Mountain Valley Pipeline Project

Docket No. CP21- -000

Appendix F

Feasibility Assessments For Technical Bores

Feasibility Assessments Included in Appendix

Crossing No. C-022 Elk River
Crossing No. C-035
Crossing No. F-021 Greenbrier River
Crossing No. G-013
Crossing No. H-031
Crossing No. I-121

C-022 (Elk River) Crossing Assessment

The Elk River crossing is approximately 296 feet long. The bore pit locations are shown on the drilling plan included in Appendix C of this SER. The guided conventional bore construction is expected to take approximately 120 days to complete. This is inclusive of guided conventional bore pit preparation, setup of boring equipment, boring activities, pipe installation, and guided conventional bore pit backfill.

The crossing, including the bore pit locations, can be accomplished within the already approved limits of disturbance (LOD). There is adequate space on both sides of the river to accommodate excavation of the launch and receive pits required to perform the bore. Guided conventional bore pits are the same depth of a conventional bore pit. However, the guided conventional bore method was selected over a conventional bore because the steerable head will help maintain a uniform path and prevent the head from diverging due to changes in strata. The guided conventional bore method will ensure a 5.5' minimum clearance between the bore and the bottom of the Elk River is maintained by using a steerable pilot bit to drill a pilot hole from one bore pit to the other with a small diameter drill stem. The clearance will be verified prior to completing the bore. The pilot string will remain the pilot hole during the conventional bore and will be connected to the front of it to stabilize the bore path.

The possibility of encountering hard rock that cannot be penetrated by the auger or cobbles that divert the bore away from the intended path is a risk. Test borings were conducted near the guided conventional bore pit location south of the crossing to determine the type of material expected to be encountered during the conventional boring process. Generally, the bore path is comprised of clay and shale type materials with a range of hardness levels. The bulk of the bore path is anticipated to be along an undulating boundary between sandstone bedrock and overlying alluvium/granular fill material. There was no indication that would raise concerns about the feasibility of the conventional boring process. A summary of the geological conditions is provided in Appendix I of this SER.

Mountain Valley also completed a Resistivity Imaging Study for crossing the Elk River in accessible areas to help identify the subsurface geology along the guided conventional bore path. The guided conventional bore path is interpreted to extend along or near an undulating boundary between sandstone bedrock and the overlying saturated alluvium, with as much as approximately 130 feet of the proposed guided conventional bore passing through unconsolidated alluvium. The conventional bore machine utilized for the bore will first cut a pilot bore path with a smaller hole prior to a single guided conventional auger bore pass in order to increase the chances of a successful bore.

According to the geotechnical data, groundwater may be encountered within the bore pits. Any groundwater will be pumped and filtered to maintain a safe working environment during the crossing. The project's standard dewatering structure has been enhanced for sensitive crossings like the Elk River. After discharging through a sediment filter bag, the water is then filtered through an interior cell that comprised of double stacked straw bales and geotextile fabric, reinforced with cattle fencing to help maintain the structural integrity. After filtering through

these devices, the water is then filtered through another row of double stacked straw bales, geotextile fabric, and cattle fencing. The structure will be in a well vegetated area to increase the retention and filtration of the water. The pumping rates will be monitored and modified to ensure that the structure does not overtop, and water is properly filtered. Using this structure greatly reduces the amount of turbid water discharging from the work area and potentially mixing with the Elk River. The dewatering structure will be located with the already approved LOD. However, if at any time a temporary dewatering structure is required off LOD, Mountain Valley will obtain permission from the landowner prior to building the structure.

Direct discharge to the Elk River or nearby tributaries will not occur. The bore pits on the both sides of the crossing will be reinforced using sheet piling or trench boxes, which provide structural support, and help prevent the infiltration of groundwater. There is a potential risk that bedrock fractures may intersect the bore pits when operating near a waterbody. If groundwater does enter the guided conventional bore pits, it will be pumped from the pit and circulated through the dewatering structure described above. Additionally, well points will be installed around the bore pits prior to construction and dewatered in order to remove water from the operating area. The dewatering device will be located within an existing temporary workspace. Any potential inadvertent release of material would be comprised of water, rock cuttings, suspended dust particles, and soil. Any resulting turbidity would be minute compared to an open cut disturbance or the result of an inadvertent return during an HDD process. The guided conventional bore crossing method was selected over the Direct Pipe© method because the available workspace will not accommodate a launch pit and pipe string for extensive excavation on the receiving side of the crossing would be needed for the Direct Pipe© method.

