Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0760 (Dowell's Draft at MP AP-1 117.07)

Photograph 2 (IMG_0625.jpg)

Date: 06-April-2016

Direction: Upstream

Description: View of stream bed comprising laminar angular to subangular gravel and cobble-sized particles. Note valley wall in background.



Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0760 (Dowell's Draft at MP AP-1 117.07)

Photograph 3 (072.jpg)

Date: 06-April-2016

Direction: Downstream



Description: Terraces on right bank.

Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0760 (Dowell's Draft at MP AP-1 117.07)

Photograph 4 (081.jpg)

Date: 06-April-2016

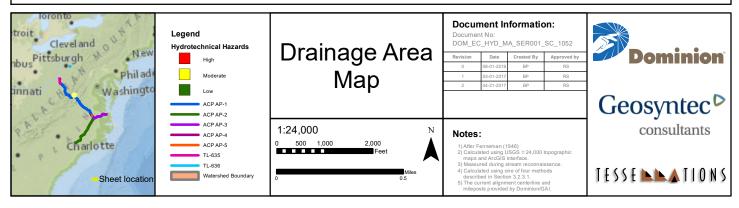
Direction: Upstream

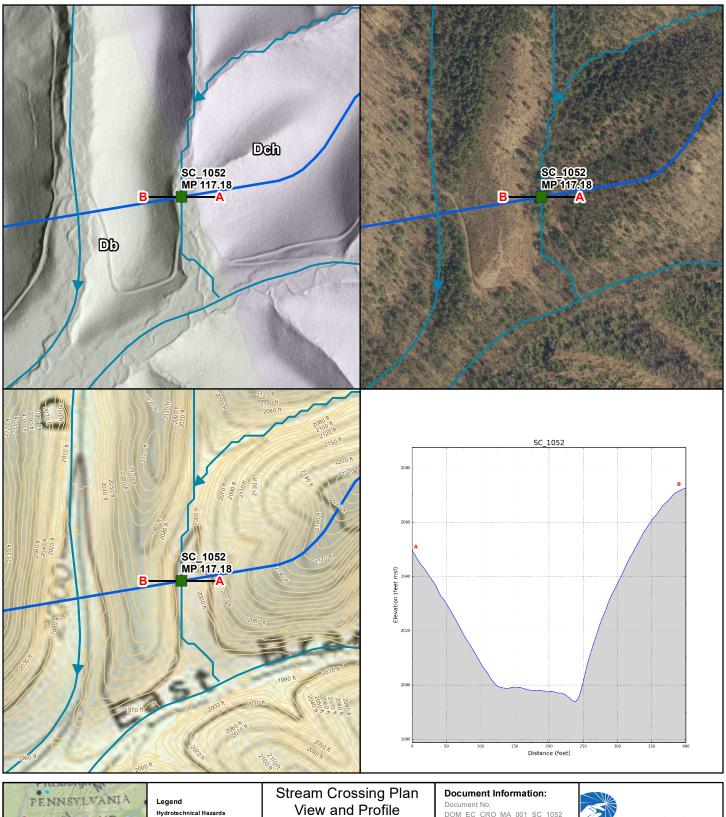
Description: Rock outcrop located approximately 250-ft downstream of pipeline crossing. Also noticeable is a knick point on the stream.

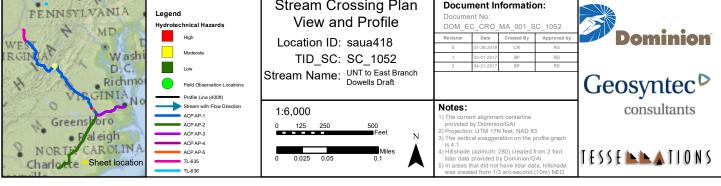




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_1052	saua418	AP-1	117.18	Virginia	Augusta	
	Attribute			Value		
	Stream Name			UNT to East Branch Dowells Draft		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	age Area (square n	niles) ²	0.183			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³			8.5		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴		0.237			
Propos	Proposed Construction Method ⁵			mp 2) Flume		









TID	SC_1052	ACP Segment	AP-1
Stream Name	UNT to East Branch Dowell's Draft	MP	117.18
Survey Date	06-April-2016	Start Time	1430 hrs

- Bankfull channel width is 8.5 feet and bankfull depth is 1.16 feet.
- Stream is confined on the right bank by steep slope with rock outcrop with strike and dip of N25°W 22°.
- Stream is laterally stable. No significant indicators of lateral mobility towards the left bank where the floodplain is comprised of several alluvial terraces.
- Pipeline crossing located upstream of a forest road culvert crossing.
- Stream located in a mixed deciduous and coniferous forest.
- Narrow valley with active floodplain approximately 54 feet wide.
- Additional information on stream crossing is available on stream reconnaissance form.

Given debris flow hazard, it is recommended to bury pipeline into bedrock with at least 1.5-foot of cover above the crown from valley wall to valley wall.

		•			
Date:	16-Apr-16	Stream Name:	UNT to East Branch Dowells Draft		
Crossing ID:	SC_1052				
-	Section 2	- - Region and Valley D	escription		
Part 1: Watershe					
Land Use X Natural Agricultural Urban Suburban Rural Industrial Cattle grazing	Vegetation None Grass Pasture Crops Shrubs X Deciduous Forest/trees	Valley Side Features None Occasional X Frequent	Failure Locations X None Away from river Along river		
Part 3: Floodplain Floodplain Width None 1 < river width 1-5 river width X 5-10 river width > 10 river width	h Land Use X Natural hs Agricultural hs Urban lths Suburban	Vegetation None Grass Pasture Orchards Crops Shrubs X Deciduous Fo			
Part 4: Vertical C	Confinement				
Terraces	Levees	Levee Location			
None	X None	Along channel ba	nk		
X Left bank	Natural	Set back < 1 river			
X Right bank	Constructed	Set back > 1 river	· width		
Part 5: Lateral Replanform Straight Meandering Braided Anastomosed Engineered	elation of Channel to Valley Meander Chara Mild bends Moderate b X Tight bends	ends			
Section 3 - Channel Description (select all that apply)					
Part 6: Channel I Bed Controls None Occasional X Frequent Confined	Description (select all that application (select all that application) Control Types None X Bedrock Boulders		Control Types None Bedrock Boulders Other Debris Mining Reservoir Knickpoint		

Flow Habit X Perennial	Channel Width:	8.5'		
Flashy perennia				
Intermittent	Cascade or step-p			
Ephemeral	X Plane, pool-riffle, o	dune-rippie		
	Dialded			
Part 7: Bed Sedime	ent Description (select all t	hat apply)		
Bed Material	Bar Types		Bar Vegetation	Bar Width
Clay Silt	None Alternate bars	Silt Sand	X None Grasses	None Narrow
Sand	X Point bars	X Gravel	Reeds/shrubs	Moderate
Gravel	Mid-channel bars	X Cobbles	Trees	X Wide
X Cobbles	Diagonal bars			
Boulders X Bedrock	Irregular/combination Braided	Percent san	d in bed = <10	%
X Dedilock	Dialded	r ercent sam	u III beu – 10	70
		- Bank Survey (select all		
Bank Characterist			Right Bank	
	Clay Silt		Clay Silt	
Bank Materia	Gravel		Gravel	
Dank Wateria	X Cobbles		Cobbles	
	Boulders Bedrock		Boulders X Bedrock	
			_ X _ DedTock	
	X No layers		X No layers	
	Cohesive		Cohesive	
Layer Materia	Sand Gravel		Sand Gravel	
	Cobbles		Cobbles	
	Boulders		Boulders	
Bank Height				
	Steep		X Steep	
Bank Slope	Moderate		Moderate	
·	X Shallow		Shallow	
	Name		□ Name	
	None Grasses/annuals		None Grasses/annua	als
	Reeds/shrubs		Reeds/shrubs	
Bank	X Trees:	 ,	X Trees:	
Vegetation	Falling trees? X Y Tree density spars	N se X dense	Falling trees? Tree density	X Y N sparse X dense
	Tree health X good			X good poor
	tree ages X young		tree ages X yo	
	tree diversity Y	N	tree diversity	Y
	location of erosion	type of erosion	location of erosion	type of erosion
Bank Erosion	outside meander bend	X fluvial	outside meand	ler bend X fluvial
and Failure	inside meander bend	geotechnical	inside meande	Ш,
Location	opposite bar or obstruct	ж	opposite bar of X general	เ บมอแนบแบบ
	~		~	



Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_1052, UNT to East Branch Dowell's Draft at MP 117.18 (AP-1)

Photograph 1 (ING_0626.jpg)

Date: 06-April-2016

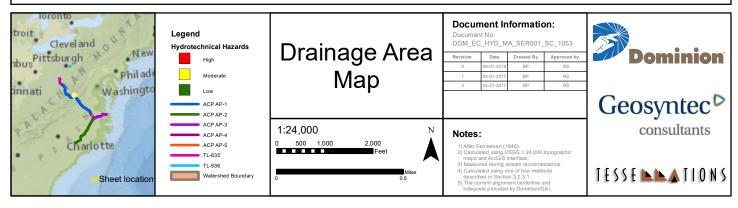
Direction: Downstream

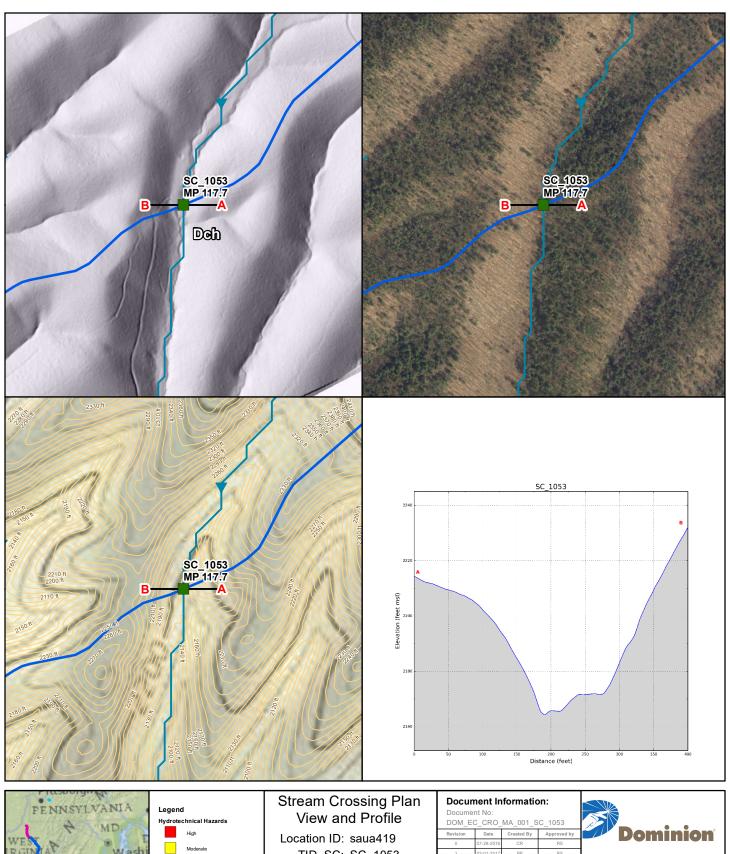
Description: View of steep slope providing confinement on right bank with rock outcropping at toe (red arrow)

