Alternatives Analysis Table
Riverine Resources
Luzerne County

Watercourse ID and Crossing Number[1]	Watercourse Name	Milepost[2]	Latitude	Longitude	Primary Pipeline Crossing Method[3]	Secondary Pipeline Crossing Method[3]	Tertiary Pipeline Crossing Method[3]	Geology Constraints	Topography Constraints	Insufficient Workspace to Stage Trenchless	Practicality	Other (See Justification)	Implementing Trenchless Technology	Routing to Minimize	Crossing at Narrowest Location	Co-Locating	Reducing LOD	Minimizing Construction Duration	Adhering to Construction Timing Windows	Implementing BMPs	Justification
092414_GO_1001_P_IM	Trout Brook	0.6	41.346530	-75.899263	BX	BX	BX				X	X	X		X		X			X	Incorporated into the Lower Demunds Road bored crossing.
032818_WA_1000_P_IN	UNT to Trout Brook	1.4	41.341448	-75.921899	DPX	FX	CD				X	X					X	X	X	X	Time to cross justifies open-cut, workspace reduced to 75'. Estimated crossing timeframe is 48 hours.
050416_DB_1001_I_MI	UNT to Abrahams Creek	2.1	41.337719	-75.910593	DPX	FX	DX-NF				X	X			X		X	X		X	Intermittent stream is part of a wetland. Time to cross justifies open-cut. Estimated crossing timeframe is 24 hours.
011815_JC_1000_I_MI	UNT to Abrahams Creek	2.6	41.332003	-75.904784	DPX	FX	DX-NF				X	X			X		X	X		X	Time to cross justifies open-cut, workspace reduced to 75'. Estimated crossing timeframe is 24 hours.
011815_JC_1001_P_MI	UNT to Toby Creek	3.1	41.325872	-75.899495	DPX	FX	CD		X		X				X		X	X	X	X	Topography would require deep bore pits, and adjacent residence units limit the workspace required for other trenchless construction methods. Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 48 hours.
011815_JC_1002_I_MI	UNT to Toby Creek	3.1	41.325641	-75.899263	DPX	FX	DX-NF				X	X			X		X	X	X	X	Intermittent stream is part of a wetland . Time to cross justifies open-cut, workspace reduced to 75'. Estimated crossing timeframe is 48 hours.
101717_AB_1001_I_MI	UNT to Toby Creek	3.5	41.322740	-75.892915	DPX	FX	DX-NF		X		X	X			X		X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
020916_BT_1001_I_MI	UNT to Abrahams Creek	4.3R2	41.322800	-75.879463	DPX	FX	DX-NF		X		X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
020916_BT_1003_P_MI	UNT to Abrahams Creek	4.3R2	41.322343	-75.878331	DPX	FX	CD			X	X				X		X	X	X	X	Timing to cross justifies open cut. Over half LOD is in culverted section of stream. Existing route not conducive to trenchless crossing. Estimated crossing timeframe is 24 hours
020916_BT_1006_I_MI	UNT to Abrahams Creek	5.1	41.313760	-75.869775	N/A	N/A	N/A			X	X				X		X	X	X	X	Time to cross justifies open-cut, workspace reduced to 75' in stream. Existing route not conducive to trenchless crossing. Feature not crossed by pipeline.
020916_BT_1007_I_MI	UNT to Abrahams Creek	5.1	41.313748	-75.869682	DPX	FX	DX-NF		X		X	X			X		X	X	X	X	Steep topography on either side would make trenchless crossing difficult. Estimated crossing timeframe is 24 hours.
092314_GO_1001_I_MI	UNT to Abrahams Creek	6	41.308143	-75.853945	DPX	FX	DX-NF				X	X			X		X	X		X	Time to cross justifies open-cut. Existing route not conducive to other trenchless methods like HDD. Estimated crossing timeframe is 48 hours.
