NATURAL GAS TRANSMISSION PIPELINE COST ESTIMATE
E.W. BROWN GENERATING STATION
30” PROPOSED PIPELINE

GARRARD & MERCER COUNTIES, KENTUCKY

SUBMITTED, REV. 0: 01/25/2017

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SECTION 1

EXECUTIVE SUMMARY

PROJECT DESCRIPTION

This report describes the results of a preliminary cost study for Kentucky Utilities (KU/LG&E) E.W. Brown Generating Station in Mercer County, Kentucky. The scope of the project consisted of a detailed ± 20% cost estimate for each of the following cases:

1. 20” HDD of Dix River & tie-in to existing 20” pipeline, MAOP 1,480 PSIG
2. 30” HDD of Dix River & tie-in to existing 20” pipeline temporarily, MAOP 1,000 PSIG
3. 30” HDD of Dix River & tie-in to existing 20” pipeline temporarily, MAOP 1,480 PSIG
4. 30” 11 mile pipeline & 30” HDD of Dix River (this option would be combined with #1 and results in 2 pipeline crossings of the Dix River), MAOP 1,000 PSIG
5. 30” 11 mile pipeline & 30” HDD of Dix River (this option would be combined with #1 and results in 2 pipeline crossings of the Dix River), MAOP 1,480 PSIG
6. 30” 11 mile pipeline & tie-in to 30” HDD of Dix River (this option would be combined with #2 and results in 1 pipeline crossing of the Dix River), MAOP 1,000 PSIG
7. 30” 11 mile pipeline & tie-in to 30” HDD of Dix River (this option would be combined with #3 and results in 1 pipeline crossing of the Dix River), MAOP 1,480 PSIG
8. Station facilities required to pack 11 miles of 30” pipeline to 1,450 psig using new compression (this option would be combined with #5 or #7).
9. Station facilities required to pack 11 miles of 30” pipeline to 1,000 psig using the existing compression (this option would be combined with #4 or #6).
10. Station facilities required to pack 11 miles of 30” pipeline to 1,450 psig using new and existing compression (this option would be combined with #5 or #7).

The proposed pipeline route would parallel the existing 20” pipeline, utilizing a 30” diameter pipeline designed with a 0.125” corrosion allowance and installed in an existing transmission power line corridor (owned and operated by KU/LG&E). At the south end of the pipeline there is an interconnect where gas is received from Texas Eastern Transmission (TET) or Tennessee Gas Pipeline (TGP). Just before the pipeline reaches the E.W. Brown Generating Station there is a large crossing of the Dix River. The project also includes pigging facilities, compressor facilities and meter and regulator facilities.

The proposed compression equipment and facilities would be installed at the existing interconnect station site and in some cases additional property would be needed. All new piping would be designed with a 0.50 design factor and a 0.125” corrosion allowance. The project also includes gas cooling and auxiliary equipment as needed to provide a fully functional compressor station.

EN Engineering (“ENE”) performed on-site field investigation of the proposed pipeline route and station. The investigation included both an aerial imagery evaluation of the pipeline route and a surface investigation of key areas by driving roads that access the proposed pipeline route along with evaluation of existing drawings and operating conditions. The project also included working with select subcontractors to identify project requirements and estimated costs for construction, environmental permitting, survey services and geotechnical services. The material project costs were developed using budgetary bid pricing from various equipment vendors, pipe and material manufacturers and suppliers. Project costs for similar projects and similar facilities were also used to develop the project cost estimates.

COST ESTIMATE RESULTS

The cost estimates were prepared using 2017 project costs and can be found in Section 5 of this report. The total estimated cost of each option evaluated is listed below:

Summary of Cost Estimate Results			
Option 1 - Results in 2 HDD crossings (20" & 30") of Dix River			
Description	**1,000 PSIG MAOP Option 1 A**	**1,480 PSIG MAOP Option 1 B ***	**1,480 PSIG MAOP Option 1 C ****
20" HDD of Dix River, 1480 MAOP	$ 8,284,384	$ 8,284,384	$ 8,284,384
30" 11 mile Pipeline & 30" HDD of Dix River (inlcudes M&R)	$ 57,895,921	$ 62,950,510	$ 62,950,510
Interconnect Station - Compressor Facilities	$ 195,014	$ 7,543,152	$ 7,990,376
Total Cost	**$ 66,375,319**	**$ 78,778,045**	**$ 79,225,270**
Option 2 - Results in 1 HDD crossing (30") of Dix River			
Description	**1,000 PSIG MAOP Option 2 A**	**1,480 PSIG MAOP Option 2 B ***	**1,480 PSIG MAOP Option 2 C ****
30" HDD of Dix River	$ 13,276,046	$ 13,363,648	$ 13,363,648
30" 11 mile Pipeline (includes M&R)	$ 50,563,399	$ 53,445,432	$ 53,445,432
Interconnect Station - Compressor Facilities	$ 195,014	$ 7,543,152	$ 7,990,376
Total Cost	**$ 64,034,460**	**$ 74,352,232**	**$ 74,799,457**

*Option 1 & 2 B Includes compression case #10 listed above

**Option 1 & 2 C Includes compression case #8 listed above

PROJECT RISKS AND IMPACTS

The project has various uncertainties and risks that may impact the project costs. ENE has attempted to evaluate the impact of these risks on the project. The most significant project risks are listed below:

- HDD Feasibility due to potential Karst areas
- Rock present along whole pipeline route
- Change in pipeline diameter
- Delivery and supply pressures and flow rates

The total impact to the project for all of these risks is difficult to estimate both in terms of likelihood and cost of the risk.

LIMITATIONS OF THE REPORT

Cost estimates prepared by EN Engineering for this project were prepared with good faith and reasonable care and are the opinion of EN Engineering as to what the actual costs may be at the time of construction. Since there are many variables that may impact the cost of construction, materials, equipment, ROW and services for a project of this nature, the cost estimates provided in this report are ENE's best effort to determine the approximate cost of the proposed facilities. The cost estimates contained in this report are not a guarantee of the future project costs.

SECTION 2

PIPELINE ROUTE & LAND ACQUISITION

OVERVIEW OF PIPELINE ROUTE

The preliminary design study and cost estimates were developed using a 30" pipeline. The approximate 11 mile pipeline route that was studied ties into an existing pipeline, TGP or TET, and terminates at E.W. Brown Generating Station in Mercer County, KY. The pipeline route is on or adjacent to an existing LG&E/KU transmission power line right-of-way.

Based on a preliminary evaluation of the proposed route, it is expected that 90% of the route would be in Class 1 (60%) and Class 2 (30%) areas, based on DOT gas pipeline classifications. Class 3 pipe will be used for the HDD of the Dix River and inside the E.W. Brown Generating Station.

The last mile of the route veers off the power line right of way to provide a better location for the HDD of the Dix River, see route maps and preliminary HDD designs in Attachment #3. Building a pipeline on an existing right-of-way provides a distinct advantage when obtaining easements from landowners and permitting agencies.

LAND ACQUISITION

The proposed pipeline will be installed approximately 15' from the existing 20" pipeline, which has an existing permanent easement of 30' centered on the existing line. The proposed pipeline will require an additional 15' of new permanent easement resulting in a total of 45' of Permanent Easement. Temporary Workspace adjacent to the Permanent Easement will also be obtained. The total construction workspace required will be 100' (45' of permanent easement and 55' of temporary workspace), 30' on the spoil side and 70' on the working side. Other areas such as road crossings, stream crossings and directional drill sites will require additional temporary workspace.

Land values were obtained using the Garrard County PVA system. Mercer County land values were not considered for this cost estimate due to 98% of the route being in Garrard County.

Eminent domain and the corresponding ability to condemn and acquire the necessary rights of way may impact both the ability to acquire the ROW and the cost. The impact to the ROW acquisition costs for not having eminent domain varies significantly for different project types and different locales. The proposed route for this project follows an existing corridor almost exclusively and is located in mostly rural areas. The vast majority of affected land is pastures/hayfields with a limited amount of cultivated farmland.

The easement costs were calculated using an average per acre cost, $2,500/acre, obtained from the Garrard County PVA system. The temporary workspace costs were calculated using 50% of the per acre cost. Easement acreages are estimated and valued separately for permanent easements and temporary workspace. Permanent Easement acreage is calculated at 20 acres for the 11 mile proposed pipeline (15 foot of proposed permanent easement). The compressor/M&R station was assumed to require an additional acre of permanent easement. The 20" receiver site (relocated to east side of Dix River) was assumed to require 0.13 (75' x 75') of permanent easement. Contractor yard and pipe yard were assumed to be 5 acres each. Temporary Workspace is calculated at 73 acres for the 11 mile proposed pipeline (55 feet of temporary workspace not including the existing and proposed permanent easement). Additional temporary workspace (ATWS) is calculated at 23.5 acres for the 11 mile proposed pipeline. The ATWS calculation includes the following:

- Four (4) 100' x 50' ATWS per road and stream crossing
- 400' x 400' for Compressor Station & M&R Station construction
- 3800' x 75' Stringing Area for HDD of Dix River
- 200' x 200' working areas for exit and entry of HDD of Dix River
- 300' x 300' for Receiver Site (for relocation of 20" receiver east side of Dix River)

Temporary access roads will be required for construction, approximately 6 access roads were assumed for the cost estimate. Permit fees may be required for crossing various town, county, state and federal roads, an average cost of $500 per road crossing was assumed.

FEATURES CROSSED

The table below lists the features crossed by the pipeline route, approximately 12 roads and 14 waterbodies, along with the method for crossing that feature. The aerial maps for the route can be found in Attachment 2.

Garrard County Pipeline Crossings		
Description	**Feature**	**Method**
Middle Fork Sugar Creek Tributary	Stream	Open
Kemper Ln	Paved Road	Bore
Humphrey Ln	Dirt Road	Open
West Fork Sugar Creek	Stream	Open
West Fork Sugar Creek	Stream	Open
West Fork Sugar Creek Tributary	Stream	Open
West Fork Sugar Creek Tributary	Stream	Open
Mt Hebron Rd	Paved Road	Bore
Canoe Creek	Stream	Open
Canoe Creek Tributary	Stream	Open
Canoe Creek Rd	Paved Road	Bore
Canoe Way	Gravel Road	Open
Unknown Creek	Stream	Open
Lexington Rd (Hwy 27)	Paved Hwy	Bore
Lexington Rd/Pine Crest Rd	Paved Road	Bore
Dairy Way	Paved Road	Bore
Unknown Creek	Stream	Open
Kennedy Bridge Rd	Paved Road	Bore
Unknown Creek	Stream	Open
High Bridge Rd	Paved Road	Bore
Rocky Fork	Stream	Open
Ben Naylor Rd	Paved Road	Bore
Rocky Fork	Stream	Open
Hamilton Springs Rd	Paved Road	Bore
Rocky Fork	Stream	Open
Dix River	River	HDD

PIPELINE CONSTRUCTION CONSIDERATIONS & CHALLENGES

While there are challenges to physical construction such as water body, wetlands and road crossings, these are all addressed with today's pipeline construction techniques and do not present significant physical barriers. All paved road crossings are proposed to be conventionally bored. The intermittent streams and ephemeral streams are assumed to be open cut with flume pipe. Gravel roads and small pond crossings are to be constructed using the open cut method.

The Dix River will be crossed using the directional drill method because of the drop in elevation. The river is at the bottom of a rather deep ravine at this crossing point and right outside of the E.W. Brown Generating Station. Laney Drilling visited this site to determine the feasibility of this crossing. A conventional directional drill method was chosen because of the terrain. The cost included is based on drilling from one side and not using the intersect method (using two drill rigs that would intersect in the middle). Once more information is available (geotech) Laney could determine if a pilot hole intersect would be beneficial from a cost and feasibility perspective. However, an intersect method would increase the cost (would require an additional drill rig) but reduce the overall schedule for the drill. Due to the potential for rock and karst areas near the Dix River, Laney provided recommendations for soil boring locations and soil boring depths along the drill route. The geotechnical information that would be obtained is extremely valuable and necessary for drilling contractors to determine the feasibility of this crossing.

SECTION 3

COMPRESSOR, METERS & REGULATING STATION

OVERVIEW OF METER AND REGULATION FACILITIES

The meter and regulating station at the beginning of the pipeline will be upgraded to increase capacity to 550 MMSCFD with a minimum supply pressure of 575 PSIG from either of the two suppliers, TET or TGP. A pressure drop of approximately 10 PSID has been assumed for the purposes of the cost estimate. The gas will be fed through independent, parallel M&R facilities; one from TET and the other from TGP. The flow is assumed to come entirely from one supplier or the other. Controlled flow portioning between the two sources has not been considered for this cost estimate.

The facilities will consist of multiple parallel ultrasonic meter runs followed by controlling ball valves used in a flow control configuration. Pipeline MAOP upstream and downstream of the station as well as station MAOP are all assumed to be the same, so no over pressure protection will be required in the regulation runs. After regulation, the two facilities will tee together to flow to the existing 20" pipeline and proposed future 30" pipeline that feeds the existing CT units and possible future combined cycle plant. A bypass feed is present to supply gas to the existing and possible new reciprocating compressor described in the compressor station portion of this project.

The following upgrades will be required at the station:

- Replace the current (3) orifice meters with (5) ultrasonic meter runs of the same size, utilizing the existing headers.
- Replace the existing regulator runs with (4) control valve runs and a bypass, upsizing the headers to 30" pipe
- Replace all station pipe downstream of the regulation headers with 30" pipe

The minimum delivery pressure required for the CT power plant is 525 PSIG, with a 575 PSIG minimum supply pressure from the TET or TGP pipelines. The station was sized to 10 PSID attempting to achieve the minimum pressure drop possible without unreasonably driving up size and cost. This assumption results in approximately 25 PSID across the pipeline to the CT power plant and therefore the CT M&R station can be designed for approximately a 15 PSID pressure drop. It will need to be confirmed whether the existing CT M&R station can meet this pressure drop. If not, the existing CT M&R station will need to be upgraded to meet the 525 PSIG delivery pressure.

The 25 PSID assumption would also require that the proposed 30" pipeline be dedicated to the 288 MMSCFD flow to the CT power plant. The existing 20" pipeline would need to dedicated to supplying gas to the proposed combined cycle plant and these two lines would need to remain hydraulically separated. Since this would result in a lower delivery pressure for the combined cycle plant, a full line sized compressor would need to be installed to boost pressure to the required plant inlet pressure. This is in contrast to the CT power plant which is assumed to meet delivery pressure under free flowing conditions from the TET or TGP pipelines without any additional compression required.

OVERVIEW OF COMPRESSION FACILITIES

At the existing interconnect station there is an 800 BHP EMD compressor unit that is currently used to pack up the existing 20" pipeline from pipeline delivery pressure to 1,450 psig. The following cases were evaluated for facilities to provide the same type of pack and hold service for the proposed 30" pipeline.

CASE 8 – The installation of a new EMD compressor package and associated equipment, piping and valves to pack an 11 miles section of 30" pipe from 570 psig to 1,450 psig. It is assumed that the existing compressor unit would not be used after the new unit becomes operational or would be used as a backup unit. The existing unit would take approximately 23 hours to pack the 30" line to the 1,450 psig pressure. The new unit would also be used to pack the existing 20" line up to 1,450 psig and could perform this task in significantly less than 10 hours.

CASE 9 – The installation of a new piping to connect the existing EMD compressor package to the new 30" line. The existing gas cooler and other associated equipment would be used as needed. The existing facilities would be used to pack the 11 mile section of 30" pipe from 570 psig to 1,000 psig. The unit would take approximately 10 ½ hours to pack the line.

CASE 10 – The installation of a new EMD compressor package and associated equipment, piping and valves was sized to perform in parallel with the existing compressor unit to pack an 11 miles section of 30" pipe from 570 psig to 1,450 psig in a 10 hour period or less. These new facilities would be very similar to those required for the Case 1 conditions.

The following data and assumptions were used to size the compressor equipment and facilities for the cost studies:

1. The natural gas to be compressed has a Specific Gravity of .594 and a HHV BTU content of 1,064 BTU/Cu. Ft.
2. Station site elevation is 900 feet AMSL.
3. Site Ambient Temperature Range of -10° to 105°F.
4. Minimum Suction Pressure to unit of 570 psig.
5. Maximum Suction Pressure to unit of 700 psig.
6. Maximum Discharge Pressure of 1,000 psig or 1,450 psig depending on the case being estimated.
7. Existing 20" and new 30" pipelines are 11 miles in length.
8. All piping and vessels will be tested to 1.5 times design and will have a 0.50 design factor.
9. The motor/compressor package and the gas cooler will be suitable for installation in Class 1, Division 2, Group D locations.
10. Motor driving the compressor will be fixed speed.
11. The compressor will be a single stage, reciprocating type and have unloaders and pockets for capacity control.
12. All new piping and vessels will be designed for 1,480 psig.
13. Maximum allowable discharge temperature from gas cooler is 125°F.
14. The new compressor and/or the existing compressor will be used only to pack the pipelines from 570 psig to either 1,000 psig or 1,450 psig and not to provide continuous fuel gas flow to the power plant. Equipment was size to pack the lines to the desired pressure in 10 hours or less.
15. All estimated costs for material, equipment, labor and services are in 2017 dollars.
16. The cost to retire and remove the existing motor/compressor unit was not included in the cost study. The existing unit must remain in service until the new unit is operational.
17. Costs to expand or modify the existing power supply lines to the substation were not estimated or included in the studies.
18. The new compressor package and unit valves will be automated. (PLC)
19. All scrubbers, pulsation bottles, pumps, heaters, instrumentation and control panels required for operation of the motor/compressor package will be included on the skid, except for motor starters.
20. Liquids from vessels and equipment shall be piped to the existing waste storage tank.
21. All vessels will be ASME designed and stamped.
22. The gas cooler will be a horizontal fin fan type with vertical air flow and have a hail guard and vibration switches. Design pressure and temperature for the cooler are 1,480 psig at 250°F.
23. The cost estimates include a canopy for the compressor package and the additional property for the site to install the unit and canopy adjacent to the existing unit. However, there may be enough space to install the new unit under the exiting canopy, which would eliminate the new canopy and the need for more property. These items would have to be determined during detailed design.
24. It is assumed that there are no significant cultural resources on or adjacent to the existing station site. No county level environmental ordinances or permits have been identified that would apply to the proposed pipeline project.
25. No AFUDC, Overhead or Contingency were include in the cost estimates.

NOTE: Vendors' sizing of the compressor resulted in either an Ariel JGD4 or KBU4 being used.

CONSTRUCTION OF COMPRESSION FACILITIES

The following information was given to a construction contractor to assist in providing an estimate for the cost to install the new compression facilities. Marked-up P&IDs and Plot Plans were also provided along with a list of equipment and materials.

"The unit will be installed at one of LG&E's existing facilities in Garrard County Kentucky, where they have an existing 800 BHP EMD compressor unit. The new unit is proposed to be a fixed speed, motor driven reciprocating compressor package with the following operating conditions and requirements.

1. Suction Pressure – 570 psig minimum
2. Discharge Pressure – 1,450 psig maximum
3. Flow Rate – 55 MMSCFD
4. Gas Specific Gravity will be 0.594.
5. Site Elevation is 900 Ft.
6. Piping MAWP is 1,480 PSIG
7. All piping to be hydro-tested to 1.5 X Design Pressure.
8. Substation work will be done by others. Contractor to run cable from substation to transformer outside of New Control Building and all other power and control cables/wiring within the plant.
9. Motor will be rated for Class 1, Division 2 location
10. Motor/Compressor Skid will include the following:
    a. Suction Scrubber
    b. Cylinder Pulsation Bottles – to be shipped loose and installed in field
    c. Lube Oil Day Tank
    d. Kim Hot Start Heater/Pump Package
    e. Skid edge connection for liquid dump lines
    f. Control Panel

LG&E will provide all equipment listed in the Major Material list and all piping and valves 2" and larger.

- Contractor can use Non-Union or Union crews for the installation of the facilities.
- Estimate should assume the work will be done in late 2020, estimate can be made in 2017 dollars and ENE can escalate as needed.
- Compressor "Building" is a 20' X 40' X 16' Eve Canopy with a skirt wall running 2 Feet below the eve line. Structure will have a 5 Ton overhead crane system. Structure to be erected by Contractor and Contractor shall pour building foundation and floor. .
- Control Building will be a skid mounted prefabricated building 13' X 35' with a 14'-6" Eve and will be shipped to site with MCC, DC converter, motor starter, lighting and battery rack already installed. Contractor shall install foundation and set skid.
- The area where Control building will be installed is level. Proposed location for Compressor Building will have to be excavated and leveled as most of that area is 5 to 8 feet above existing station elevation.
- Contractor shall install the EMD Compressor skid, level and grout in place.
- Contractor will pour the foundation for and set the transformer next to the Control building.
- Contractor will tie discharge piping into the existing 20" pipeline and the new 30" pipeline. The new 30" pipeline and launcher will be installed by others.

- The new gas cooler and associated foundation will be installed by the Contractor. Cooler will have leg extensions that will need to be installed in the field.
- Contractor shall install all conduit, cable and wire. All instruments not furnished with the skids or equipment will be installed by the Contractor, however this is expected to be about 10 or 12 items.
- Contractor shall install 600 feet of new chain link fencing with barbed wire and 1 new man gate.
- Lighting shall be installed in the Compressor Building. Two yard pole mounted flood lights shall be installed, including foundations.
- Contractor shall provide all supervision, labor, equipment, rigging, slings, power tools, hand tools, fuel, sanitation facilities, water, electrical power and temporary lighting for construction, consumables, office trailers, storage containers, PPE and safety equipment, welding machines, generators, cranes, pumps, matting and other equipment and services needed to install all equipment, piping, valves, vessels and buildings for the station expansion.
- Contractor shall unload at site, all equipment and materials supplied by LG&E.
- Contractor shall provide all NDT and Radiographic services.

MATERIALS PROVIDED BY THE CONTRACTOR

- Sand, crushed rock, fill material, concrete, rebar, anchor bolts, yard lights and fixtures, wire, cable, conduit and conduit fittings, grout, paint, fencing and gate and silt fence and erosion control devices as needed to build the facilities.
- Site survey to set foundation locations and grade elevations.
- All pipe, pipe fittings, SS tubing and SS tubing fittings less than 2".
- EZ Line pipe supports and all steel for misc. pipe supports.
- All materials, pumps, test equipment, recorders, gaskets, etc. needed for testing of piping.

ASSUMPTIONS

1. No well point dewatering will be required.
2. After material and equipment are delivered to the site it becomes the Contractor's responsibility and all security shall be provided by the Contractor.
3. The Contractor shall have a Safety Coordinator on site at all times work is being performed.
4. The EMD Compressor package will be delivered completely assembled, except for the pulsation bottles, dive coupling and scrubber instruments.
5. LG&E will provide the first fill of all fluids for the equipment.
6. LG&E will perform all gas handling, pressurization and blowdown activities.
7. Hand digging or hydro-vac shall be used for all below grade piping and conduit runs.
8. Cable tray will not be used.
9. Contractor shall provide material and coat all below grade fitting and welds. Below grade pipe will be provided FBE coated.
10. A geotech report and all construction drawings will be furnished by LG&E.
11. The compressor package will be a 3,000 BHP motor driving a 4 cylinder reciprocating compressor.
12. The gas cooler will be a horizontal fin fan type.
13. Areas around new equipment and buildings shall be 4" of crushed rock over a geotech fabric.
14. LG&E will furnish all Permits, except those needed by Contractor for shipping, hauling, waste disposal or using local roads. "

SECTION 4

ENVIRONMENTAL & GEOTECHNICAL CONDSIDERATIONS

OVERVIEW OF ENVIRONMENTAL

EN Engineering subcontracted Cardno to complete an on-site review of the proposed pipeline route and HDD of the Dix River, as well as an environmental cost study. The results of their study can be found in Section 6 Attachment #1, including a statement of work, permit table and route maps. Also included in Cardno's statement of work are costs for completing geotechnical work associated with the HDD of the Dix River and soil borings at the compressor/M&R station.

OVERVIEW OF GEOTECHNICAL

EN Engineering also contacted another geotechnical firm, Terracon, to provide pricing for the geotechnical work associated with the HDD of the Dix River and soil borings at the compressor/M&R station. The costs provided by Terracon have been used in the cost estimates. Terracon provided a brief study of the drill area and pipeline route, the findings are presented below:

Geology

According to the Kentucky Geological Survey (KGS), the general area surrounding the project site is underlain by the following:

- Overburden Soils – unconsolidated sediments from the Quaternary age and Alluvium soils consisting of sand, silt, clay, and gravel. For the alluvium, silt and clay are medium to dark brownish gray; sand is light brown, fine to very fine.
- Camp Nelson Limestone Formation of the Middle Ordovician Age - the limestone, light-gray to light-brownish-gray, contains some calcareous dolomite that makes up about 20 to 50 percent of the rock. The tubes of dolomite lie in a tangled network parallel to the bedding, with some cutting across the bedding.
- Tyrone Limestone and Oregon Formation of the Middle Ordovician - light gray to light olive gray, containing specks and small tubes of clear calcite, and very light gray to light brownish-gray, containing pods and interlaced tubes of yellowish-gray, micrograined, calcareous dolomite. Bentonite is also present within this formation and is underlain by thin chert layers.
- Lower Part of Lexington Limestone - comprised of the Grier Limestone Member, Macedonia Bed, Logana Member, and Curdsville Limestone Member
    - Grier Limestone - Limestone, light-gray, bioclastic, poorly sorted, fossiliferous, in irregular beds about 0.5 feet thick and alternating with sets of nodularly bedded fossiliferous limestone with much micrograined calcite matrix. Brachiopods and bryozoans are abundant in this limestone.
    - Macedonia Bed - interbedded limestone and shale; uppermost 2 to 3 feet interbedded light-olive-gray micrograined limestone and olive-gray to medium-gray shale; underlain by 5 to 8 feet of brachiopod coquina that weathers pinkish gray
    - Logana Member - Interbedded limestone and shale. Uppermost 2 to 3 feet interbedded light-olive-gray micrograined limestone and olive gray to medium-gray shale
    - Curdsville Limestone Member - limestone; medium to light-gray, medium to coarse-grained, lower part is well sorted, locally crossbedded, and grades upward into irregularly bedded poorly sorted fossiliferous limestone. Thin unit of micrograined limestone and are shale present.

Karst potential in the area is listed by KGS as medium to very high. Mapped sinkholes are noted throughout the area, as can be seen on the attached karst map for the area, see Section 6 Attachment #2.

Boring Log Information for this Area

After reviewing GIS information, no borings were performed within a 5 mile radius of this site. However, numerous projects have been performed for this region; including in the Danville, Nicholasville, and Lexington areas. The core data for these sites is fairly consistent, encountering mostly limestone and shale; with shale being encountered more near the top of bedrock, with deeper borings typically encountering competent limestone bedrock. Some borings encountered shale interbedded with limestone. Dolostone, another soluble rock similar to limestone, was also encountered in borings in the Stanford, Kentucky area.

For shale, strengths typically varied from extremely weak to weak (uniaxial compressive strengths ranging from around 40 psi to around 4,000 psi). Limestones and dolostones strengths typically ranged from weak to very strong (UC strengths ranging from about 700 psi to over 15,000 psi). For interbedded layers of shale and limestone, the strengths would vary widely. Some clay infilling would also be encountered in some borings.

Additional Considerations

Geophysical Testing - Based on discussions with Terracon's geologist who would direct the geophysical testing services, the geophysical testing that would be used has a depth range between 80 to 100 feet. Electrical Resistivity Imaging (ERI) utilizing an Electrical Resistivity Tomography (ERT) would be utilized. Geophysical lines would be run along the top of the ravine and then additional lines would be laid out at the base of the ravine along both sides of the river. Measurements would then extend down another 80 to 100 feet. However, there could be a gap of maybe tens or hundreds of feet in between these two areas where readings occur due to the middle of the ravine being inaccessible. Accessing the sides of the ravine to run lines was considered, but quality of data would be limited, at best.

Another option would be to use reflection seismic analysis, using vibro-seismic trucks to run the analysis. This testing can cover a depth of approximately 400 to 500 feet, and would be performed by a specialty contractor. The main drawback with this type of testing is that it typically only picks up large voids, such as caverns, large sinkholes, etc. It will typically not pick up small voids and narrow clay-filled seams that can still be problematic for pipelines.

Terracon has the capability to drill as deep as 1200 feet or more, using the appropriate soil boring rigs. Smaller rigs can typically drill to 300 to 500 feet and larger rigs range from 800 to 1200 feet, but can possibly go deeper.

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SECTION 5

CASE #1
20” HDD of Dix River & Tie-in to Existing 20” Pipeline
MAOP 1,480 PSIG

Preliminary Cost Estimate - 20" HDD of Dix River & Tie-in to Existing 20", 1480 PSIG MAOP

PROJECT LG&E Garrard County Pipeline — **LOCATION** Garrard & Mercer Counties, KY
1 Miles, 30" Pipeline, 2019 Installation
1,480 psig Design Pressure/MAOP, 1/8" Corrosion Allowance
DATE January 25, 2017 — **TYPE** Budget Type Estimate, 10-20% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**PIPELINE MATERIAL**					
3	20" x 0.500" 5LX70 DSAW, PSL2 Pipe with FBE Coating & Powercrete Coating, Including Freight	FOOT	4,200	$ 115.00	$ 483,000.00	Class 3 Pipe - HDD, Incudes 5% Kicker
4	20" x 0.500" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,800	$ 100.00	$ 180,000.00	Pipe to tie-in to existing 20"
5	20" FBE Coated 3D Fittings, 90 deg.	EACH	2	$ 5,200.00	$ 10,400.00	
6	Marker Sign & Post	EACH	2	$ 20.00	$ 40.00	
7	**Material Subtotal**				**$ 673,440.00**	
8	Sales Tax	%	6.0%	$ 673,440.00	$ 40,406.40	
9	**Sales Tax Subtotal**				**$ 40,406.40**	
10	**FREIGHT**					
11	Freight For All Non-Pipe Materials	LOT	7.5%	$ 10,440.00	$ 783.00	
12	**Freight Subtotal**				**$ 783.00**	
13	**TOTAL MATERIAL AND FREIGHT COST**				**$ 714,629.40**	
14						
15	**CONSTRUCTION (AVERAGED 3 CONTRACTORS)**					
16	RR Off Load & Transport Pipe to Storage Yard	FOOT	6,000	$ 4.63	$ 27,780.00	Offload Rail Car & Load Truck, Transport, Offload Truck
17	Lay 20" x .500" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	5,521	$ 410.00	$ 2,263,610.00	Pipe to tie-in to existing 20"
18	20" Directional Drill of Dix River W/ 20" x .500" X70 Line Pipe, FBE + PC coating (In Addition to Lay Price)	FOOT	3,755	$ 795.00	$ 3,124,907.00	From Laney Quote
19	Provide X-Ray Services for Non-Destructive Inspection	MILE	1.8	$ 42,197.00	$ 74,129.26	
20	Hydrostatic Test 20" Pipe	FOOT	5,521	$ 6.08	$ 33,586.08	
21	Dry 30" Pipe to (-)38 Deg. F.	FOOT	5,521	$ 2.75	$ 15,182.75	
22	Stoppling and Tie-in to Existing 20"	EACH	1	$ 250,000.00	$ 250,000.00	
23	Drill and Blast Rock (Per Linear Foot of Trench)	FOOT	1,000	$ 106.67	$ 106,666.67	
24	Provide Trench Padding Machine and Pad Ditch	FOOT	1,000	$ 16.17	$ 16,166.67	
25	Furnish and Install Sandbag/Foam Trench Breaker	EACH	10	$ 1,533.33	$ 15,333.33	
26	Supply and Install Wood Mats	EACH	50	$ 665.83	$ 33,291.67	50 Mats per Mile
27	Installing Cathodic Protection Test Stations and AC Mitigation	EACH	1	$ 325,500.00	$ 325,500.00	
28	Installing Pipeline Marker Signs	EACH	2	$ 250.00	$ 500.00	4 Per Mile
29	Supply and Installing Straw Bales	EACH	25	$ 18.75	$ 468.75	25 Bales Per Mile
30	Supply and Install Orange Safety Fence	FOOT	50	$ 4.83	$ 241.67	50' of Orange Safety Fence Per Mile
31	Supply and Install Silt Fence	FOOT	400	$ 8.25	$ 3,300.00	400' of Silt Fence Per Mile
32	Supply and Installing Erosion Control Fabric	SQ. YD.	25	$ 7.83	$ 195.83	25 Sq. Yd. Per Mile
33	Supply and Installing Crushed Rock and Geotextile Fabric Under Rock at Road Accesses	SQ. YD.	60	$ 38.17	$ 2,290.00	60 Sq. Yd. Per Mile
34	Supply and install Filter Bags for Dewatering	EACH	1	$ 941.67	$ 470.83	1 Per 2 Miles
35	Reseeding	ACRE	2	$ 1,750.00	$ 3,500.00	2 Acres Per Mile
36	Installing Anchored Mulch	ACRE	1	$ 3,233.33	$ 3,233.33	1 Acre Per Mile
37	**TOTAL CONSTRUCTION COST**				**$ 6,300,353.84**	
38						
39	**SURVEY SERVICES (USED ENCOMPASS PROPOSAL)**					
40	**Preliminary Survey**					
41	Project Manager	HOUR	6	$ 95.00	$ 570.00	1 Hour/Day for Project Oversight
42	RLS	HOUR	17	$ 85.00	$ 1,445.00	
43	Two Person Crew with GPS	DAY	6	$ 850.00	$ 5,100.00	One - 2 Person Crew - 1 Week -6 Days/Week
44	Data Processor	DAY	6	$ 75.00	$ 450.00	1 Data Processor - 1 Week -6 Days/Week
45	Sundays no work, per diem only	DAY	0	$ 142.00	$ -	
46	Mileage, additional over 100 per day	MILE	600	$ 0.54	$ 324.00	1 Vehicles-1 Week - 6 Days/Week-100 Miles/D

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
47	Survey Supplies	EACH	6	$ 310.00	$ 1,860.00	One - 2 Person Survey Crew
48	Per Diem	DAY	12	$ 142.00	$ 1,704.00	2 Field Employees - 1 Week - 6 Days/Week
49	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
50	**Sub-Total Preliminary Survey**				**$ 13,853.00**	
51	**Pre-Construction Staking**					
52	Project Manager	HOUR	6	$ 95.00	$ 570.00	1 Hour/Day for Project Oversight
53	Survey Supervisor	DAY	6	$ 85.00	$ 510.00	1 Hour/Day for Data Oversight and Review
54	Two Person Crew with GPS	DAY	6	$ 850.00	$ 5,100.00	One - 2 Person Crew - 1 Week - 6 Days/Week
55	Data Processing	HOUR	10	$ 75.00	$ 750.00	1 Data Processor
56	Sundays no work, per diem only	DAY	0	$ 142.00	$ -	
57	Mileage, additional over 100 per day	MILE	600	$ 0.54	$ 324.00	1 Vehicles-1 Week - 6 Days/Week-100 Miles/D
58	Survey Supplies	EACH	6	$ 310.00	$ 1,860.00	One - 2 Person Survey Crew
59	Per Diem	DAY	12	$ 142.00	$ 1,704.00	2 Field Employees - 1 Week - 6 Days/Week
60	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
61	**Sub-total Pre-Con Staking**				**$ 13,218.00**	
62	**As-built Survey**					
63	Project Manager	HOUR	12	$ 95.00	$ 1,140.00	0.5 Hr/Crew Day
64	Survey Supervisor	HOUR	12	$ 85.00	$ 1,020.00	0.5 Hr/Crew Day
65	Two Person Crew with GPS	DAY	24	$ 850.00	$ 20,400.00	1 Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
66	Data Processing	HOUR	36	$ 75.00	$ 2,700.00	1.5 Hr/Crew Day
67	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
68	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicle - 1 Month - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
69	Survey Supplies	DAY	24	$ 310.00	$ 7,440.00	1 Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
70	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Months - 4 Weeks/Month - 6 Days/Week
71	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
72	**Sub-total As-built Survey**				**$ 44,348.00**	
73	**Other Survey**					
74	Preparation of Non-Certified Property Plats	EACH	3	$ 435.00	$ 1,305.00	
75	Certified Plats	EACH	0	$ 865.00	$ -	
76	**Sub-Total Other Survey**				**$ 1,305.00**	
77	**TOTAL SURVEY SERVICES COST**				**$ 72,724.00**	
78						
79	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
80	**Easements**					
81	30-Ft Wide Permanent Easement	ACRE	3.6	$ 2,500.00	$ 9,090.91	
82	Easement Recording fees	EACH	3.0	$ 25.00	$ 75.00	
83	**Easement Costs Subtotal**				**$ 9,165.91**	
84	**Temporary and Construction**					
85	Temporary Workspace for Construction - 75-Ft wide	ACRE	3.1	$ 1,250.00	$ 3,873.97	75' Wide Construction Workspace (30' new perm. Easement), 50% of per acre cost
86	Additional Temporary Workspace	ACRE	8.6	$ 1,250.00	$ 10,761.02	100'x100' for Tie-In, Stringing Area for HDD (3800'x75')
87	Pipe Storage Yard	ACRE	2.0	$ 1,250.00	$ 2,500.00	2 acres
88	Temporary Access Roads	ACRE	0.1	$ 1,250.00	$ 143.48	
89	**Temporary and Construction Subtotal**				**$ 17,278.47**	
90	**Construction Damages**					
91	Crop Damages - Permanent Easement	ACRE	0.4	$ 625.00	$ 227.27	10% of Permanent Easement, 25% of per acre cost
92	Crop Damages - Temporary Workspace	ACRE	0.3	$ 625.00	$ 193.70	10% of Temporary Workspace, 25% of per acre cost
93	Crop Damages - Additional Temporary Workspace	ACRE	0.9	$ 625.00	$ 538.05	10% of Additional Temporary Workspace, 25% of per acre cost
94	**Construction Damages Construction Subtotal**				**$ 959.02**	
95	**Permit Fees - Roads and Railroads**					
96	Survey Permits - Miscellaneous	EACH	3	$ 150.00	$ 450.00	
97	**Permit Fees Subtotal**				**$ 450.00**	

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
98	**TOTAL RIGHT-OF-WAY COST**				**$ 27,853.40**	
99						
100	**LEGAL AND PUBLIC AFFAIRS**					
101	Legal Fees	HR	50	$ 350.00	$ 17,500.00	
102	Public Affairs Fees - Principal #1	HR	25	$ 200.00	$ 5,000.00	
103	Public Affairs Fees - Principal #2	HR	25	$ 200.00	$ 5,000.00	
104	Senior Consultant	HR	50	$ 170.00	$ 8,500.00	
105	Public Affairs Expenses - Printing, Travel, Etc.	LOT	1	$ 25,000.00	$ 25,000.00	
106	**TOTAL LEGAL AND PUBLIC AFFAIRS COST**				**$ 61,000.00**	
107						
108	**ENVIRONMENTAL (USED CARDNO PROPOSAL)**					
109	Delineation and RTE Review HDD Crossing of Dix River	LS	1	$ 15,400.00	$ 15,400.00	
110	Regulated "Waters of the U.S." Permitting	LS	1	$ 21,250.00	$ 21,250.00	
111	Cultural Resources Services for HDD Crossing of Dix River	LS	1	$ 20,430.00	$ 20,430.00	
112	History/Architecture Investigation	LS	1	$ 15,500.00	$ 15,500.00	
113	**TOTAL ENVIRONMENTAL COST**				**$ 72,580.00**	
114						
115	**GEOTECHNICAL SERVICES (USED TERRACON PROPOSAL)**					
116	**Drilling Services**					
117	Drilling Coordination	LS	1	$ 1,500.00	$ 1,500.00	
118	Mob/Demob	LS	2	$ 2,000.00	$ 4,000.00	
119	Drilling and Sampling (Day Rate)	DAY	28	$ 2,500.00	$ 70,000.00	
120	Per Diem (3 man crew)	DAY	28	$ 480.00	$ 13,440.00	
121	Grouting - Borehole Abandonment	PER LF	1,735	$ 7.50	$ 13,012.50	
122	Boring Inspector (if req'd)	HOUR	209	$ 95.00	$ 19,855.00	
123	Mileage for Inspector	MILE	1,716	$ 0.75	$ 1,287.00	
124	**Drilling Services Subtotal**				**$ 123,094.50**	
125	**Laboratory Testing Services**					
126	Moisture Content Test	EACH	6	$ 8.00	$ 48.00	
127	Sieve and Hydrometer Analysis	EACH	3	$ 116.00	$ 348.00	
128	Atterberg Limits Determination	EACH	3	$ 60.00	$ 180.00	
129	Unconfined Compression Test	EACH	50	$ 80.00	$ 4,000.00	
130	**Lab Testing Services Subtotal**				**$ 4,576.00**	
131	**Engineering Services**					
132	Geotechnical Report Preparation	LS	1	$ 6,500.00	$ 6,500.00	
133	Geophysical Testing	LS	1	$ 16,500.00	$ 16,500.00	
134	Reflection Seismic Analysis	COST +15%	1.15	$ 52,000.00	$ 59,800.00	
135	**Engineering Services Subtotal**				**$ 82,800.00**	
136	**TOTAL GEOTECHNICAL SERVICES COST**				**$ 210,470.50**	
137						
138	**INSPECTION SERVICES**					
139	**Material Inspection Services**					
140	Pipe Mill	MAN/WEEK	1	$ 7,000.00	$ 7,000.00	1 Pipe Mill Inspector for 1 week
141	Coating Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Coating Mill Inspectors for 1 week
142	Loadout at Pipe Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
143	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Man Weeks to Inspect Valves, Hot Bends, Fittings, etc.
144	Railroad Offload and Transport Pipe to Storage Yard	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
145	**Material Inspection Services Subtotal**				**$ 33,000.00**	
146	**Construction Inspection Services**					
147	Chief Inspector	MAN/WEEK	12	$ 7,700.00	$ 92,400.00	1 Construction Spread-3 Months Each
148	Welding Inspector	MAN/WEEK	8	$ 7,500.00	$ 60,000.00	1 Construction Spreads-2 Months Each-1 W. Inspect/Spread