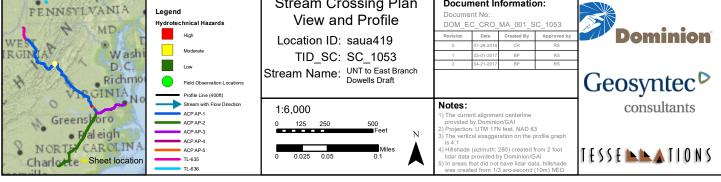




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_1053	saua419	AP-1	117.7	Virginia	Augusta	
	Attribute			Value		
	Stream Name			UNT to East Branch Dowells Draft		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	age Area (square n	niles)²	0.064			
	Flow Regime		Intermittent			
Meas	Measured Bank Full Width (ft) ³			4		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴		13.643			
Propos	Proposed Construction Method ⁵			mp 2) Flume		









TID	SC_1053	ACP Segment	AP-1
Stream Name	UNT to East Branch Dowell's Draft	MP	117.70
Survey Date	06-April-2016	Start Time	1530 hrs

- Stream is located within a narrow, colluvial valley (51-feet wide) that is densely forested.
- Bankfull channel width is 4 feet and bankfull channel depth is 0.65 feet.
- Stream is confined on the left bank by a steep slope with the floodplain beyond the right bank with evidence of past mass sediment movements.
- Sections of stream flow go sub-surface downstream of the crossing.
- Belt width of channel is approximately 40 feet.
- Relatively steep longitudinal channel slope estimated in the field at 2.78%.
- Rock outcrop identified approximately 50 feet upstream of pipeline crossing where the stream is a cascading over the bedrock(see photo log).
- Stream bed comprised of angular to sub-angular cobble and gravel-sized particles where bedrock is not outcropping.
- Additional information on stream crossing is available on stream reconnaissance form.

Given debris flow hazard, it is recommended to bury pipeline into bedrock with at least 1.5-foot of cover above the crown from valley wall to valley wall.

		•			
Date:	6-Apr-16	Stream Name:	UNT to East Branch Dowells Draft		
Crossing ID:	SC_1053				
L					
Section 2 - Region and Valley Description					
Part 1: Watershed Land Use X Natural Agricultural Urban Suburban Rural Industrial Cattle grazing	Part 2: River Valley Con Vegetation None Grass Pasture Crops X Shrubs X Deciduous Forest/trees X Coniferous Forest/trees	None Occasional X Frequent	Failure Locations X None Away from river Along river		
Part 3: Floodplain Floodplain Width None 1 < river widths 1-5 river widths 5-10 river width X > 10 river width	Land Use X Natural S Agricultural S Urban hs Suburban	Vegetation None Grass Pasture Orchards Crops X Shrubs X Deciduous Fo			
Part 4: Vertical Co	onfinement				
Terraces None Left bank X Right bank	Levees X None Natural Constructed	Levee Location Along channel bar Set back < 1 river Set back > 1 river	width		
Part 5: Lateral Rel Planform X Straight Meandering Braided Anastomosed Engineered	Iation of Channel to Valley Meander Chara X Mild bends Moderate b Tight bends	ends Some Meand	ers		
	Section 3 - Channel Description (select all that apply)				
Part 6: Channel D Bed Controls None Occasional Frequent X Confined	escription (select all that appl Control Types None X Bedrock Boulders	Width Controls (Control Types None Debris Mining Boulders Reservoir Knickpoint		

Flow Habit X Perennial	Channel Width:	4.0'		
Flashy perennia	al M-B Classification X Cascade or step-p	ool		
Ephemeral	Plane, pool-riffle,			
	Braided			
	ent Description (select all t			
Bed Material Clay	Bar Types X None	Bar Material Silt	Bar Vegetation None	Bar Width None
Silt	Alternate bars	Sand	Grasses	Narrow
Sand	Point bars	Gravel	Reeds/shrubs	Moderate
Gravel X Cobbles	Mid-channel bars Diagonal bars	Cobbles	Trees	Wide
Boulders	Irregular/combination			
X Bedrock	Braided	Percent sar	nd in bed =	%
		- Bank Survey (select al		
Bank Characterist	ic Left Bank Clay		Right Bank Clay	
	Silt		Silt	
Bank Material	Gravel Cobbles		X Gravel X Cobbles	
	Boulders		X Cobbles Boulders	
	X Bedrock		Bedrock	
	X No layers		X No layers	
	Cohesive		Cohesive	
Layer Materia	Sand Gravel		Sand Gravel	
	Cobbles		Cobbles	
	Boulders		Boulders	
Bank Height		0.65'	0.65	;
Bank Height		0.00	0.00	,
	X Steep		Steep	
Bank Slope	Moderate		Moderate	
	Shallow		X Shallow	
	None		None	
	Grasses/annuals Reeds/shrubs		Grasses/annua Reeds/shrubs	als
Bank	X Trees:	<u></u>	X Trees:	
Vegetation	Falling trees? Y Tree density spars	X N se X dense	Falling trees? Tree density	Y X N sparse X dense
	Tree health X good			X good poor
	tree ages youn	g X mature old		oung X mature old
	tree diversity XY		tree diversity	X Y L N
Bank Erosion	location of erosion outside meander bend	type of erosion X fluvial	location of erosion outside means	type of erosion der bend X fluvial
and Failure	inside meander bend	geotechnical	inside meande	
Location	opposite bar or obstru	<u> </u>	opposite bar o	
	X general		X general	



Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_1053, UNT to East Branch Dowell's Draft at MP 117.70 (AP-1)

Photograph 1 (IMG_0628.jpg)

Date: 06-April-2016

Direction: Upstream

Description: Stream steppool in bedrock approximately 50 feet upstream of crossing. Stream bed comprises angular to subangular cobble and gravel-sized particles when bedrock is not evident.



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Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_1053, UNT to East Branch Dowell's Draft at MP 117.70 (AP-1)

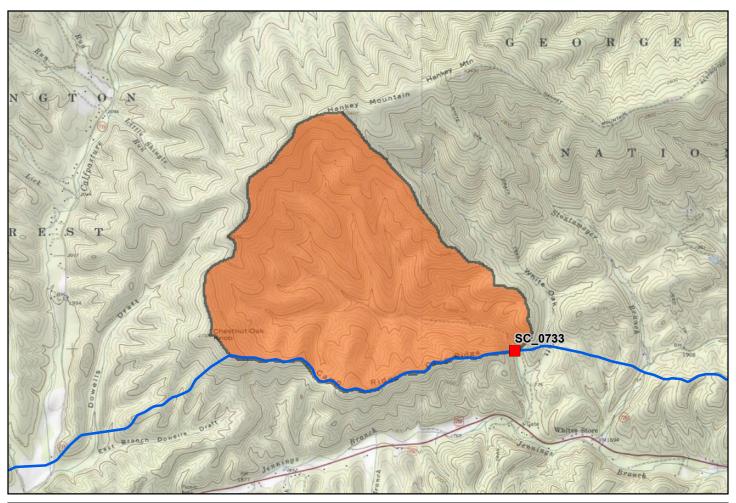
Photograph 2 (IMG_0629.jpg)

Date: 06-April-2016

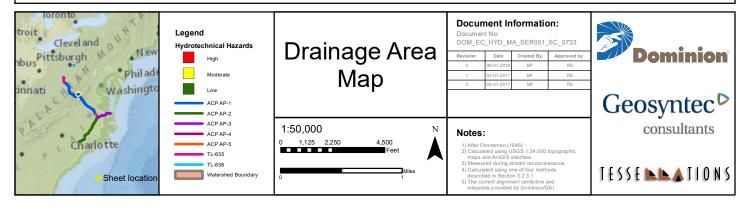
Direction: Downstream

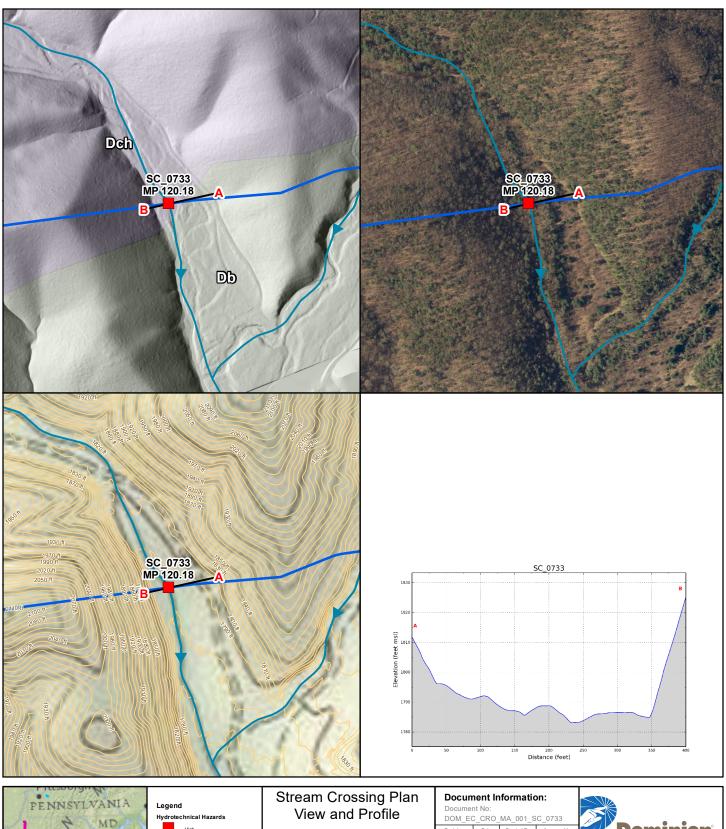
Description: View of crossing location (orange survey tape) within noticeable dense deciduous forest and lateral confinement at the left bank.