092414_GO_1002_I_IN	Abrahams Creek	6.1	41.307219	-75.852585	DPX	FX	DX-NF		X		X	X			X		X	X		X	Time to cross justifies open-cut, workspace reduced to 75' in stream. Estimated crossing timeframe is 48 hours.
092414_GO_1003_P_IM	UNT to Susquehanna River	6.2R2	41.305865	-75.850449	DPX	FX	CD				X				X		X	X		X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 48 hours.
102315_WA_1001_P_MA (1) - 1	Susquehanna River	6.9	41.301427	-75.839206	CD	CD	CD	X		X	X						X	X		X	Geology indicates cobble - not conducive to HDD, Direct Pipe, nor Microtunnel. Limited workspace for trenchless technologies like HDD and Direct Pipe due to nearby residencies and businesses. Estimated crossing timeframe is 60 days.
102315_WA_1001_P_MA (1) - 2	Susquehanna River	7.2	41.299318	-75.836335	CD	CD	CD	X		X	X						X	X		X	Geology indicates cobble - not conducive to HDD, Direct Pipe, nor Microtunnel. Limited workspace for trenchless technologies like HDD and Direct Pipe due to nearby residencies and businesses. Estimated crossing timeframe is 60 days.
102315_WA_1001_P_MA (2) - 1	Susquehanna River (Cofferdam crossing)	7	41.302896	-75.834354	N/A	N/A	N/A	X		X	X						X	X		X	Geology indicates cobble - not conducive to HDD, Direct Pipe, nor Microtunnel. Limited workspace for trenchless technologies like HDD and Direct Pipe due to nearby residencies and businesses. Feature not crossed by pipeline.

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102315_WA_1001_P_MA (2) - 2	Susquehanna River (Cofferdam crossing)	7.1	41.301451	-75.832772	N/A	N/A	N/A	X		X	X						X	X		X	Geology indicates cobble - not conducive to HDD, Direct Pipe, nor Microtunnel. Limited workspace for trenchless technologies like HDD and Direct Pipe due to nearby residencies and businesses. Feature not crossed by pipeline.
071416_GM_1001_P_IN	Gardner Creek	9.7R2	41.279798	-75.811849	DPX	FX	CD		X	X		X			X		X	X		X	Significant elevation change, steep slope on the north side (12 degrees) and over 55 feet thick fill/mine spoil deposits on the south side of crossing present challenges to trenchless construction methods. See site-specific justification discussion in the Gardner Creek Alternatives Analysis .
050416_DB_1002_I_MI	UNT to Mill Creek	10.1R2	41.275114	-75.809256	DPX	FX	DX-NF					X			X			X	X	X	Workspace configuration at crossing is required for pullback operations of St. Rte. 315 HDD Estimated crossing timeframe is 24 hours.
110514_JC_1002_P_IM	Mill Creek	10.8R2	41.266725	-75.800212	DPX	FX	CD	X	X	X	X				X		X	X	X	X	Cannot bore due to steep slope and rocky terrian. Slope on the north side (28%) presents challenges to HDD, Direct Pipe and Microtunnel construciton methods. In addition, bore pits of over 6 feet deep would be required due to the elevation difference of the stream channel and the south side of crossing (very unsafe). Workspace reduced to 75' through stream. Estimated crossing duraction is 48 hours.
121614_JC_1000_P_MI	Deep Creek	11.5R2	41.261322	-75.791256	DPX	FX	CD	X	X		X			X	X		X	X	X	X	Cannot bore due to steep slope and rocky terrian. Deviation crosses stream perpendicularly rather than through meanders, as it would if co-located with power line easement. Workspace reduced to 75' through stream and floodway. Estimated crossing duration is 48 hours.
121614_JC_1001_E_MI	UNT to Deep Creek	11.5R2	41.260502	-75.789742	DPX	FX	DX-NF				X				X		X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
121514_JC_1001_E_MI	UNT to Mill Creek	12.4R2	41.251750	-75.778697	DPX	FX	DX-NF				X	X			X	X	X	X	X	X	Workspace reduced to 75' through stream and floodway. Estimated crossing timeframe is 24 hours.