Given the above assessment, the guided conventional bore method and the dewatering structures and locations provide greater environmental protection for crossing the Elk River. Pilot guided conventional bore eliminates instream activity and provides minimal inadvertent return risk.

The Elk River crossing is underlain by the Pennsylvanian New River Formation of the Pottsville Group, a clastic sedimentary bedrock formation. The unit is comprised of predominantly sandstone, with some shale, siltstone, and coal, and grades to nearly all sandstone in the subsurface. Near the crossing location, the Sewell Coal seam is present in the hillsides above the river. These bedrock formations are not karst forming. The Elk River crossing is not in a karst area.

1 C-035 Crossing Assessment

The proposed crossing spans wetland W-H60 and W-H61 in Webster County, West Virginia. RK&K was requested to assess this crossing location and its extents approximately 150-feet on either side of the location identified by MVP. This proposed crossing spans approximately 300-feet form PI to PI and there is an elevation change of approximately 5 feet from the highest to the lowest point of the bore, and an elevation change of 5 feet from bore pit to bore pit.

As part of this trenchless crossing assessment, RK&K considered the terrain and the available workspace on both sides of the crossing. Our desktop assessment included identifying adequate workspace for the drill rig, all related equipment and pipe handling area based on each crossing method. Each method outlined below was assessed based on its feasibility at this location. The assessment also considered possible minor adjustments to the pipeline route to increase the feasibility of the trenchless crossing methods.

- Conventional Bore – ±300-foot bore from pit to pit: This proposed conventional bore is a feasible crossing method within the proposed MVP C-035 crossing. The bore would start at the Point of Intersection (PI) located approximately at station 0+60 and continue north for 300 feet to its exit point at approximately station 3+60. The proposed bore will have a minimum depth of approximately 5 feet below the existing wetlands.
- HDD: HDD is not a feasible crossing method within the current alignment. The 300-foot long straight section between PI's is not long enough to accommodate an HDD with an elevation change of 5-feet. We based our analysis on a bend radius of 2,500-feet and an entry/exit angle of 12° and 6° respectively. In addition, the available workspace appears limited based on the existing terrain. Minor adjustments in the alignment and layout do not increase the feasibility of an HDD at this location.
- Direct Pipe ©: Direct Pipe © is not a feasible crossing method within the current alignment. The available workspace will not accommodate the launch pit and pipe string. The 300-foot straight section is not long enough to achieve the desired 10-foot depth under the wetlands with the 2,500-foot radius without extensive excavation. A Direct Pipe © layout with an entry angle of 8° was used in the feasibility assessment. Minor adjustments in the alignment and layout do not increase the feasibility of Direct Pipe © at this location.

1.1 Site Geology

The proposed crossing is located in the Appalachian Low Plateau physiographic province. The geology is characterized primarily as predominantly sandstone, and shale. The overall formation is the Alleghany Formation with the Pineville and Gilpin soil series at the near surface. High rock and stone fragment content has been reported in soils overlying rock in this area. Materials requiring rock drilling techniques to penetrate are anticipated at this site.

1.2 C-035 Crossing Discussion

Based on preliminary desktop assessment, the crossing is feasible via conventional bore methods.

1.2.1 Conventional Bore – ±300-foot bore from pit to pit

The proposed conventional jack and bore will be approximately 300-feet in length from launching pit to receiving pit. There is adequate space on both sides of the crossing to accommodate excavation of the launch and receive pits required to perform the bore. The length of the bore, at 300 feet, is less than the typical 600-foot maximum for conventional bores making this bore less of a risk when compared to longer large-diameter bores. There is the potential for encountering hard rock at this site and therefore rock drilling techniques are anticipated at this site. The current layout of this bore may require some clearing and grading on both the launch and receiving pits side.

The benefits associated with this bore include:

- The boring length is less than the typical industry length limits.
- This option requires no adjustment to the proposed alignment.

The risks associated with this bore include:

- The possibility of encountering hard rock or cobbles that cannot be penetrated by the auger.

Based on preliminary assessment and the existing available subsurface geotechnical information, this crossing is feasible via conventional bore methods. Additional geotechnical investigations will be needed to define the crossing's subsurface conditions.