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
149	Utility Inspector	MAN/WEEK	8	$ 7,500.00	$ 60,000.00	1 Construction Spreads-2 Months Each-1 U. Inspect/Spread
150	Office Manager	MAN/WEEK	15	$ 4,500.00	$ 67,500.00	1 Construction Spreads-3 Months Each
151	Environmental Training	MAN/DAY	2	$ 1,250.00	$ 2,500.00	
152	Environmental Inspection	MAN/WEEK	8	$ 7,500.00	$ 60,000.00	1 Inspectors-2 Months-4 Weeks/Mo-6 Days/Week
153	Construction Office Expenses - Office Rental	MO	3	$ 1,500.00	$ 4,500.00	1 Construction Spreads-3 Months Each
154	Construction Office Expenses - Office Supplies	MO	3	$ 1,000.00	$ 3,000.00	1 Construction Spreads-3 Months Each
155	**Construction Inspection Services Subtotal**				**$ 349,900.00**	
156	**TOTAL INSPECTION SERVICES COST**				**$ 382,900.00**	
157						
158	**ENGINEERING SERVICES**					
159	Project/Design Management	HR	200	$ 174.00	$ 34,800.00	
160	Project Engineering	HR	150	$ 112.00	$ 16,800.00	
161	Cathodic Protection Engineering (Includes field time and travel day rates)	HR	40	$ 112.00	$ 4,480.00	
162	Cathodic Protection Commissioning and Install Support (Includes day rate and travel)	DAY	2	$ 3,000.00	$ 6,000.00	
163	Construction Drafting w/ CADD Equipment	HR	300	$ 80.00	$ 24,000.00	
164	As-Built Drafting w/ CADD Equipment	HR	40	$ 112.00	$ 4,480.00	
165	Procurement	HR	10	$ 106.00	$ 1,060.00	
166	Metallurgical Consulting	HR	10	$ 184.00	$ 1,840.00	
167	Project Controls Engineer	HR	10	$ 100.00	$ 1,000.00	
168	Administrative Support	HR	10	$ 69.00	$ 690.00	
169	Misc. (Printing, FedEx, Travel etc.)	LS	1	$ 5,000.00	$ 5,000.00	
170	**Engineering Subtotal**				**$ 100,150.00**	
171	Engineering Contingency	%	20.0%	$ 100,150.00	$ 20,030.00	
172	**TOTAL ENGINEERING SERVICES COST**				**$ 120,180.00**	
173						
174	**TOTAL COST ESCALATION (2.0% INFLATION FOR 2 YEARS)**		2.0%	$ 7,962,691.14	**$ 321,692.72**	
175						
176	**TOTAL PROJECT COST**				**$ 8,284,384**	
177						
178	**TOTAL COST PER MILE**				**$ 8,284,383.86**	
179	**TOTAL COST PER FOOT**				**$ 1,569**	

CASE #2
30” HDD of Dix River & Tie-in to Existing 20” Pipeline
MAOP 1,000 PSIG

Preliminary Cost Estimate - 30" HDD of Dix River & Tie-in to Existing 20", 1000 PSIG MAOP

PROJECT LG&E Garrard County Pipeline
1.5 Miles, 30" Pipeline, 2019 Installation
1,000 psig Design Pressure/MAOP, 1/8" Corrosion Allowance

LOCATION Garrard & Mercer Counties, KY

DATE January 25, 2017

TYPE Budget Type Estimate, 10-20% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**PIPELINE MATERIAL**					
3	30" x 0.554" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	2,400	$ 119.00	$ 285,600.00	Class 3 Pipe - Includes 2% Kicker
4	30" x 0.554" 5LX70 DSAW, PSL2 Pipe with FBE Coating & Powercrete Coating, Including Rail Freight	FOOT	4,200	$ 144.00	$ 604,800.00	Class 3 Pipe - HDD, Incudes 5% Kicker
5	20" x 0.500" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,800	$ 100.00	$ 180,000.00	Pipe to tie-in to existing 20"
6	30" FBE Coated 3D Fittings, Class 3, 45 deg.	EACH	4	$ 5,462.20	$ 21,848.80	
7	30" FBE Coated 3D Fittings, Class 3, 90 deg.	EACH	2	$ 7,173.10	$ 14,346.20	
8	20" FBE Coated 3D Fittings, 90 deg.	EACH	2	$ 5,200.00	$ 10,400.00	
9	Misc. 20" Material for Tie-in to 30" & relocation of 20" Receiver	EACH	1	$ 150,000.00	$ 150,000.00	
10	Marker Sign & Post	EACH	2	$ 20.00	$ 40.00	
11	**Material Subtotal**				**$ 1,267,035.00**	
12	Sales Tax	%	6.0%	$ 1,267,035.00	$ 76,022.10	
13	**Sales Tax Subtotal**				**$ 76,022.10**	
14	**FREIGHT**					
15	Freight For All Non-Pipe Materials	LOT	7.5%	$ 196,635.00	$ 14,747.63	
16	**Freight Subtotal**				**$ 14,747.63**	
17	**TOTAL MATERIAL AND FREIGHT COST**				**$ 1,357,804.73**	
18						
19	**CONSTRUCTION (AVERAGED 3 CONTRACTORS)**					
20	RR Off Load & Transport Pipe to Storage Yard	FOOT	8,400	$ 4.63	$ 38,892.00	Offload Rail Car & Load Truck, Transport, Offload Truck
21	Lay 30" x .554" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	6,113	$ 450.00	$ 2,750,850.00	HDD Location
22	Lay 20" x .500" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	1,766	$ 410.00	$ 724,060.00	Pipe to tie-in to existing 20"
23	30" Directional Drill of Dix River W/ 30" x .554" X70 Line Pipe, FBE + PC coating (In Addition to Lay Price)	FOOT	3,755	$ 1,445.00	$ 5,565,397.00	From Laney Quote
24	Provide X-Ray Services for Non-Destructive Inspection	MILE	1.5	$ 42,197.00	$ 62,967.83	
25	Hydrostatic Test 30" Pipe	FOOT	7,879	$ 6.08	$ 47,930.58	
26	Dry 30" Pipe to (-)38 Deg. F.	FOOT	7,879	$ 2.75	$ 21,667.25	
27	Relocate and Install 20" Receiver and Associated Tie-in Piping	EACH	1	$ 450,000.00	$ 450,000.00	
28	Drill and Blast Rock (Per Linear Foot of Trench)	FOOT	1,000	$ 106.67	$ 106,666.67	
29	Provide Trench Padding Machine and Pad Ditch	FOOT	1,000	$ 16.17	$ 16,166.67	
30	Furnish and Install Sandbag/Foam Trench Breaker	EACH	10	$ 1,533.33	$ 15,333.33	
31	Supply and Install Wood Mats	EACH	75	$ 665.83	$ 49,937.50	50 Mats per Mile
32	Installing Cathodic Protection Test Stations and AC Mitigation	EACH	1	$ 325,500.00	$ 325,500.00	
33	Installing Pipeline Marker Signs	EACH	2	$ 250.00	$ 500.00	4 Per Mile
34	Supply and Installing Straw Bales	EACH	38	$ 18.75	$ 703.13	25 Bales Per Mile
35	Supply and Install Orange Safety Fence	FOOT	75	$ 4.83	$ 362.50	50' of Orange Safety Fence Per Mile
36	Supply and Install Silt Fence	FOOT	600	$ 8.25	$ 4,950.00	400' of Silt Fence Per Mile
37	Supply and Installing Erosion Control Fabric	SQ. YD.	38	$ 7.83	$ 293.75	25 Sq. Yd. Per Mile
38	Supply and Installing Crushed Rock and Geotextile Fabric Under Rock at Road Accesses	SQ. YD.	90	$ 38.17	$ 3,435.00	60 Sq. Yd. Per Mile
39	Supply and install Filter Bags for Dewatering	EACH	1	$ 941.67	$ 706.25	1 Per 2 Miles
40	Reseeding	ACRE	3	$ 1,750.00	$ 5,250.00	2 Acres Per Mile
41	Installing Anchored Mulch	ACRE	2	$ 3,233.33	$ 4,850.00	1 Acre Per Mile
42	**TOTAL CONSTRUCTION COST**				**$ 10,196,419.46**	
43						
44	**SURVEY SERVICES (USED ENCOMPASS PROPOSAL)**					
45	**Preliminary Survey**					
46	Project Manager	HOUR	6	$ 95.00	$ 570.00	1 Hour/Day for Project Oversight

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
47	RLS	HOUR	17	$ 85.00	$ 1,445.00	
48	Two Person Crew with GPS	DAY	6	$ 850.00	$ 5,100.00	One - 2 Person Crew - 1 Week -6 Days/Week
49	Data Processor	DAY	6	$ 75.00	$ 450.00	1 Data Processor - 1 Week -6 Days/Week
50	Sundays no work, per diem only	DAY	0	$ 142.00	$ -	
51	Mileage, additional over 100 per day	MILE	600	$ 0.54	$ 324.00	1 Vehicles-1 Week - 6 Days/Week-100 Miles/D
52	Survey Supplies	EACH	6	$ 310.00	$ 1,860.00	One - 2 Person Survey Crew
53	Per Diem	DAY	12	$ 142.00	$ 1,704.00	2 Field Employees - 1 Week - 6 Days/Week
54	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
55	**Sub-Total Preliminary Survey**				**$ 13,853.00**	
56	**Pre-Construction Staking**					
57	Project Manager	HOUR	6	$ 95.00	$ 570.00	1 Hour/Day for Project Oversight
58	Survey Supervisor	DAY	6	$ 85.00	$ 510.00	1 Hour/Day for Data Oversight and Review
59	Two Person Crew with GPS	DAY	6	$ 850.00	$ 5,100.00	One - 2 Person Crew - 1 Week - 6 Days/Week
60	Data Processing	HOUR	10	$ 75.00	$ 750.00	1 Data Processor
61	Sundays no work, per diem only	DAY	0	$ 142.00	$ -	
62	Mileage, additional over 100 per day	MILE	600	$ 0.54	$ 324.00	1 Vehicles-1 Week - 6 Days/Week-100 Miles/D
63	Survey Supplies	EACH	6	$ 310.00	$ 1,860.00	One - 2 Person Survey Crew
64	Per Diem	DAY	12	$ 142.00	$ 1,704.00	2 Field Employees - 1 Week - 6 Days/Week
65	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
66	**Sub-total Pre-Con Staking**				**$ 13,218.00**	
67	**As-built Survey**					
68	Project Manager	HOUR	12	$ 95.00	$ 1,140.00	0.5 Hr/Crew Day
69	Survey Supervisor	HOUR	12	$ 85.00	$ 1,020.00	0.5 Hr/Crew Day
70	Two Person Crew with GPS	DAY	24	$ 850.00	$ 20,400.00	1 Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
71	Data Processing	HOUR	36	$ 75.00	$ 2,700.00	1.5 Hr/Crew Day
72	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
73	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicle - 1 Month - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
74	Survey Supplies	DAY	24	$ 310.00	$ 7,440.00	1 Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
75	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Months - 4 Weeks/Month - 6 Days/Week
76	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
77	**Sub-total As-built Survey**				**$ 44,348.00**	
78	**Other Survey**					
79	Preparation of Non-Certified Property Plats	EACH	3	$ 435.00	$ 1,305.00	
80	Certified Plats	EACH	0	$ 865.00	$ -	
81	**Sub-Total Other Survey**				**$ 1,305.00**	
82	**TOTAL SURVEY SERVICES COST**				**$ 72,724.00**	
83						
84	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
85	**Easements**					
86	45-Ft Wide Permanent Easement (30" & 20")	ACRE	8.2	$ 2,500.00	$ 20,454.55	
87	Receiver Site Agreement (Relocation of 20" Receiver)	ACRE	0.1	$ 2,500.00	$ 325.00	75' x 75'
88	Easement Recording fees	EACH	3.0	$ 25.00	$ 75.00	
89	**Easement Costs Subtotal**				**$ 20,854.55**	
90	**Temporary and Construction**					
91	Temporary Workspace for Construction - 100-Ft wide	ACRE	4.1	$ 1,250.00	$ 5,165.29	100' Wide Construction Workspace (30' existing easement, 15' new perm. Easement), 50% of per acre cost
92	Additional Temporary Workspace	ACRE	10.4	$ 1,250.00	$ 13,056.70	300'x300' for Receiver Site, Stringing Area for HDD (3800'x75')
93	Pipe Storage Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
94	Temporary Access Roads	ACRE	0.1	$ 1,250.00	$ 143.48	
95	**Temporary and Construction Subtotal**				**$ 24,615.47**	
96	**Construction Damages**					
97	Crop Damages - Permanent Easement	ACRE	0.8	$ 625.00	$ 511.36	10% of Permanent Easement, 25% of per acre cost

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
98	Crop Damages - Temporary Workspace	ACRE	0.4	$ 625.00	$ 258.26	10% of Temporary Workspace, 25% of per acre cost
99	Crop Damages - Additional Temporary Workspace	ACRE	1.0	$ 625.00	$ 652.84	10% of Additional Temporary Workspace, 25% of per acre cost
100	**Construction Damages Construction Subtotal**				**$ 1,422.46**	
101	**Permit Fees - Roads and Railroads**					
102	Roads	EACH	0	$ 500.00	$ -	# of Road Crossings
103	Survey Permits - Miscellaneous	EACH	3	$ 150.00	$ 450.00	
104	**Permit Fees Subtotal**				**$ 450.00**	
105	**TOTAL RIGHT-OF-WAY COST**				**$ 47,342.48**	
106						
107	**LEGAL AND PUBLIC AFFAIRS**					
108	Legal Fees	HR	50	$ 350.00	$ 17,500.00	
109	Public Affairs Fees - Principal #1	HR	25	$ 200.00	$ 5,000.00	
110	Public Affairs Fees - Principal #2	HR	25	$ 200.00	$ 5,000.00	
111	Senior Consultant	HR	50	$ 170.00	$ 8,500.00	
112	Public Affairs Expenses - Printing, Travel, Etc.	LOT	1	$ 25,000.00	$ 25,000.00	
113	**TOTAL LEGAL AND PUBLIC AFFAIRS COST**				**$ 61,000.00**	
114						
115	**ENVIRONMENTAL (USED CARDNO PROPOSAL)**					
116	Delineation and RTE Review HDD Crossing of Dix River	LS	1	$ 15,400.00	$ 15,400.00	
117	Regulated "Waters of the U.S." Permitting	LS	1	$ 21,250.00	$ 21,250.00	
118	Cultural Resources Services for HDD Crossing of Dix River	LS	1	$ 20,430.00	$ 20,430.00	
119	History/Architecture Investigation	LS	1	$ 15,500.00	$ 15,500.00	
120	**TOTAL ENVIRONMENTAL COST**				**$ 72,580.00**	
121						
122	**GEOTECHNICAL SERVICES (USED TERRACON PROPOSAL)**					
123	**Drilling Services**					
124	Drilling Coordination	LS	1	$ 1,500.00	$ 1,500.00	
125	Mob/Demob	LS	2	$ 2,000.00	$ 4,000.00	
126	Drilling and Sampling (Day Rate)	DAY	28	$ 2,500.00	$ 70,000.00	
127	Per Diem (3 man crew)	DAY	28	$ 480.00	$ 13,440.00	
128	Grouting - Borehole Abandonment	PER LF	1,735	$ 7.50	$ 13,012.50	
129	Boring Inspector (if req'd)	HOUR	209	$ 95.00	$ 19,855.00	
130	Mileage for Inspector	MILE	1,716	$ 0.75	$ 1,287.00	
131	**Drilling Services Subtotal**				**$ 123,094.50**	
132	**Laboratory Testing Services**					
133	Moisture Content Test	EACH	6	$ 8.00	$ 48.00	
134	Sieve and Hydrometer Analysis	EACH	3	$ 116.00	$ 348.00	
135	Atterberg Limits Determination	EACH	3	$ 60.00	$ 180.00	
136	Unconfined Compression Test	EACH	50	$ 80.00	$ 4,000.00	
137	**Lab Testing Services Subtotal**				**$ 4,576.00**	
138	**Engineering Services**					
139	Geotechnical Report Preparation	LS	1	$ 6,500.00	$ 6,500.00	
140	Geophysical Testing	LS	1	$ 16,500.00	$ 16,500.00	
141	Reflection Seismic Analysis	COST +15%	1.15	$ 52,000.00	$ 59,800.00	
142	**Engineering Services Subtotal**				**$ 82,800.00**	
143	**TOTAL GEOTECHNICAL SERVICES COST**				**$ 210,470.50**	
144						
145	**INSPECTION SERVICES**					
146	**Material Inspection Services**					
147	Pipe Mill	MAN/WEEK	1	$ 7,000.00	$ 7,000.00	1 Pipe Mill Inspector for 1 week
148	Coating Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Coating Mill Inspectors for 1 week

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
149	Loadout at Pipe Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
150	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Man Weeks to Inspect Valves, Hot Bends, Fittings, etc.
151	Railroad Offload and Transport Pipe to Storage Yard	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
152	**Material Inspection Services Subtotal**				**$ 33,000.00**	
153	**Construction Inspection Services**					
154	Chief Inspector	MAN/WEEK	20	$ 7,700.00	$ 154,000.00	1 Construction Spread-5 Months Each
155	Welding Inspector	MAN/WEEK	12	$ 7,500.00	$ 90,000.00	1 Construction Spreads-4 Months Each-1 W. Inspect/Spread
156	Utility Inspector	MAN/WEEK	16	$ 7,500.00	$ 120,000.00	1 Construction Spreads-4 Months Each-1 U. Inspect/Spread
157	Office Manager	MAN/WEEK	20	$ 4,500.00	$ 90,000.00	1 Construction Spreads-5 Months Each
158	Environmental Training	MAN/DAY	2	$ 1,250.00	$ 2,500.00	
159	Environmental Inspection	MAN/WEEK	16	$ 7,500.00	$ 120,000.00	1 Inspectors-4 Months-4 Weeks/Mo-6 Days/Week
160	Construction Office Expenses - Office Rental	MO	5	$ 1,500.00	$ 7,500.00	1 Construction Spreads-5 Months Each
161	Construction Office Expenses - Office Supplies	MO	5	$ 1,000.00	$ 5,000.00	1 Construction Spreads-5 Months Each
162	**Construction Inspection Services Subtotal**				**$ 589,000.00**	
163	**TOTAL INSPECTION SERVICES COST**				**$ 622,000.00**	
164						
165	**ENGINEERING SERVICES**					
166	Project/Design Management	HR	200	$ 174.00	$ 34,800.00	
167	Project Engineering	HR	150	$ 112.00	$ 16,800.00	
168	Cathodic Protection Engineering (Includes field time and travel day rates)	HR	40	$ 112.00	$ 4,480.00	
169	Cathodic Protection Commissioning and Install Support (Includes day rate and travel)	DAY	2	$ 3,000.00	$ 6,000.00	
170	Construction Drafting w/ CADD Equipment	HR	300	$ 80.00	$ 24,000.00	
171	As-Built Drafting w/ CADD Equipment	HR	40	$ 112.00	$ 4,480.00	
172	Procurement	HR	10	$ 106.00	$ 1,060.00	
173	Metallurgical Consulting	HR	10	$ 184.00	$ 1,840.00	
174	Project Controls Engineer	HR	10	$ 100.00	$ 1,000.00	
175	Administrative Support	HR	10	$ 69.00	$ 690.00	
176	Misc. (Printing, FedEx, Travel etc.)	LS	1	$ 5,000.00	$ 5,000.00	
177	**Engineering Subtotal**				**$ 100,150.00**	
178	Engineering Contingency	%	20.0%	$ 100,150.00	$ 20,030.00	
179	**TOTAL ENGINEERING SERVICES COST**				**$ 120,180.00**	
180						
181	**TOTAL COST ESCALATION (2.0% INFLATION FOR 2 YEARS)**		2.0%	$ 12,760,521.17	**$ 515,525.06**	
182						
183	**TOTAL PROJECT COST**				**$ 13,276,046**	
184						
185	**TOTAL COST PER MILE**				**$ 8,850,697.48**	
186	**TOTAL COST PER FOOT**				**$ 1,676**	

CASE #3
30” HDD of Dix River & Tie-in to Existing 20” Pipeline
MAOP 1,480 PSIG

Preliminary Cost Estimate - 30" HDD of Dix River & Tie-in to Existing 20", 1480 PSIG MAOP

PROJECT LG&E Garrard County Pipeline
1.5 Miles, 30" Pipeline, 2019 Installation
1,480 psig Design Pressure/MAOP, 1/8" Corrosion Allowance

LOCATION Garrard & Mercer Counties, KY

DATE January 25, 2017

TYPE Budget Type Estimate, 10-20% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**PIPELINE MATERIAL**					
3	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	2,400	$ 161.00	$ 386,400.00	Class 3 Pipe - Includes 2% Kicker
4	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating & Powercrete Coating, Including Rail Freight	FOOT	4,200	$ 184.00	$ 772,800.00	Class 3 Pipe - HDD, Incudes 5% Kicker
5	20" x 0.500" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,800	$ 100.00	$ 180,000.00	Pipe to tie-in to existing 20"
6	30" FBE Coated 3D Fittings, Class 3, 45 deg.	EACH	4	$ 6,979.50	$ 27,918.00	
7	30" FBE Coated 3D Fittings, Class 3, 90 deg.	EACH	2	$ 9,666.80	$ 19,333.60	
8	20" FBE Coated 3D Fittings, 90 deg.	EACH	2	$ 5,200.00	$ 10,400.00	
9	Misc. 20" Material for Tie-in to 30" & relocation of 20" Receiver	EACH	1	$ 150,000.00	$ 150,000.00	
10	Marker Sign & Post	EACH	2	$ 20.00	$ 40.00	
11	**Material Subtotal**				**$ 1,546,891.60**	
12	Sales Tax	%	6.0%	$ 1,546,891.60	$ 92,813.50	
13	**Sales Tax Subtotal**				**$ 92,813.50**	
14	**FREIGHT**					
15	Freight For All Non-Pipe Materials	LOT	7.5%	$ 207,691.60	$ 15,576.87	
16	**Freight Subtotal**				**$ 15,576.87**	
17	**TOTAL MATERIAL AND FREIGHT COST**				**$ 1,655,281.97**	
18						
19	**CONSTRUCTION (AVERAGED 3 CONTRACTORS)**					
20	RR Off Load & Transport Pipe to Storage Yard	FOOT	8,400	$ 4.63	$ 38,892.00	Offload Rail Car & Load Truck, Transport, Offload Truck
21	Lay 30" x .759" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	6,113	$ 500.00	$ 3,056,500.00	HDD Location
22	Lay 20" x .500" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	1,766	$ 410.00	$ 724,060.00	Pipe to tie-in to existing 20"
23	30" Directional Drill of Dix River W/ 30" x .759" X70 Line Pipe, FBE + PC coating (In Addition to Lay Price)	FOOT	3,755	$ 1,445.00	$ 5,565,397.00	From Laney Quote
24	Provide X-Ray Services for Non-Destructive Inspection	MILE	1.5	$ 42,197.00	$ 62,967.83	
25	Hydrostatic Test 30" Pipe	FOOT	7,879	$ 6.08	$ 47,930.58	
26	Dry 30" Pipe to (-)38 Deg. F.	FOOT	7,879	$ 2.75	$ 21,667.25	
27	Relocate and Install 20" Receiver and Associated Tie-in Piping	EACH	1	$ 450,000.00	$ 450,000.00	
28	Drill and Blast Rock (Per Linear Foot of Trench)	FOOT	1,000	$ 106.67	$ 106,666.67	
29	Provide Trench Padding Machine and Pad Ditch	FOOT	1,000	$ 16.17	$ 16,166.67	
30	Furnish and Install Sandbag/Foam Trench Breaker	EACH	10	$ 1,533.33	$ 15,333.33	
31	Supply and Install Wood Mats	EACH	75	$ 665.83	$ 49,937.50	50 Mats per Mile
32	Installing Cathodic Protection Test Stations and AC Mitigation	EACH	1	$ 325,500.00	$ 325,500.00	
33	Installing Pipeline Marker Signs	EACH	2	$ 250.00	$ 500.00	4 Per Mile
34	Supply and Installing Straw Bales	EACH	38	$ 18.75	$ 703.13	25 Bales Per Mile
35	Supply and Install Orange Safety Fence	FOOT	75	$ 4.83	$ 362.50	50' of Orange Safety Fence Per Mile
36	Supply and Install Silt Fence	FOOT	600	$ 8.25	$ 4,950.00	400' of Silt Fence Per Mile
37	Supply and Installing Erosion Control Fabric	SQ. YD.	38	$ 7.83	$ 293.75	25 Sq. Yd. Per Mile
38	Supply and Installing Crushed Rock and Geotextile Fabric Under Rock at Road Accesses	SQ. YD.	90	$ 38.17	$ 3,435.00	60 Sq. Yd. Per Mile
39	Supply and install Filter Bags for Dewatering	EACH	1	$ 941.67	$ 706.25	1 Per 2 Miles
40	Reseeding	ACRE	3	$ 1,750.00	$ 5,250.00	2 Acres Per Mile
41	Installing Anchored Mulch	ACRE	2	$ 3,233.33	$ 4,850.00	1 Acre Per Mile
42	**TOTAL CONSTRUCTION COST**				**$ 10,502,069.46**	
43						
44	**SURVEY SERVICES (USED ENCOMPASS PROPOSAL)**					
45	**Preliminary Survey**					
46	Project Manager	HOUR	6	$ 95.00	$ 570.00	1 Hour/Day for Project Oversight

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
47	RLS	HOUR	17	$ 85.00	$ 1,445.00	
48	Two Person Crew with GPS	DAY	6	$ 850.00	$ 5,100.00	One - 2 Person Crew - 1 Week -6 Days/Week
49	Data Processor	DAY	6	$ 75.00	$ 450.00	1 Data Processor - 1 Week -6 Days/Week
50	Sundays no work, per diem only	DAY	0	$ 142.00	$ -	
51	Mileage, additional over 100 per day	MILE	600	$ 0.54	$ 324.00	1 Vehicles-1 Week - 6 Days/Week-100 Miles/D
52	Survey Supplies	EACH	6	$ 310.00	$ 1,860.00	One - 2 Person Survey Crew
53	Per Diem	DAY	12	$ 142.00	$ 1,704.00	2 Field Employees - 1 Week - 6 Days/Week
54	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
55	**Sub-Total Preliminary Survey**				**$ 13,853.00**	
56	**Pre-Construction Staking**					
57	Project Manager	HOUR	6	$ 95.00	$ 570.00	1 Hour/Day for Project Oversight
58	Survey Supervisor	DAY	6	$ 85.00	$ 510.00	1 Hour/Day for Data Oversight and Review
59	Two Person Crew with GPS	DAY	6	$ 850.00	$ 5,100.00	One - 2 Person Crew - 1 Week - 6 Days/Week
60	Data Processing	HOUR	10	$ 75.00	$ 750.00	1 Data Processor
61	Sundays no work, per diem only	DAY	0	$ 142.00	$ -	
62	Mileage, additional over 100 per day	MILE	600	$ 0.54	$ 324.00	1 Vehicles-1 Week - 6 Days/Week-100 Miles/D
63	Survey Supplies	EACH	6	$ 310.00	$ 1,860.00	One - 2 Person Survey Crew
64	Per Diem	DAY	12	$ 142.00	$ 1,704.00	2 Field Employees - 1 Week - 6 Days/Week
65	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
66	**Sub-total Pre-Con Staking**				**$ 13,218.00**	
67	**As-built Survey**					
68	Project Manager	HOUR	12	$ 95.00	$ 1,140.00	0.5 Hr/Crew Day
69	Survey Supervisor	HOUR	12	$ 85.00	$ 1,020.00	0.5 Hr/Crew Day
70	Two Person Crew with GPS	DAY	24	$ 850.00	$ 20,400.00	1 Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
71	Data Processing	HOUR	36	$ 75.00	$ 2,700.00	1.5 Hr/Crew Day
72	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
73	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicle - 1 Month - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
74	Survey Supplies	DAY	24	$ 310.00	$ 7,440.00	1 Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
75	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Months - 4 Weeks/Month - 6 Days/Week
76	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
77	**Sub-total As-built Survey**				**$ 44,348.00**	
78	**Other Survey**					
79	Preparation of Non-Certified Property Plats	EACH	3	$ 435.00	$ 1,305.00	
80	Certified Plats	EACH	0	$ 865.00	$ -	
81	**Sub-Total Other Survey**				**$ 1,305.00**	
82	**TOTAL SURVEY SERVICES COST**				**$ 72,724.00**	
83						
84	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
85	**Easements**					
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145	**INSPECTION SERVICES**					
146	**Material Inspection Services**					
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151	Railroad Offload and Transport Pipe to Storage Yard	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
152	**Material Inspection Services Subtotal**				**$ 33,000.00**	
153	**Construction Inspection Services**					
154	Chief Inspector	MAN/WEEK	20	$ 7,700.00	$ 154,000.00	1 Construction Spread-5 Months Each
155	Welding Inspector	MAN/WEEK	12	$ 7,500.00	$ 90,000.00	1 Construction Spreads-4 Months Each-1 W. Inspect/Spread
156	Utility Inspector	MAN/WEEK	16	$ 7,500.00	$ 120,000.00	1 Construction Spreads-4 Months Each-1 U. Inspect/Spread
157	Office Manager	MAN/WEEK	20	$ 4,500.00	$ 90,000.00	1 Construction Spreads-5 Months Each
158	Environmental Training	MAN/DAY	2	$ 1,250.00	$ 2,500.00	
159	Environmental Inspection	MAN/WEEK	16	$ 7,500.00	$ 120,000.00	1 Inspectors-4 Months-4 Weeks/Mo-6 Days/Week
160	Construction Office Expenses - Office Rental	MO	5	$ 1,500.00	$ 7,500.00	1 Construction Spreads-5 Months Each
161	Construction Office Expenses - Office Supplies	MO	5	$ 1,000.00	$ 5,000.00	1 Construction Spreads-5 Months Each
162	**Construction Inspection Services Subtotal**				**$ 589,000.00**	
163	**TOTAL INSPECTION SERVICES COST**				**$ 622,000.00**	
164						
165	**ENGINEERING SERVICES**					
166	Project/Design Management	HR	200	$ 174.00	$ 34,800.00	
167	Project Engineering	HR	150	$ 112.00	$ 16,800.00	
168	Cathodic Protection Engineering (Includes field time and travel day rates)	HR	40	$ 112.00	$ 4,480.00	
169	Cathodic Protection Commissioning and Install Support (Includes day rate and travel)	DAY	2	$ 3,000.00	$ 6,000.00	
170	Construction Drafting w/ CADD Equipment	HR	300	$ 80.00	$ 24,000.00	
171	As-Built Drafting w/ CADD Equipment	HR	40	$ 112.00	$ 4,480.00	
172	Procurement	HR	10	$ 106.00	$ 1,060.00	
173	Metallurgical Consulting	HR	10	$ 184.00	$ 1,840.00	
174	Project Controls Engineer	HR	10	$ 100.00	$ 1,000.00	
175	Administrative Support	HR	10	$ 69.00	$ 690.00	
176	Misc. (Printing, FedEx, Travel etc.)	LS	1	$ 5,000.00	$ 5,000.00	
177	**Engineering Subtotal**				**$ 100,150.00**	
178	Engineering Contingency	%	20.0%	$ 100,150.00	$ 20,030.00	
179	**TOTAL ENGINEERING SERVICES COST**				**$ 120,180.00**	
180						
181	**TOTAL COST ESCALATION (2.0% INFLATION FOR 2 YEARS)**		2.0%	$ 13,363,648.41	**$ 539,891.40**	
182						
183	**TOTAL PROJECT COST**				**$ 13,363,648**	
184						
185	**TOTAL COST PER MILE**				**$ 8,909,098.94**	
186	**TOTAL COST PER FOOT**				**$ 1,687**	

CASE #4
30” 11 mile pipeline & 30” HDD of Dix River
MAOP 1,000 PSIG

Preliminary Cost Estimate - 30" 11 Mile Pipeline & 30" HDD of Dix River, 1000 PSIG MAOP

PROJECT LG&E Garrard County Pipeline
11 Miles, 30" Pipeline, 2020 Installation
1,000 psig Design Pressure/MAOP, 1/8" Corrosion Allowance

LOCATION Garrard & Mercer Counties, KY

DATE January 25, 2017

TYPE Budget Type Estimate, 10-20% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**PIPELINE MATERIAL**					
3	30" x 0.423" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	33,960	$ 95.00	$ 3,226,200.00	Class 1 Pipe - Includes 3% Kicker
4	30" x 0.482" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,160	$ 106.00	$ 122,960.00	Class 2 Pipe - Includes 3% Kicker
5	30" x 0.482" 5LX70 DSAW, PSL2 Pipe with FBE Coating & ARO Coating, Including Rail Freight	FOOT	17,640	$ 124.00	$ 2,187,360.00	Class 2 Pipe - Road & Stream Bores, Includes 3% Kicker
6	30" x 0.554" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	2,400	$ 119.00	$ 285,600.00	Class 3 Pipe - Includes 2% Kicker
7	30" x 0.554" 5LX70 DSAW, PSL2 Pipe with FBE Coating & Powercrete Coating, Including Rail Freight	FOOT	4,000	$ 144.00	$ 576,000.00	Class 3 Pipe - HDD, Incudes 5% Kicker
8	30" FBE Coated 3D Fittings, Class 1, 90 deg.	EACH	11	$ 6,470.20	$ 71,172.20	1 per mile
9	30" FBE Coated 3D Fittings, Class 1, 45 deg.	EACH	20	$ 4,100.00	$ 82,000.00	4 per road crossing, 5 out of 12 roads total
10	30" FBE Coated 3D Fittings, Class 2, 45 deg.	EACH	28	$ 4,404.40	$ 123,323.20	4 per road crossing, 7 out of 12 roads total
11	30" FBE Coated 3D Fittings, Class 3, 45 deg.	EACH	4	$ 5,462.20	$ 21,848.80	Extras
12	30" FBE Coated 3D Fittings, Class 3, 90 deg.	EACH	4	$ 7,173.10	$ 28,692.40	Extras
13	30" Launcher Assembly	EACH	1	$ 310,000.00	$ 310,000.00	
14	30" Receiver Assembly	EACH	1	$ 310,000.00	$ 310,000.00	
15	Marker Sign & Post	EACH	55	$ 20.00	$ 1,100.00	5 Per Mile
16	Decouplers w/ External Disconnect Switch	EACH	17	$ 5,200.00	$ 88,400.00	
17	AC Mitigation	EACH	15,000	$ 8.85	$ 132,750.00	
18	Deep Well Groundbed & Rectifier w/ RMU	EACH	2	$ 12,500.00	$ 25,000.00	
19	AC Deep Wells	FT	1	$ 2,500.00	$ 2,500.00	
20	Foreign Pipeline Crossing Test Stations	FT	10	$ 700.00	$ 7,000.00	
21	Coupon Test Stations	EACH	10	$ 4,000.00	$ 40,000.00	
22	Standard Two-Wire Test Stations	EACH	20	$ 200.00	$ 4,000.00	
23	**Pipeline Material Subtotal**				**$ 7,645,906.60**	
24	**M&R MATERIAL**					
25	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	300	$ 161.00	$ 48,300.00	
26	12" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	160	$ 67.00	$ 10,720.00	
27	8" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	40	$ 40.00	$ 1,600.00	
28	10"x 0.365" Unidirectional Ultrasonic Meter Tube, ANSI CL600, 5LX-60 DSAW, PSL2 Pipe, W/ 4-Path Meter Body and CPA 50E Flow Conditioner Plate, Calibrated	EACH	10	$ 110,000.00	$ 1,100,000.00	
29	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	10	$ 21,000.00	$ 210,000.00	
30	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	10	$ 9,500.00	$ 95,000.00	
31	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	8	$ 23,000.00	$ 184,000.00	
32	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	8	$ 10,500.00	$ 84,000.00	
33	8" Becker T0 Control Valve, CL600, w/ Actuation	EACH	8	$ 70,000.00	$ 560,000.00	
34	8" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	4	$ 7,500.00	$ 30,000.00	
35	8" FE Plug Valve, CL600, API 6D, Gear Operated	EACH	2	$ 7,500.00	$ 15,000.00	
36	30" x 0.750" Tee X60	EACH	3	$ 5,500.00	$ 16,500.00	
37	30" x 0.750" Weld Cap X60	EACH	2	$ 2,600.00	$ 5,200.00	
38	30" x 0.750" x 8" x 0.322" Extruded Branch Connection X60	EACH	4	$ 10,500.00	$ 42,000.00	
39	30" x 0.750" x 12" x 0.375" Extruded Branch Connection X60	EACH	16	$ 10,500.00	$ 168,000.00	
40	12" x 0.375" x 8" x 0.322" Concentric Reducer X52	EACH	16	$ 130.00	$ 2,080.00	
41	12" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	32	$ 800.00	$ 25,600.00	
42	8" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	28	$ 320.00	$ 8,960.00	
43	Daniels Danalyzer Gas Chromatograph	EACH	1	$ 70,000.00	$ 70,000.00	
44	Gas Chromatograph Carrier and Calibration Gas Tankage and Accessories	EACH	1	$ 30,000.00	$ 30,000.00	
45	Gas Chromatograph Gas Conditioning, Controls, and Tap Accessories	EACH	1	$ 10,000.00	$ 10,000.00	