121814_JC_1010_P_MI	UNT to Mill Creek	13	41.249719	-75.774108	BX	BX	BX				X		X							X	Workspace reduced to 75' through stream and floodway. Estimated crossing duration is 48 hours.
121814_JC_1011_P_MI	UNT to Mill Creek	13.1	41.249490	-75.773361	DPX	FX	CD		X	X	X	X			X		X	X	X	X	Constraints associated with bore of SR 2 39 and 121814_JC_1 11_P_MI, nearby residence, and steep slope prevent trenchless construction. Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours
121814_JC_1013_E_MI	UNT to Mill Creek	13.2	41.249039	-75.771928	DPX	FX	DX-NF				X	X			X		X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours with its width being 2 '.
121814_JC_1012_E_MI	UNT to Mill Creek	13.2	41.248398	-75.770579	BX	BX	BX				X	X	X				X			X	Stream incorporated as part of I476 bored crossing. Workspace reduced to 75' through stream and floodway. Estimated crossing duration is 48 hours.
121814_JC_1007_E_MI	UNT to Mill Creek	13.3	41.247999	-75.770256	BX	BX	BX				X	X	X				X			X	Stream incorporated as part of I476 bored crossing. Workspace reduced to 75' through stream and floodway. Estimated crossing duration is 48 hours.
121814_JC_1008_P_MI - 1	UNT to Mill Creek	13.3	41.247696	-75.770010	DPX	FX	CD				X				X		X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
121814_JC_1005_P_MI	UNT to Mill Creek	13.6	41.244100	-75.767517	DPX	FX	CD				X				X	X	X	X	X	X	Steep slope on the south side of crossing (16%) present challenges to trenchless construction methods (HDD, Direct Pipe, Microtunnel). Workspace reduced to 75' in stream and floodway. Estimated crossing duration is 48 hours.

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121814_JC_1006_I_MI	UNT to Mill Creek	13.6	41.244035	-75.767435	DPX	FX	DX-NF				X	X			X	X	X	X	X	X	Steep slope on the south side of crossing (16%) present challenges to trenchless construction methods (HDD, Direct Pipe, Microtunnel). Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
121814_JC_1004_I_MI	UNT to Mill Creek	13.7	41.243136	-75.766302	DPX	FX	DX-NF				X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
121814_JC_1003_I_MI	UNT to Mill Creek	13.8	41.241668	-75.764336	N/A	N/A	N/A				X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Feature not crossed by pipeline.
121814_JC_1002_P_MI	UNT to Mill Creek	13.9	41.241128	-75.763772	DPX	FX	CD		X		X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
121814_JC_1001_P_MI	UNT to Mill Creek	13.9	41.240526	-75.763013	DPX	FX	CD		X		X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Time to cross justifies open cut. Estimated crossing timeframe is 24 hours.
111014_JC_1001_E_MI	UNT to Mill Creek	14.1	41.238520	-75.760495	DPX	FX	DX-NF		X		X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
041017_NJ_1002_I_MI	UNT to Little Bear Creek	14.7	41.232180	-75.752526	DPX	FX	DX-NF				X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway.Estimated crossing timeframe is 24 hours.
043015_JC_1001_I_MI	UNT to Little Bear Creek	15	41.229629	-75.749334	DPX	FX	DX-NF				X	X			X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
112114_JC_1003_P_IM - 1	UNT to Bear Creek	16.2	41.217339	-75.733550	DPX	FX	CD	X	X		X					X	X	X		X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
112114_JC_1002_P_MI	Bear Creek	16.2	41.217030	-75.733055	DPX	FX	CD		X		X				X	X	X	X		X	Workspace reduced to 75' in stream and floodway. Estimated crossing duration is 48 hours.
112114_JC_1001_P_MI - 1	UNT to Bear Creek	16.4	41.215436	-75.730538	DPX	FX	CD		X		X				X	X	X	X		X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours.
