing:

- the location and nature of the release;
- corrective actions being taken; and
- the nature of the impact caused by the frac-out.

The applicable agencies to be contacted within 24 hours are as follows:

- United States Army Corps of Engineers, Louisville District: 513-315-6100
- KY Division of Water: 502-564-2380

7.0 FAILURE SCENARIOS

It is difficult to define a set of circumstances in advance that define "failure" of the HDD method. The decision to abandon HDD should take into account the conditions encountered on a given crossing.

7.1 ADVERSE CONDITIONS RELATED TO DRILLING

7.1.1 Adverse Conditions During Pilot-Hole Drilling

Adverse conditions encountered during pilot-hole drilling generally occur in the form of high thrust or rotation loads on the drill string. This typically results from unconsolidated or coarse-grained material packing around the drill pipe as it is advanced. Ultimately, friction can increase to the point that the drill string cannot be advanced or retracted, at which point it may be abandoned in place or parted by some means including intentionally twisting it off with the rig.

As loads on the drill string increase, the contractor will adjust drilling fluid properties and work the hole by tripping the drill string out and back in. These measures are generally successful and abandonment of an HDD crossing due to excessive loads during pilot-hole drilling is very rare.

Another adverse condition that can occur during pilot-hole drilling is a lack of directional control resulting in either a violation of pilot-hole position tolerances or an unacceptable angular change. This can occur when the drill bit is deflected off a boulder or cobble lens or when attempting to penetrate a hard bedrock formation at depth. Redrilling efforts are usually successful and abandonment of an HDD crossing due to a lack of directional control is very rare.

7.1.2 Adverse Conditions During Reaming

Adverse conditions during reaming generally involve excessive tensile or torsional loads when enlarging a hole through either hard rock or discontinuous materials such as fractured rock or glacial till. In this situation, application of excessive torque from the rig can result in the drill pipe being twisted off downhole, resulting in the reamer becoming stuck. If the reamer cannot be freed, the drill pipe is generally twisted off, either intentionally or unintentionally, and both the reamer and some amount of drill pipe are abandoned downhole.

As loads increase, the contractor will adjust drilling fluid properties and trip the reamer out of the hole to mechanically displace material. A stuck reamer is more difficult to free up than a pilot-hole drill bit. Reamers are generally designed to move forward, not backward.

Reaming through hard or unusually abrasive rock can lead to failure of reaming tools downhole due to excessive wear. This often results in roller cones or other portions of the reaming tool being lost downhole where they can present an obstacle to subsequent reaming passes or installation of the pipeline. Fishing operations to retrieve pieces of a reaming tool lost downhole are time consuming and often unsuccessful.

7.1.3 Adverse Conditions During Pullback

As with reaming, adverse conditions during pullback generally involve excessive tensile or torsional loads which can ultimately result in the pull section becoming stuck. Excessive torque and pulling forces applied in an attempt to free the pipe can result in twisting off downhole. If a partially installed pull section cannot be withdrawn, the contractor's only option is to start over,

offsetting to one side and drilling a new pilot-hole. Pipe left in the hole has to be replaced and a new pull section has to be fabricated.

7.2 CONTINGENCY PLANS FOR SPECIFIC OPERATIONAL CONDITIONS

HDD installations may fail for a number of reasons. Courses of action to consider if these adverse operational conditions occur are outlined below. These Contingency Plans are guidelines. The specific course of action to be employed will be based on an analysis of the conditions encountered during construction.

7.2.1 Twist-Off and Solution Cavity Encountered During Pilot-Hole

There are two potential conditions that could arise during pilot-hole drilling: twist-off or encounter with the solution cavity. If there is a reasonable chance that the bottom hole assembly and/or drill pipe lost downhole can be retrieved using fishing tools, the contractor will commence fishing operations; otherwise, the contractor will offset within the approved workspace as surveyed and redrill the pilot-hole around the twisted off segment.

If the solution cavity is not extensive (i.e., extending no more than a few feet along the drilled path) and the bit successfully re-enters the formation after passing through the void, the contractor will proceed with the pilot-hole at Duke Energy's discretion. If the solution cavity is extensive, the contractor will offset and begin a new pilot-hole in an effort to avoid the solution cavity.