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
46	**M&R Material Subtotal**				**$ 2,716,960.00**	
47	Miscellaneous Small Diameter Pipe, Fittings, Equipment, and Instrumentation	%	10.0%	$ 3,226,960.00	$ 322,696.00	
48	**Misc. Material Subtotal**				**$ 322,696.00**	
49	Sales Tax	%	6.0%	$ 10,685,562.60	$ 641,133.76	
50	**Sales Tax Subtotal**				**$ 641,133.76**	
51	**FREIGHT**					
52	Freight For All Non-Pipe Materials	LOT	7.5%	$ 4,239,142.60	$ 317,935.70	
53	**Freight Subtotal**				**$ 317,935.70**	
54	**TOTAL MATERIAL AND FREIGHT COST**				**$ 11,644,632.05**	
55						
56	**CONSTRUCTION (AVERAGED 3 CONTRACTORS)**					
57	RR Off Load & Transport 30" Pipe to Storage Yard	FOOT	59,160	$ 4.63	$ 273,910.80	Offload Rail Car & Load Truck, Transport, Offload Truck
58	Lay 30" x .423" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	32,962	$ 354.04	$ 11,669,866.48	Class 1 Location
59	Lay 30" x .482" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	18,212	$ 357.37	$ 6,508,422.44	Class 2 Location + Road Xings + Stream Xings
60	Lay 30" x .554" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	6,113	$ 374.04	$ 2,286,506.52	HDD Location
61	30" Directional Drill of Dix River W/ 30" x .554" X70 Line Pipe, FBE + PC coating (In Addition to Lay Price)	FOOT	3,755	$ 1,445.00	$ 5,565,397.00	From Laney Quote
62	30" Water Body Open Cut Installation (In Addition to Lay Price)	FOOT	1,040	$ 747.23	$ 777,120.93	Approx. 13 stream crossings
63	30" Wetland Open Cut Installation (In Addition to Lay Price)	FOOT	360	$ 487.50	$ 175,500.00	Approx. 3 wetland crossings
64	30" Conventional Road Bore (In Addition to Lay Price)	FOOT	960	$ 957.16	$ 918,874.93	W/ Class 2 pipe, Approx. 10 bored road crossings
65	Provide X-Ray Services for Non-Destructive Inspection - 30"	MILE	11.0	$ 42,197.00	$ 464,167.00	
66	Hydrostatic Test 30" Pipe	FOOT	57,287	$ 6.08	$ 348,495.92	
67	Dry 30" Pipe to (-)38 Deg. F.	FOOT	57,287	$ 2.75	$ 157,539.25	
68	Fabricate and Install 30" Launcher Assembly	EACH	1	$ 608,333.33	$ 608,333.33	
69	Fabricate and Install 30" Receiver Assembly	EACH	1	$ 608,333.33	$ 608,333.33	
70	Fabricate and Install M&R Facilities	EACH	1	$ 1,700,000.00	$ 1,700,000.00	All work including, site work, concrete, fabrication, install, painting, etc. (received cost from Michels only)
71	Drill and Blast Rock (Per Linear Foot of Trench)	FOOT	29,040	$ 106.67	$ 3,097,600.00	50% of route
72	Provide Trench Padding Machine and Pad Ditch	FOOT	29,040	$ 16.17	$ 469,480.00	50% of route
73	Furnish and Install Sandbag/Foam Trench Breaker	EACH	330	$ 1,533.33	$ 506,000.00	30 per Mile
74	Sheet Piling	SQ. YD.	200	$ 202.33	$ 40,466.67	
75	Trench Box	EACH	11	$ 150.00	$ 1,650.00	1 per Mile
76	Supply and Install Wood Mats	EACH	550	$ 665.83	$ 366,208.33	50 Mats per Mile
77	Removing and Chipping of Trees and Brush	ACRE	73	$ 16,575.00	$ 1,215,500.00	
78	Supply and Install Concrete Set On Weights on 30" Pipe	EACH	70	$ 1,841.67	$ 128,916.67	Installed @20' Intervals in Waterbody & Wetland Crossings
79	Installing Cathodic Protection Test Stations and AC Mitigation	EACH	1	$ 325,500.00	$ 325,500.00	
80	Installing Pipeline Marker Signs	EACH	55	$ 250.00	$ 13,750.00	4 Per Mile
81	Supply and Installing Straw Bales	EACH	275	$ 18.75	$ 5,156.25	25 Bales Per Mile
82	Supply and Install Orange Safety Fence	FOOT	550	$ 4.83	$ 2,658.33	50' of Orange Safety Fence Per Mile
83	Supply and Install Silt Fence	FOOT	5,500	$ 8.25	$ 45,375.00	500' of Silt Fence Per Mile
84	Supply and Installing Erosion Control Fabric	SQ. YD.	550	$ 7.83	$ 4,308.33	50 Sq. Yd. Per Mile
85	Supply and Installing Crushed Rock and Geotextile Fabric Under Rock at Road Accesses	SQ. YD.	660	$ 38.17	$ 25,190.00	60 Sq. Yd. Per Mile
86	Supply and install Filter Bags for Dewatering	EACH	6	$ 941.67	$ 5,179.17	1 Per 2 Miles
87	Reseeding	ACRE	22	$ 1,750.00	$ 38,500.00	2 Acres Per Mile
88	Installing Anchored Mulch	ACRE	11	$ 3,233.33	$ 35,566.67	1 Acre Per Mile
89	**TOTAL CONSTRUCTION COST**				**$ 38,389,473.35**	
90						
91	**SURVEY SERVICES (USED ENCOMPASS PROPOSAL)**					
92	**Preliminary Survey**					
93	Project Manager	HOUR	40	$ 95.00	$ 3,800.00	
94	RLS	HOUR	68	$ 85.00	$ 5,780.00	
95	Two Person Crew with GPS	DAY	48	$ 850.00	$ 40,800.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month-6 Days/Week
96	Data Processor	DAY	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
97	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
98	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles-1 Months-4 Weeks/Month - 6 Days/Week-100 Miles/D
99	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
100	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
101	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
102	**Sub-Total Preliminary Survey**				**$ 71,268.00**	
103	**Pre-Construction Staking**					
104	Project Manager	HOUR	24	$ 95.00	$ 2,280.00	1 Hour/Day for Project Oversight
105	Survey Supervisor	DAY	24	$ 85.00	$ 2,040.00	1 Hour/Day for Data Oversight and Review
106	Two Person Crew with GPS	DAY	24	$ 850.00	$ 20,400.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
107	Data Processing	HOUR	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week
108	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
109	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles - 1 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
110	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
111	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
112	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
113	**Sub-total Pre-Con Staking**				**$ 45,608.00**	
114	**As-built Survey**					
115	Project Manager	HOUR	168	$ 95.00	$ 15,960.00	0.5 Hr/Crew Day
116	Survey Supervisor	HOUR	168	$ 85.00	$ 14,280.00	0.5 Hr/Crew Day
117	Two Person Crew with GPS	DAY	336	$ 850.00	$ 285,600.00	2 Crews - 7 Months - 4 Weeks/Month - 6 Days/Week
118	Data Processing	HOUR	504	$ 75.00	$ 37,800.00	1.5 Hr/Crew Day
119	Sundays no work, per diem only	DAY	112	$ 142.00	$ 15,904.00	4 Field Employees - 7 Months - 4 Sundays/Month
120	Mileage, additional over 100 per day	MILE	33,600	$ 0.54	$ 18,144.00	2 Vehicles - 7 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
121	Survey Supplies	DAY	336	$ 310.00	$ 104,160.00	2 Crews - 7 Months - 4 Weeks/Month - 6 Days/Week
122	Per Diem	DAY	672	$ 142.00	$ 95,424.00	4 Field Employees - 7 Months - 4 Weeks/Month - 6 Days/Week
123	Mob/Demob	EACH	8	$ 600.00	$ 4,800.00	Two - 2 Person Survey Crew
124	**Sub-total As-built Survey**				**$ 592,072.00**	
125	**Other Survey**					
126	Preparation of Non-Certified Property Plats	EACH	64	$ 435.00	$ 27,840.00	
127	Certified Plats	EACH	0	$ 865.00	$ -	
128	**Sub-Total Other Survey**				**$ 27,840.00**	
129	**TOTAL SURVEY SERVICES COST**				**$ 736,788.00**	
130						
131	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
132	**Easements**					
133	15-Ft Wide Additional Permanent Easement	ACRE	20.0	$ 2,500.00	$ 50,000.00	
134	Compressor/M&R/Launcher Site Easement	ACRE	1.0	$ 2,500.00	$ 2,500.00	
135	Easement Recording fees	EACH	64.0	$ 25.00	$ 1,600.00	
136	Cathodic Protection - Deep Well Groundbed & Rectifier	EACH	2.0	$ 625.00	$ 1,250.00	25% of per acre cost
137	**Easement Costs Subtotal**				**$ 55,350.00**	
138	**Temporary and Construction**					
139	Temporary Workspace for Construction - Additional 55-Ft wide	ACRE	73.3	$ 1,250.00	$ 91,666.67	100' Wide Construction Workspace (30' existing easement, 15' new perm. Easement), 50% of per acre cost
140	Additional Temporary Workspace - All Crossings	ACRE	23.5	$ 1,250.00	$ 29,413.45	4 ATWS (100'x50' each) per road & stream crossing, 400'x400' for Comp. Sta., Stringing Area for HDD (3800'x75')
141	Contractor Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
142	Pipe Storage Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
143	Temporary Access Roads	ACRE	0.7	$ 1,250.00	$ 860.88	6 access roads, 25' x 200'
144	**Temporary and Construction Subtotal**				**$ 134,441.00**	
145	**Construction Damages**					
146	Crop Damages - Permanent Easement	ACRE	2.0	$ 625.00	$ 1,250.00	10% of Permanent Easement, 25% of per acre cost
147	Crop Damages - Temporary Workspace	ACRE	7.3	$ 625.00	$ 4,583.33	10% of Temporary Workspace, 25% of per acre cost

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
148	Crop Damages - Additional Temporary Workspace	ACRE	2.4	$ 625.00	$ 1,470.67	10% of Additional Temporary Workspace, 25% of per acre cost
149	**Construction Damages Construction Subtotal**				**$ 7,304.01**	
150	**Permit Fees - Roads and Railroads**					
151	Roads	EACH	12	$ 500.00	$ 6,000.00	# of Road Crossings
152	Survey Permits - Miscellaneous	EACH	64	$ 150.00	$ 9,600.00	
153	**Permit Fees Subtotal**				**$ 15,600.00**	
154	**TOTAL LAND ACQUISITION COST**				**$ 212,695.01**	
155						
156	**LEGAL AND PUBLIC AFFAIRS**					
157	Legal Fees	HR	200	$ 350.00	$ 70,000.00	
158	Public Affairs Fees - Principal #1	HR	250	$ 200.00	$ 50,000.00	
159	Public Affairs Fees - Principal #2	HR	250	$ 200.00	$ 50,000.00	
160	Senior Consultant	HR	100	$ 170.00	$ 17,000.00	
161	Public Affairs Expenses - Printing, Travel, Etc.	LOT	2	$ 25,000.00	$ 50,000.00	
162	**TOTAL LEGAL AND PUBLIC AFFAIRS COST**				**$ 237,000.00**	
163						
164	**ENVIRONMENTAL (USED CARDNO PROPOSAL)**					
165	Delineation and RTE Review HDD Crossing of Dix River	LS	1	$ 15,400.00	$ 15,400.00	
166	Delineation and RTE Review of Pipeline Corridor	LS	1	$ 50,100.00	$ 50,100.00	
167	Regulated "Waters of the U.S." Permitting	LS	1	$ 21,250.00	$ 21,250.00	
168	Cultural Resources Services for HDD Crossing of Dix River	LS	1	$ 20,430.00	$ 20,430.00	
169	Cultural Resources Services for Pipeline Corridor	LS	1	$ 60,700.00	$ 60,700.00	
170	History/Architecture Investigation	LS	1	$ 15,500.00	$ 15,500.00	
171	**TOTAL ENVIRONMENTAL COST**				**$ 183,380.00**	
172						
173	**GEOTECHNICAL SERVICES (USED TERRACON PROPOSAL)**					
174	**Drilling Services**					
175	Drilling Coordination	LS	1	$ 2,000.00	$ 2,000.00	
176	Mob/Demob	LS	2	$ 2,000.00	$ 4,000.00	
177	Drilling and Sampling (Day Rate)	DAY	30	$ 2,500.00	$ 75,000.00	
178	Per Diem (3 man crew)	DAY	30	$ 480.00	$ 14,400.00	
179	Grouting - Borehole Abandonment	PER LF	1,895	$ 7.50	$ 14,212.50	
180	Boring Inspector (if req'd)	HOUR	224	$ 95.00	$ 21,280.00	
181	Mileage for Inspector	MILE	1,838	$ 0.75	$ 1,378.50	
182	**Drilling Services Subtotal**				**$ 132,271.00**	
183	**Laboratory Testing Services**					
184	Moisture Content Test	EACH	30	$ 8.00	$ 240.00	
185	Sieve and Hydrometer Analysis	EACH	15	$ 116.00	$ 1,740.00	
186	Atterberg Limits Determination	EACH	15	$ 60.00	$ 900.00	
187	One Dimensional Consolidation Test	EACH	4	$ 540.00	$ 2,160.00	
188	Unconfined Compression Test	EACH	50	$ 80.00	$ 4,000.00	
189	**Lab Testing Services Subtotal**				**$ 9,040.00**	
190	**Engineering Services**					
191	Geotechnical Report Preparation	LS	1	$ 10,000.00	$ 10,000.00	
192	Geophysical Testing	LS	1	$ 16,500.00	$ 16,500.00	
193	Reflection Seismic Analysis	COST +15%	1.15	$ 52,000.00	$ 59,800.00	
194	**Engineering Services Subtotal**				**$ 86,300.00**	
195	**TOTAL GEOTECHNICAL SERVICES COST**				**$ 227,611.00**	
196						
197	**INSPECTION SERVICES**					
198	**Material Inspection Services**					

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
199	Pipe Mill	MAN/WEEK	5	$ 7,000.00	$ 35,000.00	4 Pipe Mill Inspectors (1 Lead, 2 Bench & 1 NDT for 5 weeks)
200	Coating Mill	MAN/WEEK	9	$ 6,500.00	$ 58,500.00	2 Coating Mill Inspectors (1 lead & 1 Bench for 9 weeks)
201	Loadout at Pipe Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
202	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Man Weeks to Inspect Valves, Hot Bends, Fittings, etc.
203	Railroad Offload and Transport Pipe to Storage Yard	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
204	**Material Inspection Services Subtotal**				**$ 113,000.00**	
205	**Construction Inspection Services**					
206	Chief Inspector	MAN/WEEK	32	$ 7,700.00	$ 246,400.00	1 Construction Spread-8 Months Each
207	Welding Inspector	MAN/WEEK	84	$ 7,500.00	$ 630,000.00	1 Construction Spreads-7 Months Each-3 W. Inspect/Spread
208	Utility Inspector	MAN/WEEK	140	$ 7,500.00	$ 1,050,000.00	1 Construction Spreads-7 Months Each-5 U. Inspect/Spread
209	Office Manager	MAN/WEEK	32	$ 4,500.00	$ 144,000.00	1 Construction Spreads-8 Months Each
210	Environmental Training	MAN/DAY	2	$ 1,250.00	$ 2,500.00	
211	Environmental Inspection	MAN/WEEK	28	$ 7,500.00	$ 210,000.00	1 Inspectors-7 Months-4 Weeks/Mo-6 Days/Week
212	Construction Office Expenses - Office Rental	MO	8	$ 1,500.00	$ 12,000.00	1 Construction Spreads-8 Months Each
213	Construction Office Expenses - Office Supplies	MO	8	$ 1,000.00	$ 8,000.00	1 Construction Spreads-8 Months Each
214	**Construction Inspection Services Subtotal**				**$ 2,302,900.00**	
215	**TOTAL INSPECTION SERVICES COST**				**$ 2,415,900.00**	
216						
217	**ENGINEERING SERVICES**					
218	Project/Design Management	HR	2,225	$ 174.00	$ 387,150.00	
219	Project Engineering	HR	3,000	$ 112.00	$ 336,000.00	
220	Cathodic Protection /AC Mitigation (Includes field time and travel day rates)	HR	315	$ 112.00	$ 35,280.00	
221	Construction Drafting w/ CADD Equipment	HR	6,150	$ 80.00	$ 492,000.00	
222	As-Built Drafting w/ CADD Equipment	HR	325	$ 112.00	$ 36,400.00	
223	Procurement	HR	125	$ 106.00	$ 13,250.00	
224	Metallurgical Consulting	HR	80	$ 184.00	$ 14,720.00	
225	Project Controls Engineer	HR	40	$ 100.00	$ 4,000.00	
226	Administrative Support	HR	40	$ 69.00	$ 2,760.00	
227	Misc. (Printing, FedEx, Travel etc.)	LS	1	$ 12,000.00	$ 12,000.00	
228	**Engineering Subtotal**				**$ 1,333,560.00**	
229	Engineering Contingency	%	20.0%	$ 1,333,560.00	$ 266,712.00	
230	**TOTAL ENGINEERING SERVICES COST**				**$ 1,600,272.00**	
231						
232	**TOTAL COST ESCALATION (2.0% INFLATION FOR 2 YEARS)**		2.0%	$ 55,647,751.41	**$ 2,248,169.16**	
233						
232	**TOTAL PROJECT COST**				**$ 57,895,921**	
233						
234	**TOTAL COST PER MILE**				**$ 5,263,265.51**	
235	**TOTAL COST PER FOOT**				**$ 997**	

CASE #5
30” 11 mile pipeline & 30” HDD of Dix River
MAOP 1,480 PSIG

Preliminary Cost Estimate - 30" 11 Mile Pipeline & 30" HDD of Dix River, 1480 PSIG MAOP

PROJECT LG&E Garrard County Pipeline
11 Miles, 30" Pipeline, 2020 Installation
1,480 psig Design Pressure/MAOP, 1/8" Corrosion Allowance

LOCATION Garrard & Mercer Counties, KY

DATE January 25, 2017

TYPE Budget Type Estimate, 10-20% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**PIPELINE MATERIAL**					
3	30" x 0.556" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	33,960	$ 122.00	$ 4,143,120.00	Class 1 Pipe - Includes 3% Kicker
4	30" x 0.654" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,160	$ 140.00	$ 162,400.00	Class 2 Pipe - Includes 3% Kicker
5	30" x 0.654" 5LX70 DSAW, PSL2 Pipe with FBE Coating & ARO Coating, Including Rail Freight	FOOT	17,640	$ 158.00	$ 2,787,120.00	Class 2 Pipe - Road & Stream Bores, Includes 3% Kicker
6	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	2,400	$ 161.00	$ 386,400.00	Class 3 Pipe - Includes 2% Kicker
7	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating & Powercrete Coating, Including Rail Freight	FOOT	4,000	$ 184.00	$ 736,000.00	Class 3 Pipe - HDD, Incudes 5% Kicker
8	30" FBE Coated 3D Fittings, Class 1, 90 deg.	EACH	11	$ 7,195.10	$ 79,146.10	1 per mile
9	30" FBE Coated 3D Fittings, Class 1, 45 deg.	EACH	20	$ 5,800.00	$ 116,000.00	4 per road crossing, 5 out of 12 roads total
10	30" FBE Coated 3D Fittings, Class 2, 45 deg.	EACH	28	$ 6,079.70	$ 170,231.60	4 per road crossing, 7 out of 12 roads total
11	30" FBE Coated 3D Fittings, Class 3, 45 deg.	EACH	4	$ 6,979.50	$ 27,918.00	Extras
12	30" FBE Coated 3D Fittings, Class 3, 90 deg.	EACH	4	$ 9,666.80	$ 38,667.20	Extras
13	30" Launcher Assembly	EACH	1	$ 370,000.00	$ 370,000.00	
14	30" Receiver Assembly	EACH	1	$ 350,000.00	$ 350,000.00	
15	Marker Sign & Post	EACH	55	$ 20.00	$ 1,100.00	5 Per Mile
16	Decouplers w/ External Disconnect Switch	EACH	17	$ 5,200.00	$ 88,400.00	
17	AC Mitigation	EACH	15,000	$ 8.85	$ 132,750.00	
18	Deep Well Groundbed & Rectifier w/ RMU	EACH	2	$ 12,500.00	$ 25,000.00	
19	AC Deep Wells	FT	1	$ 2,500.00	$ 2,500.00	
20	Foreign Pipeline Crossing Test Stations	FT	10	$ 700.00	$ 7,000.00	
21	Coupon Test Stations	EACH	10	$ 4,000.00	$ 40,000.00	
22	Standard Two-Wire Test Stations	EACH	20	$ 200.00	$ 4,000.00	
23	**Pipeline Material Subtotal**				**$ 9,667,752.90**	
24	**M&R MATERIAL**					
25	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	300	$ 161.00	$ 48,300.00	
26	12" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	160	$ 67.00	$ 10,720.00	
27	8" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	40	$ 40.00	$ 1,600.00	
28	10"x 0.365" Unidirectional Ultrasonic Meter Tube, ANSI CL600, 5LX-60 DSAW, PSL2 Pipe, W/ 4-Path Meter Body and CPA 50E Flow Conditioner Plate, Calibrated	EACH	10	$ 110,000.00	$ 1,100,000.00	
29	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	10	$ 21,000.00	$ 210,000.00	
30	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	10	$ 9,500.00	$ 95,000.00	
31	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	8	$ 23,000.00	$ 184,000.00	
32	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	8	$ 10,500.00	$ 84,000.00	
33	8" Becker T0 Control Valve, CL600, w/ Actuation	EACH	8	$ 70,000.00	$ 560,000.00	
34	8" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	4	$ 7,500.00	$ 30,000.00	
35	8" FE Plug Valve, CL600, API 6D, Gear Operated	EACH	2	$ 7,500.00	$ 15,000.00	
36	30" x 0.750" Tee X60	EACH	3	$ 5,500.00	$ 16,500.00	
37	30" x 0.750" Weld Cap X60	EACH	2	$ 2,600.00	$ 5,200.00	
38	30" x 0.750" x 8" x 0.322" Extruded Branch Connection X60	EACH	4	$ 10,500.00	$ 42,000.00	
39	30" x 0.750" x 12" x 0.375" Extruded Branch Connection X60	EACH	16	$ 10,500.00	$ 168,000.00	
40	12" x 0.375" x 8" x 0.322" Concentric Reducer X52	EACH	16	$ 130.00	$ 2,080.00	
41	12" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	32	$ 800.00	$ 25,600.00	
42	8" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	28	$ 320.00	$ 8,960.00	
43	Daniels Danalyzer Gas Chromatograph	EACH	1	$ 70,000.00	$ 70,000.00	
44	Gas Chromatograph Carrier and Calibration Gas Tankage and Accessories	EACH	1	$ 30,000.00	$ 30,000.00	
45	Gas Chromatograph Gas Conditioning, Controls, and Tap Accessories	EACH	1	$ 10,000.00	$ 10,000.00	

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
46	**M&R Material Subtotal**				**$ 2,716,960.00**	
47	Miscellaneous Small Diameter Pipe, Fittings, Equipment, and Instrumentation	%	10.0%	$ 3,326,960.00	$ 332,696.00	
48	**Misc. Material Subtotal**				**$ 332,696.00**	
49	Sales Tax	%	6.0%	$ 12,717,408.90	$ 763,044.53	
50	**Sales Tax Subtotal**				**$ 763,044.53**	
51	**FREIGHT**					
52	Freight For All Non-Pipe Materials	LOT	7.5%	$ 4,454,068.90	$ 334,055.17	
53	**Freight Subtotal**				**$ 334,055.17**	
54	**TOTAL MATERIAL AND FREIGHT COST**				**$ 13,814,508.60**	
55						
56	**CONSTRUCTION (AVERAGED 3 CONTRACTORS)**					
57	RR Off Load & Transport 30" Pipe to Storage Yard	FOOT	59,160	$ 4.63	$ 273,910.80	Offload Rail Car & Load Truck, Transport, Offload Truck
58	Lay 30" x .556" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	32,962	$ 400.96	$ 13,216,381.44	Class 1 Location
59	Lay 30" x .654" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	18,212	$ 404.29	$ 7,362,955.89	Class 2 Location + Road Xings + Stream Xings
60	Lay 30" x .759" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	6,113	$ 420.96	$ 2,573,316.97	HDD Location
61	30" Directional Drill of Dix River W/ 30" x .759" X70 Line Pipe, FBE + PC coating (In Addition to Lay Price)	FOOT	3,755	$ 1,445.00	$ 5,565,975.00	From Laney Quote
62	30" Water Body Open Cut Installation (In Addition to Lay Price)	FOOT	1,040	$ 747.23	$ 777,120.93	Approx. 13 stream crossings
63	30" Wetland Open Cut Installation (In Addition to Lay Price)	FOOT	360	$ 487.50	$ 175,500.00	Approx. 3 wetland crossings
64	30" Conventional Road Bore (In Addition to Lay Price)	FOOT	960	$ 957.16	$ 918,874.93	W/ Class 2 pipe, Approx. 10 bored road crossings
65	Provide X-Ray Services for Non-Destructive Inspection - 30"	MILE	11.0	$ 42,197.00	$ 464,167.00	
66	Hydrostatic Test 30" Pipe	FOOT	57,287	$ 6.08	$ 348,495.92	
67	Dry 30" Pipe to (-)38 Deg. F.	FOOT	57,287	$ 2.75	$ 157,539.25	
68	Fabricate and Install 30" Launcher Assembly	EACH	1	$ 608,333.33	$ 608,333.33	
69	Fabricate and Install 30" Receiver Assembly	EACH	1	$ 608,333.33	$ 608,333.33	
70	Fabricate and Install M&R Facilities	EACH	1	$ 1,700,000.00	$ 1,700,000.00	All work including, site work, concrete, fabrication, install, painting, etc. (received cost from Michels only)
71	Drill and Blast Rock (Per Linear Foot of Trench)	FOOT	29,040	$ 106.67	$ 3,097,600.00	50% of route
72	Provide Trench Padding Machine and Pad Ditch	FOOT	29,040	$ 16.17	$ 469,480.00	50% of route
73	Furnish and Install Sandbag/Foam Trench Breaker	EACH	330	$ 1,533.33	$ 506,000.00	30 per Mile
74	Sheet Piling	SQ. YD.	200	$ 202.33	$ 40,466.67	
75	Trench Box	EACH	11	$ 150.00	$ 1,650.00	1 per Mile
76	Supply and Install Wood Mats	EACH	550	$ 665.83	$ 366,208.33	50 Mats per Mile
77	Removing and Chipping of Trees and Brush	ACRE	73	$ 16,575.00	$ 1,215,500.00	
78	Supply and Install Concrete Set On Weights on 30" Pipe	EACH	70	$ 1,841.67	$ 128,916.67	Installed @20' Intervals in Waterbody & Wetland Crossings
79	Installing Cathodic Protection Test Stations and AC Mitigation	EACH	1	$ 325,500.00	$ 325,500.00	
80	Installing Pipeline Marker Signs	EACH	55	$ 250.00	$ 13,750.00	4 Per Mile
81	Supply and Installing Straw Bales	EACH	275	$ 18.75	$ 5,156.25	25 Bales Per Mile
82	Supply and Install Orange Safety Fence	FOOT	550	$ 4.83	$ 2,658.33	50' of Orange Safety Fence Per Mile
83	Supply and Install Silt Fence	FOOT	5,500	$ 8.25	$ 45,375.00	500' of Silt Fence Per Mile
84	Supply and Installing Erosion Control Fabric	SQ. YD.	550	$ 7.83	$ 4,308.33	50 Sq. Yd. Per Mile
85	Supply and Installing Crushed Rock and Geotextile Fabric Under Rock at Road Accesses	SQ. YD.	660	$ 38.17	$ 25,190.00	60 Sq. Yd. Per Mile
86	Supply and install Filter Bags for Dewatering	EACH	6	$ 941.67	$ 5,179.17	1 Per 2 Miles
87	Reseeding	ACRE	22	$ 1,750.00	$ 38,500.00	2 Acres Per Mile
88	Installing Anchored Mulch	ACRE	11	$ 3,233.33	$ 35,566.67	1 Acre Per Mile
89	**TOTAL CONSTRUCTION COST**				**$ 41,077,910.21**	
90						
91	**SURVEY SERVICES (USED ENCOMPASS PROPOSAL)**					
92	**Preliminary Survey**					
93	Project Manager	HOUR	40	$ 95.00	$ 3,800.00	
94	RLS	HOUR	68	$ 85.00	$ 5,780.00	
95	Two Person Crew with GPS	DAY	48	$ 850.00	$ 40,800.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month-6 Days/Week
96	Data Processor	DAY	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
97	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
98	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles-1 Months-4 Weeks/Month - 6 Days/Week-100 Miles/D
99	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
100	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
101	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
102	**Sub-Total Preliminary Survey**				**$ 71,268.00**	
103	**Pre-Construction Staking**					
104	Project Manager	HOUR	24	$ 95.00	$ 2,280.00	1 Hour/Day for Project Oversight
105	Survey Supervisor	DAY	24	$ 85.00	$ 2,040.00	1 Hour/Day for Data Oversight and Review
106	Two Person Crew with GPS	DAY	24	$ 850.00	$ 20,400.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
107	Data Processing	HOUR	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week
108	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
109	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles - 1 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
110	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
111	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
112	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
113	**Sub-total Pre-Con Staking**				**$ 45,608.00**	
114	**As-built Survey**					
115	Project Manager	HOUR	168	$ 95.00	$ 15,960.00	0.5 Hr/Crew Day
116	Survey Supervisor	HOUR	168	$ 85.00	$ 14,280.00	0.5 Hr/Crew Day
117	Two Person Crew with GPS	DAY	336	$ 850.00	$ 285,600.00	2 Crews - 7 Months - 4 Weeks/Month - 6 Days/Week
118	Data Processing	HOUR	504	$ 75.00	$ 37,800.00	1.5 Hr/Crew Day
119	Sundays no work, per diem only	DAY	112	$ 142.00	$ 15,904.00	4 Field Employees - 7 Months - 4 Sundays/Month
120	Mileage, additional over 100 per day	MILE	33,600	$ 0.54	$ 18,144.00	2 Vehicles - 7 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
121	Survey Supplies	DAY	336	$ 310.00	$ 104,160.00	2 Crews - 7 Months - 4 Weeks/Month - 6 Days/Week
122	Per Diem	DAY	672	$ 142.00	$ 95,424.00	4 Field Employees - 7 Months - 4 Weeks/Month - 6 Days/Week
123	Mob/Demob	EACH	8	$ 600.00	$ 4,800.00	Two - 2 Person Survey Crew
124	**Sub-total As-built Survey**				**$ 592,072.00**	
125	**Other Survey**					
126	Preparation of Non-Certified Property Plats	EACH	64	$ 435.00	$ 27,840.00	
127	Certified Plats	EACH	0	$ 865.00	$ -	
128	**Sub-Total Other Survey**				**$ 27,840.00**	
129	**TOTAL SURVEY SERVICES COST**				**$ 736,788.00**	
130						
131	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
132	**Easements**					
133	15-Ft Wide Additional Permanent Easement	ACRE	20.0	$ 2,500.00	$ 50,000.00	
134	Compressor/M&R/Launcher Site Easement	ACRE	1.0	$ 2,500.00	$ 2,500.00	
135	Easement Recording fees	EACH	64.0	$ 25.00	$ 1,600.00	
136	Cathodic Protection - Deep Well Groundbed & Rectifier	EACH	2.0	$ 625.00	$ 1,250.00	25% of per acre cost
137	**Easement Costs Subtotal**				**$ 55,350.00**	
138	**Temporary and Construction**					
139	Temporary Workspace for Construction - Additional 55-Ft wide	ACRE	73.3	$ 1,250.00	$ 91,666.67	100' Wide Construction Workspace (30' existing easement, 15' new perm. Easement), 50% of per acre cost
140	Additional Temporary Workspace - All Crossings	ACRE	23.5	$ 1,250.00	$ 29,413.45	4 ATWS (100'x50' each) per road & stream crossing, 400'x400' for Comp. Sta., Stringing Area for HDD (3800'x75')
141	Contractor Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
142	Pipe Storage Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
143	Temporary Access Roads	ACRE	0.7	$ 1,250.00	$ 860.88	6 access roads, 25' x 200'
144	**Temporary and Construction Subtotal**				**$ 134,441.00**	
145	**Construction Damages**					
146	Crop Damages - Permanent Easement	ACRE	2.0	$ 625.00	$ 1,250.00	10% of Permanent Easement, 25% of per acre cost
147	Crop Damages - Temporary Workspace	ACRE	7.3	$ 625.00	$ 4,583.33	10% of Temporary Workspace, 25% of per acre cost

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
148	Crop Damages - Additional Temporary Workspace	ACRE	2.4	$ 625.00	$ 1,470.67	10% of Additional Temporary Workspace, 25% of per acre cost
149	**Construction Damages Construction Subtotal**				**$ 7,304.01**	
150	**Permit Fees - Roads and Railroads**					
151	Roads	EACH	12	$ 500.00	$ 6,000.00	# of Road Crossings
152	Survey Permits - Miscellaneous	EACH	64	$ 150.00	$ 9,600.00	
153	**Permit Fees Subtotal**				**$ 15,600.00**	
154	**TOTAL LAND ACQUISITION COST**				**$ 212,695.01**	
155						
156	**LEGAL AND PUBLIC AFFAIRS**					
157	Legal Fees	HR	200	$ 350.00	$ 70,000.00	
158	Public Affairs Fees - Principal #1	HR	250	$ 200.00	$ 50,000.00	
159	Public Affairs Fees - Principal #2	HR	250	$ 200.00	$ 50,000.00	
160	Senior Consultant	HR	100	$ 170.00	$ 17,000.00	
161	Public Affairs Expenses - Printing, Travel, Etc.	LOT	2	$ 25,000.00	$ 50,000.00	
162	**TOTAL LEGAL AND PUBLIC AFFAIRS COST**				**$ 237,000.00**	
163						
164	**ENVIRONMENTAL (USED CARDNO PROPOSAL)**					
165	Delineation and RTE Review HDD Crossing of Dix River	LS	1	$ 15,400.00	$ 15,400.00	
166	Delineation and RTE Review of Pipeline Corridor	LS	1	$ 50,100.00	$ 50,100.00	
167	Regulated "Waters of the U.S." Permitting	LS	1	$ 21,250.00	$ 21,250.00	
168	Cultural Resources Services for HDD Crossing of Dix River	LS	1	$ 20,430.00	$ 20,430.00	
169	Cultural Resources Services for Pipeline Corridor	LS	1	$ 60,700.00	$ 60,700.00	
170	History/Architecture Investigation	LS	1	$ 15,500.00	$ 15,500.00	
171	**TOTAL ENVIRONMENTAL COST**				**$ 183,380.00**	
172						
173	**GEOTECHNICAL SERVICES (USED TERRACON PROPOSAL)**					
174	**Drilling Services**					
175	Drilling Coordination	LS	1	$ 2,000.00	$ 2,000.00	
176	Mob/Demob	LS	2	$ 2,000.00	$ 4,000.00	
177	Drilling and Sampling (Day Rate)	DAY	30	$ 2,500.00	$ 75,000.00	
178	Per Diem (3 man crew)	DAY	30	$ 480.00	$ 14,400.00	
179	Grouting - Borehole Abandonment	PER LF	1,895	$ 7.50	$ 14,212.50	
180	Boring Inspector (if req'd)	HOUR	224	$ 95.00	$ 21,280.00	
181	Mileage for Inspector	MILE	1,838	$ 0.75	$ 1,378.50	
182	**Drilling Services Subtotal**				**$ 132,271.00**	
183	**Laboratory Testing Services**					
184	Moisture Content Test	EACH	30	$ 8.00	$ 240.00	
185	Sieve and Hydrometer Analysis	EACH	15	$ 116.00	$ 1,740.00	
186	Atterberg Limits Determination	EACH	15	$ 60.00	$ 900.00	
187	One Dimensional Consolidation Test	EACH	4	$ 540.00	$ 2,160.00	
188	Unconfined Compression Test	EACH	50	$ 80.00	$ 4,000.00	
189	**Lab Testing Services Subtotal**				**$ 9,040.00**	
190	**Engineering Services**					
191	Geotechnical Report Preparation	LS	1	$ 10,000.00	$ 10,000.00	
192	Geophysical Testing	LS	1	$ 16,500.00	$ 16,500.00	
193	Reflection Seismic Analysis	COST +15%	1.15	$ 52,000.00	$ 59,800.00	
194	**Engineering Services Subtotal**				**$ 86,300.00**	
195	**TOTAL GEOTECHNICAL SERVICES COST**				**$ 227,611.00**	
196						
197	**INSPECTION SERVICES**					
198	**Material Inspection Services**					

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
199	Pipe Mill	MAN/WEEK	5	$ 7,000.00	$ 35,000.00	4 Pipe Mill Inspectors (1 Lead, 2 Bench & 1 NDT for 5 weeks)
200	Coating Mill	MAN/WEEK	9	$ 6,500.00	$ 58,500.00	2 Coating Mill Inspectors (1 lead & 1 Bench for 9 weeks)
201	Loadout at Pipe Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
202	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Man Weeks to Inspect Valves, Hot Bends, Fittings, etc.
203	Railroad Offload and Transport Pipe to Storage Yard	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
204	**Material Inspection Services Subtotal**				**$ 113,000.00**	
205	**Construction Inspection Services**					
206	Chief Inspector	MAN/WEEK	32	$ 7,700.00	$ 246,400.00	1 Construction Spread-8 Months Each
207	Welding Inspector	MAN/WEEK	84	$ 7,500.00	$ 630,000.00	1 Construction Spreads-7 Months Each-3 W. Inspect/Spread
208	Utility Inspector	MAN/WEEK	140	$ 7,500.00	$ 1,050,000.00	1 Construction Spreads-7 Months Each-5 U. Inspect/Spread
209	Office Manager	MAN/WEEK	32	$ 4,500.00	$ 144,000.00	1 Construction Spreads-8 Months Each
210	Environmental Training	MAN/DAY	2	$ 1,250.00	$ 2,500.00	
211	Environmental Inspection	MAN/WEEK	28	$ 7,500.00	$ 210,000.00	1 Inspectors-7 Months-4 Weeks/Mo-6 Days/Week
212	Construction Office Expenses - Office Rental	MO	8	$ 1,500.00	$ 12,000.00	1 Construction Spreads-8 Months Each
213	Construction Office Expenses - Office Supplies	MO	8	$ 1,000.00	$ 8,000.00	1 Construction Spreads-8 Months Each
214	**Construction Inspection Services Subtotal**				**$ 2,302,900.00**	
215	**TOTAL INSPECTION SERVICES COST**				**$ 2,415,900.00**	
216						
217	**ENGINEERING SERVICES**					
218	Project/Design Management	HR	2,225	$ 174.00	$ 387,150.00	
219	Project Engineering	HR	3,000	$ 112.00	$ 336,000.00	
220	Cathodic Protection /AC Mitigation (Includes field time and travel day rates)	HR	315	$ 112.00	$ 35,280.00	
221	Construction Drafting w/ CADD Equipment	HR	6,150	$ 80.00	$ 492,000.00	
222	As-Built Drafting w/ CADD Equipment	HR	325	$ 112.00	$ 36,400.00	
223	Procurement	HR	125	$ 106.00	$ 13,250.00	
224	Metallurgical Consulting	HR	80	$ 184.00	$ 14,720.00	
225	Project Controls Engineer	HR	40	$ 100.00	$ 4,000.00	
226	Administrative Support	HR	40	$ 69.00	$ 2,760.00	
227	Misc. (Printing, FedEx, Travel etc.)	LS	1	$ 12,000.00	$ 12,000.00	
228	**Engineering Subtotal**				**$ 1,333,560.00**	
229	Engineering Contingency	%	20.0%	$ 1,333,560.00	$ 266,712.00	
230	**TOTAL ENGINEERING SERVICES COST**				**$ 1,600,272.00**	
231						
232	**TOTAL COST ESCALATION (2.0% INFLATION FOR 2 YEARS)**		2.0%	$ 60,506,064.82	**$ 2,444,445.02**	
233						
232	**TOTAL PROJECT COST**				**$ 62,950,510**	
233						
234	**TOTAL COST PER MILE**				**$ 5,722,773.62**	
235	**TOTAL COST PER FOOT**				**$ 1,084**	

CASE #6
30” 11 mile Pipeline & Tie-in to 30” HDD of Dix River
MAOP 1,000 PSIG

Preliminary Cost Estimate - 30" 10 Mile Pipeline & Tie-in to Existing 30" Crossing of Dix River, 1000 PSIG MAOP

PROJECT LG&E Garrard County Pipeline
9.5 Miles, 30" Pipeline, 2020 Installation
1,000 psig Design Pressure/MAOP, 1/8" Corrosion Allowance

LOCATION Garrard & Mercer Counties, KY

DATE January 25, 2017

TYPE Budget Type Estimate, 10-20% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**PIPELINE MATERIAL**					
3	30" x 0.423" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	33,960	$ 95.00	$ 3,226,200.00	Class 1 Pipe - Includes 3% Kicker
4	30" x 0.482" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,160	$ 106.00	$ 122,960.00	Class 2 Pipe - Includes 3% Kicker
5	30" x 0.482" 5LX70 DSAW, PSL2 Pipe with FBE Coating & ARO Coating, Including Rail Freight	FOOT	17,640	$ 124.00	$ 2,187,360.00	Class 2 Pipe - Road & Stream Bores, Includes 3% Kicker
6	20" x 0.500" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,800	$ 100.00	$ 180,000.00	Pipe to tie-in to existing 20"
7	30" FBE Coated 3D Fittings, Class 1, 90 deg.	EACH	11	$ 6,470.20	$ 71,172.20	1 per mile
8	30" FBE Coated 3D Fittings, Class 1, 45 deg.	EACH	20	$ 4,100.00	$ 82,000.00	4 per road crossing, 5 out of 12 roads total
9	30" FBE Coated 3D Fittings, Class 2, 45 deg.	EACH	28	$ 4,404.40	$ 123,323.20	4 per road crossing, 7 out of 12 roads total
10	30" FBE Coated 3D Fittings, Class 3, 90 deg.	EACH	2	$ 7,173.10	$ 14,346.20	Extras
11	20" FBE Coated 3D Fittings, 90 deg.	EACH	2	$ 5,200.00	$ 10,400.00	
12	30" Launcher Assembly	EACH	1	$ 310,000.00	$ 310,000.00	
13	30" Receiver Assembly	EACH	1	$ 310,000.00	$ 310,000.00	
14	Misc. 20" Material for Tie-in to 30" & relocation of 20" Receiver	EACH	1	$ 150,000.00	$ 150,000.00	
15	Marker Sign & Post	EACH	48	$ 20.00	$ 950.00	5 Per Mile
16	Decouplers w/ External Disconnect Switch	EACH	17	$ 5,200.00	$ 88,400.00	
17	AC Mitigation	EACH	15,000	$ 8.85	$ 132,750.00	
18	Deep Well Groundbed & Rectifier w/ RMU	EACH	2	$ 12,500.00	$ 25,000.00	
19	AC Deep Wells	FT	1	$ 2,500.00	$ 2,500.00	
20	Foreign Pipeline Crossing Test Stations	FT	10	$ 700.00	$ 7,000.00	
21	Coupon Test Stations	EACH	10	$ 4,000.00	$ 40,000.00	
22	Standard Two-Wire Test Stations	EACH	20	$ 200.00	$ 4,000.00	
23	**Pipeline Material Subtotal**				**$ 7,088,361.60**	
24	**M&R MATERIAL**					
25	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	300	$ 161.00	$ 48,300.00	
26	12" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	160	$ 67.00	$ 10,720.00	
27	8" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	40	$ 40.00	$ 1,600.00	
28	10"x 0.365" Unidirectional Ultrasonic Meter Tube, ANSI CL600, 5LX-60 DSAW, PSL2 Pipe, W/ 4-Path Meter Body and CPA 50E Flow Conditioner Plate, Calibrated	EACH	10	$ 110,000.00	$ 1,100,000.00	
29	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	10	$ 21,000.00	$ 210,000.00	
30	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	10	$ 9,500.00	$ 95,000.00	
31	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	8	$ 23,000.00	$ 184,000.00	
32	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	8	$ 10,500.00	$ 84,000.00	
33	8" Becker T0 Control Valve, CL600, w/ Actuation	EACH	8	$ 70,000.00	$ 560,000.00	
34	8" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	4	$ 7,500.00	$ 30,000.00	
35	8" FE Plug Valve, CL600, API 6D, Gear Operated	EACH	2	$ 7,500.00	$ 15,000.00	
36	30" x 0.750" Tee X60	EACH	3	$ 5,500.00	$ 16,500.00	
37	30" x 0.750" Weld Cap X60	EACH	2	$ 2,600.00	$ 5,200.00	
38	30" x 0.750" x 8" x 0.322" Extruded Branch Connection X60	EACH	4	$ 10,500.00	$ 42,000.00	
39	30" x 0.750" x 12" x 0.375" Extruded Branch Connection X60	EACH	16	$ 10,500.00	$ 168,000.00	
40	12" x 0.375" x 8" x 0.322" Concentric Reducer X52	EACH	16	$ 130.00	$ 2,080.00	
41	12" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	32	$ 800.00	$ 25,600.00	
42	8" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	28	$ 320.00	$ 8,960.00	
43	Daniels Danalyzer Gas Chromatograph	EACH	1	$ 70,000.00	$ 70,000.00	
44	Gas Chromatograph Carrier and Calibration Gas Tankage and Accessories	EACH	1	$ 30,000.00	$ 30,000.00	
45	Gas Chromatograph Gas Conditioning, Controls, and Tap Accessories	EACH	1	$ 10,000.00	$ 10,000.00	