References:

S&ME Engineering, Desktop HDD Geologic Hazard Assessment, 16 Selected Crossings, August 17, 2015.

Draper Aden, MVP-024_Att 3_Geologic Conditions_rev3, July 2020.

F-021 (Greenbrier River) Crossing Assessment

The Greenbrier River crossing is approximately 1,250 feet long. The Direct Pipe© bore pit locations are shown on the drilling plan in Appendix C of this SER. The Direct Pipe© bore construction is expected to take up to 120 days to complete. This is inclusive of bore pit preparation, setup of boring equipment, boring activities, pipe installation, and bore pit backfill.

The crossing, including the Direct Pipe© bore pit locations, can be accomplished within the already-approved limits of disturbance (LOD). The relatively small receiving pit can be accommodated on the north side of the river. There is a shallower entry pit needed due to the nature of the Direct Pipe© method when compared to a conventional bore. The steering capabilities of a Direct Pipe © bore would allow Mountain Valley to dig shallower pits; whereas a conventional bore is straight, and pits would have to be excavated to the depth of the pipe. This provides several benefits from both a constructability and safety standpoint.

The Direct Pipe © pit is approximately 10-feet deep compared to a conventional bore pit depth of over 30-feet deep. As compared to the HDD method, Direct Pipe © typically uses up to 90% less bentonite and 80% less water and operates at much lower pressures. This results in reduced risk of inadvertent returns (IR). Also, unlike an HDD, the drilling fluid is recirculated though a system of hoses which are contained in the bore pipe. A very small amount of Bentonite is introduced to the annulus for lubricating the bore pipe and protecting the pipe coating.

Groundwater may be encountered within the Direct Pipe© bore pits. Any groundwater will be pumped and filtered to maintain a safe working environment during the crossing. The project's standard dewatering structure has been enhanced for sensitive crossings like the Greenbrier River. After discharging through a sediment filter bag, the water is then filtered through an interior cell that comprised of double stacked straw bales and geotextile fabric, reinforced with cattle fencing to help maintain the structural integrity. After filtering through these devices, the water is then filtered through another row of double stacked straw bales, geotextile fabric, and cattle fencing. The structure will be in a well vegetated area to increase the retention and filtration of the water. The pumping rates will be monitored and modified to ensure that the structure does not overtop, and water is properly filtered. Using this structure greatly reduces the amount of turbid water discharging from the work area and potentially mixing with the Greenbrier River.

Direct discharge to the Greenbrier River or nearby tributaries will not occur.

The predominant risk associated with the 42-inch Direct Pipe© bore include the possibility of encountering hard rock or cobbles that cannot be penetrated by the auger or cobbles that divert the bore away from the intended path. Direct Pipe© literature indicates that rock harder than 21,500 psi and cobbles/boulders larger than 30% of the pipe diameter can preclude Direct Pipe© methods.

Test borings were conducted near the bore pit locations on both sides of the crossing to determine the type of material expected to be encountered during the boring process. Generally, the bore path is comprised of a shale layer. This shale layer is a transition zone between

underlying limestone and overlying alluvium. Additionally, the bore path may extend through zones of fractured bedrock beneath the north and south banks of the river. There was no indication that would raise concerns about the feasibility of the Direct Pipe© boring process. A summary of the geological conditions is provided in Appendix I of this SER.

Mountain Valley also completed a Resistivity Imaging Study for crossing the Greenbrier River in accessible areas to help identify the subsurface geology along the Direct Pipe© bore path. The bore path is interpreted to extend through a shale layer as described in the test boring logs. The resistivity data also suggest the bore bath may extend through zones of fractured bedrock beneath the south and north banks of the river.

Mountain Valley does not anticipate conditions that would cause a loss of fluids. The Direct Pipe© equipment that Mountain Valley plans to utilize on the Greenbrier River bore comes equipped with downhole pressure monitoring capabilities. This will be closely monitored throughout the boring process to reduce the risk of inadvertent returns. Should downhole pressures drift from the acceptable range for the given soil conditions, adjustments will be made to bring the downhole pressure back into the acceptable range. A series of remotely controlled valves are located within the boring machine to allow for immediate control of the drilling and annulus pressures. Mountain Valley will also provide continuous surface monitoring for inadvertent returns during drilling.

