MOTT MACDONALD

PennEast PIPELINE

APPENDIX A

HDD SUMMARY TABLE

HDD ID	Resource(s) Crossed	Crossing Length (ft)[1]	MP begin[2, 3]	MP End[2,3]	County	Wetland Resource Value Classification[4]	Surface Water Quality Classification[5]	Sensitive Resource[6]	Within 450ft of a Well/Water Supply[7]
Pennsylvania/New Jersey									
Delaware River	Delaware River, Delaware Canal & forested and scrub-shrub wetlands	2,836	77.4	77.9	Bucks / Hunterdon	Exceptional	WWF/DRBC	Historic Canal, Archaeological Site nearby, State Park (DCNR), Public Water Supply	Yes
New Jersey									
Milford Warren Glenn Rd.	Milford Warren Glenn Rd., NJDEP mapped wetlands, Spring Mills Brook, and Spring Mills Brook UNT	2,449	82.1	82.5R2	Hunterdon	Exceptional	FW2-TPC1	None	Yes
Nishisakawick Creek	Nishisakawick Creek, Nishisackawick Creek UNT, & forested wetland	3,301	87.4R3	88	Hunterdon	Exceptional	FW2-NTC1	Long-tailed Salamander habitat	Yes
Lockatong Creek	Lockatong Creek, Lockatong Creek UNT & forested, scrub-shrub and emergent wetlands,	6,308	91.4R2	92.6R2	Hunterdon	Exceptional	FW2-NTC1	None	No
Featherbed Lane	Featherbed Lane, Lockatong Creek UNT, NJDEP mapped wetlands, forested & emergent wetlands	2,752	93.4R2	93.9R2	Hunterdon	Exceptional	FW2-NTC1	None	Yes
Wickecheoke Creek Tributary	Wickecheoke Creek UNT,NJDEP mapped wetlands & forested wetlands	3,663	94.8R2	95.4R2	Hunterdon	Intermediate	FW2-NTC1	None	Yes
Wickecheoke Creek	Wickecheoke Creek, Wickecheoke Creek UNT, and NJDEP mapped wetlands	3,309	96.5R2	97.1R2	Hunterdon	Exceptional	FW2-TMC1	Long-tailed Salamander habitat	Yes
Brookville Hollow Rd.	Brookville Hollow Rd., Delaware & Raritan Canal UNT, NJDEP mapped wetlands	3,013	98.3R2	98.8	Hunterdon	Exceptional	FW2-NT	None	Yes
Alexauken Creek	Alexauken Creek, Alexauken Creek UNT, NJDEP mapped wetlands, forested wetlands	6,300	99.7R2	100.9R2	Hunterdon	Exceptional/Intermediate	FW2-TMC1	None	Yes

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HDD ID	Resource(s) Crossed	Crossing Length (ft)[1]	MP begin[2, 3]	MP End[2,3]	County	Wetland Resource Value Classification[4]	Surface Water Quality Classification[5]	Sensitive Resource[6]	Within 450ft of a Well/Water Supply[7]
Pleasant Valley Rd.	Pleasant Valley Road, Moore's Creek, Moore's Creek UNT, & Forested Wetlands	3,100	105.5R2	106R2	Mercer	Exceptional/ Intermediate	FW2-TM	Wood Turtle habitat	No
Washington Crossing Pennington Rd.	Washington Crossing Pennington Road, Woolsey Brook, & emergent wetlands	2,699	110.4	110.9	Mercer	Intermediate	FW2-NT	None	Yes

Notes:

1. Lengths are approximate and subject to field verification. See design reports for additional information.
2. All route deviations implemented after the September 2015 FERC Filing are denoted with an "R" and indicate a milepost equation. Mileposts with an "R1" indicate route deviations implemented and provided to FERC prior to the issuance of the Draft Environmental Impact Statement. Mileposts with an "R2" indicate route deviations implemented as part of this September 2016 Supplemental Filing. Mileposts with an "R3 indicate route deviations implemented post-FERC certificate issuance. All mileposts without an "R" indicate that the route has not changed since the September 2015 Application.
3. Begin/End MPs are at the approximate locations of HDD entry/exit points.
4. Anticipated New Jersey wetland resource value classification in accordance with the NJ Freshwater Wetlands Protection Act Rules at N.J.A.C. 7:7A. PADEP and NJDEP make the final determinations regarding resource values.
5. Source: Stream Sections that Support Wild Trout Production (PFBC, 2018), Class A Wild Trout Waters (PFBC, 2018), Trout Stocked Streams (PFBC, 2018), New Jersey Surface Water Quality Standards (NJDEP 2010), Delaware River Designation per Delaware River Basin Commission, (DRBC, 2015).
6. New Jersey sensitive resources based on publicly available data and field survey results to date reflecting the presence of NJ State-listed threatened or endangered species considered to be Critically Dependent on Water Quality for Survival. Resources should be confirmed prior to construction, based on updated survey results.
7. Well locations obtained a database of wells identified through public databases, civil survey, and landowner input. Well Data based on current survey data as of 6/2019. Table will be updated as additional survey information becomes available.