46	**M&R Material Subtotal**				**$ 2,716,960.00**	
47	Miscellaneous Small Diameter Pipe, Fittings, Equipment, and Instrumentation	%	10.0%	$ 3,066,960.00	$ 306,696.00	
48	**Misc. Material Subtotal**				**$ 306,696.00**	
49	Sales Tax	%	6.0%	$ 10,112,017.60	$ 606,721.06	
50	**Sales Tax Subtotal**				**$ 606,721.06**	
51	**FREIGHT**					
52	Freight For All Non-Pipe Materials	LOT	7.5%	$ 4,276,025.40	$ 320,701.91	
53	**Freight Subtotal**				**$ 320,701.91**	
54	**TOTAL MATERIAL AND FREIGHT COST**				**$ 11,039,440.56**	
55						
56	**CONSTRUCTION (AVERAGED 3 CONTRACTORS)**					
57	RR Off Load & Transport 30" Pipe to Storage Yard	FOOT	54,571	$ 4.45	$ 242,840.95	Offload Rail Car & Load Truck, Transport, Offload Truck
58	Lay 30" x .423" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	32,962	$ 381.00	$ 12,558,522.00	Class 1 Location
59	Lay 30" x .482" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	18,212	$ 381.00	$ 6,938,772.00	Class 2 Location + Road Xings + Stream Xings
60	Lay 20" x .500" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	1,766	$ 347.30	$ 613,331.80	Pipe to tie-in to existing 20"
61	30" Water Body Open Cut Installation (In Addition to Lay Price)	FOOT	1,040	$ 826.85	$ 859,921.39	Approx. 13 stream crossings
62	30" Wetland Open Cut Installation (In Addition to Lay Price)	FOOT	360	$ 543.75	$ 195,750.00	Approx. 3 wetland crossings
63	30" Conventional Road Bore (In Addition to Lay Price)	FOOT	960	$ 1,148.24	$ 1,102,312.40	W/ Class 2 pipe, Approx. 10 bored road crossings
64	Provide X-Ray Services for Non-Destructive Inspection - 30"	MILE	9.5	$ 45,000.00	$ 427,500.00	
65	Hydrostatic Test 30" Pipe	FOOT	51,174	$ 7.38	$ 377,408.25	
66	Dry 30" Pipe to (-)38 Deg. F.	FOOT	51,174	$ 3.63	$ 185,505.75	
67	Fabricate and Install 30" Launcher Assembly	EACH	1	$ 625,000.00	$ 625,000.00	
68	Fabricate and Install 30" Receiver Assembly	EACH	1	$ 625,000.00	$ 625,000.00	
69	Relocate and Install 20" Receiver and Associated Tie-in Piping	EACH	1	$ 450,000.00	$ 450,000.00	
70	Fabricate and Install M&R Facilities	EACH	1	$ 1,700,000.00	$ 1,700,000.00	All work including, site work, concrete, fabrication, install, painting, etc. (received cost from Michels only)
71	Drill and Blast Rock (Per Linear Foot of Trench)	FOOT	25,080	$ 137.50	$ 3,448,500.00	50% of route
72	Provide Trench Padding Machine and Pad Ditch	FOOT	25,080	$ 12.25	$ 307,230.00	50% of route
73	Furnish and Install Sandbag/Foam Trench Breaker	EACH	285	$ 1,550.00	$ 441,750.00	30 per Mile
74	Sheet Piling	SQ. YD.	200	$ 283.50	$ 56,700.00	
75	Trench Box	EACH	10	$ 150.00	$ 1,425.00	1 per Mile
76	Supply and Install Wood Mats	EACH	475	$ 625.00	$ 296,875.00	50 Mats per Mile
77	Removing and Chipping of Trees and Brush	ACRE	63	$ 18,000.00	$ 1,140,000.00	
78	Supply and Install Concrete Set On Weights on 30" Pipe	EACH	70	$ 1,012.50	$ 70,875.00	Installed @20' Intervals in Waterbody & Wetland Crossings
79	Installing Cathodic Protection Test Stations and AC Mitigation	EACH	1	$ 325,500.00	$ 325,500.00	
80	Installing Pipeline Marker Signs	EACH	48	$ 150.00	$ 7,125.00	4 Per Mile
81	Supply and Installing Straw Bales	EACH	238	$ 19.50	$ 4,631.25	25 Bales Per Mile
82	Supply and Install Orange Safety Fence	FOOT	475	$ 6.00	$ 2,850.00	50' of Orange Safety Fence Per Mile
83	Supply and Install Silt Fence	FOOT	4,750	$ 10.00	$ 47,500.00	500' of Silt Fence Per Mile
84	Supply and Installing Erosion Control Fabric	SQ. YD.	475	$ 8.00	$ 3,800.00	50 Sq. Yd. Per Mile
85	Supply and Installing Crushed Rock and Geotextile Fabric Under Rock at Road Accesses	SQ. YD.	570	$ 46.25	$ 26,362.50	60 Sq. Yd. Per Mile
86	Supply and install Filter Bags for Dewatering	EACH	5	$ 925.00	$ 4,393.75	1 Per 2 Miles
87	Reseeding	ACRE	19	$ 1,875.00	$ 35,625.00	2 Acres Per Mile
88	Installing Anchored Mulch	ACRE	10	$ 4,250.00	$ 40,375.00	1 Acre Per Mile
89	**TOTAL CONSTRUCTION COST**				**$ 33,163,382.04**	
90						
91	**SURVEY SERVICES (USED ENCOMPASS PROPOSAL)**					
92	**Preliminary Survey**					
93	Project Manager	HOUR	40	$ 95.00	$ 3,800.00	
94	RLS	HOUR	68	$ 85.00	$ 5,780.00	
95	Two Person Crew with GPS	DAY	48	$ 850.00	$ 40,800.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month-6 Days/Week
96	Data Processor	DAY	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week
97	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
98	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles-1 Months-4 Weeks/Month - 6 Days/Week-100 Miles/D

99	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
100	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
101	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
102	**Sub-Total Preliminary Survey**				**$ 71,268.00**	
103	**Pre-Construction Staking**					
104	Project Manager	HOUR	24	$ 95.00	$ 2,280.00	1 Hour/Day for Project Oversight
105	Survey Supervisor	DAY	24	$ 85.00	$ 2,040.00	1 Hour/Day for Data Oversight and Review
106	Two Person Crew with GPS	DAY	24	$ 850.00	$ 20,400.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
107	Data Processing	HOUR	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week
108	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
109	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles - 1 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
110	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
111	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
112	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
113	**Sub-total Pre-Con Staking**				**$ 45,608.00**	
114	**As-built Survey**					
115	Project Manager	HOUR	120	$ 95.00	$ 11,400.00	0.5 Hr/Crew Day
116	Survey Supervisor	HOUR	120	$ 85.00	$ 10,200.00	0.5 Hr/Crew Day
117	Two Person Crew with GPS	DAY	240	$ 850.00	$ 204,000.00	2 Crews - 5 Months - 4 Weeks/Month - 6 Days/Week
118	Data Processing	HOUR	360	$ 75.00	$ 27,000.00	1.5 Hr/Crew Day
119	Sundays no work, per diem only	DAY	80	$ 142.00	$ 11,360.00	4 Field Employees - 5 Months - 4 Sundays/Month
120	Mileage, additional over 100 per day	MILE	24,000	$ 0.54	$ 12,960.00	2 Vehicles - 5 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
121	Survey Supplies	DAY	240	$ 310.00	$ 74,400.00	2 Crews - 5 Months - 4 Weeks/Month - 6 Days/Week
122	Per Diem	DAY	480	$ 142.00	$ 68,160.00	4 Field Employees - 5 Months - 4 Weeks/Month - 6 Days/Week
123	Mob/Demob	EACH	8	$ 600.00	$ 4,800.00	Two - 2 Person Survey Crew
124	**Sub-total As-built Survey**				**$ 424,280.00**	
125	**Other Survey**					
126	Preparation of Non-Certified Property Plats	EACH	62	$ 435.00	$ 26,970.00	
127	Certified Plats	EACH	0	$ 865.00	$ -	
128	**Sub-Total Other Survey**				**$ 26,970.00**	
129	**TOTAL SURVEY SERVICES COST**				**$ 568,126.00**	
130						
131	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
132	**Easements**					
133	15-Ft Wide Additional Permanent Easement	ACRE	17.3	$ 2,500.00	$ 43,181.82	
134	Launcher Site Agreement (Comp. Station)	ACRE	1.0	$ 2,500.00	$ 2,500.00	
135	Receiver Site Agreement (Relocation of 20" Receiver)	ACRE	1.0	$ 2,500.00	$ 2,500.00	
136	Easement Recording fees	EACH	62.0	$ 25.00	$ 1,550.00	
137	Cathodic Protection Anode Beds	EACH	2.0	$ 625.00	$ 1,250.00	25% of per acre cost
138	**Easement Costs Subtotal**				**$ 50,981.82**	
139	**Temporary and Construction**					
140	Temporary Workspace for Construction - Additional 55-Ft wide	ACRE	63	$ 1,250.00	$ 79,166.67	100' Wide Construction Workspace (30' existing easement, 15' new perm. Easement)
141	Additional Temporary Workspace - All Crossings	ACRE	17	$ 1,250.00	$ 21,522.04	4 ATWS (100'x50' each) per road & stream crossing, 400'x400' for Comp. Sta., 300'x300' for Receiver Site
142	Contractor Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
143	Pipe Storage Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
144	Temporary Access Roads	ACRE	0.7	$ 1,250.00	$ 860.88	6 access roads, 25' x 200'
145	**Temporary and Construction Subtotal**				**$ 114,049.59**	
146	**Construction Damages**					
147	Crop Damages - Permanent Easement	ACRE	1.7	$ 625.00	$ 1,079.55	10% of Permanent Easement, 25% of per acre cost
148	Crop Damages - Temporary Workspace	ACRE	6.3	$ 625.00	$ 3,958.33	10% of Temporary Workspace, 25% of per acre cost
149	Crop Damages - Additional Temporary Workspace	ACRE	1.7	$ 625.00	$ 1,076.10	10% of Additional Temporary Workspace, 25% of per acre cost
150	**Construction Damages Construction Subtotal**				**$ 6,113.98**	
151	**Permit Fees - Roads and Railroads**					

152	Roads	EACH	12	$ 500.00	$ 6,000.00	# of Road Crossings
153	Survey Permits - Miscellaneous	EACH	64	$ 150.00	$ 9,600.00	
154	**Permit Fees Subtotal**				**$ 15,600.00**	
155	**TOTAL LAND ACQUISITION COST**				**$ 186,745.39**	
156						
157	**LEGAL AND PUBLIC AFFAIRS**					
158	Legal Fees	HR	200	$ 350.00	$ 70,000.00	
159	Public Affairs Fees - Principal #1	HR	250	$ 200.00	$ 50,000.00	
160	Public Affairs Fees - Principal #2	HR	250	$ 200.00	$ 50,000.00	
161	Senior Consultant	HR	100	$ 170.00	$ 17,000.00	
162	Public Affairs Expenses - Printing, Travel, Etc.	LOT	2	$ 25,000.00	$ 50,000.00	
163	**TOTAL LEGAL AND PUBLIC AFFAIRS COST**				**$ 237,000.00**	
164						
165	**ENVIRONMENTAL (USED CARDNO PROPOSAL)**					
166	Delineation and RTE Review of Pipeline Corridor	LS	1	$ 50,100.00	$ 50,100.00	
167	Regulated "Waters of the U.S." Permitting	LS	1	$ 21,250.00	$ 21,250.00	
168	Cultural Resources Services for Pipeline Corridor	LS	1	$ 60,700.00	$ 60,700.00	
169	History/Architecture Investigation	LS	1	$ 15,500.00	$ 15,500.00	
170	**TOTAL ENVIRONMENTAL COST**				**$ 147,550.00**	
171						
172	**GEOTECHNICAL SERVICES (USED TERRACON PROPOSAL)**					
173	**Drilling Services**					
174	Drilling Coordination	LS	1	$ 500.00	$ 500.00	
175	Mob/Demob	LS	1	$ 1,500.00	$ 1,500.00	
176	Drilling and Sampling (Day Rate)	DAY	2	$ 2,500.00	$ 5,000.00	
177	Per Diem (3 man crew)	DAY	2	$ 480.00	$ 960.00	
178	Grouting - Borehole Abandonment	PER LF	160	$ 7.50	$ 1,200.00	
179	Boring Inspector (if req'd)	HOUR	15	$ 95.00	$ 1,425.00	
180	Mileage for Inspector	MILE	122	$ 0.75	$ 91.50	
181	**Drilling Services Subtotal**				**$ 10,676.50**	
182	**Laboratory Testing Services**					
183	Moisture Content Test	EACH	24	$ 8.00	$ 192.00	
184	Sieve and Hydrometer Analysis	EACH	12	$ 116.00	$ 1,392.00	
185	Atterberg Limits Determination	EACH	12	$ 60.00	$ 720.00	
186	One Dimensional Consolidation Test	EACH	4	$ 540.00	$ 2,160.00	
187	**Lab Testing Services Subtotal**				**$ 4,464.00**	
188	**Engineering Services**					
189	Geotechnical Report Preparation	LS	1	$ 3,500.00	$ 3,500.00	
190	**Engineering Services Subtotal**				**$ 3,500.00**	
191	**TOTAL GEOTECHNICAL SERVICES COST**				**$ 18,640.50**	
192						
193	**INSPECTION SERVICES**					
194	**Material Inspection Services**					
195	Pipe Mill	MAN/WEEK	4	$ 7,000.00	$ 28,000.00	4 Pipe Mill Inspectors (1 Lead, 2 Bench & 1 NDT for 4 weeks)
196	Coating Mill	MAN/WEEK	8	$ 6,500.00	$ 52,000.00	2 Coating Mill Inspectors (1 lead & 1 Bench for 8 weeks)
197	Loadout at Pipe Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
198	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Man Weeks to Inspect Valves, Hot Bends, Fittings, etc.
199	Railroad Offload and Transport Pipe to Storage Yard	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
200	**Material Inspection Services Subtotal**				**$ 99,500.00**	
201	**Construction Inspection Services**					
202	Chief Inspector	MAN/WEEK	24	$ 7,700.00	$ 184,800.00	1 Construction Spread-6 Months Each
203	Welding Inspector	MAN/WEEK	60	$ 7,500.00	$ 450,000.00	1 Construction Spreads-5 Months Each-3 W. Inspect/Spread
204	Utility Inspector	MAN/WEEK	100	$ 7,500.00	$ 750,000.00	1 Construction Spreads-5 Months Each-5 U. Inspect/Spread

205	Office Manager	MAN/WEEK	24	$ 4,500.00	$ 108,000.00	1 Construction Spreads-6 Months Each
206	Environmental Training	MAN/DAY	2	$ 1,250.00	$ 2,500.00	
207	Environmental Inspection	MAN/WEEK	20	$ 7,500.00	$ 150,000.00	1 Inspectors-5 Months-4 Weeks/Mo-6 Days/Week
208	Construction Office Expenses - Office Rental	MO	6	$ 1,500.00	$ 9,000.00	1 Construction Spreads-6 Months Each
209	Construction Office Expenses - Office Supplies	MO	6	$ 1,000.00	$ 6,000.00	1 Construction Spreads-6 Months Each
210	**Construction Inspection Services Subtotal**				**$ 1,660,300.00**	
211	**TOTAL INSPECTION SERVICES COST**				**$ 1,759,800.00**	
212						
213	**ENGINEERING SERVICES**					
214	Project/Design Management	HR	2,000	$ 174.00	$ 348,000.00	
215	Project Engineering	HR	2,700	$ 112.00	$ 302,400.00	
216	Cathodic Protection Engineering (Includes field time and travel day rates)	HR	250	$ 112.00	$ 28,000.00	
217	Cathodic Protection Commissioning and Install Support (Includes day rate and travel)	DAY	4	$ 3,000.00	$ 12,000.00	
218	Construction Drafting w/ CADD Equipment	HR	5,775	$ 80.00	$ 462,000.00	
219	As-Built Drafting w/ CADD Equipment	HR	300	$ 112.00	$ 33,600.00	
220	Procurement	HR	125	$ 106.00	$ 13,250.00	
221	Metallurgical Consulting	HR	80	$ 184.00	$ 14,720.00	
222	Project Controls Engineer	HR	40	$ 100.00	$ 4,000.00	
223	Administrative Support	HR	40	$ 69.00	$ 2,760.00	
224	Misc. (Printing, FedEx, Travel etc.)	LS	1	$ 12,000.00	$ 12,000.00	
225	**Engineering Subtotal**				**$ 1,232,730.00**	
226	Engineering Contingency	%	20.0%	$ 1,232,730.00	$ 246,546.00	
227	**TOTAL ENGINEERING SERVICES COST**				**$ 1,479,276.00**	
228						
229	**TOTAL COST ESCALATION (2.0% INFLATION FOR 2 YEARS)**		2.0%	$ 48,599,960.49	**$ 1,963,438.40**	
230						
229	**TOTAL PROJECT COST**				**$ 50,563,399**	
230						
231	**TOTAL COST PER MILE**				**$ 5,322,463.04**	
232	**TOTAL COST PER FOOT**				**$ 1,008**	

CASE #7
30” 11 mile Pipeline & Tie-in to 30” HDD of Dix River
MAOP 1,480 PSIG

Preliminary Cost Estimate - 30" 10 Mile Pipeline & Tie-in to Existing 30" Crossing of Dix River, 1480 PSIG MAOP

PROJECT LG&E Garrard County Pipeline
9.5 Miles, 30" Pipeline, 2020 Installation
1,480 psig Design Pressure/MAOP, 1/8" Corrosion Allowance

LOCATION Garrard & Mercer Counties, KY

DATE January 25, 2017

TYPE Budget Type Estimate, 10-20% Accuracy

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**					
2	**PIPELINE MATERIAL**					
3	30" x 0.556" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	33,960	$ 122.00	$ 4,143,120.00	Class 1 Pipe - Includes 3% Kicker
4	30" x 0.654" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,160	$ 140.00	$ 162,400.00	Class 2 Pipe - Includes 3% Kicker
5	30" x 0.654" 5LX70 DSAW, PSL2 Pipe with FBE Coating & ARO Coating, Including Rail Freight	FOOT	17,640	$ 158.00	$ 2,787,120.00	Class 2 Pipe - Road & Stream Bores, Includes 3% Kicker
6	20" x 0.500" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	1,800	$ 100.00	$ 180,000.00	Pipe to tie-in to existing 20"
7	30" FBE Coated 3D Fittings, Class 1, 90 deg.	EACH	11	$ 6,470.20	$ 71,172.20	1 per mile
8	30" FBE Coated 3D Fittings, Class 1, 45 deg.	EACH	20	$ 5,800.00	$ 116,000.00	4 per road crossing, 5 out of 12 roads total
9	30" FBE Coated 3D Fittings, Class 2, 45 deg.	EACH	28	$ 4,404.40	$ 123,323.20	4 per road crossing, 7 out of 12 roads total
10	30" FBE Coated 3D Fittings, Class 3, 90 deg.	EACH	2	$ 7,173.10	$ 14,346.20	Extras
11	20" FBE Coated 3D Fittings, 90 deg.	EACH	2	$ 5,200.00	$ 10,400.00	
12	30" Launcher Assembly	EACH	1	$ 310,000.00	$ 310,000.00	
13	30" Receiver Assembly	EACH	1	$ 310,000.00	$ 310,000.00	
14	Misc. 20" Material for Tie-in to 30" & relocation of 20" Receiver	EACH	1	$ 150,000.00	$ 150,000.00	
15	Marker Sign & Post	EACH	48	$ 20.00	$ 950.00	5 Per Mile
16	Decouplers w/ External Disconnect Switch	EACH	17	$ 5,200.00	$ 88,400.00	
17	AC Mitigation	EACH	15,000	$ 8.85	$ 132,750.00	
18	Deep Well Groundbed & Rectifier w/ RMU	EACH	2	$ 12,500.00	$ 25,000.00	
19	AC Deep Wells	FT	1	$ 2,500.00	$ 2,500.00	
20	Foreign Pipeline Crossing Test Stations	FT	10	$ 700.00	$ 7,000.00	
21	Coupon Test Stations	EACH	10	$ 4,000.00	$ 40,000.00	
22	Standard Two-Wire Test Stations	EACH	20	$ 200.00	$ 4,000.00	
23	**Pipeline Material Subtotal**				**$ 8,678,481.60**	
24	**M&R MATERIAL**					
25	30" x 0.759" 5LX70 DSAW, PSL2 Pipe with FBE Coating, Including Rail Freight	FOOT	300	$ 161.00	$ 48,300.00	
26	12" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	160	$ 67.00	$ 10,720.00	
27	8" x 0.500" 5LX52 DSAW, PSL2 Pipe Bare	FOOT	40	$ 40.00	$ 1,600.00	
28	10"x 0.365" Unidirectional Ultrasonic Meter Tube, ANSI CL600, 5LX-60 DSAW, PSL2 Pipe, W/ 4-Path Meter Body and CPA 50E Flow Conditioner Plate, Calibrated	EACH	10	$ 110,000.00	$ 1,100,000.00	
29	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	10	$ 21,000.00	$ 210,000.00	
30	10" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	10	$ 9,500.00	$ 95,000.00	
31	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, w/ Shafer Actuator	EACH	8	$ 23,000.00	$ 184,000.00	
32	12" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	8	$ 10,500.00	$ 84,000.00	
33	8" Becker T0 Control Valve, CL600, w/ Actuation	EACH	8	$ 70,000.00	$ 560,000.00	
34	8" FE Ball Valve, CL600, Full Port, Trunion Mounted, API 6D, Gear Operated	EACH	4	$ 7,500.00	$ 30,000.00	
35	8" FE Plug Valve, CL600, API 6D, Gear Operated	EACH	2	$ 7,500.00	$ 15,000.00	
36	30" x 0.750" Tee X60	EACH	3	$ 5,500.00	$ 16,500.00	
37	30" x 0.750" Weld Cap X60	EACH	2	$ 2,600.00	$ 5,200.00	
38	30" x 0.750" x 8" x 0.322" Extruded Branch Connection X60	EACH	4	$ 10,500.00	$ 42,000.00	
39	30" x 0.750" x 12" x 0.375" Extruded Branch Connection X60	EACH	16	$ 10,500.00	$ 168,000.00	
40	12" x 0.375" x 8" x 0.322" Concentric Reducer X52	EACH	16	$ 130.00	$ 2,080.00	
41	12" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	32	$ 800.00	$ 25,600.00	
42	8" Flange Set, CL600, w/ Gasket, Nuts, and Bolts	EACH	28	$ 320.00	$ 8,960.00	
43	Daniels Danalyzer Gas Chromatograph	EACH	1	$ 70,000.00	$ 70,000.00	
44	Gas Chromatograph Carrier and Calibration Gas Tankage and Accessories	EACH	1	$ 30,000.00	$ 30,000.00	
45	Gas Chromatograph Gas Conditioning, Controls, and Tap Accessories	EACH	1	$ 10,000.00	$ 10,000.00	

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
46	**M&R Material Subtotal**				**$ 2,716,960.00**	
47	Miscellaneous Small Diameter Pipe, Fittings, Equipment, and Instrumentation	%	10.0%	$ 3,066,960.00	$ 306,696.00	
48	**Misc. Material Subtotal**				**$ 306,696.00**	
49	Sales Tax	%	6.0%	$ 11,702,137.60	$ 702,128.26	
50	**Sales Tax Subtotal**				**$ 702,128.26**	
51	**FREIGHT**					
52	Freight For All Non-Pipe Materials	LOT	7.5%	$ 4,310,025.40	$ 323,251.91	
53	**Freight Subtotal**				**$ 323,251.91**	
54	**TOTAL MATERIAL AND FREIGHT COST**				**$ 12,727,517.76**	
55						
56	**CONSTRUCTION (AVERAGED 3 CONTRACTORS)**					
57	RR Off Load & Transport 30" Pipe to Storage Yard	FOOT	54,571	$ 4.45	$ 242,840.95	Offload Rail Car & Load Truck, Transport, Offload Truck
58	Lay 30" x .556" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	32,962	$ 400.96	$ 13,216,381.44	Class 1 Location
59	Lay 30" x .654" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	18,212	$ 404.29	$ 7,362,955.89	Class 2 Location + Road Xings + Stream Xings
60	Lay 20" x .500" X70 Line Pipe Including Soil Sep., Coating Field Welds & All Tie-Ins	FOOT	1,766	$ 347.30	$ 613,331.80	Pipe to tie-in to existing 20"
61	30" Water Body Open Cut Installation (In Addition to Lay Price)	FOOT	1,040	$ 826.85	$ 859,921.39	Approx. 13 stream crossings
62	30" Wetland Open Cut Installation (In Addition to Lay Price)	FOOT	360	$ 543.75	$ 195,750.00	Approx. 3 wetland crossings
63	30" Conventional Road Bore (In Addition to Lay Price)	FOOT	960	$ 1,148.24	$ 1,102,312.40	W/ Class 2 pipe, Approx. 10 bored road crossings
64	Provide X-Ray Services for Non-Destructive Inspection - 30"	MILE	9.5	$ 45,000.00	$ 427,500.00	
65	Hydrostatic Test 30" Pipe	FOOT	51,174	$ 7.38	$ 377,408.25	
66	Dry 30" Pipe to (-)38 Deg. F.	FOOT	51,174	$ 3.63	$ 185,505.75	
67	Fabricate and Install 30" Launcher Assembly	EACH	1	$ 625,000.00	$ 625,000.00	
68	Fabricate and Install 30" Receiver Assembly	EACH	1	$ 625,000.00	$ 625,000.00	
69	Relocate and Install 20" Receiver and Associated Tie-in Piping	EACH	1	$ 450,000.00	$ 450,000.00	
70	Fabricate and Install M&R Facilities	EACH	1	$ 1,700,000.00	$ 1,700,000.00	All work including, site work, concrete, fabrication, install, painting, etc. (received cost from Michels only)
71	Drill and Blast Rock (Per Linear Foot of Trench)	FOOT	25,080	$ 137.50	$ 3,448,500.00	50% of route
72	Provide Trench Padding Machine and Pad Ditch	FOOT	25,080	$ 12.25	$ 307,230.00	50% of route
73	Furnish and Install Sandbag/Foam Trench Breaker	EACH	285	$ 1,550.00	$ 441,750.00	30 per Mile
74	Sheet Piling	SQ. YD.	200	$ 283.50	$ 56,700.00	
75	Trench Box	EACH	10	$ 150.00	$ 1,425.00	1 per Mile
76	Supply and Install Wood Mats	EACH	475	$ 625.00	$ 296,875.00	50 Mats per Mile
77	Removing and Chipping of Trees and Brush	ACRE	63	$ 18,000.00	$ 1,140,000.00	
78	Supply and Install Concrete Set On Weights on 30" Pipe	EACH	70	$ 1,012.50	$ 70,875.00	Installed @20' Intervals in Waterbody & Wetland Crossings
79	Installing Cathodic Protection Test Stations and AC Mitigation	EACH	1	$ 325,500.00	$ 325,500.00	
80	Installing Pipeline Marker Signs	EACH	48	$ 150.00	$ 7,125.00	4 Per Mile
81	Supply and Installing Straw Bales	EACH	238	$ 19.50	$ 4,631.25	25 Bales Per Mile
82	Supply and Install Orange Safety Fence	FOOT	475	$ 6.00	$ 2,850.00	50' of Orange Safety Fence Per Mile
83	Supply and Install Silt Fence	FOOT	4,750	$ 10.00	$ 47,500.00	500' of Silt Fence Per Mile
84	Supply and Installing Erosion Control Fabric	SQ. YD.	475	$ 8.00	$ 3,800.00	50 Sq. Yd. Per Mile
85	Supply and Installing Crushed Rock and Geotextile Fabric Under Rock at Road Accesses	SQ. YD.	570	$ 46.25	$ 26,362.50	60 Sq. Yd. Per Mile
86	Supply and install Filter Bags for Dewatering	EACH	5	$ 925.00	$ 4,393.75	1 Per 2 Miles
87	Reseeding	ACRE	19	$ 1,875.00	$ 35,625.00	2 Acres Per Mile
88	Installing Anchored Mulch	ACRE	10	$ 4,250.00	$ 40,375.00	1 Acre Per Mile
89	**TOTAL CONSTRUCTION COST**				**$ 34,245,425.37**	
90						
91	**SURVEY SERVICES (USED ENCOMPASS PROPOSAL)**					
92	**Preliminary Survey**					
93	Project Manager	HOUR	40	$ 95.00	$ 3,800.00	
94	RLS	HOUR	68	$ 85.00	$ 5,780.00	
95	Two Person Crew with GPS	DAY	48	$ 850.00	$ 40,800.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month-6 Days/Week
96	Data Processor	DAY	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
97	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
98	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles-1 Months-4 Weeks/Month - 6 Days/Week-100 Miles/D
99	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
100	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
101	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
102	**Sub-Total Preliminary Survey**				**$ 71,268.00**	
103	**Pre-Construction Staking**					
104	Project Manager	HOUR	24	$ 95.00	$ 2,280.00	1 Hour/Day for Project Oversight
105	Survey Supervisor	DAY	24	$ 85.00	$ 2,040.00	1 Hour/Day for Data Oversight and Review
106	Two Person Crew with GPS	DAY	24	$ 850.00	$ 20,400.00	One - 2 Person Crew - 1 Month - 4 Weeks/Month - 6 Days/Week
107	Data Processing	HOUR	24	$ 75.00	$ 1,800.00	1 Data Processor - 1 Month - 4 Weeks/Month-6 Days/Week
108	Sundays no work, per diem only	DAY	8	$ 142.00	$ 1,136.00	2 Field Employees - 1 Month - 4 Sundays/Month
109	Mileage, additional over 100 per day	MILE	2,400	$ 0.54	$ 1,296.00	1 Vehicles - 1 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
110	Survey Supplies	EACH	24	$ 310.00	$ 7,440.00	One - 2 Person Survey Crew
111	Per Diem	DAY	48	$ 142.00	$ 6,816.00	2 Field Employees - 1 Month - 4 Weeks/Month - 6 Days/Week
112	Mob/Demob	EACH	4	$ 600.00	$ 2,400.00	One - 2 Person Survey Crew
113	**Sub-total Pre-Con Staking**				**$ 45,608.00**	
114	**As-built Survey**					
115	Project Manager	HOUR	120	$ 95.00	$ 11,400.00	0.5 Hr/Crew Day
116	Survey Supervisor	HOUR	120	$ 85.00	$ 10,200.00	0.5 Hr/Crew Day
117	Two Person Crew with GPS	DAY	240	$ 850.00	$ 204,000.00	2 Crews - 5 Months - 4 Weeks/Month - 6 Days/Week
118	Data Processing	HOUR	360	$ 75.00	$ 27,000.00	1.5 Hr/Crew Day
119	Sundays no work, per diem only	DAY	80	$ 142.00	$ 11,360.00	4 Field Employees - 5 Months - 4 Sundays/Month
120	Mileage, additional over 100 per day	MILE	24,000	$ 0.54	$ 12,960.00	2 Vehicles - 5 Months - 4 Weeks/Month - 6 Days/Week - 100 Miles/D
121	Survey Supplies	DAY	240	$ 310.00	$ 74,400.00	2 Crews - 5 Months - 4 Weeks/Month - 6 Days/Week
122	Per Diem	DAY	480	$ 142.00	$ 68,160.00	4 Field Employees - 5 Months - 4 Weeks/Month - 6 Days/Week
123	Mob/Demob	EACH	8	$ 600.00	$ 4,800.00	Two - 2 Person Survey Crew
124	**Sub-total As-built Survey**				**$ 424,280.00**	
125	**Other Survey**					
126	Preparation of Non-Certified Property Plats	EACH	62	$ 435.00	$ 26,970.00	
127	Certified Plats	EACH	0	$ 865.00	$ -	
128	**Sub-Total Other Survey**				**$ 26,970.00**	
129	**TOTAL SURVEY SERVICES COST**				**$ 568,126.00**	
130						
131	**LAND ACQUISITION ($ FROM GARRARD CO. PVA SYSTEM)**					
132	**Easements**					
133	15-Ft Wide Additional Permanent Easement	ACRE	17.3	$ 2,500.00	$ 43,181.82	
134	Launcher Site Agreement (Comp. Station)	ACRE	1.0	$ 2,500.00	$ 2,500.00	
135	Receiver Site Agreement (Relocation of 20" Receiver)	ACRE	1.0	$ 2,500.00	$ 2,500.00	
136	Easement Recording fees	EACH	62.0	$ 25.00	$ 1,550.00	
137	Cathodic Protection Anode Beds	EACH	2.0	$ 625.00	$ 1,250.00	25% of per acre cost
138	**Easement Costs Subtotal**				**$ 50,981.82**	
139	**Temporary and Construction**					
140	Temporary Workspace for Construction - Additional 55-Ft wide	ACRE	63	$ 1,250.00	$ 79,166.67	100' Wide Construction Workspace (30' existing easement, 15' new perm. Easement)
141	Additional Temporary Workspace - All Crossings	ACRE	17	$ 1,250.00	$ 21,522.04	4 ATWS (100'x50' each) per road & stream crossing, 400'x400' for Comp. Sta., 300'x300' for Receiver Site
142	Contractor Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
143	Pipe Storage Yard	ACRE	5.0	$ 1,250.00	$ 6,250.00	5 acres
144	Temporary Access Roads	ACRE	0.7	$ 1,250.00	$ 860.88	6 access roads, 25' x 200'
145	**Temporary and Construction Subtotal**				**$ 114,049.59**	
146	**Construction Damages**					
147	Crop Damages - Permanent Easement	ACRE	1.7	$ 625.00	$ 1,079.55	10% of Permanent Easement, 25% of per acre cost

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
148	Crop Damages - Temporary Workspace	ACRE	6.3	$ 625.00	$ 3,958.33	10% of Temporary Workspace, 25% of per acre cost
149	Crop Damages - Additional Temporary Workspace	ACRE	1.7	$ 625.00	$ 1,076.10	10% of Additional Temporary Workspace, 25% of per acre cost
150	**Construction Damages Construction Subtotal**				**$ 6,113.98**	
151	**Permit Fees - Roads and Railroads**					
152	Roads	EACH	12	$ 500.00	$ 6,000.00	# of Road Crossings
153	Survey Permits - Miscellaneous	EACH	64	$ 150.00	$ 9,600.00	
154	**Permit Fees Subtotal**				**$ 15,600.00**	
155	**TOTAL RIGHT-OF-WAY COST**				**$ 186,745.39**	
156						
157	**LEGAL AND PUBLIC AFFAIRS**					
158	Legal Fees	HR	200	$ 350.00	$ 70,000.00	
159	Public Affairs Fees - Principal #1	HR	250	$ 200.00	$ 50,000.00	
160	Public Affairs Fees - Principal #2	HR	250	$ 200.00	$ 50,000.00	
161	Senior Consultant	HR	100	$ 170.00	$ 17,000.00	
162	Public Affairs Expenses - Printing, Travel, Etc.	LOT	2	$ 25,000.00	$ 50,000.00	
163	**TOTAL LEGAL AND PUBLIC AFFAIRS COST**				**$ 237,000.00**	
164						
165	**ENVIRONMENTAL (USED CARDNO PROPOSAL)**					
166	Delineation and RTE Review of Pipeline Corridor	LS	1	$ 50,100.00	$ 50,100.00	
167	Regulated "Waters of the U.S." Permitting	LS	1	$ 21,250.00	$ 21,250.00	
168	Cultural Resources Services for Pipeline Corridor	LS	1	$ 60,700.00	$ 60,700.00	
169	History/Architecture Investigation	LS	1	$ 15,500.00	$ 15,500.00	
170	**TOTAL ENVIRONMENTAL COST**				**$ 147,550.00**	
171						
172	**GEOTECHNICAL SERVICES (USED TERRACON PROPOSAL)**					
173	**Drilling Services**					
174	Drilling Coordination	LS	1	$ 500.00	$ 500.00	
175	Mob/Demob	LS	1	$ 1,500.00	$ 1,500.00	
176	Drilling and Sampling (Day Rate)	DAY	2	$ 2,500.00	$ 5,000.00	
177	Per Diem (3 man crew)	DAY	2	$ 480.00	$ 960.00	
178	Grouting - Borehole Abandonment	PER LF	160	$ 7.50	$ 1,200.00	
179	Boring Inspector (if req'd)	HOUR	15	$ 95.00	$ 1,425.00	
180	Mileage for Inspector	MILE	122	$ 0.75	$ 91.50	
181	**Drilling Services Subtotal**				**$ 10,676.50**	
182	**Laboratory Testing Services**					
183	Moisture Content Test	EACH	24	$ 8.00	$ 192.00	
184	Sieve and Hydrometer Analysis	EACH	12	$ 116.00	$ 1,392.00	
185	Atterberg Limits Determination	EACH	12	$ 60.00	$ 720.00	
186	One Dimensional Consolidation Test	EACH	4	$ 540.00	$ 2,160.00	
187	**Lab Testing Services Subtotal**				**$ 4,464.00**	
188	**Engineering Services**					
189	Geotechnical Report Preparation	LS	1	$ 3,500.00	$ 3,500.00	
190	**Engineering Services Subtotal**				**$ 3,500.00**	
191	**TOTAL GEOTECHNICAL SERVICES COST**				**$ 18,640.50**	
192						
193	**INSPECTION SERVICES**					
194	**Material Inspection Services**					
195	Pipe Mill	MAN/WEEK	4	$ 7,000.00	$ 28,000.00	4 Pipe Mill Inspectors (1 Lead, 2 Bench & 1 NDT for 4 weeks)
196	Coating Mill	MAN/WEEK	8	$ 6,500.00	$ 52,000.00	2 Coating Mill Inspectors (1 lead & 1 Bench for 8 weeks)
197	Loadout at Pipe Mill	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
198	Valves, Hot Bends, Fittings, Etc.	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Man Weeks to Inspect Valves, Hot Bends, Fittings, etc.