Given the above assessment, the Direct Pipe© bore method and the dewatering structures and locations provide greater environmental protection for crossing the Greenbrier River. Direct Pipe© bore eliminates instream activity, is steerable, and provides minimal inadvertent return risk.

The Greenbrier River crossing is underlain by the Mississippian Bluefield Shale in the lower Mauch Chunk Formation. The unit is comprised of predominately shale, siltstone, and limestone, with minor sandstone, coal, and underclay. The underlying limestone bedrock formations are karst forming. The bore path is comprised of a shale layer between underlying limestone and overlying alluvium a minimum of 13 feet below the Greenbrier River. As such, the likelihood of intercepting any karst features from this bore is negligible. As there are no apparent surface karst features in the bore path or immediate work area placement of dewatering structures should not pose an issue to karst features. Should karst be discovered during the Direct Pipe© bore operations or during placement of dewatering structures, the karst mitigation plan will be employed.

1 G-013 Crossing Assessment

The proposed crossing spans streams S-Z10, S-Z11, S-Z12-EPH, S-Z13 and wetland W-Z3 in Giles County, Virginia. RK&K was requested to assess this crossing location and its extents approximately 150-feet on either side of the location identified by MVP. This proposed crossing spans approximately 330-feet form bore pit to bore pit and there is an elevation change of approximately 12 feet from the highest to the lowest point of the bore, and an elevation change of 7 feet from bore pit to bore pit.

As part of this trenchless crossing assessment, RK&K considered the terrain and the available workspace on both sides of the crossing. Our desktop assessment included identifying adequate workspace for the drill rig, all related equipment and pipe handling area based on each crossing method. Each method outlined below was assessed based on its feasibility at this location. The assessment also considered possible minor adjustments to the pipeline route to increase the feasibility of the trenchless crossing methods.

- Guided Conventional Bore – ±330-foot bore from pit to pit: This proposed guided conventional bore is a feasible crossing method within the proposed MVP G-013 crossing. The bore would start at the Point of Intersection (PI) located approximately at station 10798+50 and continue east for 330 feet to its exit point at approximately station 10801+80. The proposed bore will have a minimum depth of approximately 6.7 feet below the existing streams and wetlands. Launching and receiving pits will need to be dug to depths of 16 feet and 23 feet respectively.
- HDD: HDD is not a feasible crossing method within the current alignment. The 330-foot long straight section is not long enough to accommodate an HDD with an elevation change of 12-feet. We based our analysis on a bend radius of 2,500-feet and an entry/exit angle of 12° and 6° respectively. In addition, the available workspace appears limited based on the existing geography and the possible presence of cobbles or gravel may preclude using HDD installation techniques. Minor adjustments in the alignment and layout do not increase the feasibility of an HDD at this location.
- Direct Pipe ©: Direct Pipe © is not a feasible crossing method within the current alignment. The available workspace will not accommodate the launch pit and pipe string. The 330-foot straight section is not long enough to achieve the desired 10-foot depth under the wetlands with the 2,500-foot radius without extensive excavation. A Direct Pipe © layout with an entry angle of 8° was used in the feasibility assessment. Minor adjustments in the alignment and layout do not increase the feasibility of Direct Pipe © at this location.

1.1 Site Geology

The proposed crossing is located in the Valley and Ridge physiographic province. The geology is characterized primarily as predominantly shale and siltstone with occurrences of sandstone and limestone. The overall formation is the Brailer Formation with the Craigsville soil series at the near surface. High rock fragments, gravel and cobble

content has been reported in soils overlying rock in this area. Materials requiring rock drilling techniques to penetrate are anticipated at this site.

1.2 G-013 Crossing Discussion

Based on preliminary desktop assessment, the crossing is feasible via conventional bore methods.

1.2.1 Guided Conventional Bore – ±330-foot bore from pit to pit

The proposed guided conventional bore will be approximately 330-feet in length from launching pit to receiving pit. The guided conventional bore is a modification of a conventional bore where a small diameter pilot hole is drilled prior to conventional bore operations. There is adequate space on both sides of the crossing to accommodate excavation of the launch and receive pits required to perform the bore. The length of the bore, at 330 feet, is less than the typical 600-foot maximum for conventional bores making this bore less of a risk when compared to longer large-diameter bores. There is the potential for encountering hard rock at this site and therefore rock drilling techniques are anticipated at this site. The current layout of this bore may require some clearing and grading on both the launch and receiving pits side.