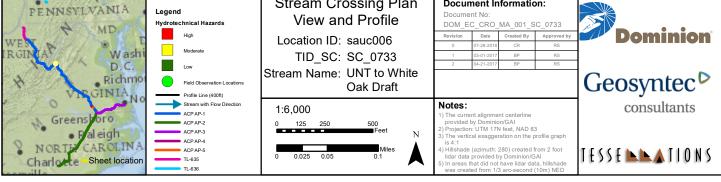




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0733	sauc006	AP-1	120.18	Virginia	Augusta	
	Attribute			Value		
	Stream Name			UNT to White Oak Draft		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	age Area (square m	niles) ²	2.246			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³			20.1		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴		1.993			
Propos	Proposed Construction Method ⁵)		









TID	SC_0733	ACP Segment	AP-1
Stream Name	UNT to White Oak Draft	MP	120.18
Survey Date	06-April-2016	Start Time	1730 hrs

- Stream is located within a densely forested valley subject to debris flow with evidence of lateral migration.
- Stream is partially confined on the right bank by valley wall.
- Stream bed comprises sub-angular to sub-rounded boulder and cobble-sized particles.
- Rock outcrop identified approximately 100 feet upstream of pipeline crossing (N90°W 67°).
- Banks comprised of cobbles and boulders.
- Stream similar to SC_0701.
- Additional information on stream crossing is available on stream reconnaissance form.

Given debris flow hazard, it is recommended to bury pipeline into bedrock with at least 1.5-foot of cover above the crown from valley wall beyond right bank to valley wall beyond left bank.

Geotechnical investigation to determine depth to bedrock at stream crossing is required (or crossing can be moved 100 ft upstream).

		•			
Date:	6-Apr-16	Stream Name:	UNT To White Oak Draft		
Crossing ID:	SC_0733				
		_			
Section 2 - Region and Valley Description Part 1: Watershed Part 2: River Valley Conditions					
Part 1: Watershed Land Use	Vegetation	nditions Valley Side Features	Failure Locations		
X Natural	None	None	None		
Agricultural Urban	Grass Pasture	Occasional	Away from river Along river		
Suburban	Crops	X Frequent	Along river		
Rural	X Shrubs				
Industrial Cattle grazing	X Deciduous Forest/trees Coniferous Forest/trees				
Cattle grazing	Confidences i diestrifees				
Part 3: Floodplain Floodplain Width	Land Use	Vegetation	Riparian Buffer Strip		
None	X Natural	None	None		
1 < river widths		Grass	< 1 river width 1-5 river widths		
X 1-5 river widths 5-10 river width		Pasture Orchards	X > 5 river widths		
> 10 river width		Crops			
	Industrial Mining	X Shrubs X Deciduous Fo	prest/trees		
	Cattle grazing	Coniferous Fo			
Dont 4. Vontical Co					
Part 4: Vertical Co Terraces	Levees	Levee Location			
X None	X None	Along channel bar			
Left bank Right bank	Natural Constructed	Set back < 1 river Set back > 1 river			
Rigiit balik	Constructed	Set back > 1 liver	wiatii		
	lation of Channel to Valley				
Planform Straight	Meander Chara Mild bends	acteristics			
X Meandering	X Moderate b	ends			
Braided	Tight bends	3			
Anastomosed Engineered					
	Section 3 - Cha	nnel Description (sele	ct all that apply)		
Part 6: Channel D	escription (select all that app	ly)			
Bed Controls	Control Types	Width Controls	Control Types Other		
None X Occasional	None X Bedrock	X None Occasional	X None Debris Bedrock Mining		
Frequent	X Boulders	Frequent	Boulders Reservoir		
Confined		Confined	Knickpoint		

Flow Habit X Perennial Flashy perennial Intermittent Ephemeral	M-B Classification Cascade or step-	pool		
српетиетаі	X Plane, pool-riffle, Braided	aune-прріе		
	t Description (select all above the part Types None Alternate bars X Point bars Mid-channel bars Diagonal bars Irregular/combination Braided	Bar Material Silt Sand X Gravel X Cobbles	Bar Vegetation None Grasses X Reeds/shrubs Trees d in bed = > 10	Bar Width None Narrow Moderate Wide
Bank Characteristic	Section 4 Left Bank	I - Bank Survey (select all	that apply) Right Bank	
Bank Material	Clay Silt X Gravel X Cobbles X Boulders Bedrock		Clay Silt X Gravel X Cobbles Boulders Bedrock	
Layer Material	X No layers Cohesive Sand Gravel Cobbles Boulders	e	X No layers Cohesive Sand Gravel Cobbles Boulders	
Bank Height		2-3'	2-3'	
Bank Slope	Steep X Moderate Shallow	Э	Steep X Moderate Shallow	
vegetation	None Grasses/annuals Reeds/shrubs X Trees: Falling trees? X Y [Tree density spar Tree health X good tree ages X your tree diversity Y [d poor	None Grasses/annua Reeds/shrubs X Trees: Falling trees? Tree density Tree health tree ages X you	Y N sparse X dense good poor
Bank Erosion and Failure Location	outside meander bend inside meander bend opposite bar or obstru	geotechnical	location of erosion outside meand inside meande opposite bar or X general	r bend geotechnical

Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0733, UNT to White Oak Draft at MP 120.18 (AP-1)

Photograph 1 (IMG_631.jpg)

Date: 06-April-2016

Direction: Upstream

Description: Stream is located in dense deciduous forest. Bed comprises subangular and subrounded boulders and cobbles.

Pipeline crossing is located at orange tape (red arrow).



Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

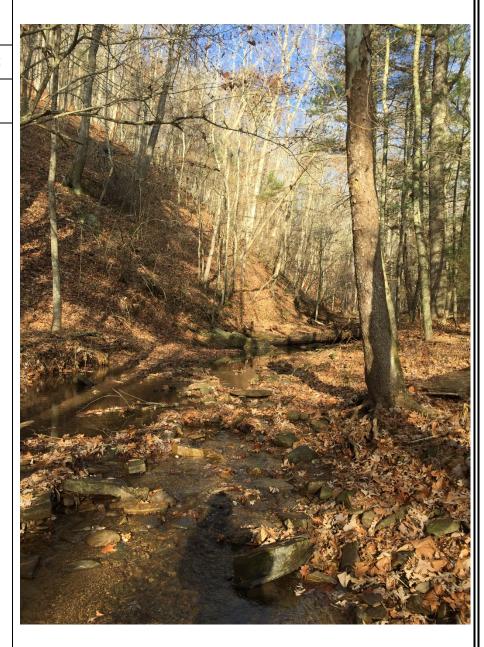
Subject Site: SC_0733, UNT to White Oak Draft at MP 120.18 (AP-1)

Photograph 2 (016.jpg)

Date: 06-November-2015

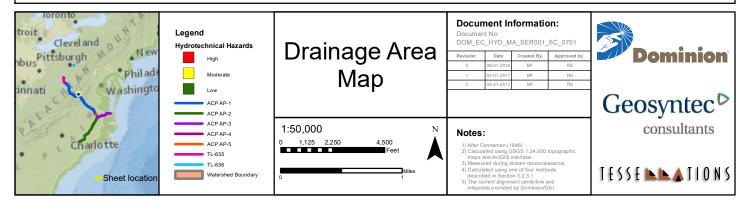
Direction: Upstream

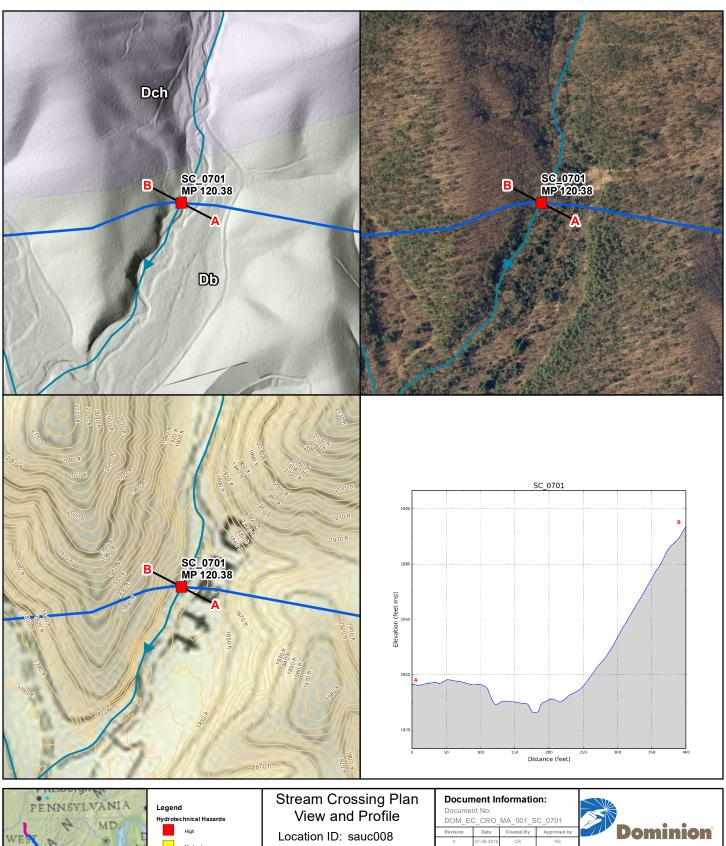
Description: View of steep slope on right bank of stream.