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
199	Railroad Offload and Transport Pipe to Storage Yard	MAN/WEEK	1	$ 6,500.00	$ 6,500.00	1 Inspector
200	**Material Inspection Services Subtotal**				**$ 99,500.00**	
201	**Construction Inspection Services**					
202	Chief Inspector	MAN/WEEK	24	$ 7,700.00	$ 184,800.00	1 Construction Spread-6 Months Each
203	Welding Inspector	MAN/WEEK	60	$ 7,500.00	$ 450,000.00	1 Construction Spreads-5 Months Each-3 W. Inspect/Spread
204	Utility Inspector	MAN/WEEK	100	$ 7,500.00	$ 750,000.00	1 Construction Spreads-5 Months Each-5 U. Inspect/Spread
205	Office Manager	MAN/WEEK	24	$ 4,500.00	$ 108,000.00	1 Construction Spreads-6 Months Each
206	Environmental Training	MAN/DAY	2	$ 1,250.00	$ 2,500.00	
207	Environmental Inspection	MAN/WEEK	20	$ 7,500.00	$ 150,000.00	1 Inspectors-5 Months-4 Weeks/Mo-6 Days/Week
208	Construction Office Expenses - Office Rental	MO	6	$ 1,500.00	$ 9,000.00	1 Construction Spreads-6 Months Each
209	Construction Office Expenses - Office Supplies	MO	6	$ 1,000.00	$ 6,000.00	1 Construction Spreads-6 Months Each
210	**Construction Inspection Services Subtotal**				**$ 1,660,300.00**	
211	**TOTAL INSPECTION SERVICES COST**				**$ 1,759,800.00**	
212						
213	**ENGINEERING SERVICES**					
214	Project/Design Management	HR	2,000	$ 174.00	$ 348,000.00	
215	Project Engineering	HR	2,700	$ 112.00	$ 302,400.00	
216	Cathodic Protection Engineering (Includes field time and travel day rates)	HR	250	$ 112.00	$ 28,000.00	
217	Cathodic Protection Commissioning and Install Support (Includes day rate and travel)	DAY	4	$ 3,000.00	$ 12,000.00	
218	Construction Drafting w/ CADD Equipment	HR	5,775	$ 80.00	$ 462,000.00	
219	As-Built Drafting w/ CADD Equipment	HR	300	$ 112.00	$ 33,600.00	
220	Procurement	HR	125	$ 106.00	$ 13,250.00	
221	Metallurgical Consulting	HR	80	$ 184.00	$ 14,720.00	
222	Project Controls Engineer	HR	40	$ 100.00	$ 4,000.00	
223	Administrative Support	HR	40	$ 69.00	$ 2,760.00	
224	Misc. (Printing, FedEx, Travel etc.)	LS	1	$ 12,000.00	$ 12,000.00	
225	**Engineering Subtotal**				**$ 1,232,730.00**	
226	Engineering Contingency	%	20.0%	$ 1,232,730.00	$ 246,546.00	
227	**TOTAL ENGINEERING SERVICES COST**				**$ 1,479,276.00**	
228						
229	**TOTAL COST ESCALATION (2.0% INFLATION FOR 2 YEARS)**		2.0%	$ 51,370,081.02	**$ 2,075,351.27**	
230						
229	**TOTAL PROJECT COST**				**$ 53,445,432**	
230						
231	**TOTAL COST PER MILE**				**$ 5,625,834.98**	
232	**TOTAL COST PER FOOT**				**$ 1,065**	

CASE #8
Station Facilities Required to Pack 11 Miles of 30” Pipeline to 1,450 psig Using New Compressor

PRELIMINARY COST ESTIMATE - LG&E GARRARD CO. COMPRESSOR STATION

PROJECT LG&E HP ADDITION **LOCATION** KY
Garrard Co. Compressor Station
CASE 8
EMD COMPRESSOR - New HP Only **DATE** January 25, 2017 **TYPE:** Detailed Cost Estimate

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**				**$ 3,196,161**	
2	3,100 + BHP EMD RECIP. COMPRESSOR PACKAGE	Each	1	$ 1,150,000	$ 1,150,000	Includes Suction Scrubber and Pulsation Bottles - Based on quotes From 3 Vendors, Averaged
3	Transformer-Substation 5,000KVA 69KV/4.16KVAC 3Phase	Each	1	$ 220,000	$ 220,000	
4	Transfomer - 75 KVA 4.16KV/480 VAC	Each	1	$ 15,000	$ 15,000	
5	Substation Structures and Materials	Lot	1	$ 182,000	$ 182,000	
6	Voltage Regulator - 5KV 1200A	Each	3	$ 10,000	$ 30,000	
7	Elect/Control Building -Prefabed Skidded 13' x 35' w 14' Eve	Each	1	$ 207,000	$ 207,000	Based on Previous ENE Project done in 2015
8	Canopy for EMD Unit - 20' x 40' w 16' Eve	Each	1	$ 55,000	$ 55,000	Based on SISCORP Budgetary Quote
9	Gas Cooler	Lot	1	$ 112,000	$ 112,000	Quotes from Tekfins and Harsco - Averaged
10	480/120 VAC 5kw UPS Package	Each	1	$ 10,000	$ 10,000	
11	MCC Equipment, Motor Starter and Switchgear	Lot	1	$ 350,000	$ 350,000	
12	8" CL600 Ball Valve, w/ Actuator Unit	Each	1	$ 14,500	$ 14,500	Vendor Quote
13	6" CL600 Ball Valve, w/ Actuator Unit	Each	1	$ 12,500	$ 12,500	Vendor Quote
14	2" CL600 Ball Valves	Each	3	$ 1,900	$ 5,700	Vendor Quote
15	6" CL600 Swing Check Valve Unit	Each	2	$ 3,500	$ 7,000	Vendor Quote
16	2" CL600 Unit Suction Valve ByPass Valve	Each	1	$ 1,900	$ 1,900	Vendor Quote
17	3" CL 600 Blowdown Valve w/Actuator	Each	1	$ 8,700	$ 8,700	Vendor Quote
18	4" CL 600 Ball Valve with Gear	Each	1	$ 3,500	$ 3,500	Vendor Quote
19	2" CL 600 Control valve	Each	2	$ 5,300	$ 10,600	Quote from Fisher
20	8" .500" Gr. B, Coated Pipe	Foot	200	$ 42	$ 8,400	Vendor Quote
21	6" .432" Gr. B, Coated Pipe	Foot	160	$ 27	$ 4,320	Vendor Quote
22	8" X .500" Elbows - Gr B	Each	12	$ 130	$ 1,560	Vendor Quote
23	6" X .432" Elbows - Gr B	Each	5	$ 105	$ 525	Vendor Quote
24	2" .218" Gr B, Pipe, Coated	Foot	150	$ 5	$ 750	Vendor Quote
25	8" CL600 Flange, gaskets and bolts	Each	5	$ 297	$ 1,485	Vendor Quote
26	8" CL900 Flange, gaskets and bolts	Each	7	$ 456	$ 3,192	Vendor Quote
27	6" CL600 Flanges, gaskets and stud bolts	Each	4	$ 212	$ 848	Vendor Quote
28	Pipe Lot & Misc.	Lot	20%	$ 1,266,480	$ 253,296	ENE Estimate
29	Allen Bradley PLC with Programming	Lot	1	$ 43,100	$ 43,100	
29	Freight for EMD Unit SKID	Lot	1.00	$ 75,000	$ 75,000	ENE Estimate Based on Previous Projects
30	Freight	Lot	7.0%	$ 1,562,876	$ 109,401	ENE Estimate Based on Previous Projects
31	**Shop Inspection for Equipment/Materials**	Each	6	$ 2,000.00	**$ 12,000**	ENE Estimate Based on Previous Projects
32	Sales Tax		6.0%	$ 2,712,876	$ 162,773	KY State Tax - Applies to All Counties
33						
34	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 3,072,050	$ 124,111	
35						
36	**INSTALLATION CONTRACTORS**				**$ 3,891,096**	
37	Station Construction - HP Installation Only	Lot	1	$ 3,500,000	$ 3,500,000	Includes all work to install all Equipment, Buildings, Conduit, Cable, Valves and Piping
38	SUBSTATION Work	Lot	1	$ 240,000	$ 240,000	ENE Estimate
39						
40	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 3,740,000	$ 151,096	
41						
42	**SURVEY AND STUDIES**				**$ 103,000**	
43	Professional Land Surveyor	Each	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
44	Geotechnical Survey	Each	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
45	Noise Study (Pre Design / Post Construction)	Each	2	$ 19,000	$ 38,000.00	Estimated by ENE
46	Piping Stress Analysis	Each	1	$ 36,500	$ 36,500.00	Quote from SWRI
47	Pulsation and Vibration Study	Each	1	$ 28,500	$ 28,500.00	Quote from SWRI
48	**LEGAL AND PUBLIC AFFAIRS**				**$ -**	

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
49	Legal Fees	Lot	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
50	Public Affairs and PR	Lot	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
51	**ENVIRONMENTAL**				**$ 25,000**	
52	Permits	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
53	Site Development & Erosion Control	Lot	1	$ 25,000	$ 25,000	Estimated by ENE
54						
55	**LAND / RIGHT-OF-WAY**				**$ -**	
56	Station Property Purchase - 1 Acres	Lot	0	$ 15,000	$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
57					$ -	
58	**ENGINEERING DESIGN**				**$ 740,050**	
59	Engineering Design	Lot	1	$ 645,000	$ 650,050	
60	PLC and Station Programming	Lot	1	$ 75,000	$ 75,000	**Programming Cost includes HP, Meters and Flow Control Valves**
61	PHA/Process Analysis	Lot	0	$ 10,000	$ -	
62	ENE Project Management Support		1	$ 15,000	$ 15,000	Estimated by ENE
63	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 868,050	$ 35,069	For Engineering, Land, Environmental, Legal/PR and Survey and Studies
64	**TOTAL PROJECT COSTS**				**$ 7,990,376**	
65						

Engineering Labor, Equipment and Material dollars used are in 2017 dollars.
Contract labor dollars used are in 2017 dollars.
***** Unit Cost or Value Provided by LG&E

CASE #9
Station Facilities Required to Pack 11 miles of 30” Pipeline to 1,000 psig Using Existing Compressor

Confidential Draft

PRELIMINARY COST ESTIMATE - LG&E GARRARD CO. COMPRESSOR STATION

PROJECT LG&E HP ADDITION **LOCATION** KY
Garrard Co. Compressor Station
CASE 9
EMD COMPRESSOR - Existing ONLY **DATE** January 25, 2017 **TYPE:** Detailed Cost Estimate

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**				**$ 35,417**	
2	3,100 + BHP EMD RECIP. COMPRESSOR PACKAGE	Each	0	$ 1,150,000	$ -	Includes Suction Scrubber and Pulsation Bottles - Based on quotes From 3 Vendors, Averaged
3	Transformers	Each	0		$ -	
4	Elect/Control Building -Prefabed Skidded 13' x 35' w 14' Eve	Each	0	$ 200,000	$ -	Based on Previous ENE Project done in 2015
5	Canopy for EMD Unit - 20' x 40' w 16' Eve	Each	0	$ 55,000	$ -	Based on SISCORP Budgetary Quote
6	Gas Cooler	Lot	0	$ 112,000	$ -	Quotes from Tekfins and Harsco - Averaged
7	Motor Starter for 3,100 HP Unit	Each	0		$ -	
8	MCC Equipment and Switchgear	Lot	0		$ -	
9	8" CL600 Ball Valve, w/ Actuator Unit	Each	1	$ 14,500	$ 14,500	Vendor Quote
10	6" CL600 Ball Valve, w/ Actuator Unit	Each	0	$ 12,500	$ -	Vendor Quote
11	2" CL600 Ball Valves	Each	1	$ 1,900	$ 1,900	Vendor Quote
12	6" CL600 Swing Check Valve Unit	Each	0	$ 3,500	$ -	Vendor Quote
13	2" CL600 Unit Suction Valve ByPass Valve	Each	1	$ 1,900	$ 1,900	Vendor Quote
14	3" CL 600 Blowdown Valve w/Actuator	Each	0	$ 8,700	$ -	Vendor Quote
15	4" CL 600 Ball Valve with Gear	Each	0	$ 3,500	$ -	Vendor Quote
16	2" CL 600 Control valve	Each	0	$ 5,300	$ -	Quote from Fisher
17	8" .500" Gr. B, Coated Pipe	Foot	100	$ 42	$ 4,200	Vendor Quote
18	6" .432" Gr. B, Coated Pipe	Foot	0	$ 27	$ -	Vendor Quote
19	8" X .500" Elbows - Gr B	Each	6	$ 130	$ 780	Vendor Quote
20	6" X .432" Elbows - Gr B	Each	0	$ 105	$ -	Vendor Quote
21	2" .218" Gr B, Pipe, Coated	Foot	45	$ 5	$ 225	Vendor Quote
22	8" CL600 Flange, gaskets and bolts	Each	4	$ 297	$ 1,188	Vendor Quote
23	8" CL900 Flange, gaskets and bolts	Each	0	$ 456	$ -	Vendor Quote
24	6" CL600 Flanges, gaskets and stud bolts	Each	0	$ 212	$ -	Vendor Quote
25	Misc. Pipe, Valves, Instruments and Electrical Equipment	Lot	22%	$ 24,693	$ 5,432	ENE Estimate
26						
26	Freight for EMD Unit SKID	Lot	0.00	$ 75,000	$ -	ENE Estimate Based on Previous Projects
27	Freight	Lot	7.0%	$ 30,125	$ 2,109	ENE Estimate Based on Previous Projects
28	**Shop Inspection for Equipment/Materials**	Each	0	$ 2,000.00	**$ -**	ENE Estimate Based on Previous Projects
29	Sales Tax		6.0%	$ 30,125	$ 1,808	KY State Tax - Applies to All Counties
30						
31	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 34,042	$ 1,375	
32						
33	**INSTALLATION CONTRACTORS**				**$ 81,151**	
34	Station Construction - HP Installation Only	Lot	1	$ 78,000	$ 78,000	Includes work to install all Valves and Piping
35	SUBSTATION Work	Lot	1		$ -	
36						
37	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 78,000	$ 3,151	
38						
39	**SURVEY AND STUDIES**				**$ -**	
40	Professional Land Surveyor	Each	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
41	Geotechnical Survey	Each	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
42	Noise Study (Pre Design / Post Construction)	Each	0		$ -	
43	Piping Stress Analysis	Each	0		$ -	
44	Pulsation and Vibration Study	Each	0		$ -	
45	**LEGAL AND PUBLIC AFFAIRS**				**$ -**	
46	Legal Fees	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
47	Public Affairs and PR	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
48						
49	**ENVIRONMENTAL**				**$ -**	

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
50	Permits	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
51	Site Development & Erosion Control	Lot	0		$ -	
52						
53	**LAND / RIGHT-OF-WAY**				**$ -**	
54	Station Property Purchase	Lot	0		$ -	None Required
55					$ -	
56	**ENGINEERING DESIGN**				**$ 75,400**	
57	Engineering Design	Lot	1	$ 40,000	$ 40,000	
58	PLC and Station Programming	Lot	1	$ 35,000	$ 35,000	**Programming Cost includes HP, Meters and Flow Control Valves**
59	PHA/Process Analysis	Lot	0	$ 10,000	$ -	
60	ENE Project Management Support	Lot	1	$ 400	$ 400	
61	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 75,400	$ 3,046	For Engineering, Land, Environmental, Legal/PR and Survey and Studies
62	**TOTAL PROJECT COSTS**				**$ 195,014**	
63						

Engineering Labor, Equipment and Material dollars used are in 2017 dollars.
Contract labor dollars used are in 2017 dollars.
***** Unit Cost or Value Provided by LG&E

CASE #10
Station Facilities Required to Pack 11 miles of 30” Pipeline to 1,450 psig Using New and Existing Compressors

Confidential Draft

PRELIMINARY COST ESTIMATE - LG&E GARRARD CO. COMPRESSOR STATION

PROJECT LG&E HP ADDITION **LOCATION** KY
Garrard Co. Compressor Station
CASE 10
EMD COMPRESSOR - New Plus Existing Unit **DATE** January 25, 2017 **TYPE:** Detailed Cost Estimate

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
1	**MATERIAL**				**$ 2,835,966**	
2	2,300 + BHP EMD RECIP. COMPRESSOR PACKAGE	Each	1	$ 885,000	$ 885,000	Includes Suction Scrubber and Pulsation Bottles -
3	Transformer-Substation 5,000KVA 69KV/4.16KVAC 3Phase	Each	1	$ 220,000	$ 220,000	
4	Transfomer - 75 KVA 4.16KV/480 VAC	Each	1	$ 15,000	$ 15,000	
5	Substation Structures and Materials	Lot	1	$ 182,000	$ 182,000	
6	Voltage Regulator - 5KV 1200A	Each	3	$ 10,000	$ 30,000	
7	Elect/Control Building -Prefabed Skidded 13' x 35' w 14' Eve	Each	1	$ 200,000	$ 200,000	Based on Previous ENE Project done in 2015
8	Canopy for EMD Unit - 20' x 40' w 16' Eve	Each	1	$ 55,000	$ 55,000	Based on SISCORP Budgetary Quote
9	Gas Cooler	Lot	1	$ 96,000	$ 96,000	Quotes from Tekfins and Harsco - Averaged
10	480/120 VAC 5kw UPS Package	Each	1	$ 10,000	$ 10,000	
11	MCC Equipment, Motor Starter and Switchgear	Lot	1	$ 330,000	$ 330,000	
12	8" CL600 Ball Valve, w/ Actuator Unit	Each	1	$ 14,500	$ 14,500	Vendor Quote
13	6" CL600 Ball Valve, w/ Actuator Unit	Each	1	$ 12,500	$ 12,500	Vendor Quote
14	2" CL600 Ball Valves	Each	3	$ 1,900	$ 5,700	Vendor Quote
15	6" CL600 Swing Check Valve Unit	Each	2	$ 3,500	$ 7,000	Vendor Quote
16	2" CL600 Unit Suction Valve ByPass Valve	Each	1	$ 1,900	$ 1,900	Vendor Quote
17	3" CL 600 Blowdown Valve w/Actuator	Each	1	$ 8,700	$ 8,700	Vendor Quote
18	4" CL 600 Ball Valve with Gear	Each	1	$ 3,500	$ 3,500	Vendor Quote
19	2" CL 600 Control valve	Each	2	$ 5,300	$ 10,600	Quote from Fisher
20	8" .500" Gr. B, Coated Pipe	Foot	200	$ 42	$ 8,400	Vendor Quote
21	6" .432" Gr. B, Coated Pipe	Foot	160	$ 27	$ 4,320	Vendor Quote
22	8" X .500" Elbows - Gr B	Each	12	$ 130	$ 1,560	Vendor Quote
23	6" X .432" Elbows - Gr B	Each	5	$ 105	$ 525	Vendor Quote
24	2" .218" Gr B, Pipe, Coated	Foot	150	$ 5	$ 750	Vendor Quote
25	8" CL600 Flange, gaskets and bolts	Each	5	$ 297	$ 1,485	Vendor Quote
26	8" CL900 Flange, gaskets and bolts	Each	7	$ 456	$ 3,192	Vendor Quote
27	6" CL600 Flanges, gaskets and stud bolts	Each	4	$ 212	$ 848	Vendor Quote
28	Misc. Pipe, Valves, Instruments and Electrical Equipment	Lot	20%	$ 1,223,480	$ 244,696	ENE Estimate
29	Allen Bradley PLC with Programming	Lot	1	$ 43,100	$ 43,100	
29	Freight for EMD Unit SKID	Lot	1	$ 68,000	$ 68,000	ENE Estimate Based on Previous Projects
30	Freight	Lot	7.0%	$ 1,511,276	$ 105,789	ENE Estimate Based on Previous Projects
31	**Shop Inspection for Equipment/Materials**	Each	6	$ 2,000.00	**$ 12,000**	ENE Estimate Based on Previous Projects
32	Sales Tax		6.0%	$ 2,396,276	$ 143,777	KY State Tax - Applies to All Counties
33						
34	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 2,725,842	$ 110,124	
35						
36	**INSTALLATION CONTRACTORS**				**$ 3,809,321**	
37	Station Construction - HP Installation Only	Lot	1	$ 3,500,000	$ 3,425,000	Includes all work to install all Equipment, Buildings, Conduit, Cable, Valves and Piping
38	SUBSTATION Work	Lot	1	$ 236,400	$ 236,400	ENE Estimate
39						
40	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 3,661,400	$ 147,921	
41						
42	**SURVEY AND STUDIES**				**$ 103,000**	
43	Professional Land Surveyor	Each	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
44	Geotechnical Survey	Each	1		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
45	Noise Study (Pre Design / Post Construction)	Each	2	$ 19,000	$ 38,000.00	Estimated by ENE
46	Piping Stress Analysis	Each	1	$ 36,500	$ 36,500.00	Quote from SWRI
47	Pulsation and Vibration Study	Each	1	$ 28,500	$ 28,500.00	Quote from SWRI
48	**LEGAL AND PUBLIC AFFAIRS**				**$ -**	
49	Legal Fees	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
50	Public Affairs and PR	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**

LINE NUM.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	AMOUNT	COMMENTS
51	**ENVIRONMENTAL**				**$ 25,000**	
52	Permits	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
53	Site Development & Erosion Control	Lot	1	$ 25,000	$ 25,000	Estimated by ENE
54						
55	**LAND / RIGHT-OF-WAY**				**$ -**	
56	Station Property Purchase - 1 Acres	Lot	0		$ -	**NOTE: THE COST FOR THIS WORK IS INCLUDED IN PRICING FOR PIPELINE WORK**
57						
58	**ENGINEERING DESIGN**				**$ 735,000**	
59	Engineering Design	Lot	1	$ 645,000	$ 645,000	
60	PLC and Station Programming	Lot	1	$ 75,000	$ 75,000	**Programming Cost includes HP, Meters and Flow Control Valves**
61	ENE Project Management Support	Lot	1	$ 15,000	$ 15,000	Estimated by ENE
62	Cost Escalation Increase (2.0 % Inflation per year for 2 years)*	Lot	2.0%	$ 863,000	$ 34,865	For Engineering, Land, Environmental, Legal/PR and Survey and Studies
63	**TOTAL PROJECT COSTS**				**$ 7,543,152**	
64						

Engineering Labor, Equipment and Material dollars used are in 2017 dollars.
Contract labor dollars used are in 2017 dollars.
***** Unit Cost or Value Provided by LG&E

SECTION 6

ATTACHMENT #1
Cardno Statement of Work, Permit Table & Route Maps

Cardno
Shaping the Future

Statement of Work

The services to be provided by Cardno pertain to the proposed Horizontal Directional Drill (HDD) beneath Dix River, a 12 mile LG&E natural gas pipeline corridor and associated staging and temporary construction areas in Garrard County, Kentucky (the "Study Area"). The proposed pipeline will run along the existing LG&E 20" pipeline (EW Brown Gas Pipeline) in Garrard County, Kentucky for approximately 12 miles, (the "site"), as referenced in the attached map.

The total potential study area consists of approximately 425 acres to be surveyed within a 150 ft. buffer (300 ft. total corridor width) along the proposed route of the pipeline. This includes the HDD crossing, HDD stringing areas and small temporary construction staging areas. Based on the December 13, 2016 meeting and subsequent discussions, Cardno is providing the proposed scope of services below to assist EN Engineering and LG&E for the proposed construction of the HDD crossing of Dix River and the 12-mile, 20-inch pipeline. Costs have been separated in the HDD crossing and the 12 mile pipeline corridor due to the potential for these areas to be surveyed during separate mobilizations.

TASK 1: DELINEATION AND RTE SPECIES REVIEW

"Waters of the United States" Delineation

Cardno will complete a regulated waters' delineation since "waters of the U.S." are known to exist within the Study Area. If wetlands are found Cardno will use the procedure described in the U.S. Army Corps of Engineers' (Corps) "Wetland Delineation Manual (1987)" and the Corps "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Piedmont and Mountain Region (Version 2.0) 2010" to delineate the area(s). The wetland delineation procedure involves examining three technical criteria: soils, hydrology, and vegetation to determine if the wetland standards established by the Corps are present. Cardno will mark the waters boundaries on the Site using standard stakes and/or flagging. After provision of the survey, as described in Note below, Cardno will plot the waters boundary on the scaled site plan. The delineation report and documentation will include Routine Onsite Determination Method data forms, photographs of the waters, a site plan showing location of waters, and a detailed description of those areas. The report will also discuss the associated permitting and mitigation requirements for waters impacts. The fixed fee of the delineation includes all professional services, labor, travel and expenses.

Rare, Threatened and Endangered Species Habitat Assessment

Cardno will review the US Fish and Wildlife Service (USFWS) County listings of rare, threatened and endangered (RTE) species to document if any RTE species are known to occur. Field crews will familiarize themselves with the habitat requirements of RTE species identified in the USFWS review. Potential RTE species habitat that are observed during wetland delineation surveys will be recorded in field notes, recorded on the GPS, and documented with a photograph whenever possible. If the habitat within any given location appears to be well suited for the presence of RTE species, field crews will record this information in the field notes.

In addition to RTE species, specific attention will be paid to raptor stick nests. Observed nests will be mapped with a GPS data point. Species observed utilizing the nest will also be noted, if possible.

Cardno assumes that access to the entire Study Area has been cleared through the appropriate entities. In the event that access to the entire Study Area has not been cleared, Cardno will have to return to complete the field work at Cardno's standard hourly rates plus expenses.

Cardno
Shaping the Future

Statement of Work

TASK 1. DELINEATION AND RTE SPECIES REVIEW
FEE TYPE: COST PLUS
NOT-TO-EXCEED

PHASE A - Delineation and RTE Review HDD Crossing at Dix River: $15,400
PHASE B - Delineation and RTE Review 12 Mile Pipeline Corridor: $50,100

Note: These costs have been split into two phases (A & B) due to the understanding that the HDD crossing at Dix River and the entire 12 mile pipeline corridor may be authorized at different times.

Task 1 Assumptions:

- Client shall be responsible for the survey of marked boundary locations and transfer of staked and/or flagged locations to a scaled site plan. Client will provide the survey in a format compatible with AutoCAD Version 2013, if required.
- If Stake/flag of wetlands and streams is requested, these locations should be surveyed within 30-days following completion of fieldwork. In the event that the survey cannot be completed within 30-days and re-staking or re-flagging is necessary, Cardno will complete these services at Cardno's standard hourly rates plus expenses.
- Cardno will contact the U.S. Fish and Wildlife Service (Section 7) as part of the current contracted task, however no surveys for individual Endangered or listed species is part of this scope.
- Cardno assumes that access to the entire Study Area has been cleared through the appropriate entities. In the event that access to the entire Property has not been cleared, Cardno will have to return to complete the field work at Cardno's standard hourly rates plus expenses.
- If the project scope should differ from that specified in this proposal, then the costs would be modified to reflect those changes.

TASK 2: REGULATED "WATERS OF THE U.S." PERMITTING

Cardno will prepare and submit an application for a Section 404 Nationwide Permit (NWP 12) and Section 401 water quality certification from the Kentucky Division of Water (KDOW) as well as all required Pre-Construction Notification (PCN) materials to the U.S. Army Corps of Engineers – Louisville District, in order to seek approval for the placement of dredged and/or fill material into jurisdictional "Waters of the United States." Following submittal of the application, Cardno will act as Client's agent and track the application throughout the review process. This includes meetings, correspondence, telephone discussions, responses to requests for additional information or clarification, etc., and negotiation with the agency on Client's behalf. As necessary, Cardno will also coordinate the submittal of additional materials requested in response to the public review, if any, with the project engineer, Client and others. Agency fees for permit processing and mitigation fees (if required) for impacts to waters are not included in this scope but can be provided as an additional expense.

In addition to submitting permit applications to the USACE and KDOW Cardno will also coordinate and submit necessary local floodplain permits for those waters crossed by the project that are regulated by the local floodplain administrator.

TASK 2. REGULATED "WATERS OF THE U.S." PERMITTING
FEE TYPE: COST PLUS
NOT TO EXCEED: $21,250.00

Task 2 Assumptions:

- In order to process applications under Section 404, the Corps must coordinate with agencies under Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act. In order to expedite the permit approval process, Cardno will contact the U.S. Fish and Wildlife Service (Section 7) and the State Historic Preservation Office (SHPO - Section 106) to initiate federal nexus coordination prior to submitting an application to the Corps.
- In order to complete this task, Client and/or Client's Engineer will need to provide Cardno with a "Waters of the U.S." Impact Plan showing project boundaries, layout and the nature of anticipated impacts on a scaled site plan.
- Please note that the scope and cost of this contract are based on Cardno's assumption that proposed activities will satisfy requirements and conditions of appropriate nationwide permits rather than an individual permit from USACE.
- If the project scope should differ from that specified in this proposal, then the costs would be modified to reflect those changes. However, this cost estimate will not be exceeded unless unexpected conditions are encountered or the scope of the project is changed significantly. The revisions in the work effort will be billed at the rates in our fee schedule.
- If mitigation is required for impacts to regulated waters; Cardno anticipates the client will purchase credits through the In-Lieu Fee (ILF) Program vs. developing permittee-responsible, or project specific mitigation plans. Client shall be responsible for the purchase of all required mitigation credits.
- Cardno will regularly contact and coordinate with the representatives of the permitting agencies to facilitate the permitting process. However, submitting an application cannot be construed as a guarantee that a permit will be issued.
- Please note that the scope and cost of this contract are based on Cardno's assumption that proposed activities will satisfy requirements and conditions of appropriate nationwide permits rather than an individual permit from USACE.

TASK 3: CULTURAL RESOURCE SURVEYS

Task 3A. Cultural Resources Services for HDD Crossing at Dix River

Cardno will conduct cultural resource survey within the proposed project corridor in support of the clients need for a United States Corp of Engineers (USACE) nationwide permit application. This proposed undertaking will also conform to the Kentucky State Historic Preservation Office (SHPO) *Specifications for Conducting Fieldwork and Preparing Cultural Resource Assessment Reports*. The proposed scope of work includes costs for a Background Literature Review of the entire 12-mile-long corridor as well as a full Phase I Archaeological Reconnaissance of the HDD and associated ancillary work areas. A broader literature review will assist in directing the work within

the HDD area as well as providing and understanding for the planning of the broader rerouted corridor.

Phase I Literature Review - Cardno will conduct a background literature review to document previously identified cultural and archaeological resources, surveys, and reports relevant to the project area, within a one-mile buffer surrounding the project corridor. This research will allow for documentation of significant cultural resources that have been reported in or near the project area and to anticipate the types of unidentified cultural resources that may be present. The entire corridor will be investigated in order to identify previously recorded resources and high probability areas. Results of this review will be presented within the Phase I archaeological report completed for the investigations of the HDD area.

HDD Phase I Reconnaissance - Cardno recommends a Phase I archaeological survey of the HDD area to ensure that archaeological resources are addressed within the permit application. Cardno will employ appropriate fieldwork methods according to Kentucky SHPO guidelines for the HDD area that will include the survey of a 300-foot-wide corridor from the existing pipeline to the proposed HDD staging area, the survey of a 75-foot-wide by 3800-foot-long temporary pipe string workspace, and limited testing of six bore hole locations proposed within the direct drill section of the corridor. No testing is proposed within the direct drill section of the corridor outside of the six proposed bore locations. If an archaeological site is identified, Cardno's field crew will record the site location, as well as relevant landscape features, with a GPS unit capable of sub-meter accuracy. Cardno will take photographs and maintain field notes to document the nature of the project area and recorded cultural resources. Cardno will submit an archaeological site record for any recorded resources. Cardno assumes that during the reconnaissance fieldwork that no more than 2 archaeological sites will be identified.

Analysis and Curation - All recovered archaeological material will be processed at Cardno's archaeological laboratory. Cardno will work with property owners to either return all artifacts collected during the survey to them or complete an agreement to curate any recovered archaeological material at a facility acceptable to the client. Cardno assumes that the amount of archaeological material will not fill more than three (3) standard Hollinger curation box (15" x 12.5" x 10"). For the purposes of this proposal, we assume the client will provide Cardno with landowner contact information to facilitate the curation process.

Technical Report of Investigations - A draft technical report will be submitted to the client within approximately four weeks following completion of field survey. The report will include the results of the records check, field methods, results, analysis, and recommendations. Cardno will assess the significance of each recorded archaeological sites according to the eligibility criteria for listing in the NRHP. Exhibits attached to the report will include site location maps and images. Cardno will produce electronic copies of the draft Phase I report and submit to the client for review. Following receipt of comments from the client, Cardno will prepare one (1) hard copy of a draft technical report. This report would be sent to the USACE Louisville District and Kentucky SHPO for review; Cardno will coordinate with the client during this process. Cardno assumes a 30 days comment period. Following receipt of any comments, Cardno will prepare and submit one (1) copy of the final Phase I report, and a CD containing an electronic copy of the report. Cardno will forward a letter concurring with the findings and recommendations of the survey upon receipt of this letter from the USACE and SHPO.

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Statement of Work

TASK 3A: CULTURAL RESOURCES SERVICES FOR HDD CROSSING AT DIX RIVER
HDD at Dix River Phase I Archaeological Reconnaissance
FEE TYPE: COST PLUS
NOT TO EXCEED: $20,430.00

Note: These costs have been split into two parts (3A & 3B) due to the understanding that the HDD crossing at Dix River and the entire 12 mile pipeline corridor may be authorized at different times.

Task 3A Assumptions:

- The literature review, including the entire 12-mile-long corridor, will be completed prior to initiating Phase I fieldwork.
- A corridor width of 300 feet is assumed for the HDD project area, unless otherwise stipulated to Cardno.
- Up to 430 shovel test probes will be excavated during the Phase I Archaeological Reconnaissance.
- Testing will not be required within the direct drill portion of the project outside of those areas stipulated above. If USACE or SHPO require testing within this portion of the project, additional fees may be necessary.
- Cardno assumes up to 6 acres of temporary staging area associated with the pipe stringing workspace will be included in this Phase I Archaeological Reconnaissance.
- Reasonable access and property owner permission for project corridor access is assured.
- The project boundaries are marked in the field or clearly evident to the field team.
- Conducive weather conditions, i.e. no heavy rain, snow, or frozen ground.
- 811 clearance (call before you dig) will not be required prior to the initiation of field work.
- No more than 2 archaeological sites will be identified.
- The recordation of additional archaeological sites will be completed under a separate cost of $1,500.00 per site.
- Mechanical auger or deep testing is outside of the current scope.
- Phase II evaluation and/or Phase III mitigation is outside of the current scope.
- This proposal does not include Tribal consultation or inventory of properties of religious and cultural significance (including TCP's).
- Recovered archaeological material will be limited to no more than 50 artifacts and will fill no more than 1 standard Hollinger curation box (15" x 12.5" x 10").
- The client will provide Cardno with landowner contact information for artifact curation.
- The project area does not traverse any federal land and an ARPA permit will not be required.

Task 3B. Cultural Resources Services 12 Mile Pipeline Corridor

Phase I Archaeological Reconnaissance - Cardno will conduct cultural resource services within the proposed project corridor in support of the clients need for a United States Corp of Engineers (USACE) nationwide permit application. This proposed undertaking will also conform to the Kentucky State Historic Preservation Office (SHPO) *Specifications for Conducting Fieldwork and Preparing Cultural Resource Assessment Reports*. The proposed scope of work includes costs for a full Phase I Archaeological Reconnaissance of the entire 12-mile-long corridor and associated ancillary work areas.

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Statement of Work

Phase I Literature Review - Cardno will conduct a background literature review to document previously identified cultural resources, surveys, and reports relevant to the project area, within a one-mile buffer surrounding the project corridor. This research will allow for documentation of significant cultural resources that have been reported in or near the project area and to anticipate the types of unidentified cultural resources that may be present. The entire corridor will be investigated in order to identify previously recorded resources and high probability areas. Results of this review will inform the planning for the preceding Phase I reconnaissance.

Phase I Reconnaissance - Cardno recommends a Phase I archaeological survey of the project corridor to ensure that archaeological resources are addressed within the permit application. Cardno will employ appropriate fieldwork methods in accordance with Kentucky SHPO guidelines. The survey will include approximately 12 miles of 300-foot-wide corridor that follows the existing pipeline to the proposed HDD staging area. The proposed survey also includes up to 16 acres of temporary workspaces related to the construction and storage of equipment for the pipeline, and limited testing of six bore hole locations proposed within the direct drill section of the corridor. No testing is proposed within the direct drill section of the corridor outside of the six proposed bore locations. If an archaeological site is identified, Cardno archaeologists will record the site location, as well as relevant landscape features, with a GPS unit capable of sub-meter accuracy. Cardno will take photographs and maintain field notes to document the nature of the project area and recorded cultural resources. Cardno will submit an archaeological site record for recorded resources. Cardno assumes that during the reconnaissance fieldwork that no more than 15 archaeological sites will be identified.

Analysis and Curation - All recovered archaeological material will be processed at Cardno's archaeological laboratory. Cardno will work with property owners to either return all artifacts collected during the survey to them or complete an agreement to curate any recovered archaeological material at a facility acceptable to the client. Cardno assumes that the amount of archaeological material will not fill more than three (3) standard Hollinger curation box (15" x 12.5" x 10"). For the purposes of this proposal, we assume the client will provide Cardno with landowner contact information to facilitate the curation process.

Technical Report of Investigations - A draft technical report will be submitted to the client within approximately six weeks following completion of field survey. The report will include the results of the records check, field methods, results, analysis, and recommendations. Cardno will assess the significance of each recorded archaeological site according to the eligibility criteria for listing in the NRHP. Exhibits attached to the report will include site mapping and images. Cardno will produce electronic copies of the draft Phase I report and submit to the client for review. Following receipt of comments from the client, Cardno will prepare one (1) hard copy of a draft technical report. This report would be sent to the USACE Louisville District and Kentucky SHPO for review; Cardno will coordinate with the client during this process. Cardno assumes a 30 days comment period. Following receipt of any comments, Cardno will prepare and submit one (1) copy of the final Phase I report, and a CD containing an electronic copy of the report. Cardno will forward a letter concurring with the findings and recommendations of the survey upon receipt of this letter from the USACE and SHPO.

TASK 3B: CULTURAL RESOURCES SERVICES 12 MILE PIPELINE CORRIDOR
12 Mile Pipeline Corridor Phase I Archaeological Reconnaissance
FEE TYPE: COST PLUS
NOT TO EXCEED: $60,700.^{00}

Note: These costs have been split into two parts (3A & 3B) due to the understanding that the HDD crossing at Dix River and the entire 12 mile pipeline corridor may be authorized at different times.

Task 3B Assumptions:

- The literature review will be completed prior to initiating Phase I fieldwork.
- A corridor width of 300 feet is assumed for the entire project, unless otherwise stipulated to Cardno.
- Up to 2,000 shovel test probes will be excavated during the Phase I Archaeological Reconnaissance.
- Testing will not be required within the direct drill portion of the project outside of those areas stipulated above. If USACE or SHPO require testing within this portion of the project, additional fees may be necessary.
- Cardno assumes up to 16 acres of temporary workspace, including the pipe stringing workspace associated with HDD area, staging/ laydown yards, and temporary access roads.
- Reasonable access and property owner permission for project corridor access is assured.
- The project boundaries are marked in the field or clearly evident to the field team.
- Conducive weather conditions, i.e. no heavy rain, snow, or frozen ground.
- 811 clearance (call before you dig) will not be required prior to the initiation of fieldwork.
- No more than 15 archaeological sites will be identified.
- The recordation of additional archaeological sites will be completed under a separate cost of $1,500.00 per site.
- Mechanical auger or deep testing is outside of the current scope.
- Phase II evaluation and/or Phase III mitigation is outside of the current scope.
- This proposal does not include Tribal consultation or inventory of properties of religious and cultural significance (including TCP's).
- Recovered archaeological material will be limited to no more than 375 artifacts and will fill no more than 3 standard Hollinger curation box (15" x 12.5" x 10").
- The client will provide Cardno with landowner contact information for artifact curation.
- The project area does not traverse any federal land and an ARPA permit will not be required.
-

TASK 4. HISTORY/ARCHITECTURE INVESTIGATION

If required by the USACE, Cardno will conduct a History/Architecture investigation for the proposed project to meet the client's needs and conform to Kentucky SHPO guidelines. For the purposes of this proposal we assume no more than 20 discrete properties will require History/Architecture investigation. Based on aerials and preliminary background information, the project area may contain properties that will require review under Section 106 of the National Historic Preservation Act (NHPA) (36 CFR Part 800). Currently, the NRHP eligibility of these structures is unknown. Cardno will identify historic architectural resources that may be eligible for the National Register of Historic Places (NRHP) and determine the proposed project's effects on any NRHP-eligible resources.

Background Research - Prior to conducting the fieldwork, Cardno will perform background research to identify architectural resources that are potentially eligible as historic properties. Research will focus on using historic maps and aerials as well as the county assessor's website, a review of SHPO databases, and other local repositories to identify known properties eligible for the National Register of Historic Places (NRHP) and other resources that based upon their construction date may be eligible for the NRHP.

History/Architecture Fieldwork
After completing the research, Cardno will conduct fieldwork to identify historic architectural resources within the APE. During the fieldwork, Cardno will gather data (field notes and photographs) necessary for identification and evaluation of the resources in order to prepare the HPR. One field crew will be utilized for the historic architecture survey.

History/Architecture Report - Cardno will prepare the History/Architecture Report based on the data obtained during the history/architecture investigation. Cardno will identify resources that may be eligible for the NRHP within the APE, as well as the proposed project's effects on any NRHP-eligible resources. At this time it is assumed the project's APE will contain fewer than 20 above-ground historic resources 50 years or older, that retain enough integrity to be inventoried and evaluated for NRHP eligibility. Cardno will ensure that all statutory and policy requirements are met.