The benefits associated with this bore include:

- The boring length is less than the typical industry length limits.
- This option requires no adjustment to the proposed alignment.

The risks associated with this bore include:

- The depth of the bore pit excavations.
- The possibility of encountering hard rock or cobbles that cannot be penetrated by the auger.

Based on preliminary assessment and the existing available subsurface geotechnical information, this crossing is feasible via guided conventional bore methods. Additional geotechnical investigations will be needed to define the crossing's subsurface conditions.

References:

S&ME Engineering, Desktop HDD Geologic Hazard Assessment, 16 Selected Crossings, August 17, 2015.

1 H-031 Crossing Assessment

The proposed crossing spans streams S-IJ83 and S-IJ88, and wetlands W-IJ95-PSS and W-IJ102 in Roanoke County, Virginia. RK&K was requested to assess this crossing location and its extents approximately 200-feet on either side of the location identified by MVP. This proposed crossing spans approximately 362-feet form bore pit to bore pit and there is an elevation change of approximately 7 feet from the highest to the lowest point of the ground surface within the alignment of the bore, and a ground surface elevation change of 3 feet from the front of bore pit to the front of bore pit.

As part of this trenchless crossing assessment, RK&K considered the terrain and the available workspace on both sides of the crossing. Our desktop assessment included identifying adequate workspace for the drill rig, all related equipment and pipe handling area based on each crossing method. Each method outlined below was assessed based on its feasibility at this location. The assessment also considered possible minor adjustments to the pipeline route to increase the feasibility of the trenchless crossing methods.

- Conventional Bore – ±362-foot bore from pit to pit: This proposed conventional bore is a feasible crossing method within the proposed MVP H-031 crossing. The bore would start at station 12802+23 and continue north for 362 feet to its exit point at approximately station 12798+61. The proposed bore will have a minimum depth of approximately 5 feet below the existing streams and wetlands. Launching and receiving pits will need to be dug to depths of 14 feet and 17 feet respectively.
- HDD: HDD is not a feasible crossing method within the current alignment. The 362-foot long straight section is not long enough to accommodate an HDD with an elevation change of 7-feet. We based our analysis on a bend radius of 2,500-feet and an entry/exit angle of 12° and 6° respectively. In addition, the available workspace appears limited based on the existing geography and the possible presence of gravel may preclude using HDD installation techniques. Minor adjustments in the alignment and layout do not increase the feasibility of an HDD at this location.
- Direct Pipe ©: Direct Pipe © is not a feasible crossing method within the current alignment. The available workspace will not accommodate the launch pit and pipe string. The 362-foot straight section is not long enough to achieve the desired 10-foot depth under the wetlands with the 2,500-foot radius without extensive excavation. A Direct Pipe © layout with an entry angle of 8° was used in the feasibility assessment. Minor adjustments in the alignment and layout do not increase the feasibility of Direct Pipe © at this location.

1.1 Site Geology

The proposed crossing is located in the Blue Ridge physiographic province. The geology is characterized primarily as predominantly gneiss. The overall formation is the Layered Pyroxene Granulite Formation with the Sindion soil series at the near surface. Well-developed terrace deposits commonly containing gravel have been reported in near surface soils in this area. Materials requiring rock drilling techniques to penetrate may be required at this site.

1.2 H-031 Crossing Discussion

Based on preliminary desktop assessment, the crossing is feasible via conventional bore methods.

1.2.1 Conventional Bore – ±362-foot bore from pit to pit

The proposed conventional jack and bore will be approximately 362-feet in length from launching pit to receiving pit. There is adequate space on both sides of the crossing to accommodate excavation of the launch and receive pits required to perform the bore. The length of the bore, at 362 feet, is less than the typical 600-foot maximum for conventional bores making this bore less of a risk when compared to longer large-diameter bores. There is the potential for encountering hard rock at this site and therefore rock drilling techniques may be required at this site. The current layout of this bore may require some clearing and grading on both the launch pit side.

The benefits associated with this bore include:

- The boring length is less than the typical industry length limits.
- This option requires no adjustment to the proposed alignment.

The risks associated with this bore include:

- The depth of the bore pit excavations.
- The possibility of encountering hard rock or cobbles that cannot be penetrated by the auger.