7.2.2 Twist-Off During Reaming

If the failure is to the pipe side of the reamer, the contractor will trip the reamer out with the rig, trip out the failed drill pipe with pipe side equipment, and trip back through the partially reamed pilot-hole with a directional drilling assembly. If the failure is to the rig side of the reamer, the contractor will trip out the failed pipe on the rig side. An attempt will be made to separate the drill pipe on the pipe side of the reamer from the reamer and recover the drill pipe using pipe side equipment. If it is possible to redrill around the reamer and reenter the completed pilot-hole without violating pilot-hole tolerances, the contractor will do so. If not, the contractor will offset and drill a new pilot-hole.

7.2.3 Twist-Off During Pullback

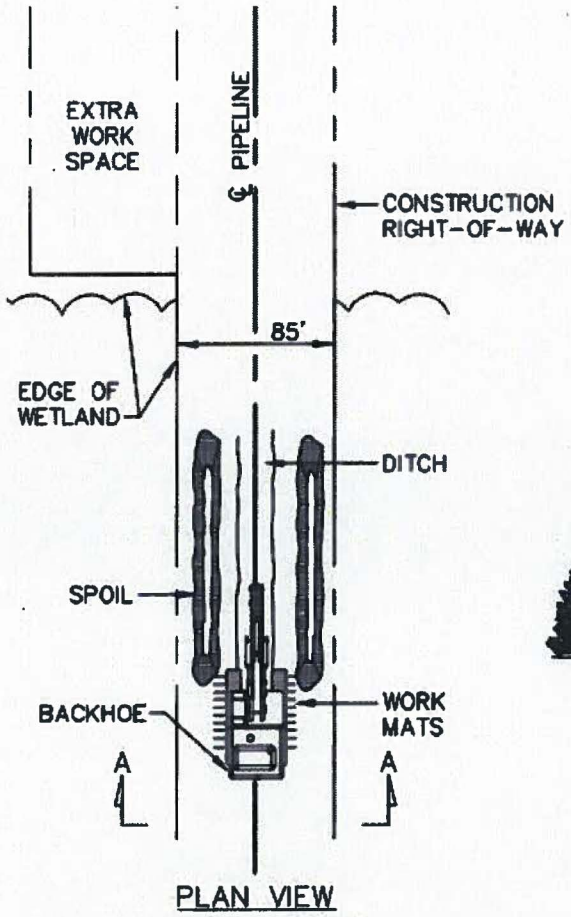
If possible, the contractor will recover the pull section using pipe side equipment or other means as available. The failed drill pipe will be tripped out and back through the reamed hole with a directional drilling assembly; otherwise, the contractor will salvage as much pipe as possible, offset, and begin a new pilot-hole.

7.3 FAILED HDD INSTALLATION

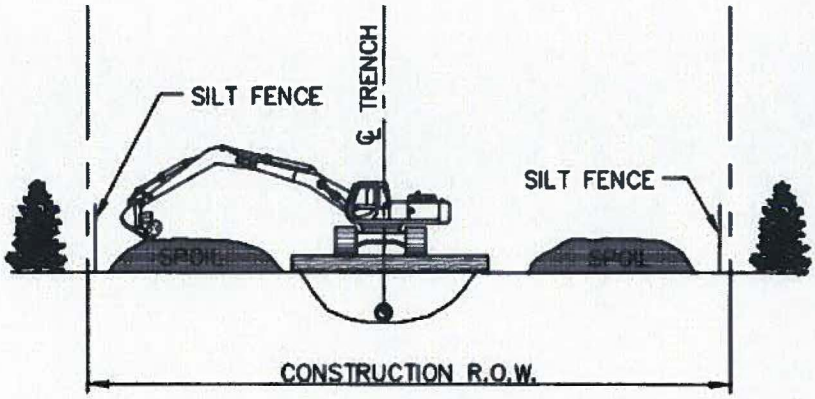
A single occurrence of the adverse conditions described above would not constitute a failure, unless the severity of the failure scenario would preclude a second attempt. Otherwise, Duke Energy would consult with the HDD Contractor before considering the abandonment of the HDD technology. Should any drilled or reamed hole need to be abandoned, it will be filled with a mixture of drilling fluid and drilled spoil as described in Section 4.0.

Contingency Plans related to the loss of drilling fluids are included in Section 4.0. If the HDD installation is unsuccessful, then Duke Energy would weigh project–specific options including

another HDD boring location or an open-cut crossing of the stream.