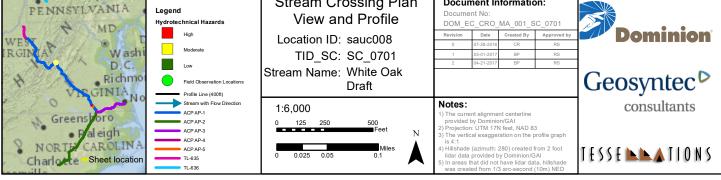




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0701	sauc008	AP-1	120.38	Virginia	Augusta	
	Attribute			Value		
	Stream Name			White Oak Draft		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	Drainage Area (square miles) ²			1.020		
	Flow Regime			Perennial		
Meas	Measured Bank Full Width (ft) ³			12.6		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴			3.826		
Propos	Proposed Construction Method ⁵			1) Flume 2) Dam and Pump		









TID	SC_0701	ACP Segment	AP-1
Stream Name	White Oak Draft	MP	120.38
Survey Date	06-April-2016	Start Time	1645 hrs

- Stream is located within a densely forested valley.
- Step-pool stream morphology that is showing signs of geomorphic lateral and vertical instability.
- Bankfull channel width is 12.6 feet and bankfull channel depth is 0.86 feet.
- Stream bed comprised of sub-angular to sub-rounded boulder and cobble-sized particles.
- Signs of debris flow including large downed trees, upstream braiding.
- Bedrock outcrop identified approximately 170 feet downstream of pipeline crossing (S80°W 51°).
- Pebble count not conducted due to high hazard and recommendation for bedrock burial.
- The left bank has been extensively eroded about 30 yards downstream with steep, near vertical, banks between 10 and 15 feet high.
 - o Top of bank height is approximately 2.5 feet in vicinity of crossing.
- Additional information on stream crossing is available on stream reconnaissance form.

Given debris flow hazard, it is recommended to bury pipeline into bedrock with at least 1.5-foot of cover above the crown from valley wall beyond right bank to valley wall beyond left bank.

Geotechnical investigation to determine depth to bedrock at stream crossing is required (or crossing can be moved 170 ft downstream where bedrock was observed).

		опол. опо восопр.				
Date:	6-Apr-16	Stream Name:	White Oak Draft			
Crossing ID:	SC_0701					
L						
		- Region and Valley D	escription			
Part 1: Watershe						
X Natural Agricultural Urban Suburban Rural Industrial Cattle grazing	Vegetation None Grass Pasture Crops X Shrubs X Deciduous Forest/trees Coniferous Forest/trees	None Occasional X Frequent	Failure Locations X None Away from river Along river			
Part 3: Floodplain Floodplain Widt None 1 < river widt X 1-5 river widt 5-10 river wid > 10 river wid	h Land Use X Natural hs Agricultural hs Urban Uths Suburban	Vegetation None Grass Pasture Orchards Crops X Shrubs X Deciduous Fo				
Part 4: Vertical 0	Confinement					
Terraces	Levees	Levee Location				
X None	X None	Along channel ba	nk			
Left bank	Natural	Set back < 1 river				
Right bank	Constructed	Set back > 1 river				
Part 5: Lateral R Planform Straight X Meandering Braided Anastomosed Engineered	elation of Channel to Valley Meander Chara X Mild bends Moderate b Tight bends	ends				
Section 3 - Channel Description (select all that apply)						
	Description (select all that app		Control Types Other			
Bed Controls	Control Types		Control Types Other			
None	None	X None	X None Debris Bedrock Mining			
Occasional	X Bedrock	Occasional				
X Frequent Confined	X Boulders	Frequent Confined	Boulders Reservoir Knickpoint			
			<u> </u>			

Flow Habit	Channel Width:	12.6		
X Perennial	ial M.D.Olassification			
Flashy perenn	ial M-B Classification X Cascade or step-	nool		
Ephemeral	Plane, pool-riffle,			
	Braided	dulic lippic		
	Draidod			
	nent Description (select all t			
Bed Material	Bar Types		Bar Vegetation	Bar Width
Clay	None	Silt Sand	X None	None
Silt Sand	Alternate bars X Point bars	X Gravel	Grasses Reeds/shrubs	Narrow Moderate
X Gravel	Mid-channel bars	X Cobbles	Trees	Wide
X Cobbles	Diagonal bars	77, 0000.00		
X Boulders	Irregular/combination			
Bedrock	Braided	Percent sar	nd in bed = < 10	%
	Santian 4	- Bank Survey (select a	II that annly)	
Bank Characteris		- Dalik Survey (Select a	Right Bank	
	Clay		Clay	
	X Silt		X Silt	
Bank Materia	X Gravel		X Gravel	
	X Cobbles Boulders		X Cobbles Boulders	
	Bedrock		Bedrock	
	Bedrock		Dedrook	
	X No layers	3	X No layers	
	Cohesive)	Cohesive	
Layer Materi	al Sand		Sand	
	Gravel Cobbles		Gravel Cobbles	
	Boulders		Boulders	
Dank Hainh	_	0.51	0.51	
Bank Heigh	τ	2.5'	2.5'	
	Steep		Steep	
Bank Slope)	X Moderate	
	Shallow		Shallow	
	None		None	
	Grasses/annuals		Grasses/annua	als
	Reeds/shrubs		Reeds/shrubs	
Bank	X Trees: Falling trees? X Y	N	X Trees: Falling trees?	√Y □N
Vegetation	Tree density spars		Tree density	sparse X dense
	Tree health X good			good poor
	tree ages X your		tree ages X yo	oung mature old
	tree diversity X Y	N	tree diversity	
	location of erosion	type of erosion	location of erosion	type of erosion
Bank Erosion	outside meander bend		outside meand	
and Failure	inside meander bend	geotechnical		
Location	opposite bar or obstru	ction	opposite bar or	obstruction
	X general		X general	

Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0701, White Oak Draft at MP 120.38 (AP-1)

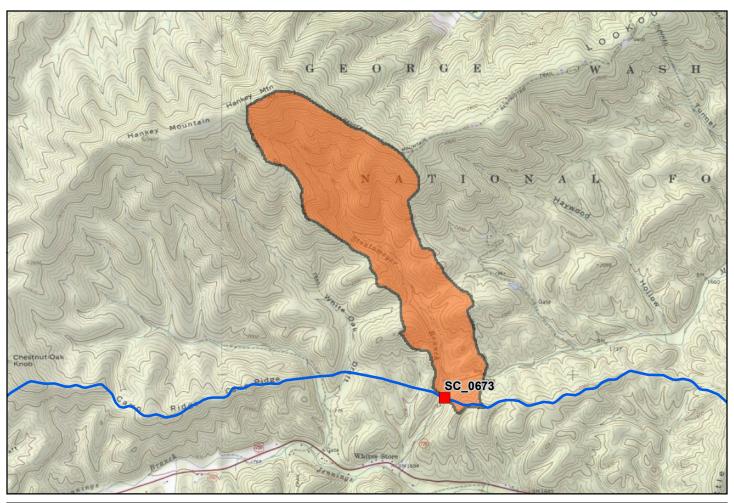
Photograph 1 (IMG_630.jpg)

Date: 06-April-2016

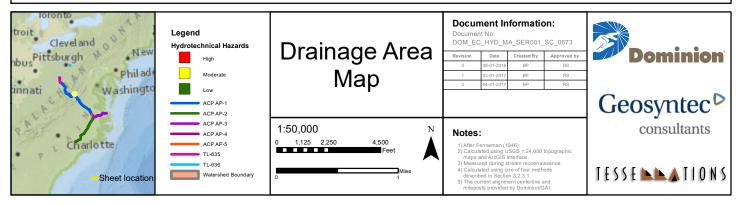
Direction: Upstream

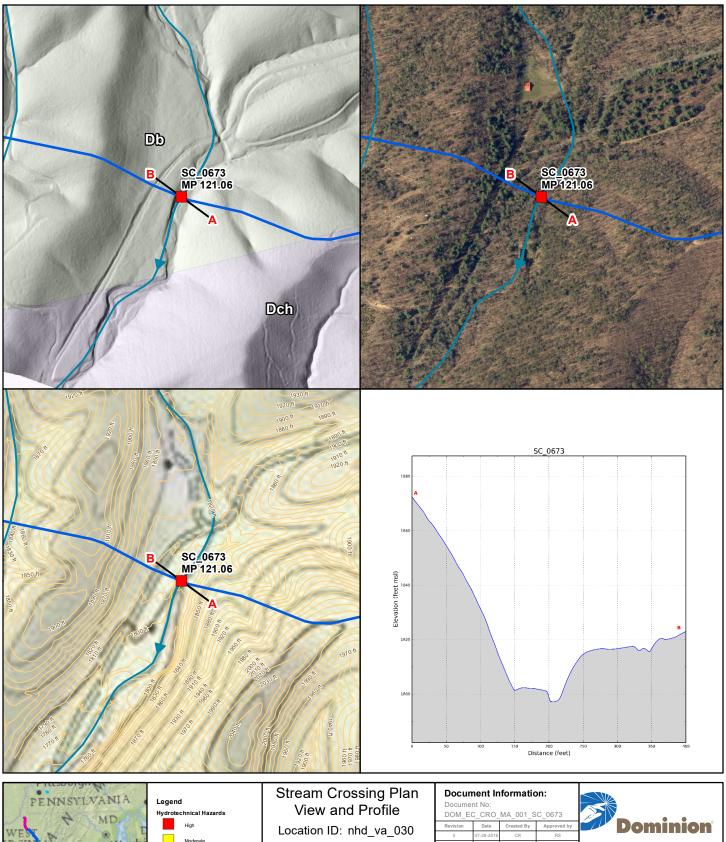
Description: Stream is located in dense deciduous forest. Bed comprises subangular and subrounded boulders and cobbles. Head cut in photo at location of crossing.