Based on preliminary assessment and the existing available subsurface geotechnical information, this crossing is feasible via conventional bore methods. Additional geotechnical investigations will be needed to define the crossing's subsurface conditions.

References:

S&ME Engineering, Desktop HDD Geologic Hazard Assessment, 16 Selected Crossings, August 17, 2015.

1 I-121 Crossing Assessment

The proposed crossing spans stream S-EF26, and wetlands W-IJ22-PEM and W-IJ22-PFO in Pittsylvania County, Virginia. RK&K was requested to assess this crossing location and its extents approximately 250-feet on either side of the location identified by MVP. This proposed crossing spans approximately 405-feet form bore pit to bore pit and there is an elevation change of approximately 7-feet from the highest to the lowest point of the ground surface within the alignment of the crossing, and a ground surface elevation change of 2-foot from the front of bore pit to the front of bore pit.

As part of this trenchless crossing assessment, RK&K considered the terrain and the available workspace on both sides of the crossing. Our desktop assessment included identifying adequate workspace for the drill rig, all related equipment and pipe handling area based on each crossing method. Each method outlined below was assessed based on its feasibility at this location. The assessment also considered possible minor adjustments to the pipeline route to increase the feasibility of the trenchless crossing methods.

- Conventional Bore – ±405-foot bore from pit to pit: This proposed conventional bore is a feasible crossing method within the proposed MVP I-121 crossing. The bore would start at station 16003+82 and continue southeast for 405 feet to its exit point at approximately station 15999+77. The proposed bore will have a minimum depth of approximately 5 feet below the existing streams and wetlands. Launching and receiving pits will need to be dug to depths of 15 feet and 16 feet respectively.
- HDD: HDD is not a feasible crossing method within the current alignment. The 405-foot long straight section is not long enough to accommodate an HDD with an elevation change of 7-feet. We based our analysis on a bend radius of 2,500-feet and an entry/exit angle of 12° and 6° respectively. In addition, the available workspace appears limited based on the existing geography and the possible presence of gravel may preclude using HDD installation techniques. Minor adjustments in the alignment and layout do not increase the feasibility of an HDD at this location.
- Direct Pipe ©: Direct Pipe © is not a feasible crossing method within the current alignment. The available workspace will not accommodate the launch pit and pipe string. The 405-foot straight section is not long enough to achieve the desired 10-foot depth under the wetlands with the 2,500-foot radius without extensive excavation. A Direct Pipe © layout with an entry angle of 8° was used in the feasibility assessment. Minor adjustments in the alignment and layout do not increase the feasibility of Direct Pipe © at this location.

1.1 Site Geology

The proposed crossing is located in the Piedmont physiographic province. The geology is characterized primarily as predominantly mica schist and gneiss with occurrences of quartzite and melange. The overall formation is the Fork Mountain Formation with the Madison soil series at the near surface. Moderate gravel content have been reported in near surface soils in this area along with poorly developed alluvial soils. Materials requiring rock drilling techniques to penetrate may be required at this site.

1.2 I-121 Crossing Discussion

Based on preliminary desktop assessment, the crossing is feasible via conventional bore methods.

1.2.1 Conventional Bore – ±405-foot bore from pit to pit

The proposed conventional jack and bore will be approximately 405-feet in length from launching pit to receiving pit. There is adequate space on both sides of the crossing to accommodate excavation of the launch and receive pits required to perform the bore. The length of the bore, at 405 feet, is less than the typical 600-foot maximum for conventional bores making this bore less of a risk when compared to longer large-diameter bores. There is the potential for encountering hard rock at this site and therefore rock drilling techniques may be required at this site. The current layout of this bore may require some clearing and grading on both the launch pit and receiving pit sides.

The benefits associated with this bore include:

- The boring length is less than the typical industry length limits.
- This option requires no adjustment to the proposed alignment.

The risks associated with this bore include:

- The depth of the bore pit excavations.
- The possibility of encountering hard rock or cobbles that cannot be penetrated by the auger.

Based on preliminary assessment and the existing available subsurface geotechnical information, this crossing is feasible via conventional bore methods. Additional geotechnical investigations will be needed to define the crossing's subsurface conditions.

References:

S&ME Engineering, Desktop HDD Geologic Hazard Assessment, 16 Selected Crossings, August 17, 2015.