112014_JC_1003_P_IM - 1	Meadow Run	16.7	41.212532	-75.725931	DPX	FX	CD		X		X					X	X	X		X	Steep slopes north (23%) and south (44%) of the crossing is impractical for trenchless methods (HDD, Direct Pipe, Microtunnel). The elevation change would require bore pits of over 5 feet deep (Unsafe). Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 48 hours
112014_JC_1002_P_MI	UNT Meadow Run	16.9	41.210735	-75.723067	DPX	FX	CD				X				X	X	X	X		X	Workspace reduced to 75' in stream, floodway, and abuttting wetlands. Estimated crossing duration is 48 hours.
112014_JC_1001_P_MI	UNT to Little Shades Creek	17.7	41.202669	-75.711108	DPX	FX	CD			X	X				X	X	X	X	X	X	Workspace reduced to 75' in stream, floodway, and abuttting wetlands. Estimated crossing timeframe is 24 hours. Proximity to Meadow Run Road and residences limits workspace availability for trenchless construction methods.
111914_JC_1002_P_IM	Little Shades Creek	18.3	41.196896	-75.702087	DPX	FX	CD				X					X	X	X	X	X	Slopes on the west side of the crossing (11%) can present challenges to trenchless methods. Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 48 hours
111914_JC_1001_P_IM	UNT to Little Shades Creek	18.4	41.196394	-75.701516	N/A	N/A	N/A				X	X				X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Feature not crossed by pipeline.
121614_JC_1009_P_IM	Shades Creek	19.6	41.179581	-75.696617	DPX	FX	CD		X	X	X			X			X	X	X	X	Workspace reduced to 75' in stream and floodway. Current route is challenging for trenchless methods. Estimated crossing timeframe is 48 hours.
121714_JC_1001_E_MI	UNT to Shades Creek	20	41.173557	-75.696364	DPX	FX	DX-NF		X		X				X	X	X	X	X	X	Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 48 hours.
121614_JC_1006_P_MI	UNT to Shades Creek	20.1	41.172410	-75.696272	DPX	FX	CD		X		X				X	X	X	X	X	X	Trenchless impractical due to sideslope. Workspace reduced to 75' in stream and floodway. Estimated crossing duration is 48 hours.

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121614_JC_1004_I_MI	UNT to Stony Run	21.2	41.157417	-75.693903	DPX	FX	DX-NF		X		X				X	X	X	X	X	X	Trenchless impractical due to sideslope. Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 24 hours with its stream width being approximately 4 '.
050615_JC_1001_P_IM	Stony Run	22.7	41.136186	-75.689567	DPX	FX	CD		X		X				X	X	X	X	X	X	Trenchless impractical due to steep slopes north of the crossing (35%), as well as south of the crossing (16%). Workspace reduced to 75' in stream and floodway. Estimated crossing timeframe is 48 hours

Notes:
1. In instances where a watercourse is crossed by the proposed pipeline or workspace multiple times, crossing numbers (e.g. "-1", "-2") have been added to the Watercourse ID.
Watercourse ID Key: P = perennial, I = intermittent, E = ephemeral, MA = major, IN = intermediate, MI = minor, C = canal, D = ditch
2. All route deviations implemented after the FERC Certificate Application are denoted with an "R" and indicate a MP equation. MPs with an "R1" indicate route deviations implemented and provided to FERC prior to the issuance of the DEIS. MPs with an "R2" indicate route deviations implemented as part of the September 2016 Route Update. MPs with an "R3 indicate route deviations implemented post-FERC Certificate issuance. All MPs without an "R" indicate that the route has not changed since the Certificate Application.
3. Crossing Type Key for Watercourse Channels:
• BX = Conventional Bore Crossing
• CD = Cofferdam Crossing
• DPX = Dam-and-Pump Crossing
• DX-NF = Dry Crossing If No Flow
• FX = Flume Crossing
• HDD = HDD Crossing
• N/A = Not Applicable