PLAN VIEW

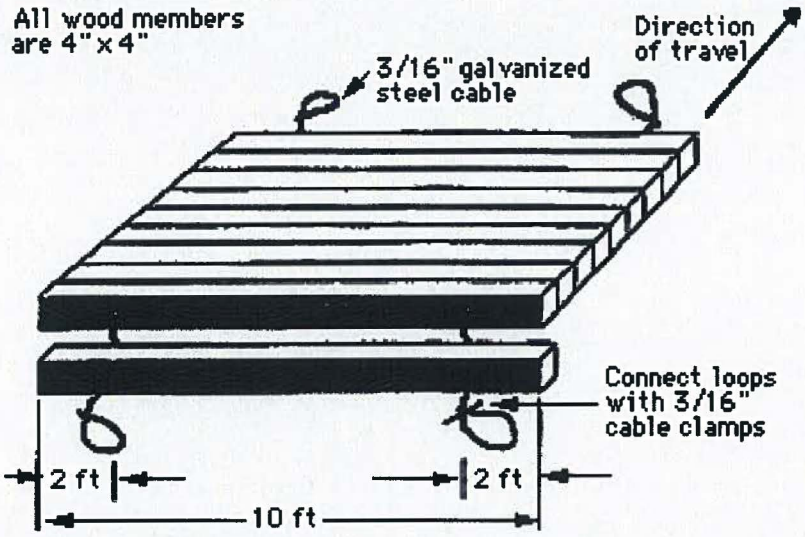


SECTION A-A

CONSTRUCTION PROCEDURES:

1. FLAG WETLAND BOUNDARIES PRIOR TO CLEARING.
2. NO REFUELING OF MOBILE EQUIPMENT IS ALLOWED WITHIN 100 FEET OF WETLAND. PLACE "NO FUELING" SIGN POSTS 100 FEET BACK FROM WETLAND BOUNDARY. REFUEL STATIONARY EQUIPMENT AS PER THE PROJECT'S SPILL PREVENTION PROCEDURES.
3. INSTALL TEMPORARY SLOPE BREAKER UPSLOPE WITHIN 100 FEET OF WETLAND BOUNDARY AS DIRECTED BY THE PROJECT.
4. RESTRICT ROOT GRUBBING TO ONLY THE AREA OVER THE DITCHLINE.
5. TOPSOIL STRIPPING SHALL NOT BE REQUIRED IN SATURATED SOIL CONDITIONS.
6. UTILIZE AMPHIBIOUS EXCAVATORS (PONTOON MOUNTED BACKHOES) OR TRACKED BACKHOES SUPPORTED BY FABRICATED TIMBER MATS OR FLOATS TO EXCAVATE TRENCH. IF FABRICATED TIMBER MATS ARE USED FOR STABILIZATION, THE BACKHOE SHALL GRADUALLY MOVE ACROSS THE WETLAND BY MOVING THE MAT FROM IMMEDIATELY BEHIND TO IMMEDIATELY IN FRONT OF THE BACKHOE'S PATH.
7. AVOID ADJACENT WETLANDS. INSTALL SEDIMENT BARRIERS (STRAW BALES AND/OR SILT FENCE) AT EDGE OF RIGHT-OF-WAY AND ALONG WETLAND EDGE IF PRACTICAL.
8. FABRICATE PIPE IN STAGING AREA OUTSIDE THE WETLAND IN THE EXTRA WORK SPACE AS INDICATED ON THE CONSTRUCTION DRAWINGS.
9. LEAVE HARD PLUGS AT THE EDGE OF THE WETLAND UNTIL JUST PRIOR TO PIPE PLACEMENT.
10. FLOAT PIPE IN PLACE, LOWER-IN, INSTALL TRENCH PLUGS AT WETLAND EDGES WHERE REQUIRED AND BACKFILL IMMEDIATELY.
11. REMOVE TIMBER MATS OR PRE-FABRICATED MATS OF NON-NATIVE MATERIAL FROM WETLANDS UPON COMPLETION.
12. RESTORE GRADE TO NEAR PRE-CONSTRUCTION TOPOGRAPHY AND INSTALL PERMANENT EROSION CONTROL.
13. THE CONSTRUCTION RIGHT-OF-WAY FOR THIS TYPE OF CONSTRUCTION SHALL BE 85 FEET.

TYPICAL UTILITY LINE WETLAND CROSSING DETAIL (NOT TO SCALE)



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A GEOTEXTILE UNDERLAYMENT SHALL BE USED UNDER THE WOOD MAT.

TYPICAL WOOD MATS FOR WETLAND CROSSINGS

NOT TO SCALE