A draft report will be submitted to the client within approximately 4-6 weeks following completion of field survey. The report will include the results of the records check, field methods, results, analysis, and recommendations. Cardno will assess the significance of each recorded architectural resource according to the eligibility criteria for listing in the NRHP. Exhibits attached to the report will include site location maps and images. Cardno will produce electronic copies of each draft history/architecture report and submit to the client for review. Following receipt of comments from the client we will prepare one (1) hard copy of a draft report. This report should be sent to the USACE Louisville District and the Kentucky SHPO for review as appropriate; Cardno will coordinate with the client during this process. Cardno assumes a 30 day comment period. Following receipt of any comments, Cardno will prepare and submit one (1) copy of the final history/architecture report, and a CD containing an electronic copy of the report. Cardno will forward a letter concurring with the findings and recommendations of the survey upon receipt of this letter from the SHPO.

TASK 4: HISTORY/ARCHITECTURE INVESTIGATION
FEE TYPE: COST PLUS
NOT TO EXCEED: $15,500.00

Task 4 Assumptions:

- The APE will consist of a 500-foot corridor extending 250 feet on each side from the centerline.
- Fieldwork will not commence until the APE is defined by the USACE and KYSHPO has had the opportunity to provide input.
- No more than 20 discrete historic properties will require investigation.
- Cardno will identify parcels of land that will be impacted by the proposed project. Prior to initiating and conducting any field studies, Notice of Survey (NOS) letters will be sent to identified property owners by the client on Cardno's behalf notifying them of the intent to

enter their property to conduct the necessary environmental investigations. Cardno will not be responsible for the NOS.
- Not more than a total of 20 buildings will be identified and documented.
- A full report detailing context, methods, findings, and recommendations for historic properties will be prepared.
- Individual state survey forms will be completed as part of the Historic Property Report.
- Scope and fee include associated GIS work.

TASK 5 GEOTECHNICAL TEST BORINGS AND ASSOCIATED LABORATORY TESTING AT HDD CROSSING AT DIX RIVER

Soil/Rock Test Borings - Cardno will subcontract ATC Group Services to complete the requested Geotechnical Borings at the proposed HDD crossing at Dix River. At the HDD site, six (6) test borings have been requested, varying from 175 to 410 feet deep.

Cardno / ATC has made the following assumptions regarding these borings in deriving the budget estimate for this work:

- All boring locations are easily accessible to a truck-mounted drill rig
- No site-specific training or classes are required by the owner and there will be no undue delays in accessing the borings
- There will be no limit on work hours
- An average of 10 feet of soil overburden at the boring locations
- NQ2 rock core size
- Offsite disposal of drill spoil and fluids will not be required
- Waxed cardboard rock core boxes will be utilized.
- An unconfined compression strength or point-load strength test (which will then be correlated to a compression strength) will be performed for every 25 feet of rock core. We propose approximately an equal number of each test.

At the Launcher Station, located about 10 miles south of the HDD site, four (4) 40-foot deep borings have been requested. The assumptions made for this site are:

- All boring locations are easily accessible to a truck-mounted drill rig
- No site-specific training or classes are required by the owner and there will be no undue delays in accessing the borings
- There will be no limit on work hours
- Offsite disposal of drill spoil and fluids will not be required
- If refusal on apparent bedrock occurs before 40 feet deep, the boring will be terminated and no rock cored
- Laboratory test quantities as follows:
  - 40 moisture content
  - 2 one-dimensional consolidation tests
  - 8 soil classifications (Atterberg Limits plus grain size analyses)
  - 4 unconfined compression tests on thin-walled (Shelby) tube soil samples

- o 20 hand penetrometer tests

Deliverables for both sites will be test boring logs, laboratory test result reports, and a brief written narrative describing the work performed and findings of the exploration and testing. The boring logs will include the soil and rock classifications and stratigraphy, results of Standard Penetration Tests, rock core and soil sample recoveries, rock RQD values and groundwater observations. The provision of engineering design recommendations or engineering designs themselves are not included in this scope of work.

TASK 5: GEOTECHNICAL TEST BORINGS AND ASSOCIATED LABORATORY TESTING AT HDD CROSSING AT DIX RIVER
FEE TYPE: FIXED FEE
FIXED FEE: $99,400.^{00}

TASK 6 GEOPHYSICAL SURVEYS AT HDD CROSSING AT DIX RIVER

Geophysical Surveys - Cardno will use ATC Group Services as a subcontractor to complete the requested Geophysical surveys at the proposed HDD crossing at Dix River. The challenge for projects is to select the correct non-intrusive tools and techniques to evaluate the karst features and depth to bedrock. In general, a variety of geophysical techniques can be applied to the mapping of subsurface features; however, certain methods, sensitive to a range of contrasting physical properties, can have attributes that make them more suitable than others depending on the site-specific conditions. Contrasting physical properties that typically are found to be useful for mapping karst, soil and bedrock include electrical conductivity or resistivity, acoustic velocity, density, and magnetic susceptibility. Of these, two candidates meet the criteria, electrical resistivity and ground penetrating radar (GPR Plus). Electrical resistivity and GPR Plus are commonly found to have the greatest range of contrast, and are most applicable for detailed characterization of Karst sites. Given the desired depth of penetration (approximately 400 feet), and the desire to image both the lateral and vertical extent of possible features, two-dimensional electrical resistivity (2-D ER) and/or GPR Plus would be selected as the method of choice to document the soil-sediment-rock profile beneath the site. Note that ER and GPR+ can be conducted across water features.

While seismic methods such as reflection and refraction are viable methods for deeper studies, the resolution of P-wave used in these methods can miss smaller scale features and are not able to image low velocity zones at depth. Since its introduction in the late 1990s, use of surface wave techniques (i.e. Refraction Microtremor, or ReMi) have rapidly increased for two reasons: (1) they provide the shear-wave velocity (VS) of ground materials, which is one of the most important geotechnical parameters in civil engineering, and (2) they are easier to use than other common seismic approaches (e.g., refraction, reflection, and surface-wave surveys). Surface wave methods using Rayleigh waves have the ability to image low velocity zones such as subsurface voids as well as depth to bedrock and thus are a nice fit for this project.

The proposed Geophysical Studies for the HDD Crossing at Dix River are the following:

- Ground Penetrating Radar Survey
- Electrical Resistivity Survey

- Refraction Microtremor Survey

Reporting - The final locations of geophysical survey lines may be adjusted based on specific site features, roadways, the river and preliminary field data. Upon completion of the field work, data from the geophysical surveys will be analyzed using proprietary software to allow for interpretation of the subsurface characteristics in the study area. The geophysical survey results will be calibrated using the existing geotechnical data including depths of known subsurface features such as soil properties, depth to groundwater, and depth to bedrock (if encountered) in the vicinity of the survey lines. A final report will then be prepared documenting the geophysical surveying, data evaluation and interpretation of the results. The report will include conclusions and recommendations concerning the potential location and relative depth of depth to bedrock and existence of subsurface voids.

Schedule - The Geophysical survey is anticipated for up to three to four (3-4) days in the field to collect data for each method used for the project. A report will be generated for the clients review within three (3) weeks of the completion of field work.

Project Budget Estimate - Based on the assumptions and scopes of work described above and the unit and hourly pricing presented on the accompanying fee schedules, we recommend the following budget estimate be used for this project:

TASK 6 GEOPHYSICAL SURVEYS AT HDD CROSSING AT DIX RIVER
FEE TYPE: FIXED FEE

Task 6A - Ground Penetrating Radar Survey: $20,870
Task 6B - Electrical Resistivity Survey: $24,420
Task 6C - Refraction Microtremor Survey: $20,930

FIXED FEE TOTAL: $66,220

Task 6 Assumptions and Limitations:

- This study includes a limited set of geophysical readings across limited portions of the site. The results and interpretations of the geophysical survey performed are considered generally reliable and were conducted in a manner generally consistent with practitioners in the field of geophysical engineering. The methods used in this investigation are considered reliable; however, there localized variations may exist in the subsurface conditions that have not been completely defined at this time. The resistivity results are not unique to geological features and more than one geologic feature or model may give similar results. Therefore, properly conducted soil test borings and other exploratory techniques are necessary to more completely determine the subsurface conditions at the site. It is recommended that a practicing geosciences or geotechnical engineering professional be contacted prior to conducting verification drilling or excavating activities.

- Field work will be completed without any delays from weather (precipitation of any kind), project area access or any other site conditions that limit ability for field crews to complete the necessary tasks to collect data.

- The proposed path for the HDD crossing will be cleared of trees, understory brush or other debris that would limit the ability for geophysical equipment to be staged on the ground to collect data.

- Due to the extreme topographical change associated with Dix River this proposal assumes that repelling off the face of the cliff will not be required to collect the necessary data for this project. If the request for data collection down the face of the cliff is requested, this service can be provided at an additional cost due to the increased safety requirements and time necessary to complete the field work. This additional cost will be provided as a change order for approval prior to the initiation of this work.

- Unknown or unmarked utility lines can cause interference in the geophysical data collection and therefore reduce the accuracy in the analysis. Due to this interference from utility lines the proposed path for the HDD crossing will be free and clear of existing utility lines or existing utility lines will be located prior to the geophysical field crew is mobilized.

FEE SCHEDULE / SUMMARY OF COSTS

Table 1. Summary of Proposed Tasks for the Project

SCOPE OF SERVICES FOR THE PROPOSED LG&E GARRARD COUNTY PIPELINE PROJECT		
Task	**Description**	**Fixed Fee Cost[2]**
Task 1A[1]	Delineation and RTE Review HDD Crossing at Dix River	**$15,400**
Task 1B[1]	Delineation and RTE Review 12 Mile Pipeline Corridor	**$50,100**
Task 2	Regulated “Waters of the U.S.” Permitting	**$21,250**
Task 3A[1]	Cultural Resources Services for HDD Crossing at Dix River	**$20,430**
Task 3B[1]	Cultural Resources Services 12 Mile Pipeline Corridor	**$60,700**
Task 4	History/Architecture Investigation	**$15,500**
Task 5	Geotechnical Test Borings and Associated Laboratory Testing at HDD Crossing at Dix River	**$99,400**
Task 6A[3]	Geophysical at HDD Crossing at Dix River - Ground Penetrating Radar Survey	**$20,870**
Task 6B[3]	Geophysical at HDD Crossing at Dix River - Electrical Resistivity Survey	**$24,420**
Task 6C[3]	Geophysical at HDD Crossing at Dix River - Refraction Microtremor Survey	**$20,930**
Total		**$349,000**

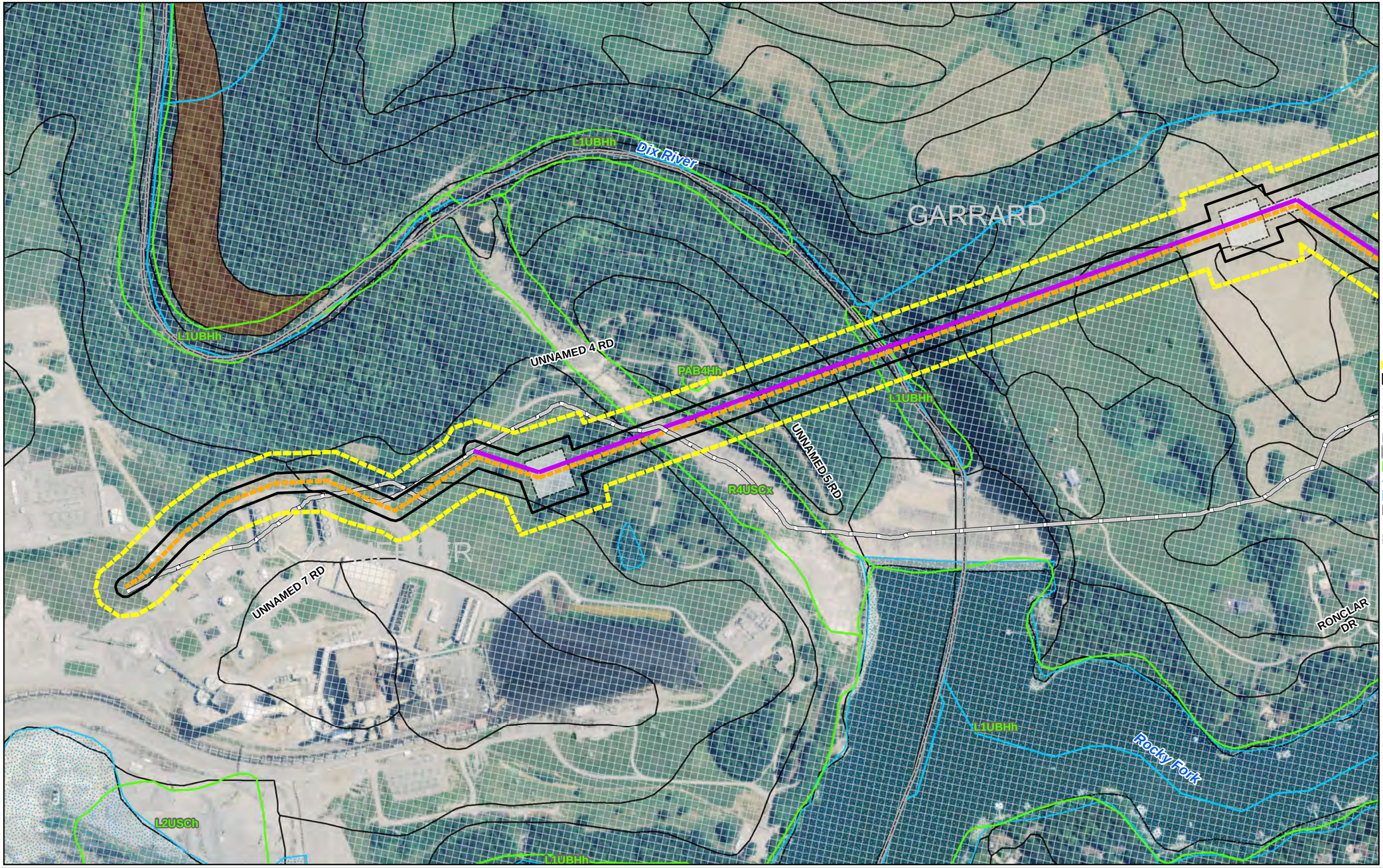
[1] – Task costs may be revised if entire project (i.e. HDD and 12 mile corridor) are surveyed at one time to limit associated mobilization costs assumed into these separate tasks.
[2] – Cardno understands that this project is being evaluated by LG&E and these estimated fixed fees may require adjustments based on the timeframe between the development of this scope of work and the award of the project.
[3] – Geophysical scope may be split per method described in the scope; however Cardno recommends multiple methods to gather information to address Karst concerns at proposed HDD crossing of Dix River.

Table 1. Potential Environmental Permits for the LG&E Natural Gas Transmission Pipeline Project

Agency	Permits/Reviews	Comments
Federal		
U.S. Army Corps of Engineers, Louisville District	USACE Clean Water Act (CWA) Section 404 Nationwide Permit (NWP) No. 12 if the total permanent impacts to wetlands are less than 0.5 acres at each wetland crossed. Need to determine if IP required. Section 10 River – determine if HDD has any issues with Dix River Removal of Pipeline within Dam – coordination needed with USACE/regulator of dam	Project goal is to stay within NWP thresholds; if impact exceed thresholds then an Individual Permit may be necessary. Dix River a non-Section 10 River; no Section 10 permit necessary. TBD – coordination with regulator of dam
U.S. Environmental Protection Agency, Region IV	NPDES – Stormwater Discharges from Construction Sites	Permitting authority delegated to state agencies in Kentucky.
U.S. Fish and Wildlife Service	Section 7 Endangered Species Act (ESA) Consultation for projects considered a federal action Clearance with no significant endangered species concerns "May Affect" determination by USFWS and Formal Section 7 Consultation	LG&E follow their existing Indiana bat & northern long-eared bat MOA with the USFWS for all tree clearing activities. (LGE confirmed to have MOA). Winter clearing preferred with potential need to purchase mitigation credits for acreage impacts to forested areas along route
U.S. Fish and Wildlife Service	Section 10 Endangered Species Act Consultation and Incidental Take Permits (If Needed)	
State of Kentucky		
Kentucky Heritage Council (KHC), State Historic Preservation Office (SHPO)	SHPO will review and comment on Project activities potentially affecting cultural resources, including Section 106 National Historic Preservation Act reviews.	Cultural survey necessary to document previously disturbed and identify any unknown resources within project construction limits to address Section 106.
Kentucky Department of Fish and Wildlife Resources (KDFWR)	Review and comment on State-listed threatened and endangered species.	
Commonwealth of Kentucky, Department for Environmental Protection (KDEP), Division of Water (DOW)	CWA Section 401 Water Quality Certification Kentucky Pollutant Discharge Elimination System (KPDES) General Permit for Stormwater Construction Permit to Construct Across or Along a Stream (needs research) Temporary Authorization to Withdraw Water Permit (Needs research) Hydrostatic Testing Wastewater Discharge Permit (Form 1 and Form SC)	Required for CWA Section 404 Individual Permit approval by USACE. If Needed. Preparation of a Stormwater Pollution Prevention Plan (SWPPP) is required. After review of Form 1 and Form SC, KYDES will provide feedback on what specific wastewater discharge permits are needed for the project, if any.

Table 1. Potential Environmental Permits for the LG&E Natural Gas Transmission Pipeline Project

Agency	Permits/Reviews	Comments
Kentucky Transportation Cabinet (KYTC) Local Municipality Roadway Engineering Offices	Encroachment/Road Crossing Permit - TBD	TBD
Local		
Local Municipalities, Kentucky, The Department of Public Works and Assets	Right-of-Way Permit	TBD
County SCD	Site Disturbance Permit Permit to Develop/Repair in a Floodplain	Requires the preparation of a detailed Erosion Prevention and Sediment Control Plan (EPSC) and a completed EPSC detailed construction plan checklist. A pre-construction site meeting and a site performance disturbance bond may be required. A "Notice of Construction" is filed upon approval of the EPSC detailed construction plan.
Local Floodplain Coordinators	Points of Contact Garrard County: Timothy Scott Mercer County: Shawn Moore	Garrard Co.: Provide same information from NWP application to County for review. Mercer Co.: requirements to be determined



Legend

- Proposed Survey Corridor (150ft Buffer) 1/5/17
- Proposed Construction Corridor (50ft Buffer) 1/5/17
- Existing 20in Pipe
- Proposed 20in Pipe
- Proposed 30in Pipe
- Addtional Temporary Workspace
- County
- NWI
- NHD Flowline
- NHD Waterbody
- Soil Delineation
- Hydric Soil
- Karst Area (Carbonate)

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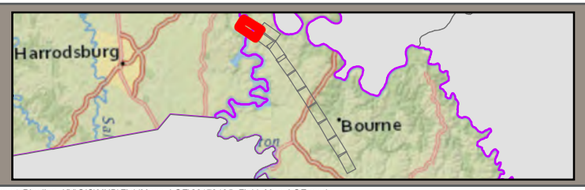

Field Map
LG&E Pipeline
EN Engineering
Garrard and Mercer Counties, Kentucky

1 in = 500 feet

0 250 500 1,000 Feet

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Project No. 16Z440800

Date: 1/25/2017

Date Created: 1/25/2017 Date Revised: 1/25/2017 File Path: R:\Projects\16\16Z\16Z440800_ENEngineering_LG&EGarrardCountyPipeline_KY\GIS\MXD\FieldMaps_LGE\20170105_Field_Map_LGE.mxd

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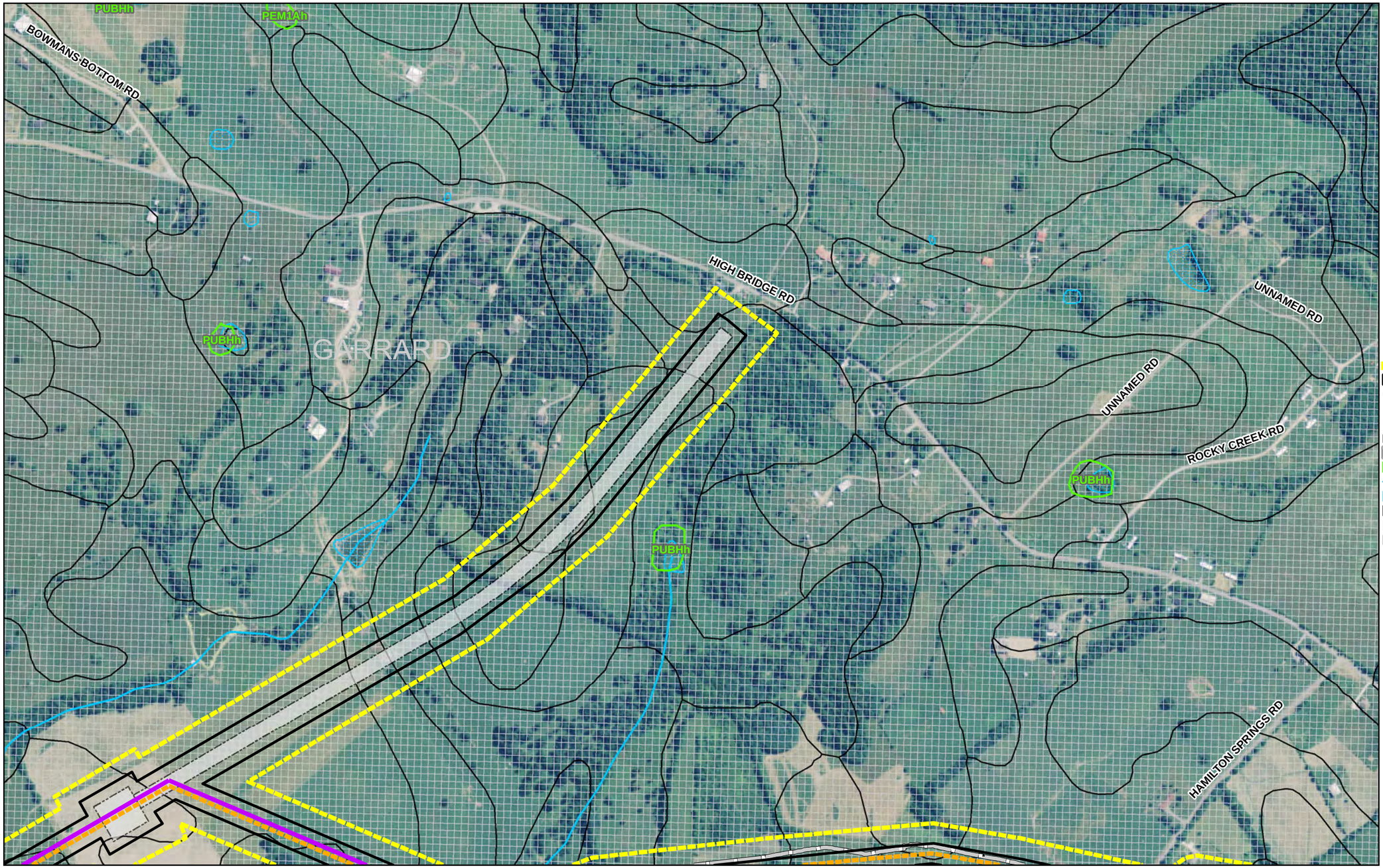

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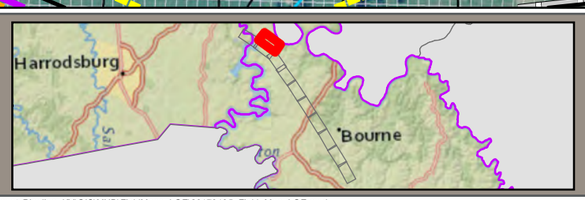

Field Map
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EN Engineering
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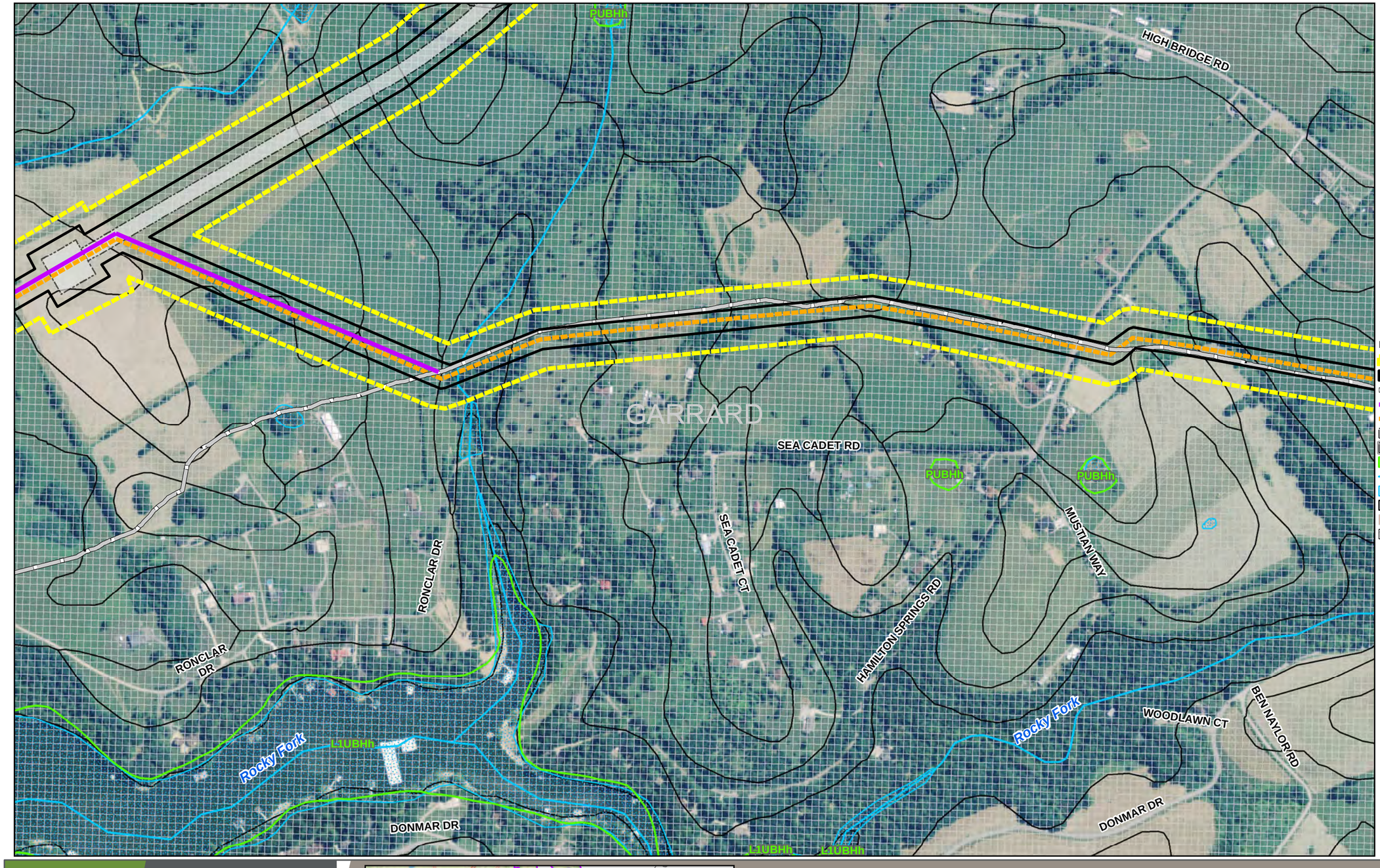

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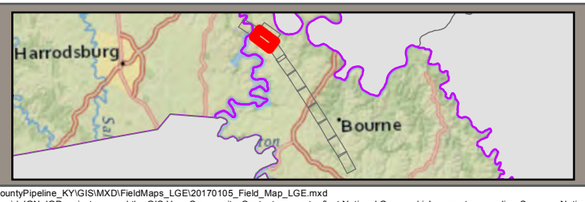

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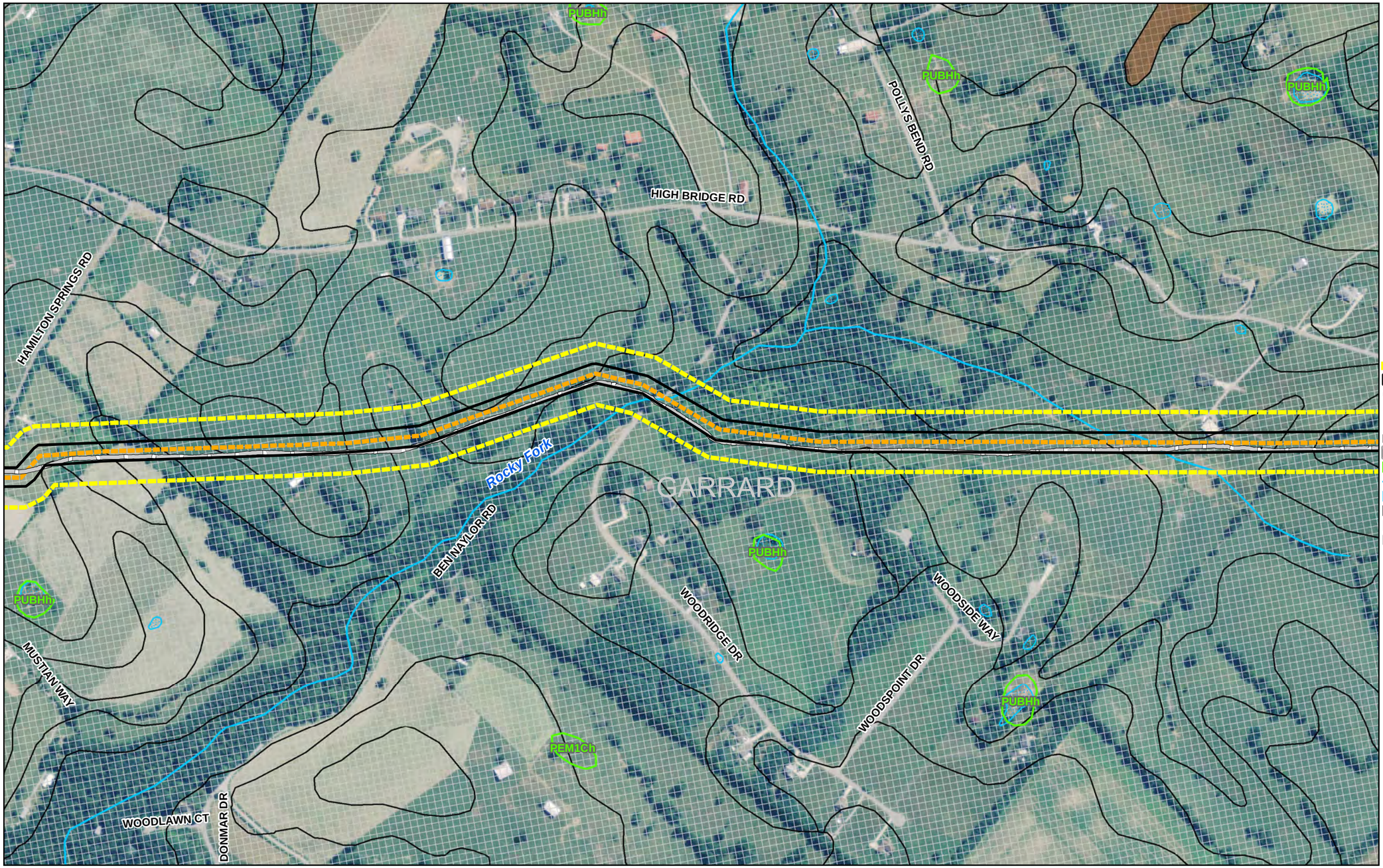

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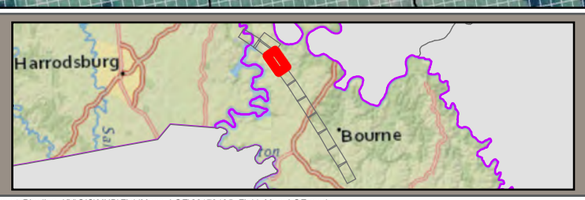

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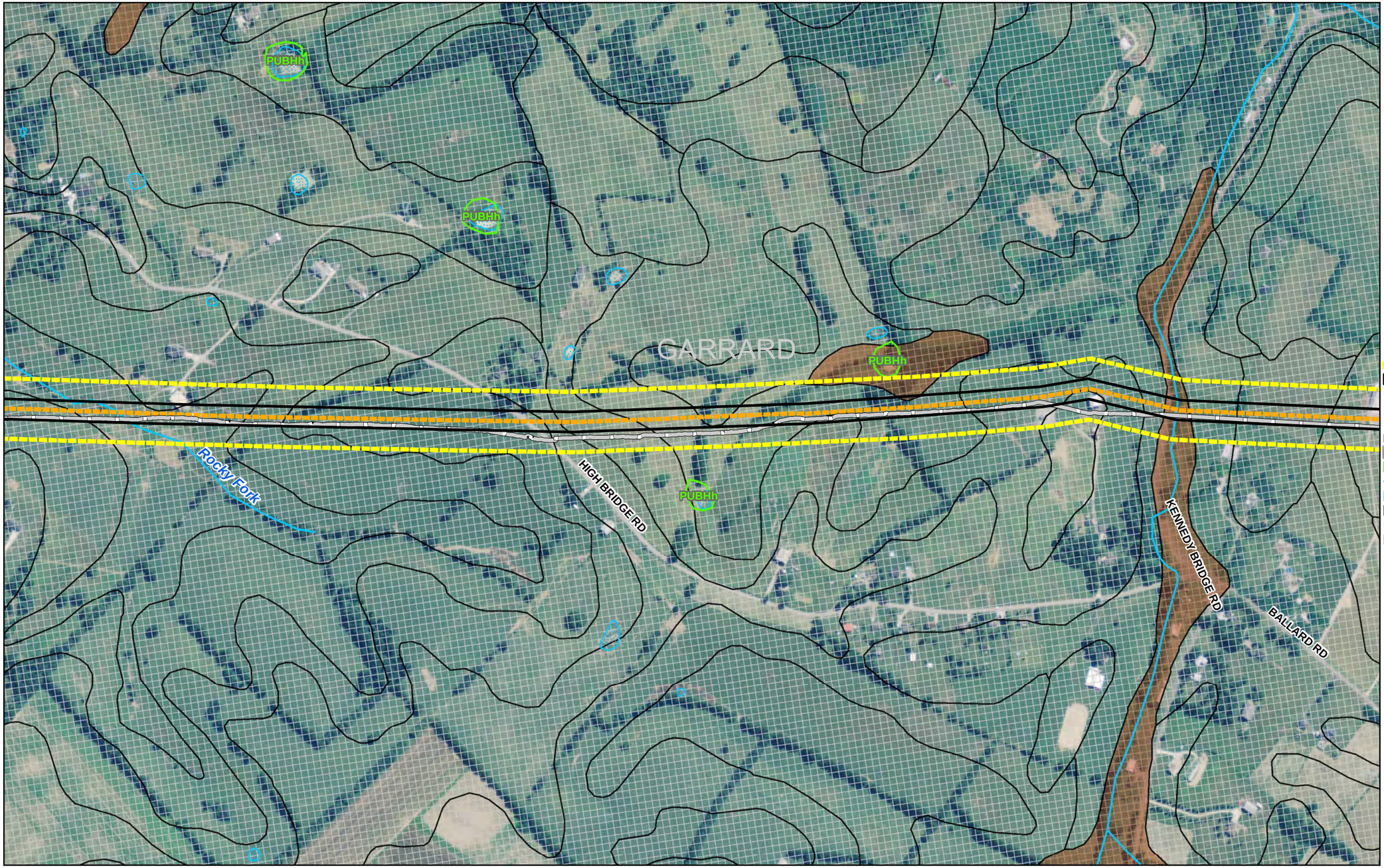

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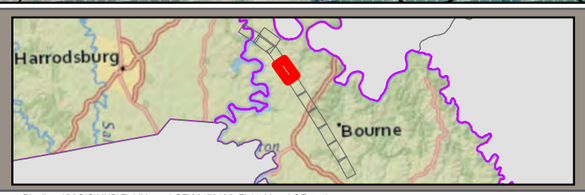

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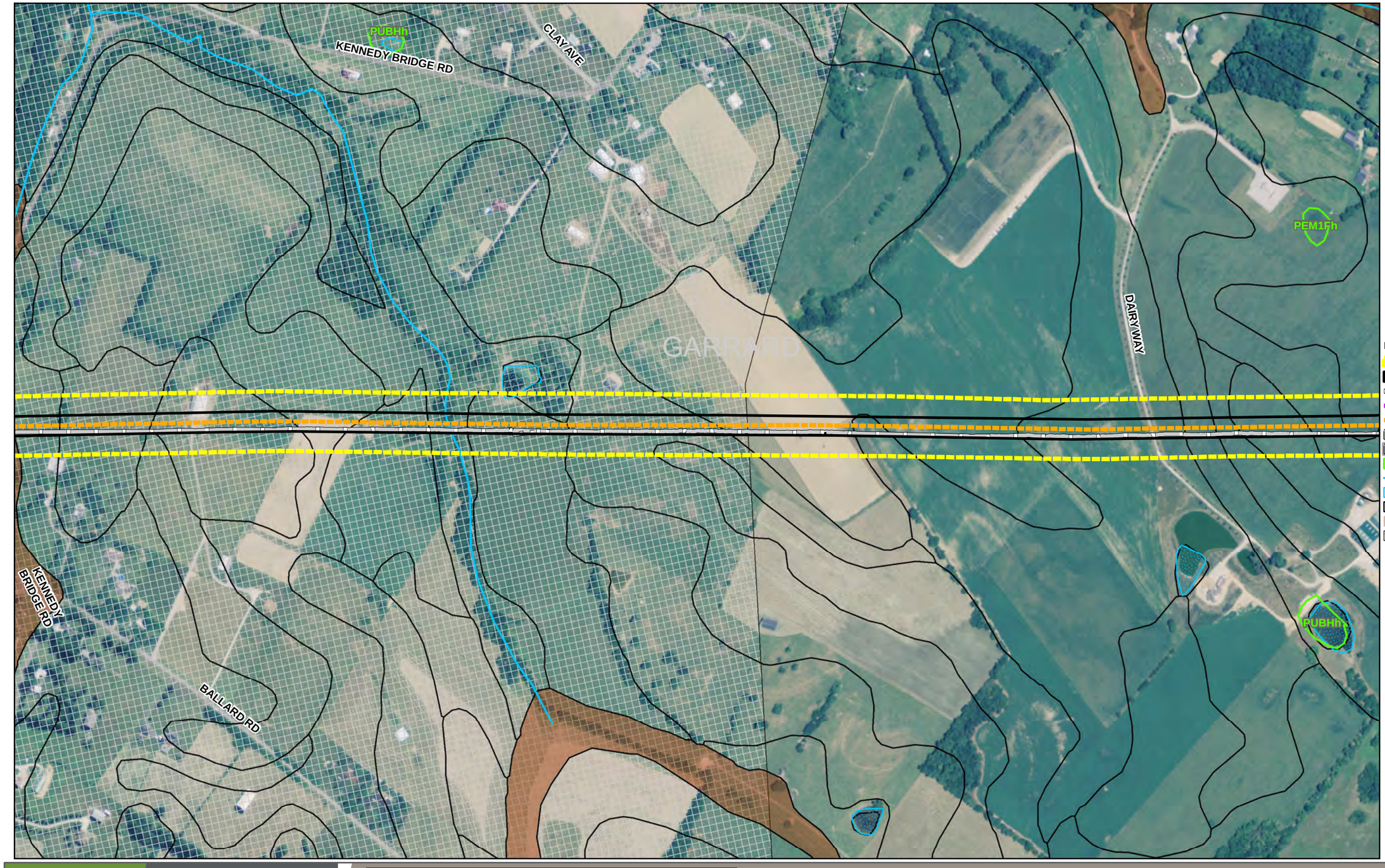

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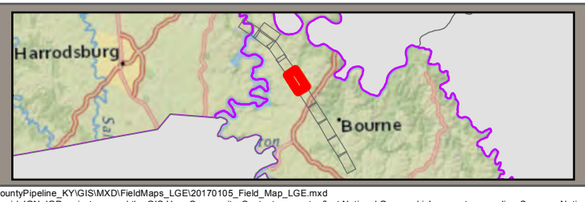