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APPENDIX B

INADVERTENT RETURN RISK ASSESSMENT

HDD ID	Potential Contributing Factors to an Inadvertent Return	Mitigation/Discussion
Pennsylvania/New Jersey		
Delaware River	Changing lithology - Changing geotechnical strata between western side (dolomite) and eastern side of the river (gneiss). Soils containing high percentage of gravels and cobbles - During the geotechnical investigation, layers of gravel and isolated boulders were observed extending to various depths on both sides of the Delaware River. These soils represent a risk to the overall bore stability, raveling of gravel into the bore, potential damage to the pipe string, and increased pullback loads/stresses. Karst Features & Fault Transitioning - Mapped Karst features include 4 surface depressions within 0.5 miles of the borings on the Pennsylvania side of the river. Controlling and maintaining fluid flow within the bore	Developing grouting plans and loss of circulation plans - This will be a Contractor workplan requirement. Implementation of casing -To support these soils and mitigate the risks associated with such deposits, a temporary conductor casing is recommended on the both sides of the HDD installation. Locating the drill outside of areas of known Karst features - HDD designed to avoid known locations of Karst features. Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Drill and intersect methodology - The drill and intersect method was chosen to mitigate risks associated with the geotechnical data provided during the investigation, such as drilling through cobbles and gravel at the entry and exit points, and hydraulic fracture through the overburden materials above the alignment. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required drilling fluid pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore
New Jersey		
Milford Warren Glenn Rd.	Controlling and maintaining fluid flow within the bore	Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required drilling fluid pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore

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HDD ID	Potential Contributing Factors to an Inadvertent Return	Mitigation/Discussion
Nishisakawick Creek	Controlling and maintaining fluid flow within the bore	Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required drilling fluid pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore
Lockatong Creek	Length of Drill – Longer HDD drill lengths require higher drilling fluid pressures to facilitate drilling fluid flow back to the drill rig. Controlling and maintaining fluid flow within the bore	Drill and intersect methodology - The drill and intersect method was chosen to mitigate risks associated with the designed length of the drill, as this strategy helps to the lower drilling fluid pressures. Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore
Featherbed Lane	No detailed bedrock information for south side – Borings could not be completed due to site access restrictions, and quality of bedrock unable to be determined. Controlling and maintaining fluid flow within the bore	Geophysical investigation completed in lieu of borings – A seismic refraction survey was completed to determine the depth to bedrock along the northern portion of the crossing. Bedrock conditions and materials assumed to be similar to those identified in completed borings on the south side of the crossing. Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required drilling fluid pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore

HDD ID	Potential Contributing Factors to an Inadvertent Return	Mitigation/Discussion
Wickecheoke Creek Tributary	Soils containing high percentage of gravels and cobbles - During the geotechnical investigation, some gravels were noted in the upper soil layer. These soils could represent a risk to the overall bore stability, raveling of gravel into the bore, potential damage to the pipe string, and increased pullback loads/stresses. Low RQD zones (<40%) - the rock quality is low for the first 40 feet of depth in the vicinity of Boring B-68. Controlling and maintaining fluid flow within the bore	Implementation of casing - During the geotechnical investigation, gravel was noted in the upper soil layer. Given the shallow depth and relatively low anticipated percentage of gravel, temporary conductor casing is not deemed necessary for the proposed crossing. However, the HDD Contractor should be prepared to install temporary conductor casing if actual soil conditions warrant its use. Developing grouting plans and loss of circulation plans for implementation if preferential drilling fluid flow pathways are encountered - This will be a Contractor workplan requirement. Refer to Schedule A-10 HDD Construction Specification. Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore
Wickecheoke Creek	Controlling and maintaining fluid flow within the bore	Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore
Brookville Hollow Rd.	No detailed bedrock information for south side – Borings could not be completed due to site access restrictions, and quality of bedrock unable to be determined. Controlling and maintaining fluid flow within the bore	Geophysical investigation completed in lieu of borings – A seismic refraction survey was completed to determine the depth to bedrock along the southern portion of the crossing. Bedrock conditions and materials assumed to be similar to those identified in completed borings on the north side of the crossing. Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore

HDD ID	Potential Contributing Factors to an Inadvertent Return	Mitigation/Discussion
Alexauken Creek	Soils containing high percentage of gravels and cobbles - During the geotechnical Investigation, some soils containing decomposed rock fragments were encountered. These soils could represent a risk to the overall bore stability, raveling of gravel into the bore, potential damage to the pipe string, and increased pullback loads/stresses. Length of Drill – Longer HDD drill lengths require higher drilling fluid pressures to facilitate drilling fluid flow back to the drill rig. Controlling and maintaining fluid flow within the bore	Implementation of casing - During the geotechnical investigation, gravel was noted in the upper soil layer. Given the shallow depth and relatively low anticipated percentage of gravel, temporary conductor casing is not deemed necessary for the proposed crossing. However, the HDD Contractor should be prepared to install temporary conductor casing if actual soil conditions warrant its use. Drill and intersect methodology - The drill and intersect method was chosen to mitigate risks associated with drilling through decomposed rock fragments and gravel at the entry and exit locations. This strategy allows for both sides of the installation to be temporarily cased during drilling operations. The drill and intersect method can also mitigates risk associated with the designed length, as this strategy helps to the lower drilling fluid pressures. Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore
Pleasant Valley Rd.	Controlling and maintaining fluid flow within the bore	Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore
Washington Crossing Pennington Rd.	Controlling and maintaining fluid flow within the bore	Locating the drill within favourable geotechnical materials at a sufficient installation depth – A stable flow pathway can be created between the drill bit and the HDD entry/exit locations when properly drilled by the HDD contractor. Hydrofracture/hydraulic fracture evaluations completed to define allowable drilling fluid pressures and required drilling fluid pressures - The results will be verified by the Contractor as part of their workplan and used during construction to limit downhole drilling fluid pressures. Contractor required by contract documents to monitor downhole annular drilling fluid pressures during entire pilot bore