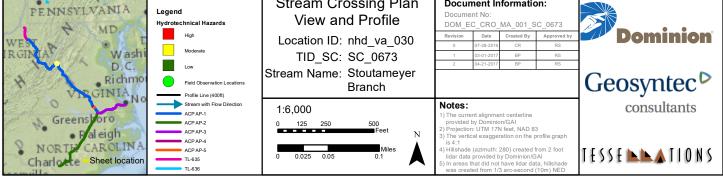




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0673	nhd_va_030	AP-1	121.06	Virginia	Augusta	
	Attribute			Value		
	Stream Name			Stoutameyer Branch		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	Drainage Area (square miles) ²			1.074		
	Flow Regime			Perennial		
Meas	Measured Bank Full Width (ft) ³			13.3		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴			2.900		
Proposed Construction Method ⁵			1) Dam and Pump 2) Flume			









TID	SC_0673	ACP Segment	AP-1
Stream Name	Stoutameyer Branch	MP	121.06
Survey Date	29-September-2016	Start Time	0840 hrs

- Crossing along a riffle in straighter section of the stream.
- Terraced on left bank with valley confinement.
- Steep slope leading to road and topographic confinement on right bank.
- BFW = 13.3 ft and BFD is approximately 1 ft.
- Maximum eroded right bank height downstream of crossing approximately 10-12-ft
- Left bank height of 3.2-ft
- Bed comprises sub-angular to rounded cobbles with gravels and few boulders up to about 2-ft diameter. Although wide range of grain size present, bed appears well armored.
- Established riparian buffer up to road on right bank and up to valley wall along left bank.
- Hummocky terrain on left floodplain within riparian buffer with minor terracing, signs of historic channels and debris materials.
- Relatively steep reach. Measured 2.9% slope using autolevel.
- Stream appears to be fairly confined and meandering within armored channel with some erosion at meanders, particularly on right bank downstream of crossing.

Evaluate scour depth for pipeline burial depth. Bury pipeline from valley wall to valley wall.

Date:	4-May-16	Stream Name:	Stoutameyer Branch		
	•	Sucam Name.	Glodiameyer Dianon		
Crossing ID:	SC_0673]			
Dani 4 Matanah		- Region and Valley D	Description		
Part 1: Watersho Land Use X Natural Agricultural Urban Suburban Rural Industrial Cattle grazin	Vegetation None Grass Pasture Crops Shrubs X Deciduous Forest/trees	Valley Side Features None Occasional X Frequent	S Failure Locations X None Away from river Along river		
Part 3: Floodpla Floodplain Wide None X 1 < river wide 1-5 river wide 5-10 river wide > 10 river wide	th Land Use X Natural ths Agricultural ths Urban dths Suburban	Vegetation None Grass Pasture Orchards Crops Shrubs X Deciduous F X Coniferous F			
Part 4: Vertical Confinement Terraces Levees Levee Location None X None Along channel bank X Left bank Set back < 1 river width X Right bank Constructed Set back > 1 river width					
Part 5: Lateral F Planform Straight X Meandering Braided Anastomose Engineered	Relation of Channel to Valley Meander Chara X Mild bends Moderate be Tight bends	ends			
Section 3 - Channel Description (select all that apply)					
Part 6: Channel Bed Controls None Occasional Frequent X Confined	Description (select all that application (Sel		Control Types None Debris Mining X Boulders Reservoir Knickpoint		

Flow Habit	Channel Width:	13.3		
X Perennial Flashy perenni Intermittent Ephemeral	M-B Classification X Cascade or step-popular plane, pool-riffle, described Braided			
Part 7: Bed Sedim Bed Material Clay Silt Sand Gravel X Cobbles X Boulders Bedrock	ent Description (select all the Bar Types None X Alternate bars Point bars Mid-channel bars Diagonal bars Irregular/combination Braided	Bar Material E	Bar Vegetation X None Grasses Reeds/shrubs Trees d in bed =	Bar Width None X Narrow Moderate Wide
Bank Characterist		Bank Survey (select all		
Bank Characterist	Clay Silt X Gravel		Right Bank Clay Silt X Gravel X Cobbles X Boulders Bedrock	
Layer Materia	X No layers Cohesive Sand Gravel Cobbles Boulders		X No layers Cohesive Sand Gravel Cobbles Boulders	
Bank Height		1.2'	1.2'	
Bank Slope	Steep X Moderate Shallow		Steep Moderate X Shallow	
Bank Vegetation	None Grasses/annuals Reeds/shrubs X Trees: Falling trees? Tree density Tree health tree ages tree diversity X Y	poor	tree ages yo	Y X N sparse X dense X good poor oung X mature old X Y N
Bank Erosion and Failure Location	location of erosion outside meander bend inside meander bend opposite bar or obstruc X general	type of erosion X fluvial geotechnical	location of erosion outside meande inside meande opposite bar o X general	er bend geotechnical

GEOSYNTEC CONSULTANTS Photographic Record



Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0673, Stoutameyer Branch at MP 121.06 (AP-1)

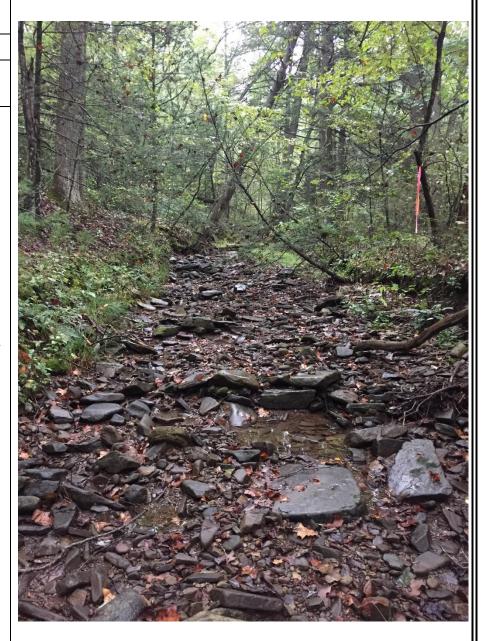
Photograph 1 (IMG_4247)

Date: 29 September 2016

Direction: looking

upstream

Description: Well defined channel with cobble bed. View from just downstream of crossing illustrating stable low banks.



GEOSYNTEC CONSULTANTS Photographic Record



Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0673, Stoutameyer Branch at MP 121.06 (AP-1)

Photograph 2 (IMG_4248.JPG)

Date: 29 September 2016

Direction: looking downstream

Description: Steep eroded right bank on outside bend, downstream of crossing. Minor terraced floodplain off left bank.





Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0673, Stoutameyer Branch at MP 121.06 (AP-1)

Photograph 3 (IMG_4250.JPG)

Date: 29 September 2016

Direction: looking downstream

Description: Steep eroded right bank on outside bend downstream of crossing. Channel bed well armored.





Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0673, Stoutameyer Branch at MP 121.06 (AP-1)

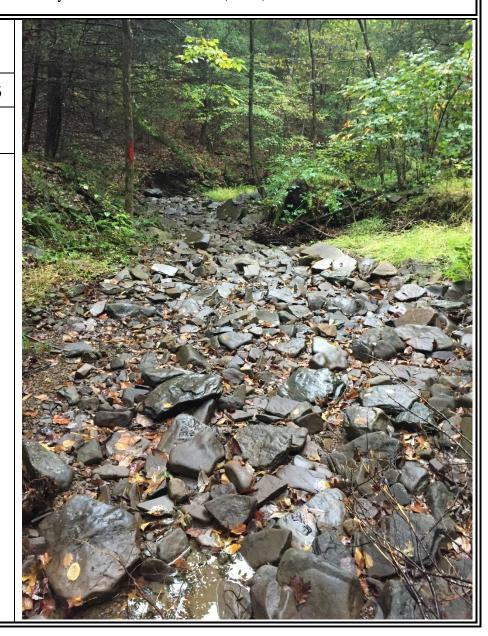
Photograph 4 (IMG_4251)

Date: 29 September 2016

Direction: looking

downstream

Description: Well armored meander bend downstream of crossing. Floodplain off right bank relatively accessible, structures present. Left bank of channel is confined by valley wall.





Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0673, Stoutameyer Branch at MP 121.06 (AP-1)

Photograph 5 (IMG_4255.JPG)

Date: 29 September 2016

Direction: looking

downstream at right bank.

Description: Eroded bank showing signs of stratification. Potential historic debris flow or channel deposits.





Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0673 (Stoutameyer Branch at MP AP-1 121.06)

Photograph 6 (IMG_4253.JPG)

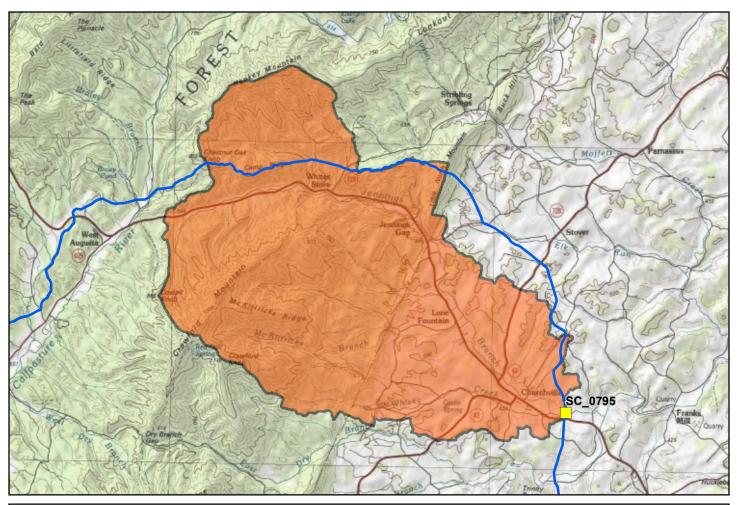
Date: 29 September 2016

Direction: looking down

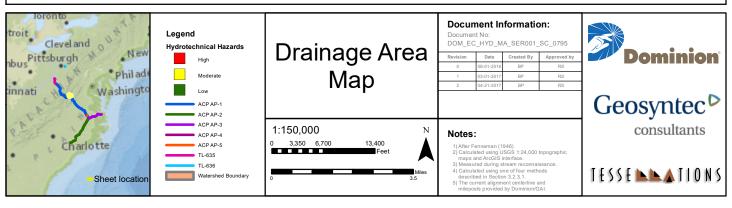
on channel bed.