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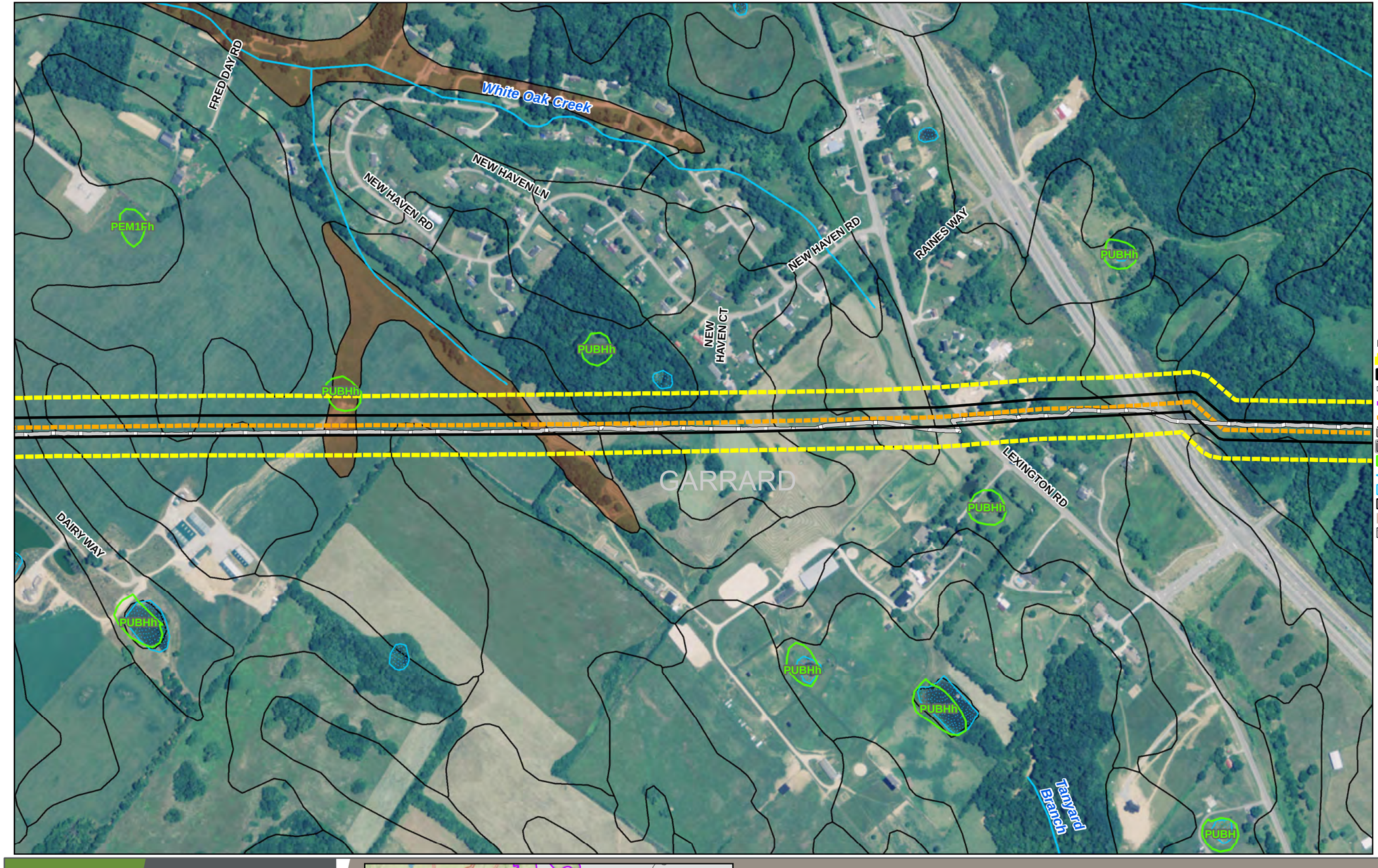

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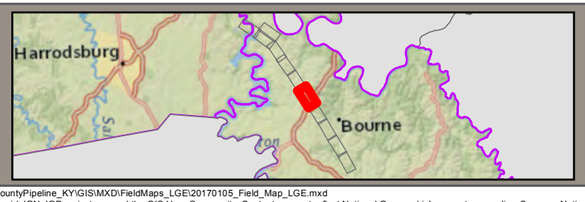

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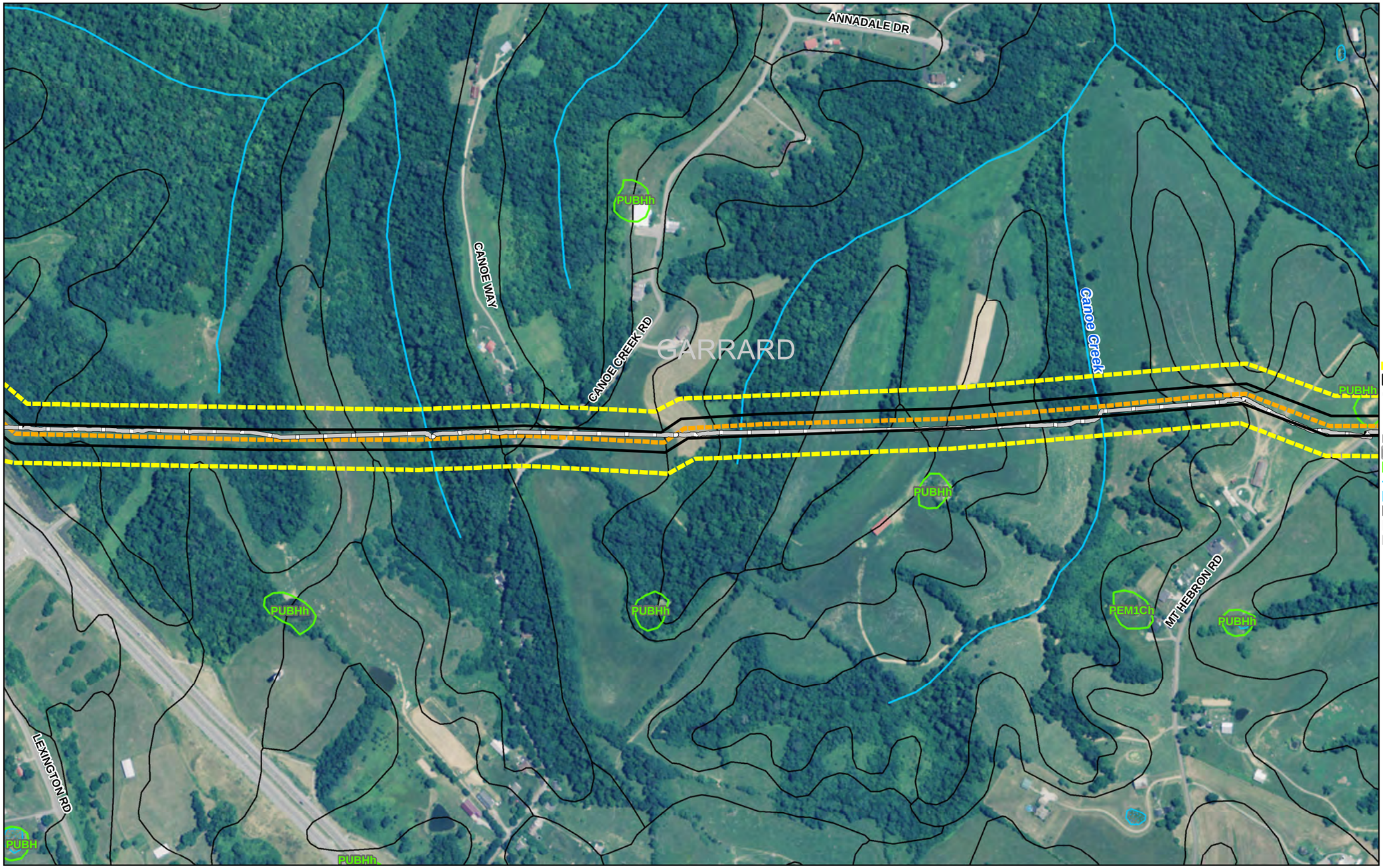

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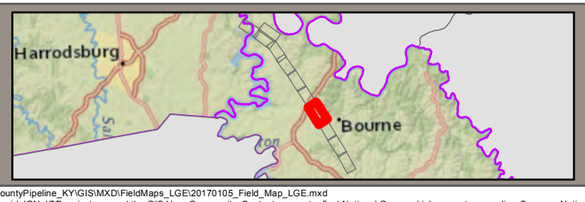

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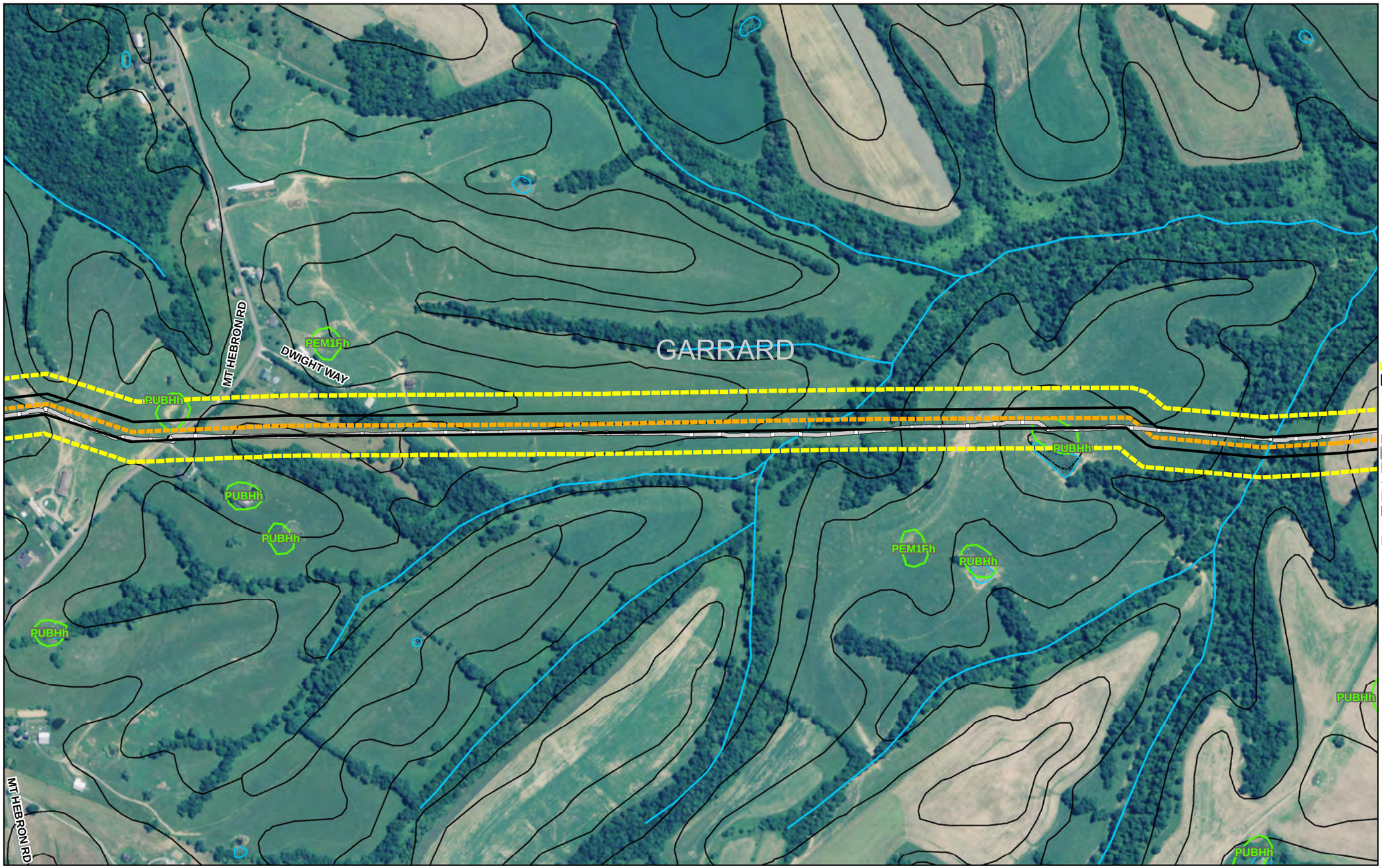

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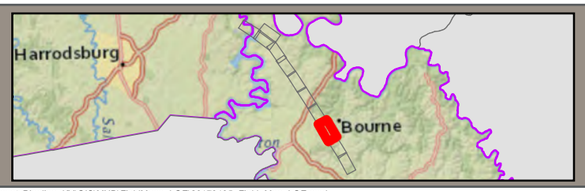

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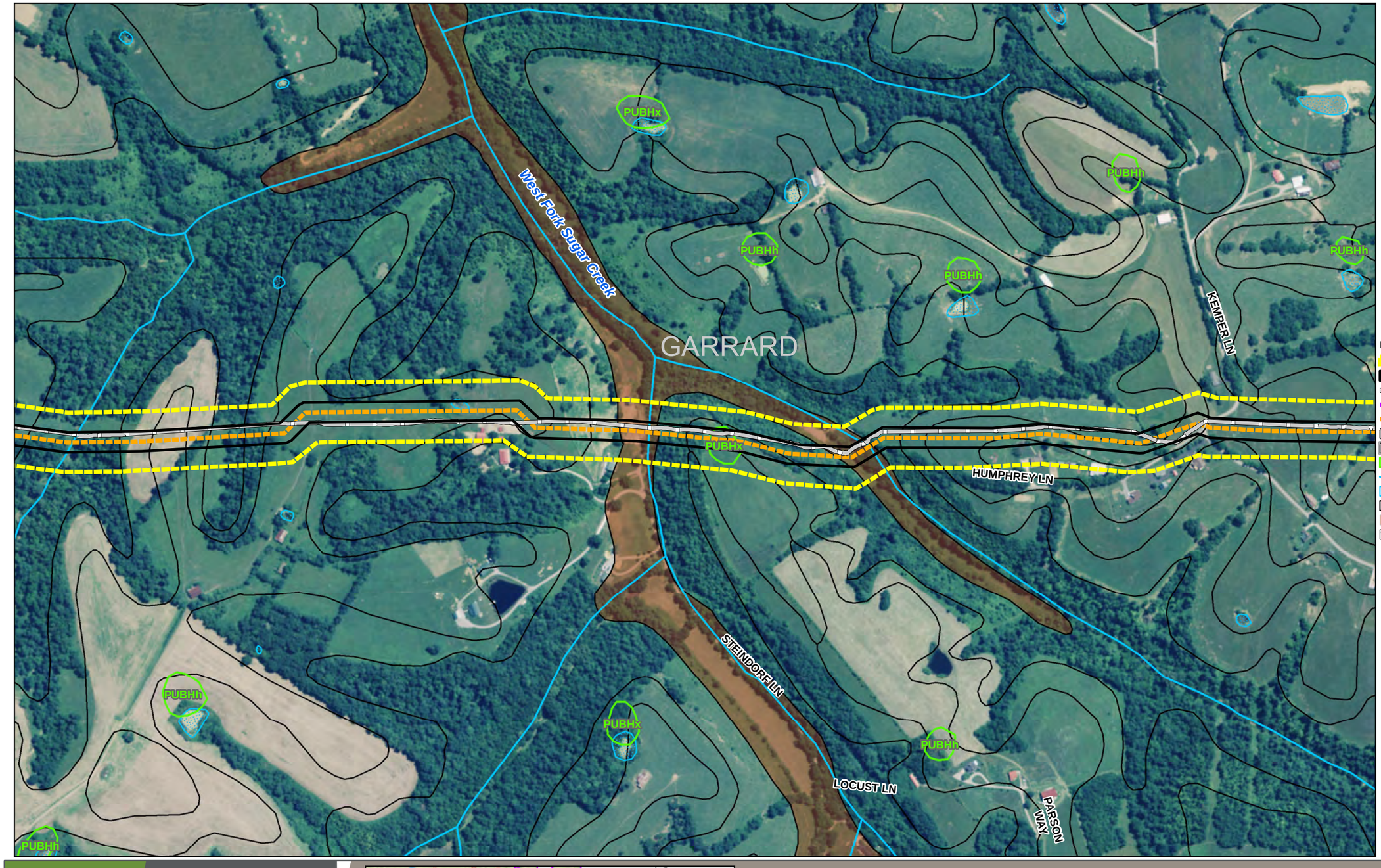

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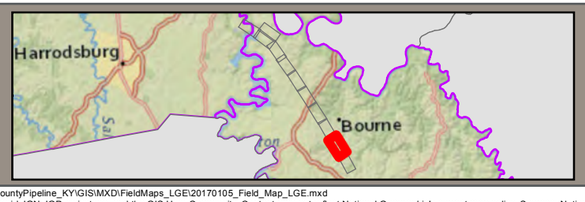

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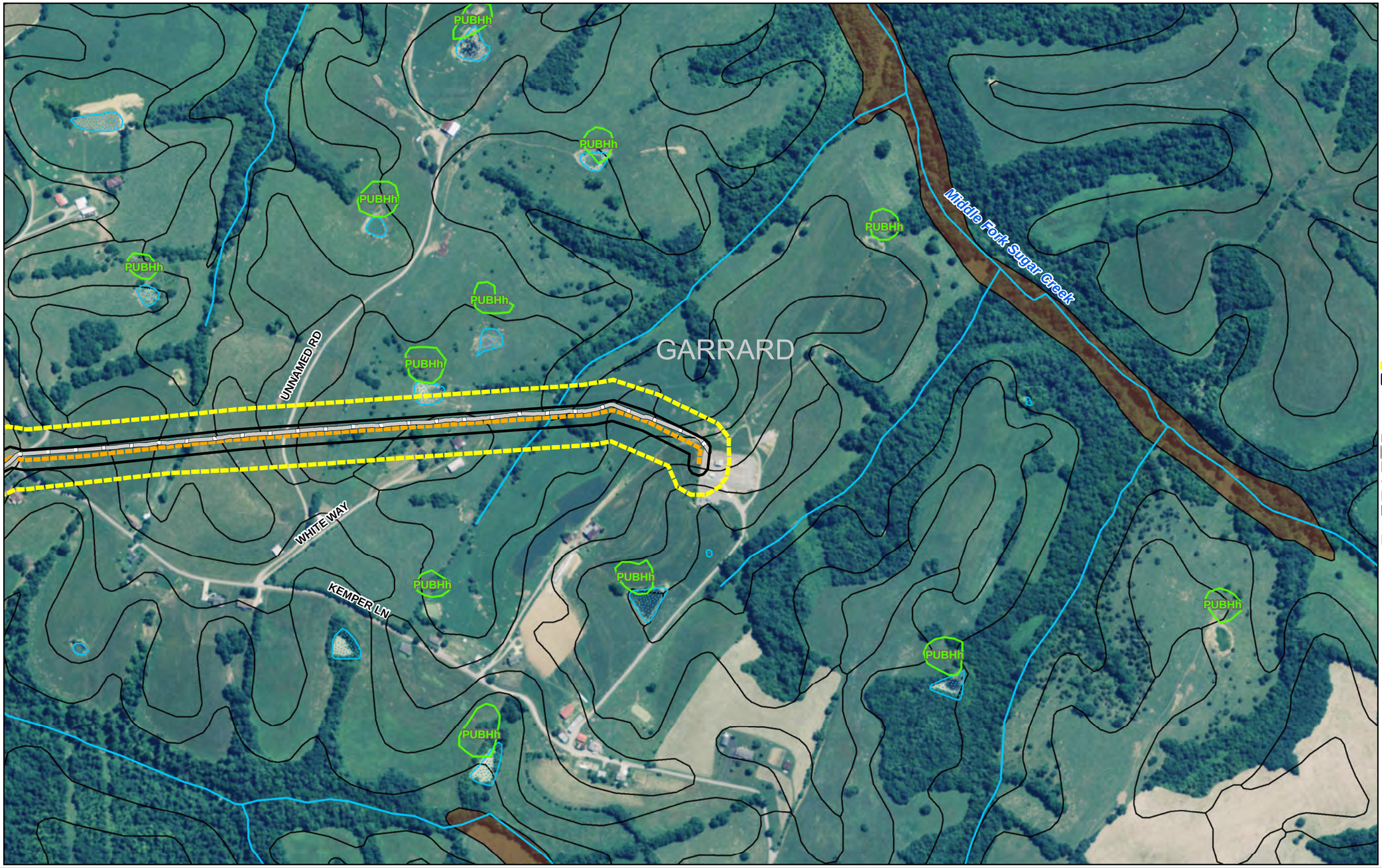

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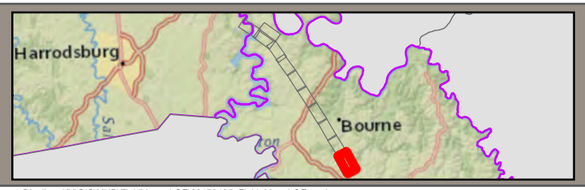

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ATTACHMENT #2
Terracon Proposal & Karst Map

January 24, 2017

EN Engineering
28100 Torch Parkway
Warrenville, Illinois 60555

Attn: Ms. Marisse (Kiehn) Williams, PMP
Project Manager

P: [630] 967-6727
F: [630] 353-7777
E: mwilliams@enengineering.com

Re: Proposal for Geotechnical Engineering Services
LG&E Garrard County Pipeline Project
Garrard County, Kentucky
Terracon Proposal No. PN3175000

Dear Ms. Williams:

Terracon Consultants, Inc. (Terracon) appreciates the opportunity to submit this proposal to provide geotechnical engineering services for the above-referenced project. The purpose of this study will be to evaluate the pertinent geotechnical conditions at the site and to develop geotechnical parameters that will aid in design and construction of a new KU/LG&E 30-inch pipeline that will run parallel to an existing 20-inch line. This proposal outlines our understanding of the project and scope of services and provides lump sum fees for our services.

1.0 PROJECT INFORMATION

1.1 Site Description

ITEM	DESCRIPTION
Location	• The proposed line and existing line run through Garrard County between Launcher Compressor Station and the E.W. Brown Generating Station near Harrodsburg, Garrard County, Kentucky (Approximate Coordinates: 37.785356/-84.703834)
Existing improvements	Existing 20-inch line runs approximately 12 miles between an existing Launcher Compressor Station and the E.W. Brown Generating Station at Dix Dam

ITEM	DESCRIPTION
Current ground cover	Grass and other vegetation at generation station. Currently unknown at the compressor station
Existing topography	Relatively level to steeply sloping and vertical

1.2 Project Description

ITEM	DESCRIPTION
Structures	Proposed 30-inch gas pipeline that will begin at Launcher Compressor Station and terminate at E.W. Brown Generating Station at Dix Dam. Pipeline will require horizontal directional drilling underneath the Dix River.
Maximum Loads	Not Provided
Grading	Not provided. Cut and fill up to 2 feet for installation of line (assumed)

Should any of the above information or assumptions be inconsistent with the planned construction, please let us know so that we may make any necessary modifications to this proposal.

2.0 SCOPE OF SERVICES

The services to be provided by Terracon are summarized in the following paragraphs.

2.1 Field Exploration

Our scope of work is based on the following boring depth requirements provided by EN Engineering for this project:

- Phase 1: E.W. Brown Generating Station – A total of six (6) borings to depths specified below:
    - Boring 1 – will be drilled to a depth of approximately 250 feet (through rock if required)
    - Boring 2 – will be drilled to a depth of approximately 350 feet (through rock if required)
    - Borings 3 – will be drilled to a depth of approximately 175 feet (through rock if required)

- Borings 4 – will be drilled to a depth of approximately 410 feet (through rock if required)

- Borings 5 – will be drilled to a depth of approximately 350 feet (through rock if required)

- Boring 6 – will be drilled to a depth of approximately 200 feet (through rock if required)

For Phase 1 estimation purposes, we have assumed depth to bedrock is approximately 20 feet beneath existing grades. For purposes of this proposal, we estimate drilling approximately 120 lineal feet of overburden soils and obtaining approximately 1615 feet of rock core sample.

- Phase 2: Launcher Compressor Station – A total of four (4) borings to depths specified below:

  - Borings 7 through 10 – will be drilled to a depth of approximately 40 feet or to a blow count of 50 bpf; whichever occurs first

For Phase 2 estimation purposes, we have assumed depth to bedrock is approximately 40 feet beneath existing grades. For purposes of this proposal, we estimate drilling approximately 160 lineal feet of overburden soils. No rock coring is proposed for this phase of the project.

2.1.1 Procedures

It is understood that Terracon will stake the borings at the requested locations

The borings will be sampled using split spoon sampling devices consistent with ASTM D1586 and thin walled sampling devices consistent with ASTM D1587. As specified, sample intervals will be continuous for the first 5 feet and then 2-foot samples will be taken at 5-foot intervals thereafter. For borings B-7 through B-10, should bedrock be encountered within the planned exploration depths, we will attempt to obtain a sample of the bedrock by over-driving the split-barrel sampler and the boring will then be terminated. Rock coring will be performed at borings B-1 through B-6, as requested, using an NQ2 core barrel if refusal on bedrock is encountered prior to reaching the required completion depth. Once the samples have been collected and classified in the field, they will be placed in appropriate sample containers for transport to our laboratory.

The field exploration will also include observations for groundwater. This will occur during the exploration program while the borehole is being advanced.

2.1.2 Phase 1 Geophysical Study

A geophysical exploration is proposed to survey the proposed horizontal direction drill portion of the project (Phase 1). The primary goals will be to locate potential karst features, including large

voids. Terracon will be using a combination of reflection seismic and Electrical Resistivity Imaging (ERI) to survey as much of the drill path as possible.

2.1.2.1 Seismic Reflection Survey

Terracon is proposing a High Resolution Compression Wave (HRPW) seismic reflection survey to identify potential voids in limestone bedrock to a depth of 300 feet below ground surface across the Dix River near Harrodsburg, KY. This work would be performed through a subcontractor (Bay Geophysical). The survey is based on employing the Wireless Seismic RT-2 Wireless Data Acquisition Recording System; a real time seismic recording system. The data acquisition methods involve a high degree of statistical redundancy to assist in locating potential karst features with a minimum of 10 foot diameter in limestone bedrock along the proposed horizontal directional drilling (HDD) path beneath the Dix River. The proposed survey locations are from the entry/exit points of the drill path toward the Dix River banks where the ground surface elevation begins to change. The survey locations are displayed on Figure 1. The drill path entry point is located on the west side of the Dix River and the exit point is located on the east side of the Dix River. The proposed HRPW surveys are as follows:

- Line 1, East side from 7+00 feet (entry point) to 20+00 feet (elevation change), a total of 1300 feet.
- Line 2, West side of Dix River from 28+50 feet (elevation change) to 45+00 feet (exit point), a total of 1650 feet.

The survey operations requires a 9 person field crew, 5 vehicles, and an ATV. The following are the specifications that will be used for all seismic lines acquired for this project:

Type of survey	S- Wave 2D reflection
Number of Channels	120
Source	16,000 lb IVI EnviroVib II
Source Interval	5 feet
Number of Sweeps	2, 4 or 8 per source location (to be determined form testing)
Sweep Length	8 or 10 second sweep (to be determined from testing)
Source Position	VP on the half station
Receiver Interval	5 feet
Record length	1.0 sec
Recording Instrument	Wireless Seismic RT-2
Geophones	6 Oyo CT-30 10 Hz Geophones over 5 feet, centered on the station
Sample Rate Interval	1.0 millisecond
Seismic Spread Configuration & Gap	Roll on/Roll off
Low Cut Filter	Out
High Cut filter	Out

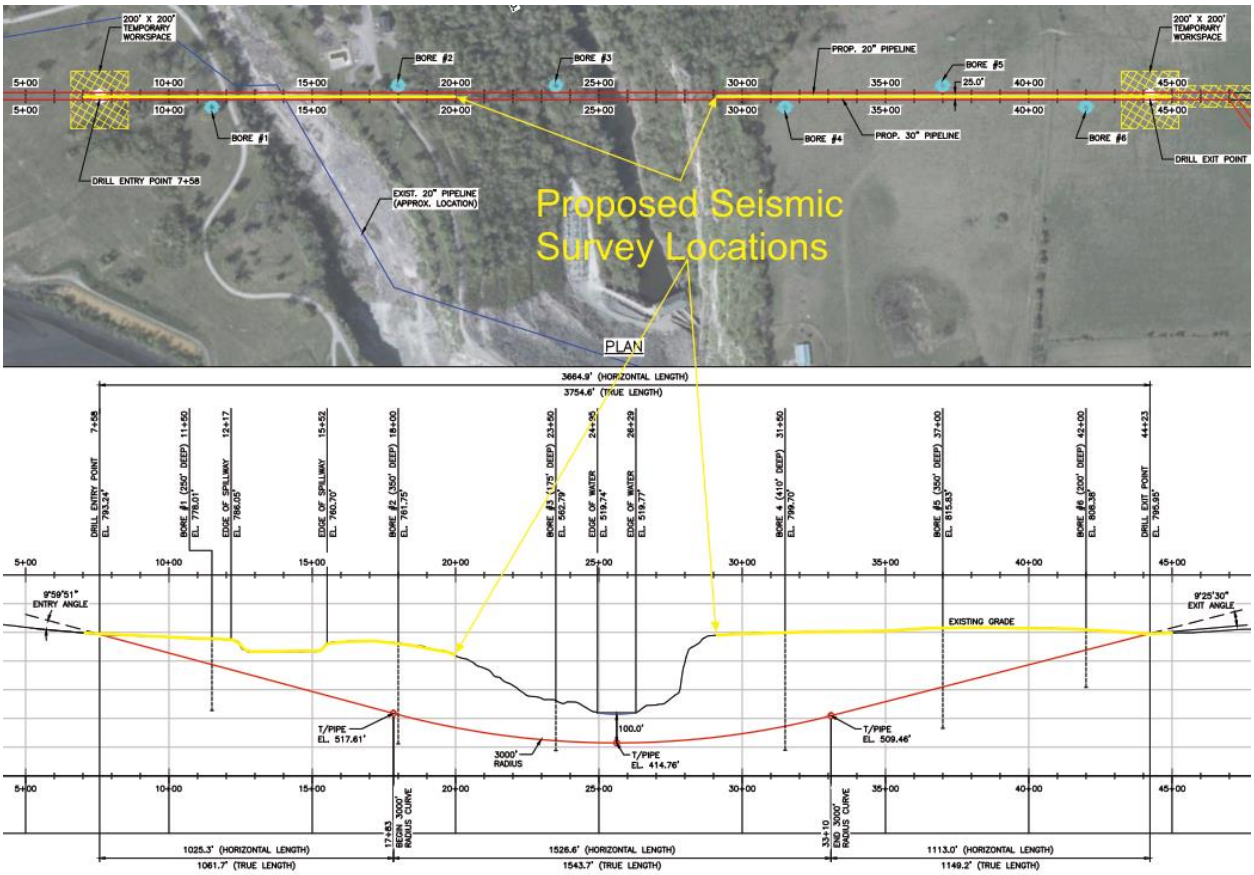


Figure 1: The yellow lines indicate the approximate locations for the proposed seismic survey lines.

2.1.2.2 Electrical Resistivity Imaging Survey

The ERI system that will be used consists of an Advanced Geosciences, Inc. (AGI) SuperSting R8 control unit and a survey line with multiple electrodes. Changes in the earth resistivity can indicate changes in lithology, saturation, voids, and amount of fracturing. The method can accurately image the interface from soil overburden to bedrock.

Based on a document and aerial review of the site, four (4) lines are being proposed, as depicted in Figure 2, below. There will be one line at the enter point, one line at the exit point, and two lines will be along the river banks (parallel to the river and perpendicular to the pipeline path). The lengths of the resistivity lines will be determined by field personnel based on site conditions and access. Steep slopes with thick vegetation may not be accessible to our equipment. All of the lines will consist of a linear array of electrode stakes, spaced approximately 5 feet apart, and connected with a cable. The lines at the enter/exit points will be approximately 555 feet long.

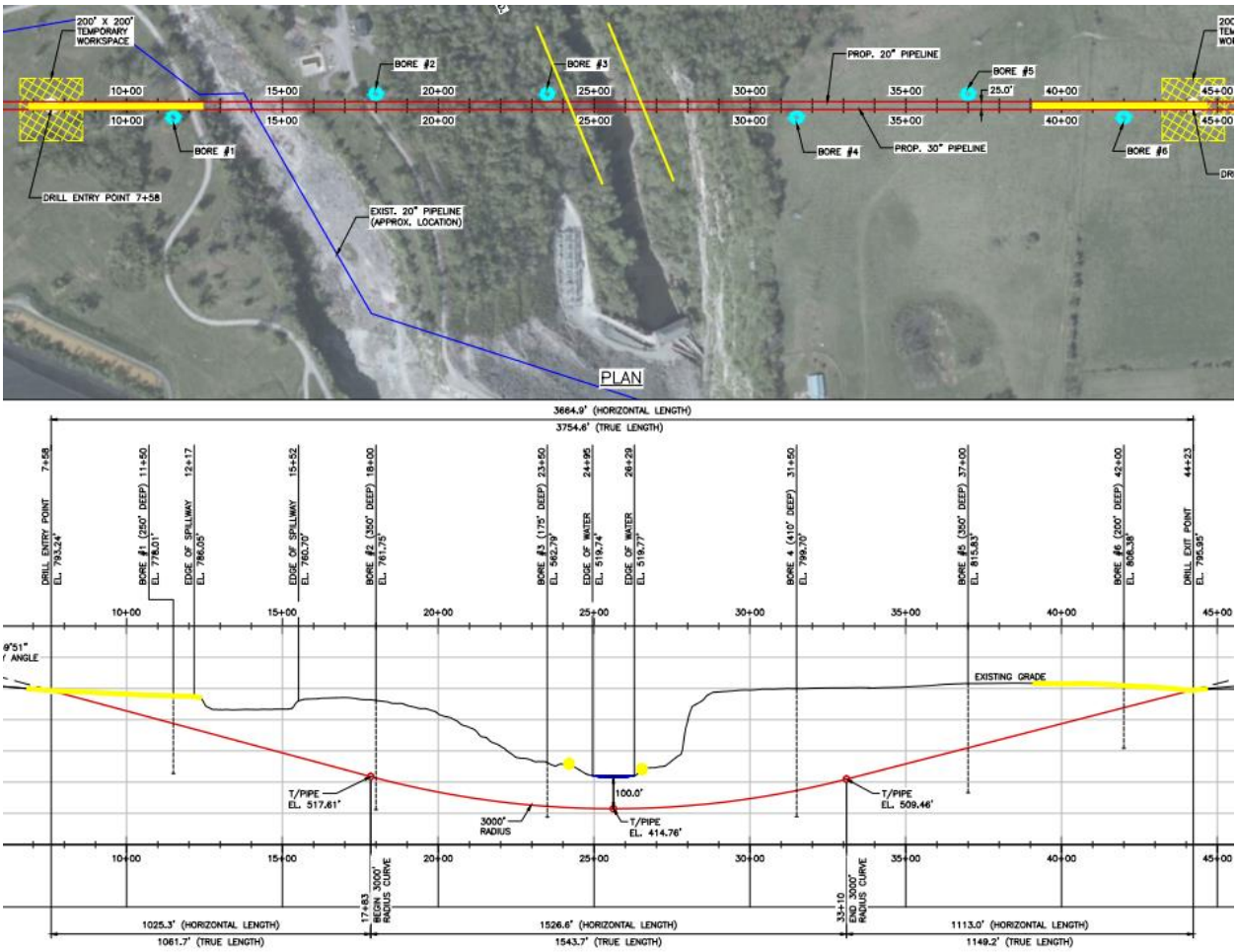


Figure 2: The yellow lines indicate the approximate locations for the proposed electrical resistivity survey lines.

The ERI system utilizes both potential and induced current electrodes that function independently of one another to measure electrical potential within the field of investigation. A transmitting current dipole, followed by a series of potential dipoles, measures the resulting voltage gradient at each electrode stake/station. As the transmitting dipole is advanced along the electrode stations, the resulting gradient measurements are collected as a two-dimensional (2D) section beneath the survey line. Terracon anticipates that the surveys will image to a depth of 115 feet below the ground surface. After completion of field services, the resistivity data will be processed using EarthImager 2D (engineered by AGI), an inversion and modeling software package.

The resistivity work will be performed by Terracon personnel and would include two geophysicists, a standard pick-up, and a small boat to transport equipment across the river.

Limitations - It should be noted that, as with any geophysical testing method, the processes rely on instrument signals to indicate physical conditions in the field. Signal information can be

affected by on-site conditions beyond the control of the operator, such as, but not limited to, cultural features (e.g., fences, light poles, power lines, buried utilities, buried metallic objects, building foundations and other induced currents in the ground), soil types, soil moisture, background noise, and/or groundwater table depth. Interpretation of those signals is based on a combination of known factors combined with the experience of the operator and the geophysical scientist evaluating the results. The resistivity test cannot be performed during or within one day of a major rain event.

2.1.2.3 Geophysical Report

A geophysical report will be included with the geotechnical report. The report will include the following:

- A brief description of the methods and equipment used.
- A brief description of the surveyed areas including mapped locations of the survey lines.
- A brief discussion on the effectiveness of the survey and a summary of the findings.
- Provide cross-sectional images of the seismic data and ERI data, with interpretations that indicate anomalous areas.
- Provide map views of the survey areas with any potential geophysical anomalies clearly indicated.

2.1.3 Site Access

Based on discussions with the client, we have assumed that the sites of the requested borings are accessible to track mounted drilling equipment and no site clearing (including dozer assistance), wet ground conditions, tree or shrub clearing, repair of landscape damage or location of underground utilities beyond contacting Kentucky 811 Utility Location Service is required. If such conditions are known to exist on the site, Terracon should be notified so that we may adjust our scope of services and fee, if necessary.

At the writing of this proposal, no hydro-vacuum or Air Knife utility clearance services have been requested by the client at either the compressor station or generating station. These services can be provided upon request. If requested, and prior to drilling operations, the boring locations at the compressor station and generating station sites can be cleared using a Hydro-vacuum or Air Knife Utility Clearance System (VacMaster 1000) to appropriate depths to ensure there are no underground interferences. Operator qualification documentation (Veriforce OQ 619) can also be provided prior to commencement of hydro-vacuum work, upon request.

In order to conduct our exploration of the project sites, we must be granted access by the property owner(s). By acceptance of this proposal without information to the contrary, we consider that you have provided access to our exploration equipment for the conduct of our work consistent with the agreed work scope.

2.1.4 Property Disturbance

We will take reasonable efforts to reduce damage to the property as a result of our exploration activities, such as rutting of the ground surface. However, in the normal course of our work some such disturbance will occur. We have not budgeted to restore the site beyond backfilling our boreholes. If there are any restrictions or special requirements regarding this site or exploration, please provide them prior to your acceptance of this proposal.

All borings will be grouted immediately after their completion. Auger cuttings would be spread onsite or left at an owner-designated location.

2.1.5 Safety

At Terracon, we all have a personal and uncompromising commitment to everyone going home safely each and every day. Our safety program, *Incident and Injury Free*® is about care and concern for people. It is our personal and organizational commitment at all levels of the company and is where safety is held as a core value as well as an operational priority. Working safely is an inseparable part of working correctly, just as much as other operational priorities, in particular quality and schedule. Prior to commencement and during the on-site activities, we will re-evaluate potential job hazards and appropriate safe working procedures.

Our field crews will make excavations to sample the soils. Such excavations could encounter subsurface utilities and/or environmental hazards. We will file appropriate notification to the local and/or state mandated excavation permit office(s), as required by state law, and we will not perform excavations without an understanding of the subsurface utilities present based upon markings made by the various responsible parties. However, such utility location services only delineate subsurface utilities in public easements, and the potential to encounter other, unknown underground hazards remains. Also, we are not aware of environmental concerns at this project site that would create health or safety hazards associated with our exploration program. Our scope considers that standard OSHA Type D Personal Protection Equipment (PPE) is appropriate.

In order to better address the potential for underground utilities or environmental hazards, and, in order to better understand other potential safety hazards associated with our field exploration program, we are available to interview you or a representative that you may suggest to obtain information about these concerns. All private lines should be marked by others prior to commencement of drilling. If an as-built utility plan or private utility location by others is not available, we can subcontract for a private utility locator for an additional fee upon request. However, please note that due to the uncertainty in locating unknown utilities, we are not responsible for damage to private utilities that are not made aware to us. On-site delays to drilling caused due to improperly marked private utilities (by others) will be invoiced at $250 per hour.

2.2 Laboratory Testing

Representative soil and rock samples will be tested in our laboratory to determine pertinent engineering characteristics. Testing will include visual classification, moisture content, Atterberg limits, sieve analysis, consolidation testing, and strength testing (including hand penetrometer and/or unconfined compression strength testing on rock/soil samples), as appropriate.

Our laboratory procedures will follow ASTM standards.

The types or actual number of laboratory tests cannot be predicted. The project engineer will review the field data from the exploration, and then assign the types and numbers of tests. Our fees have been developed with an assumption of typical types and numbers of tests for a project of this nature in this location. In the event additional testing is necessary we will notify you of this need prior to initiating the additional testing.

2.3 Geotechnical Engineering Analysis and Report

2.3.1 Phase 1 Geotechnical Data Report

The results of our field and laboratory programs will be evaluated by a professional geotechnical engineer registered in the Commonwealth of Kentucky. Based on the results of our evaluation, a geotechnical data report will be prepared that details the results of the testing performed, provides logs of the borings, and a diagram of the site/boring layout. The data report will include the following:

1. Soil boring logs with field and laboratory data, soil stratification based on visual soil classification
2. Groundwater levels observed during and after completion of drilling
3. Site and exploration location plans
4. Subsurface exploration procedures
5. Description of subsurface conditions
6. Description of geology and historical mining
7. Results of our laboratory program

2.3.2 Phase 2 Geotechnical Engineering Report

The results of our field and laboratory programs will be evaluated by a professional geotechnical engineer registered in the Commonwealth of Kentucky. The engineer will develop an analysis of subsurface conditions, perform the engineering calculations necessary to evaluate foundation alternatives and develop appropriate geotechnical engineering design criteria for earth connected phases of the project, where appropriate. At the completion of our engineering analyses, we will prepare a geotechnical engineering report that provides the following:

1. Soil boring logs with field and laboratory data, soil stratification based on visual soil classification

2. Groundwater levels observed during and after completion of drilling
3. Site and exploration location plans
4. Subsurface exploration procedures
5. Description of subsurface conditions
6. Description of geology and historical mining
7. Recommended foundation options and engineering design parameters for Launcher Compressor Station infrastructure
8. Estimated settlement of foundations for compressor station components of project
9. Suitability of slab on grade construction and recommended design/construction procedures for compressor station components of the project
10. Recommendations for remediation of unsuitable soil conditions
11. Subgrade preparation/earthwork recommendations for Launcher Compressor Station
12. Lateral earth pressure recommendations for design of below-grade structures (if applicable)
13. Seismic site classification
14. Recommendations for design of gravel roads, asphalt pavements, and concrete pavement sections for truck/drive areas, parking areas, etc.

3.0 SCHEDULE

We have developed a schedule to complete the scope of work stated in Sections 2.1 through 2.3 based upon our current drill rig availability at the date of this proposal. We anticipate starting the field work within about 10 business days of receiving written notice to proceed.

- It is anticipated that the Phase 1 field drilling program will be completed in 23 to 28 business days.

- It is expected that the Phase 2 field drilling program will be completed in about 2 days.

For Phase 1 services, we will complete laboratory testing, perform the geotechnical engineering services and issue our Geotechnical Data Report within about 4 weeks after completion of the field drilling phase. Geophysical testing will be performed simultaneously with the geotechnical engineering tasks indicated above.

For Phase 2 services, we will complete laboratory testing, perform the geotechnical engineering services and issue our Geotechnical Engineering Report within about 3 weeks after completion of the field drilling phase.

The schedule above is predicated upon our current availability and our understanding of your schedule needs. In the event the schedule provided is inconsistent with your needs, please contact us, and we will consider alternatives.

Because the schedule suggested above is tentative and dependent upon receipt of your notice to proceed, we will provide you with a specific schedule for the conduct of the project at the time of your issuance of notice to proceed.

4.0 COMPENSATION

Unit rates and estimated project fees are listed in the following Cost Estimate Tables for both phases of this project. We have estimated the total project cost based on the quantities and assumptions described in the "Scope of Services" section above. The total estimated cost for both phases does not represent a not to exceed cost, as additional drilling days may be necessary based upon weather conditions, actual subsurface and site access conditions and delays beyond our control.

Invoicing will be based on the actual quantities of services provided at the unit rates listed in the attached unit rate schedule. If conditions are encountered which warrant additional services, you will be apprised of such and your authorization will be secured prior to performing such additional services.

PHASE 1 - LG&E GARRARD COUNTY PIPELINE PROJECT - COST ESTIMATE TABLE				
DESCRIPTION OF ITEM	**UNIT PRICE**	**UNIT**	**QUANTITY**	**COST**
DRILLING SERVICES				
Drilling Coordination	$ 1,500.00	Lump Sum	1	$ 1,500.00
Mobilization/Demobilization	$ 2,000.00	Lump Sum	2	$ 4,000.00
Drilling and Sampling (Day Rate)	$ 2,500.00	Day	28	$ 70,000.00
Per Diem (3-man crew)	$ 480.00	Day	28	$ 13,440.00
Grouting - Borehole Abandonment	$ 7.50	Per LF	1735	$ 13,012.50
Site Restoration Time	$ 85.00	Man Hour	0	$ -
Rental Equipment/Supplies for Restoration	$ -	Cost + 15%	1.15	$ -
Boring Inspector (if required)	$ 95.00	Hour	209	$ 19,855.00
Hydrovac Excavation Services (estimated)	$ -	Cost + 15%	1.15	$ -
Mileage (Boring Inspector)	$ 0.75	Mile	1716	$ 1,287.00
			Subtotal	**$ 123,094.50**
LABORATORY TESTING SERVICES				
Moisture Content Test	$ 8.00	Each	6	$48.00
Sieve and Hydrometer Analysis	$ 116.00	Each	3	$348.00
Atterberg Limits Determination	$ 60.00	Each	3	$180.00
One-Dimensional Consolidation Test	$ 540.00	Each	0	$0.00
Laboratory CBR	$ 370.00	Each	0	$0.00
Unconfined Compression Test	$ 80.00	Each	50	$4,000.00
			Subtotal	**$4,576.00**
ENGINEERING SERVICES				
Geotechnical Data Report Preparation	$ 6,500.00	Lump Sum	1	$6,500.00
Geophysical Testing	$ 16,500.00	Lump Sum	1	$16,500.00
Reflection Seismic Analysis	$ 52,000.00	Cost + 15%	1.15	$59,800.00
			Subtotal	**$82,800.00**
			Total	**$210,470.50**

Phase 2 - LG&E GARRARD COUNTY PIPELINE PROJECT - COST ESTIMATE TABLE				
DESCRIPTION OF ITEM	**UNIT PRICE**	**UNIT**	**QUANTITY**	**COST**
DRILLING SERVICES				
Drilling Coordination	$ 500.00	Lump Sum	1	$ 500.00
Mobilization/Demobilization	$ 1,500.00	Lump Sum	1	$ 1,500.00
Drilling and Sampling (Day Rate)	$ 2,500.00	Day	2	$ 5,000.00
Per Diem (3-man crew)	$ 480.00	Day	2	$ 960.00
Grouting - Borehole Abandonment	$ 7.50	Per LF	160	$ 1,200.00
Site Restoration Time	$ 85.00	Man Hour	0	$ -
Rental Equipment/Supplies for Restoration	$ -	Cost + 15%	1.15	$ -
Boring Inspector (if required)	$ 95.00	Hour	15	$ 1,425.00
Hydrovac Excavation Services (estimated)	$ -	Cost + 15%	1.15	$ -
Mileage (Boring Inspector)	$ 0.75	Mile	122	$ 91.50
			Subtotal	**$ 10,676.50**
LABORATORY TESTING SERVICES				
Moisture Content Test	$ 8.00	Each	24	$192.00
Sieve and Hydrometer Analysis	$ 116.00	Each	12	$1,392.00
Atterberg Limits Determination	$ 60.00	Each	12	$720.00
One-Dimensional Consolidation Test	$ 540.00	Each	4	$2,160.00
Laboratory CBR	$ 370.00	Each	0	$0.00
Unconfined Compression Test	$ 80.00	Each	0	$0.00
			Subtotal	**$4,464.00**
ENGINEERING SERVICES				
Geotechnical Report Preparation	$ 3,500.00	Lump Sum	1	$3,500.00
			Subtotal	**$3,500.00**
			Total	**$18,640.50**

Please note that actual cost plus 15% will be charged for subcontracted services and expenses.

5.0 AUTHORIZATION

Work will be performed under the provisions of the attached Task Order. Your authorization for Terracon to proceed in accordance with this proposal can be issued by signing the attached Agreement for Services along with this proposal and returning an original copy of these documents to our Lexington, Kentucky office.

A fax or email of the signed Task Order can also be submitted to expedite the commencement of services, but we request that a signed original follow.

We appreciate the opportunity to provide this proposal and look forward to the opportunity of working with you.

Sincerely,
Terracon Consultants, Inc.

Samuel G. Guy, P.E.
Project Geotechnical Engineer

For
Prasad S. Rege, P.E.
Senior Principal

Attachments: Task Order

Reference Number: PN3175000

MASTER SERVICES AGREEMENT

TASK ORDER

This **TASK ORDER** is issued under the **MASTER SERVICES AGREEMENT** (dated 07/07/2016, agreement reference number BP00282621) between EN Engineering, Inc. ("Client") and Terracon Consultants, Inc. ("Consultant") for Services to be provided by Consultant for Client on the LG&E Garrard County Pipeline Project project ("Project"), as described in the Project Information section of the Consultant's Task Order Proposal dated 01/11/2017 ("Task Order Proposal") unless the Project is otherwise described below or in Exhibit A to this Task Order (which section or Exhibit are incorporated into this Task Order). This Task Order is incorporated into and part of the Master Services Agreement.

1. **Project Information**

   Refer to Proposal PN3175000

2. **Scope of Services** The scope of Services to be provided under this Task Order are described in the Scope of Services section of the Consultant's Task Order Proposal, unless Services are otherwise described below or in Exhibit B to this Task Order.

   Refer to Proposal PN3175000

3. **Compensation** Client shall pay compensation for the Services performed at the fees stated in the Task Order Proposal unless fees are otherwise stated below or in Exhibit C to this Task Order.

   Refer to Proposal PN3175000

All terms and conditions of the **Master Services Agreement** shall continue in full force and effect. This Task Order is accepted and Consultant is authorized to proceed.

Consultant:	**Terracon Consultants, Inc.**	Client:	**EN Engineering, Inc.**
By:	Date: **1/24/2017**	By:	Date:
Name/Title:	**Samuel G Guy / Project Engineer**	Name/Title:	**Marisse Williams / Project Manager**
Address:	**2460 Palumbo Dr**	Address:	**28100 Torch Parkway**
	Lexington, KY 40509-1117		**Warrenville, IL 60555**
Phone:	**(859) 303-9000** Fax: **(859) 303-9001**	Phone:	**(630) 967-6727** Fax:
Email:	**Sam.Guy@terracon.com**	Email:	**mwilliams@enengineering.com**

Reference Number: PN3175000

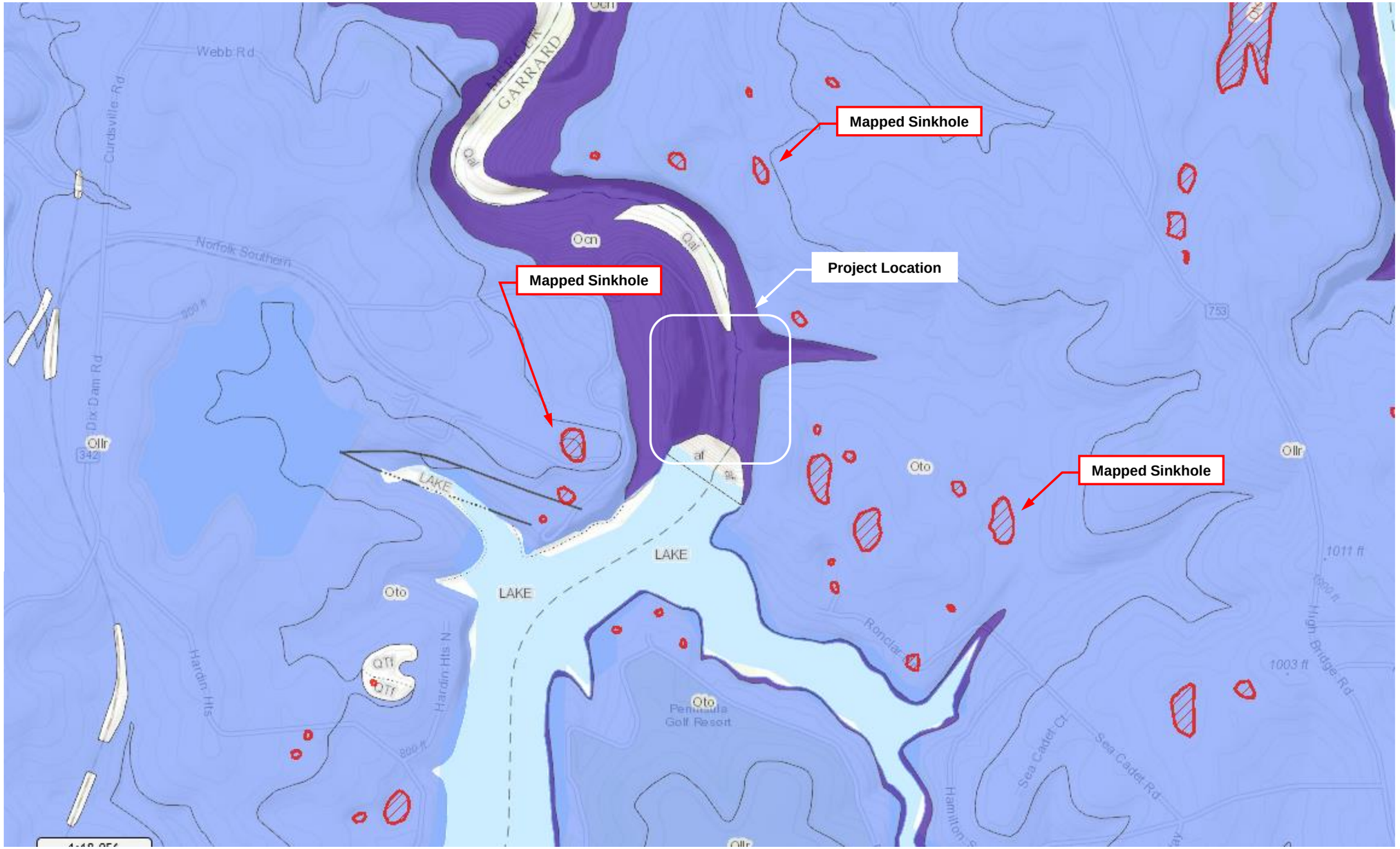
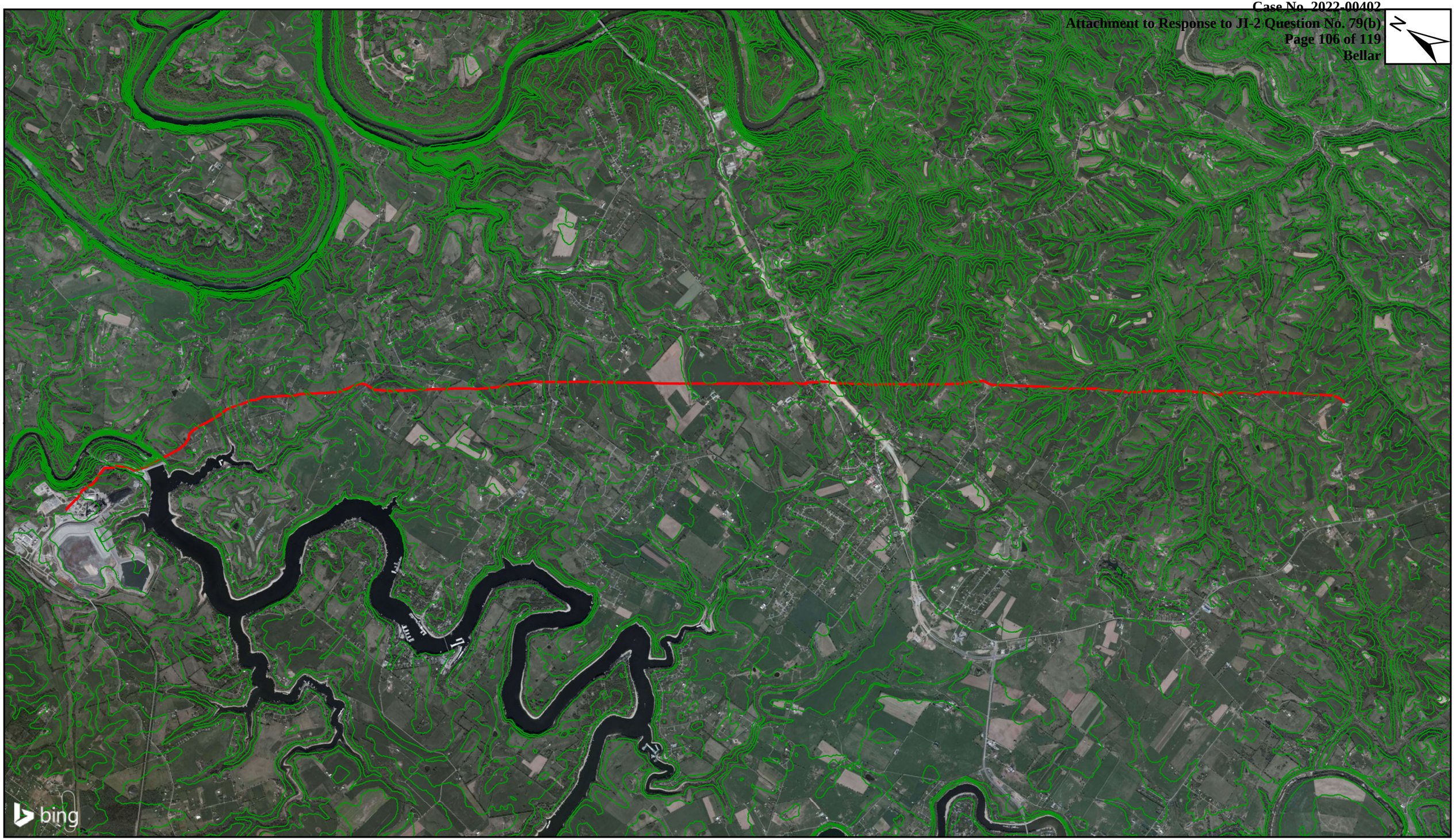


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: SGG	Project No. N3	Terracon Consulting Engineers & Scientists	PLAN VIEW SHOWING KARST FEATURES
Drawn by: SGG	Scale: NOT TO SCALE	2460 Palumbo Drive Lexington, Kentucky 40509	BROWN GENERATING STATION
Checked by:	File Name: EP-N3	PH. (859) 303-9000 FAX. (859) 303-9001	EN ENGINEERING
Approved by:	Date: 12/23/2016		GARRARD AND MERCER COUNTIES, KENTUCKY

EXHIBIT A

ATTACHMENT #3
EN Route Maps & Preliminary HDD Designs



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Pipeline

REV NUM	DATE		DESCRIPTION
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REVISION TABLE

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REFERENCE SCALE: 1 IN = 3,667 feet
PAGE: 1 of 11

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APPROVED BY:	XX
PROJECT:	0163132.00
DATE:	12/16/2015
REV:	X

LG&E BROWN GAS LINE

ENengineering

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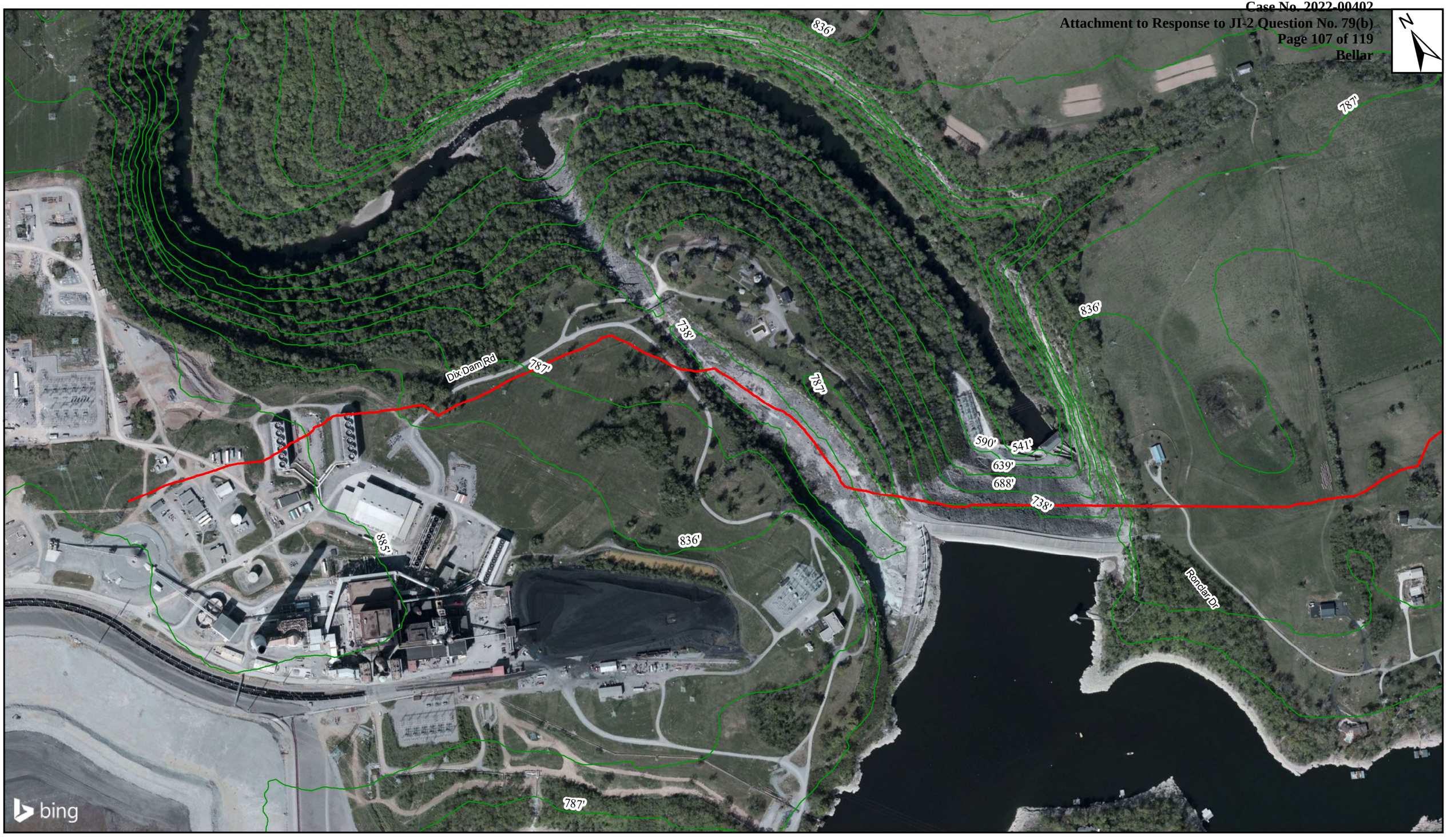

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REV NUM	DATE		DESCRIPTION
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REVISION TABLE

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PAGE: 2 of 11

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LG&E BROWN GAS LINE

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REV NUM	DATE		DESCRIPTION
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LG&E BROWN GAS LINE

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REV NUM	DATE		DESCRIPTION
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REVISION TABLE

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LG&E BROWN GAS LINE

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REV NUM	DATE		DESCRIPTION
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REVISION TABLE

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LG&E BROWN GAS LINE

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REV NUM	DATE		DESCRIPTION
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REVISION TABLE

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LG&E BROWN GAS LINE

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REV NUM	DATE		DESCRIPTION
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REVISION TABLE

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LG&E BROWN GAS LINE

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— **Pipeline**

REV NUM	DATE		DESCRIPTION
0	Date: 12/19/2016	FS	BROWN GAS LINE BASED ON KU Supply (CIPS)

REVISION TABLE

DRAWN BY:	XX
CHECKED BY:	XX
APPROVED BY:	XX
ABSOLUTE SCALE:	1:4,800
PROJECT:	0163132.00
REFERENCE SCALE:	1 IN = 400 feet
DATE:	12/16/2015
PAGE:	8 of 11
REV:	X

LG&E BROWN GAS LINE

ENengineering

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Legend

Pipeline

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LG&E BROWN GAS LINE

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Legend

Pipeline

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PAGE: 10 of 11	APPROVED BY: XX
	PROJECT: 0163132.00
	DATE: 12/16/2015
	REV: X

LG&E BROWN GAS LINE

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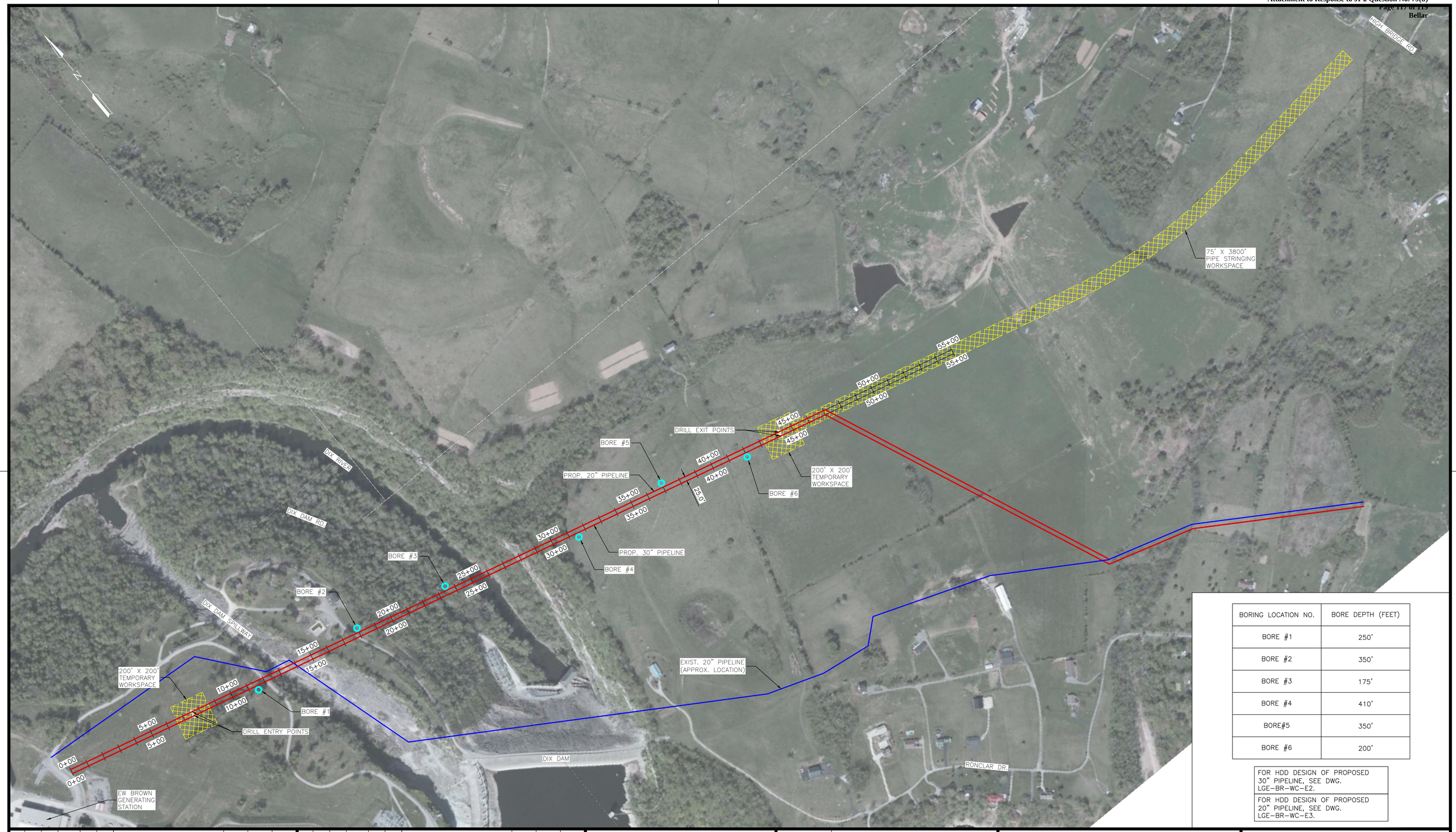


BORING LOCATION NO.	BORE DEPTH (FEET)
BORE #1	250'
BORE #2	350'
BORE #3	175'
BORE #4	410'
BORE#5	350'
BORE #6	200'

FOR HDD DESIGN OF PROPOSED 30" PIPELINE, SEE DWG. LGE-BR-WC-E2.

FOR HDD DESIGN OF PROPOSED 20" PIPELINE, SEE DWG. LGE-BR-WC-E3.

NO.	DATE	BY	PROJ NO.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY
0	12/22/16	BK				ISSUED FOR REVIEW	MDW		

ISSUED | APPROVED

REVISIONS

NO.	DATE	BY	PROJ NO.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY

ISSUED | AS BUILT | APPROVED

REVISIONS

ENengineering
28100 TORCH PARKWAY
WARRENVILLE, IL 60555
TEL. 630.353.4000
FAX 630.353.7777
WWW.ENENGINEERING.COM

TITLE
REFERENCE DRAWINGS

LG&E LOUISVILLE GAS & ELECTRIC

ISSUED FOR BID
ISSUED FOR CONSTRUCTION

PROJ. NO.
DRAWING SIZE D

20" & 30" BROWN PIPELINES HDDS CROSSING DIX RIVER WORKSPACE & STRINGING AREAS

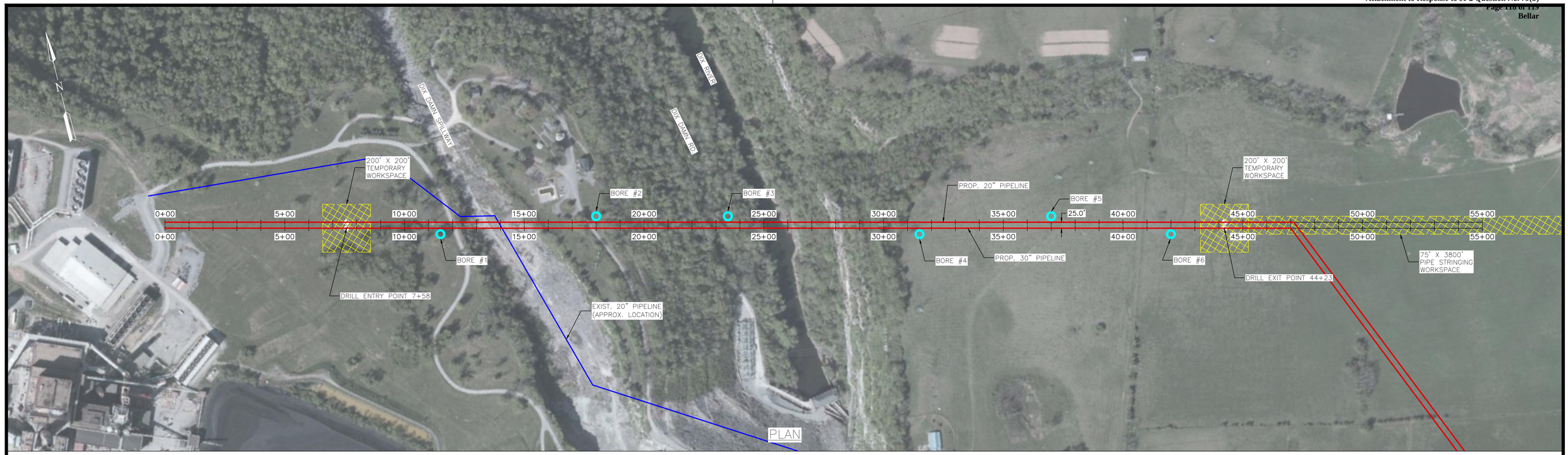
MERCER & GARRARD COUNTIES, KENTUCKY

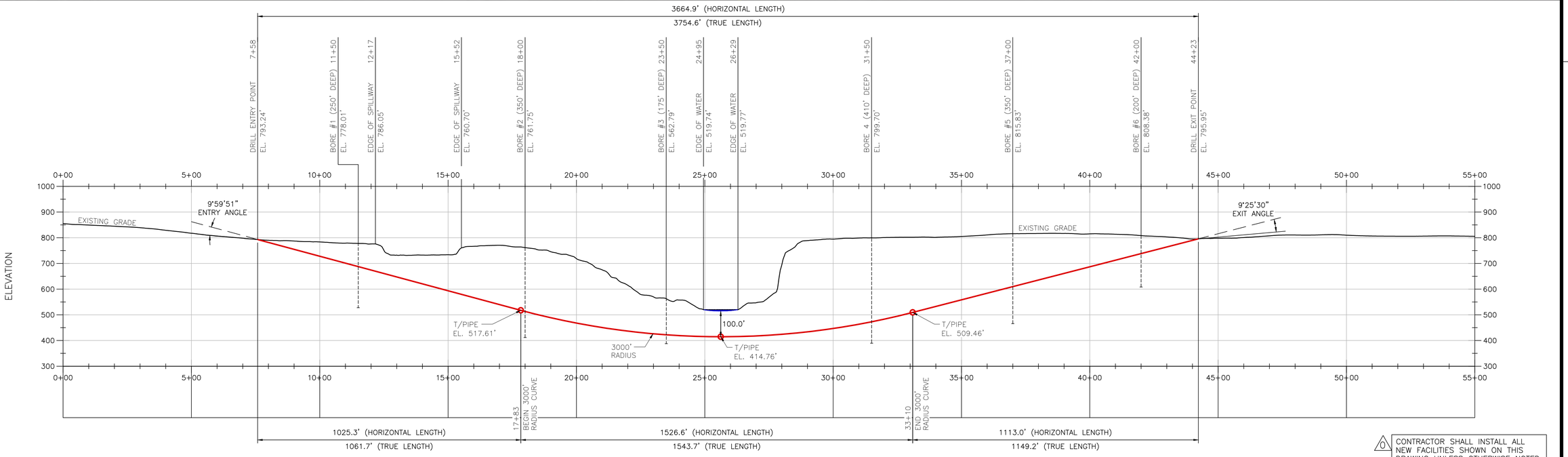
DRAWN	CHK. DR.	SCALE	DATE
BK		1" = 250'	12/21/16

PROJECT ENGR. / PROJECT MGR.: MDW

FILE NO. LGE-BR-WC-E1

FILE: I:\PROJECTS\LGE\163132.00\6 - WORKING DRAWINGS\MECHANICAL DRAWINGS\LGE-BR-WC-E1.DWG





0 CONTRACTOR SHALL INSTALL ALL NEW FACILITIES SHOWN ON THIS DRAWING UNLESS OTHERWISE NOTED.

NO.	DATE	BY	PROJ NO.	DESCRIPTION	ENGR.	DATE	BY
0	12/22/16	BK		ISSUED FOR REVIEW	MDW		

REVISIONS

NO.	DATE	BY	PROJ NO.	DESCRIPTION	ENGR.	DATE	BY
	ISSUED		AS BUILT		APPROVED		

REVISIONS

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WARRENVILLE, IL 60555
TEL. 630.353.4000
FAX 630.353.7777
WWW.ENENGINEERING.COM

TITLE
REFERENCE DRAWINGS

LG&E LOUISVILLE GAS & ELECTRIC

ISSUED FOR BID
ISSUED FOR CONSTRUCTION

PROJ. NO.
DRAWING SIZE D

30" BROWN PIPELINE HDD CROSSING DIX RIVER PLAN & PROFILE

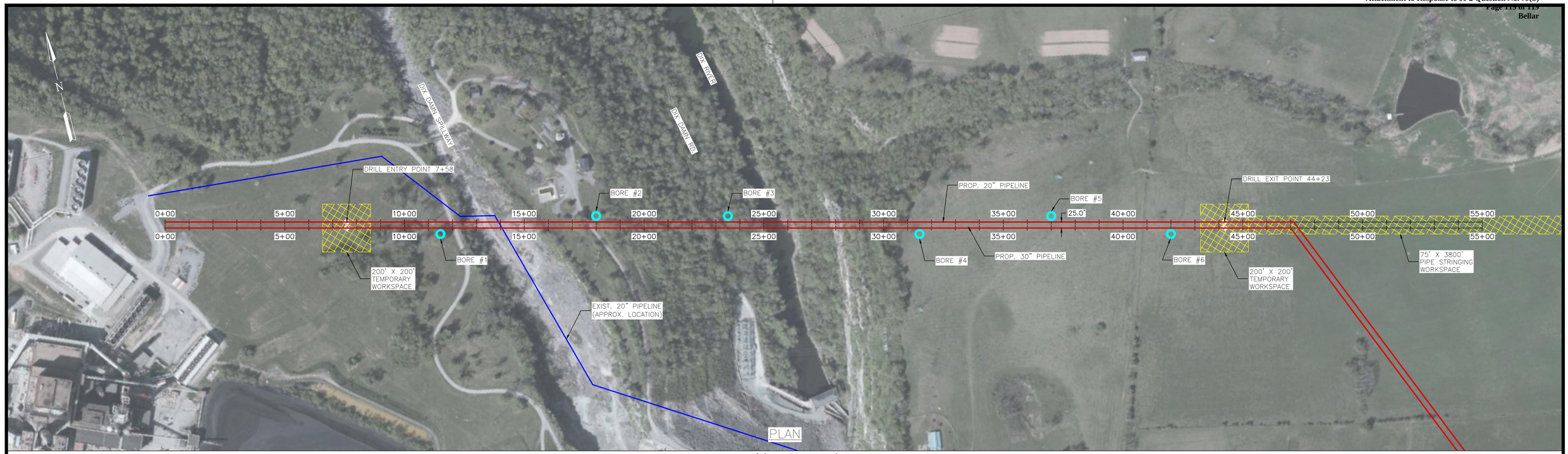
MERCER & GARRARD COUNTIES, KENTUCKY

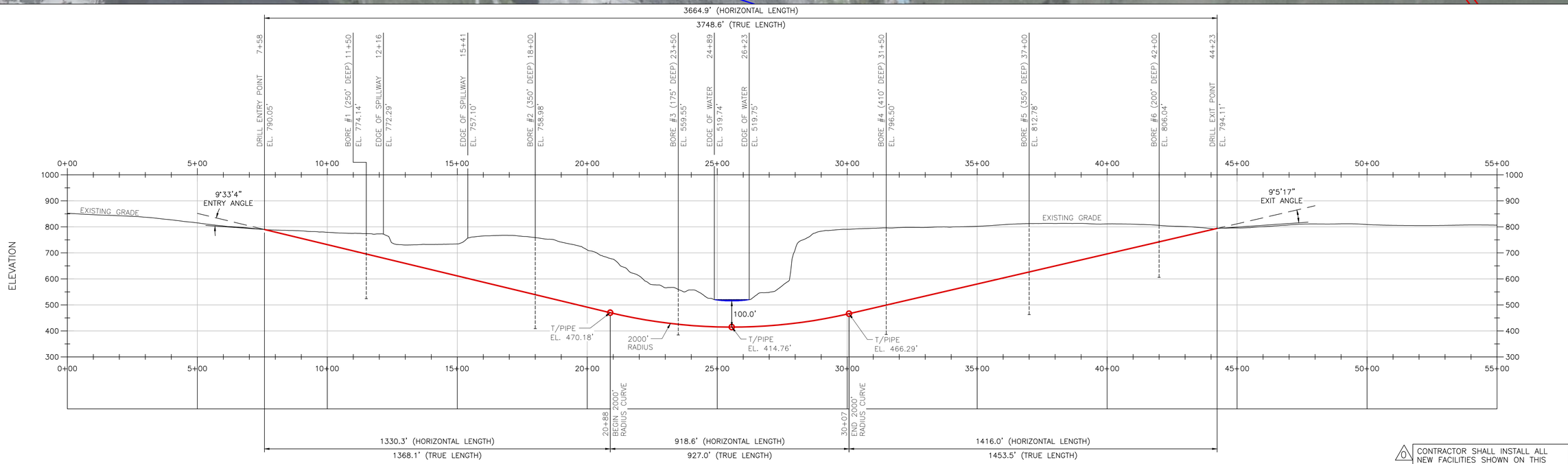
DRAWN	CHK. DR.	SCALE	DATE
BK		1" = 200'	12/21/16

PROJECT ENGR. / PROJECT MGR.: MDW

FILE NO. LGE-BR-WC-E2

FILE: I:\PROJECTS\LGE\163132.00\6 – WORKING DRAWINGS\MECHANICAL DRAWINGS\LGE-BR-WC-E2.DWG





PROFILE

0 CONTRACTOR SHALL INSTALL ALL NEW FACILITIES SHOWN ON THIS DRAWING UNLESS OTHERWISE NOTED.

NO.	DATE	BY	PROJ NO.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY
	ISSUED							APPROVED	
0	12/22/16	BK				ISSUED FOR REVIEW	MDW		

REVISIONS

NO.	DATE	BY	PROJ NO.	DATE	BY	DESCRIPTION	ENGR.	DATE	BY
	ISSUED			AS BUILT				APPROVED	

REVISIONS

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WARRENVILLE, IL 60555
TEL. 630.353.4000
FAX 630.353.7777
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TITLE

REFERENCE DRAWINGS

LOUISVILLE GAS & ELECTRIC

ISSUED FOR BID
ISSUED FOR CONSTRUCTION
PROJ. NO.
DRAWING SIZE D

20" BROWN PIPELINE HDD CROSSING DIX RIVER PLAN & PROFILE

MERCER & GARRARD COUNTIES, KENTUCKY

DRAWN	CHK. DR.	SCALE	DATE
BK		1" = 200'	12/21/16

PROJECT ENGR. / PROJECT MGR.: MDW

FILE NO. LGE-BR-WC-E3

FILE: I:\PROJECTS\LGE\163132.00\6 – WORKING DRAWINGS\MECHANICAL DRAWINGS\LGE-BR-WC-E3.DWG