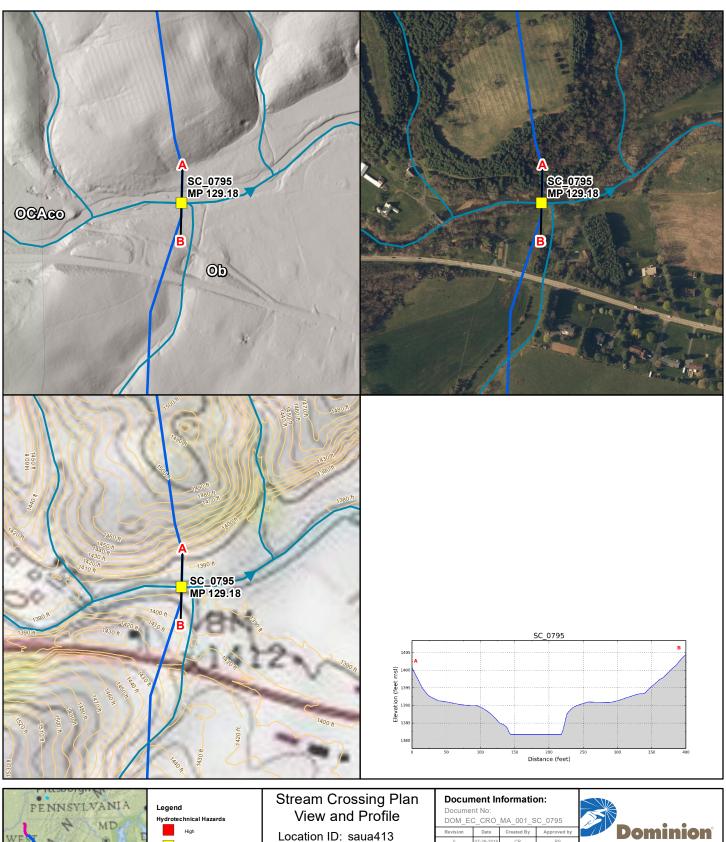
Description: Cobble bed with some gravels.

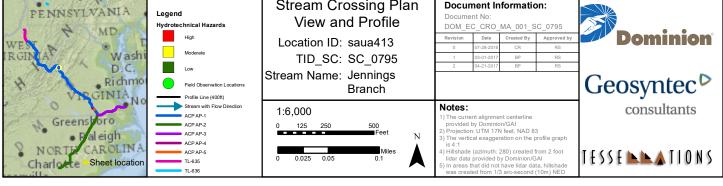




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0795	saua413	AP-1	129.18	Virginia	Augusta	
	Attribute			Value		
	Stream Name			Jennings Branch		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	age Area (square m	niles) ²	34.463			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³			65		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴			0.183		
Propos	sed Construction M	ethod ⁵	1) Cofferdam 2) Dam and Pump		









TID	SC_0795	ACP Segment	AP-1
Stream Name	Jennings Branch	MP	129.18
Survey Date	05-April-2016	Start Time	1550 hrs

- Pipeline is crossing through red tract. Therefore survey had to be conducted at bridge crossing located on Hangers Mill Rd.
- Evaluation of USGS topographical map indicates that stream is laterally confined at crossing with low likelihood for lateral migration.
- Additional information on stream crossing is available on stream reconnaissance form.

Evaluate scour depth for pipeline burial depth. Use typical procedures for locating sag bends.

Stream Reconnaissance (Based on Thorne, 1998) Section 1 - Site Description

Date:	5-Apr-16	Stream Name:	Jennings Branch
Crossing ID:	SC_0795		
l		-	
Part 1: Watersho		- Region and Valley D	escription
Land Use	Vegetation	Valley Side Features	s Failure Locations
Natural X Agricultural Urban Suburban	None X Grass X Pasture Crops	None Occasional Frequent	X None Away from river Along river
Rural	Shrubs X Deciduous Forest/trees		
X Cattle grazin	g Coniferous Forest/trees		
Part 3: Floodpla			
Floodplain Widt	h Land Use Natural	Vegetation None	Riparian Buffer Strip None
1 < river widt		X Grass	X < 1 river width
1-5 river widt		X Pasture	1-5 river widths
5-10 river wid		Orchards Crops	> 5 river widths
X > 10 liver with	Industrial	Shrubs	
	Mining	X Deciduous Fo	
	X Cattle grazing	Coniferous F	orest/trees
Part 4: Vertical (Confinement		
Terraces	Levees	Levee Location	wh.
X None Left bank	X None Natural	Along channel ba	
Right bank	Constructed	Set back > 1 river	
Part 5: Lateral R	elation of Channel to Valley		
<u>Planform</u>	Meander Chara	acteristics	
Straight	X Mild bends	d-	
X Meandering Braided	Moderate b Tight bends		
Anastomose		•	
Engineered			
	Section 3 - Cha	nnel Description (sele	ct all that apply)
Part 6: Channel	Description (select all that app	ly)	
Bed Controls	Control Types	Width Controls	Control Types Other
X None	X None	X None	X None Debris
Occasional Frequent	Bedrock Boulders	Occasional Frequent	Bedrock Mining Boulders Reservoir
Confined		Confined	Knickpoint

Flow Habit X Perennial	Channel Width:	65'		
Flashy perennial Intermittent Ephemeral	M-B Classification Cascade or step-p X Plane, pool-riffle, of			
	Braided			
Part 7: Bed Sediment Ded Material Ba	Description (select all t or Types		ar Vegetation	Bar Width
Clay	None	X Silt	None	None
X Silt X	Alternate bars Point bars		X Grasses X Reeds/shrubs	X Narrow Moderate
X Gravel	Mid-channel bars	X Cobbles	Trees	Wide
X Cobbles Boulders	Diagonal bars Irregular/combination			
Bedrock	Braided	Percent sand	d in bed =	%
	Section 4	- Bank Survey (select all	that apply)	
Bank Characteristic	Left Bank	Dank Gal Voy (Goldot an	Right Bank	
	X Clay X Silt		X Clay X Silt	
Bank Material	X Gravel		Gravel	
	Cobbles Boulders		Cobbles Boulders	
	Bedrock		Bedrock	
	X No layers		X No layers	
	Cohesive		Cohesive	
Layer Material	Sand Gravel		Sand Gravel	
	Cobbles		Cobbles	
	Boulders		Boulders	
Bank Height	3.5'	from bed	1.8' from	water
Dank Height	0.5	mom bod	1.0 110111	water
	Steep		Steep	
Bank Slope	X Moderate		X Moderate	
	Shallow		Shallow	
	None		None	-1-
<u> x</u>	Grasses/annuals Reeds/shrubs		X Grasses/annua Reeds/shrubs	als
I Bank I —	Trees:]	X Trees:	
	Iling trees? Y spars	X N se X dense	Falling trees? Tree density	Y X N X sparse dense
Tre	ee health X good	poor	Tree health 2	X good poor
	e ages younged iversity X Y	g X mature old		oung X mature old X Y N
	· <u> </u>		, <u>–</u>	
Bank Erosion	ation of erosion Toutside meander bend	type of erosion X fluvial	location of erosion outside means	
and Failure			inside meande	
Location	inside meander bend opposite bar or obstru-	geotechnical	opposite bar o	

Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

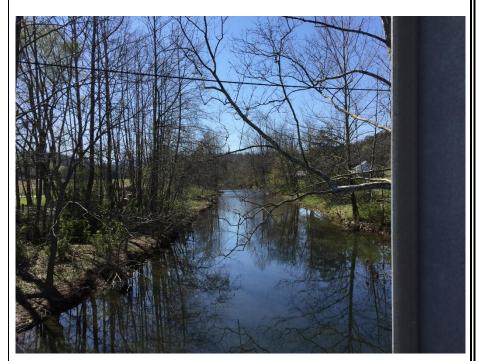
Subject Site: SC_0795, Jennings Branch at MP 129.18 (AP-1)

Photograph 1 (IMG_0015)

Date: 05-April-2016

Direction: Upstream

Description: View of thin riparian buffer near downstream bridge crossing over Hangers Mill Rd. located 0.5 miles downstream of pipeline crossing (located on red tract).





Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0795, Jennings Branch at MP 129.18 (AP-1)

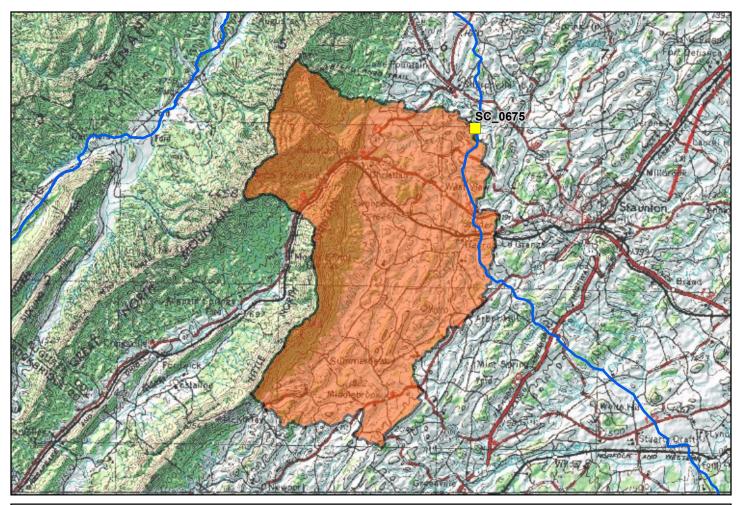
Photograph 2 (IMG_0016)

Date: 05-April-2016

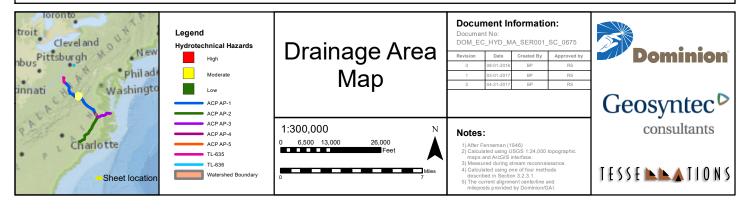
Direction: Downstream

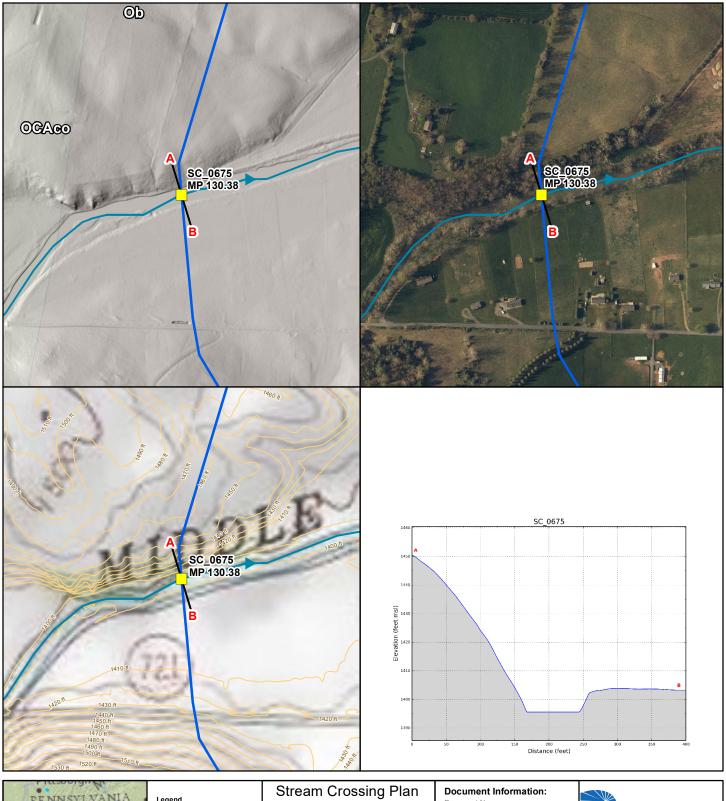


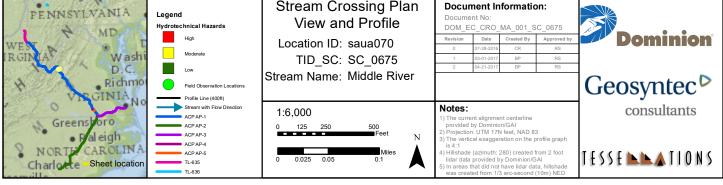
Description: View of unconfined stream



TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0675	saua070	AP-1	130.38	Virginia	Augusta	
	Attribute			Value		
	Stream Name			Middle River		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	age Area (square m	niles) ²	89.662			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³			84		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴			0.418		
Propos	sed Construction M	ethod ⁵	1) Cofferdam 2) Dam and Pump			









TID	SC_0675	ACP Segment	AP-1
Stream Name	Middle River	MP	130.38
Survey Date	05-April-2016	Start Time	1500 hrs

- Bankfull channel width is 84 feet.
- Stream crossing is at a pool with maximum water depth of approximately 3.8 feet (below water surface). Bankfull height is approximately 3.5 feet above water surface
- Top of banks heights varied with the left bank being confined by a steep maturely forested hill slope with multiple rock outcrops. The right top of bank height is approximately 7.5 feet above water surface and is not laterally confined and riparian buffer is thin (less than one river width).
- Wide floodplain beyond the right top of bank. The bankfull floodplain is only a few feet wide on both banks.
- Stream bed comprised of cobbles and sand (about 50-50 coverage) with scattered boulders.
- Right bank materials comprise fine-grained soils.
- Additional information on stream crossing is available on stream reconnaissance form.

Evaluate scour depth for pipeline burial depth. Sag bend on right bank should be located approximately one river width from top of right bank.

Stream Reconnaissance (Based on Thorne, 1998) Section 1 - Site Description

		·	
Date:	5-Apr-16	Stream Name:	Middle River
Crossing ID:	SC_0675		
ι			
Part 1: Watershe		- Region and Valley De	escription
Land Use Natural X Agricultural Urban Suburban Rural Industrial X Cattle grazing	Vegetation None X Grass X Pasture Crops Shrubs Deciduous Forest/trees	Valley Side Features None Occasional X Frequent	Failure Locations None Away from river Along river
Part 3: Floodpla Floodplain Widt None 1 < river widt 1-5 river widt X 5-10 river wid > 10 river wid	h Land Use Natural Agricultural ths Urban Otths Suburban	Vegetation None X Grass X Pasture Orchards X Crops Shrubs Deciduous For Coniferous For	
Part 4: Vertical (Terraces None Left bank X Right bank	Confinement Levees X None Natural Constructed	Levee Location Along channel ban Set back < 1 river v Set back > 1 river v	width
Part 5: Lateral R	elation of Channel to Valley		
Planform X Straight Meandering Braided Anastomosed Engineered	Meander Chara X Mild bends Moderate b Tight bends	ends	
	Section 3 - Cha	nnel Description (selec	et all that apply)
Part 6: Channel Bed Controls X None Occasional Frequent Confined	Description (select all that app Control Types X None Bedrock Boulders		Control Types None Bedrock Boulders None Reservoir Knickpoint

Left Bank Bluff Right Bank Terrace

Flow Habit	Channel Width: 84' at	Full Bank		
X Perennial Flashy perennia	al <i>M-B Classification</i>			
Intermittent	Cascade or step-po	ol		
Ephemeral	X Plane, pool-riffle, du			
<u> </u>	Braided	• •		
Part 7: Bed Sedimo	ent Description (select all tha Bar Types		ar Vegetation	Bar Width
X Clay	None	X Silt	None	None
X Silt	Alternate bars		Grasses	X Narrow ~20'
X Sand	Point bars	X Gravel	Reeds/shrubs	Moderate
Gravel	Mid-channel bars	X Cobbles	Trees	Wide
X Cobbles	Diagonal bars			
Boulders Bedrock	Irregular/combination Braided	Percent sand	l in bed = 50	%
BedTOCK	X Lateral	Percent Sand	1 III bed =	70
	Section 4 -	Bank Survey (select all	that apply)	
Bank Characterist			Right Bank	
	X Clay Silt		X Clay	
	Gravel		X Silt Gravel	
Bank Material	Cobbles		Cobbles	
	Boulders		Boulders	
	Bedrock		Bedrock	
	X No layers		X No layers	
	Cohesive		Cohesive	
Laver Meterie	Sand		Sand	
Layer Materia	Gravel		Gravel	
	Cobbles		Cobbles	
	Boulders		Boulders	
Bank Height			7.6' To terrace abo	ove from water 2.5' above
				surface water to bank full
	X Steep		X Steep	to bank full
Bank Slope	X Moderate		Moderate	
	Shallow		Shallow	
	None		None	
	X Grasses/annuals		X Grasses/annua	als
	Reeds/shrubs		Reeds/shrubs	
Bank	X Trees:	_	Trees:	
Vegetation	Falling trees? X Y	N	_	X Y N
	Tree density X sparse Tree health X good	dense poor	_	X sparse dense X good poor
	tree ages young	X mature old		oung X mature old
	tree diversity Y X		tree diversity	Y X N
	location of arrain-	huna af ann aire	loodies of area!	h a.f
Bank Erosion	location of erosion outside meander bend	type of erosion X fluvial	location of erosion outside means	type of erosion ler bend X fluvial
and Failure	inside meander bend	geotechnical	inside meande	
Location	opposite bar or obstructi		opposite bar o	<u></u>
	X general Norma	l Approach Protocol	X general	

Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0675, Middle River at MP 130.38 (AP-1)

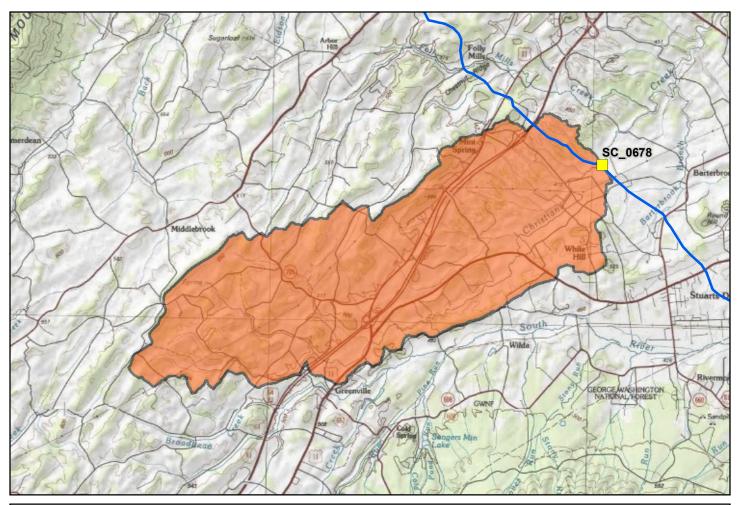
Photograph 1 (IMG_0014)

Date: 05-April-2016

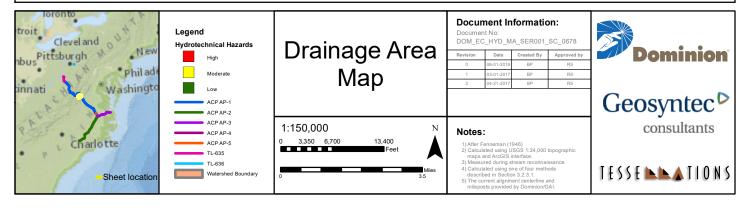
Direction: Downstream

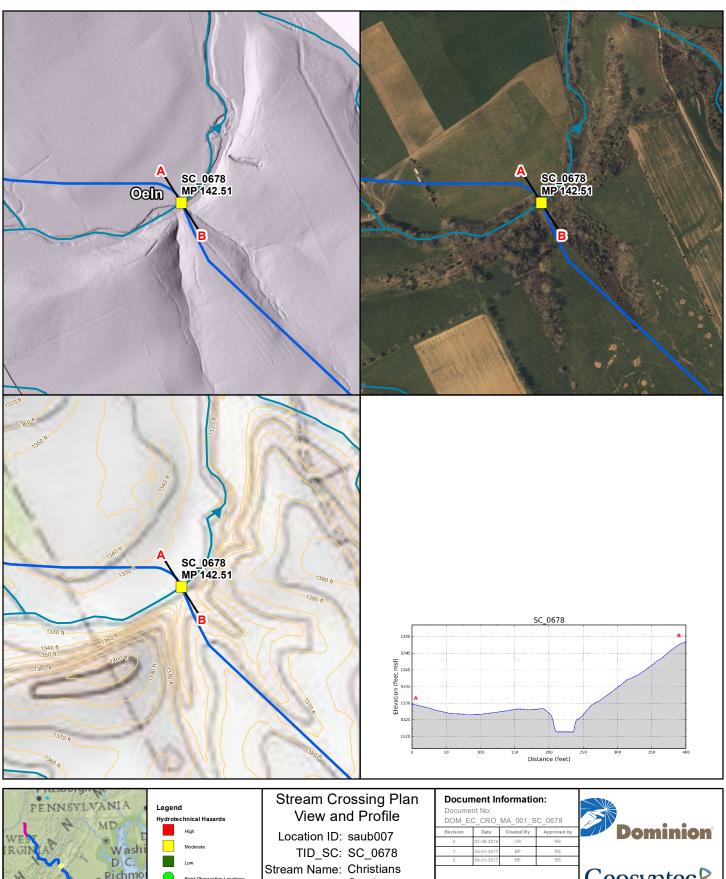
Description: Notice sloping left bank where rock outcrops were noticeable (not shown on photo). Right bank exhibits a gentle slope.

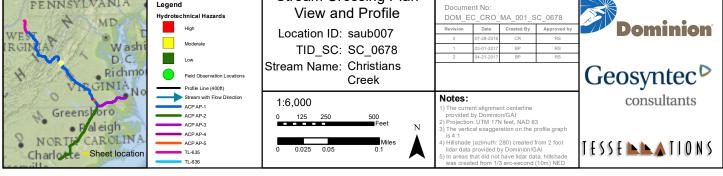




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0678	saub007	AP-1	142.51	Virginia	Augusta	
	Attribute			Value		
	Stream Name			Christians Creek		
Ph	Physiographic Province ¹			Valley And Ridge		
Drain	age Area (square n	niles) ²	25.610			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³			29		
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴			0.350		
Propos	sed Construction M	ethod ⁵	1) Dam and Pu	mp 2) Flume		









TID	SC_0678	ACP Segment	AP-1
Stream Name	Christians Creek	MP	142.51
Survey Date	05-April-2016	Start Time	1230 hrs

- Bankfull channel width is 29 feet.
- Top of bank heights varied due to the incised nature of the channel. The left bank is 4.5-ft and the right bank is 3.4-ft high. The bankfull height is 1.5-ft (measured on the right bank near the crossing) which corresponds to a bank height ratio (BHR) of 2.3 to 3.0 which is an indicator of channel instability.
- Stream bed comprised of cobble, gravel, and silt/clay.
- Riparian buffer on both banks is largely young, deciduous trees and is approximately two river widths on left bank and four widths on the right bank.
- Conducted Wolman pebble count on the cobble/gravel riffle upstream of crossing. The D₅₀ is 45 mm (coarse gravel).
- Additional information on stream crossing is available on stream reconnaissance form.

Evaluate scour depth for pipeline burial depth. Lateral migration towards the left bank should be evaluated by a fluvial geomorphologist to define best location for sag bend.

Wolman Pebble Count at SC_0678

		D. H.	0.111.		(Gravel			Sand
		Boulders	Cobbles		arse		fine	coa	arse medium
		_	Š. 3	~ ~ ~	, i	314"	₃ /8ં	**	*10
	100								
	90	-	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	1		I	1	1	-
	80	-				1		1	_
	70	-				1	1	1	-
ng	60	-				 	1	i I	-
Percent Passing	50	-				1		1	-
cent	-	-				I		1	-
Per	40	-				1	I	1	-
	30	_				' 		1	_
	20	_				I I	1	1	_
	10							1	
	0								-
	1,0	00	100	Particl	e Size	(mm)	10		



Wolman Pebble Count

Stream Reconnaissance (Based on Thorne, 1998) Section 1 - Site Description

		٦				
Date:	5-Apr-16	Stream Name:	Christians Creek			
Crossing ID:	SC_0678					
	Section 2	- Region and Valley D	escription			
Part 1: Watersh						
Natural X Agricultural Urban Suburban Rural Industrial X Cattle grazin	Vegetation None X Grass X Pasture X Crops Shrubs Deciduous Forest/trees	Valley Side Features None Occasional X Frequent	Failure Locations None Away from river X Along river			
Part 3: Floodpla Floodplain Widt None 1 < river widt 1-5 river widt X 5-10 river wid > 10 river wid	th Land Use Natural X Agricultural ths Urban dths Suburban	Vegetation None X Grass Pasture Orchards Crops X Shrubs X Deciduous Fo				
Part 4: Vertical 0 Terraces X None Left bank Right bank	Confinement Levees X None Natural Constructed	Levee Location Along channel ba Set back < 1 river Set back > 1 river	width			
Part 5: Lateral Relation of Channel to Valley Planform Meander Characteristics X Straight X Mild bends Meandering Moderate bends Braided Tight bends Anastomosed Engineered						
Section 3 - Channel Description (select all that apply)						
Part 6: Channel Bed Controls X None Occasional Frequent Confined Cobbles	Description (select all that application (select all that application) Control Types X None Bedrock Boulders		Control Types None Bedrock Boulders Other Debris Mining Reservoir Knickpoint			

Flow Habit X Perennial Flashy perennia Intermittent Ephemeral	Cascade or step-p X Plane, pool-riffle, o			
Part 7: Bed Sedime Bed Material X Clay X Silt Sand Gravel X Cobbles Boulders Bedrock	Braided ent Description (select all the Bar Types None Alternate bars X Point bars Mid-channel bars Diagonal bars Irregular/combination Braided	Bar Material X Silt Sand X Gravel X Cobbles Percent sand	Bar Vegetation None X Grasses Reeds/shrubs Trees d in bed =	Bar Width None ~0.5 to1 Narrow width Moderate Wide %
Bank Characteristi		- Bank Survey (select all	that apply) Right Bank	
Bank Material	X Clay X Silt Gravel		X Clay X Silt Gravel Cobbles Boulders Bedrock	
Layer Material	X No layers Cohesive Sand Gravel Cobbles Boulders		X No layers Cohesive Sand Gravel Cobbles Boulders	
Bank Height		4.5'	3.4'	
Bank Slope	X Steep X Moderate Shallow		X Steep X Moderate Shallow	
Bank Vegetation	None X Grasses/annuals X Reeds/shrubs Trees: Falling trees? X Y Spars Tree density X spars Tree health X good tree ages X young tree diversity Y	poor	Tree density Tree health	X Y N X sparse dense X good poor oung mature old Y X N
Bank Erosion and Failure Location	location of erosion X outside meander bend inside meander bend opposite bar or obstructions.	geotechnical	location of erosion outside meande inside meande opposite bar or general	er bend geotechnical



Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0678, Christians Creek at MP 142.51 (AP-1)

Photograph 1 (IMG_0012)

Date: 05-April-2016

Direction: Downstream

Description: View looking downstream at stream crossing location.



Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0678, Christians Creek at MP 142.51 (AP-1)

Photograph 2 (IMG_0009)

Date: 05-April-2016

Direction: Downstream

Description: View downstream from upstream cobble/gravel riffle at sharp meander bend where Wolman Pebble Count was conducted.



Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0678, Christians Creek at MP 142.51 (AP-1)

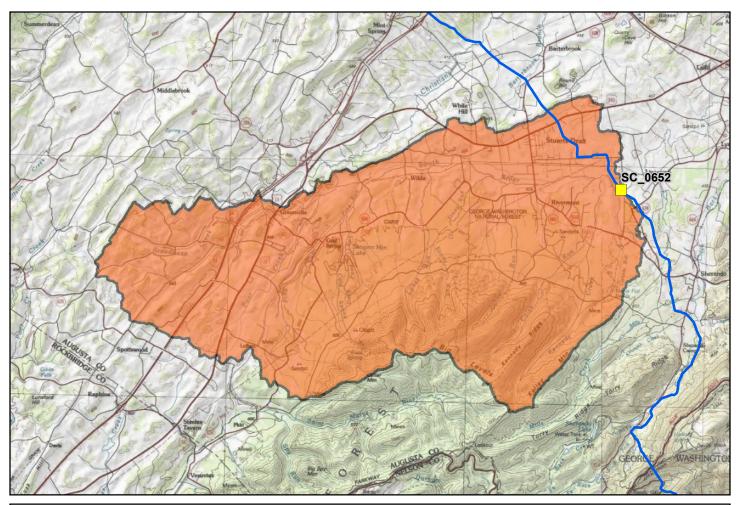
Photograph 3 (IMG_0007)

Date: 05-April-2016

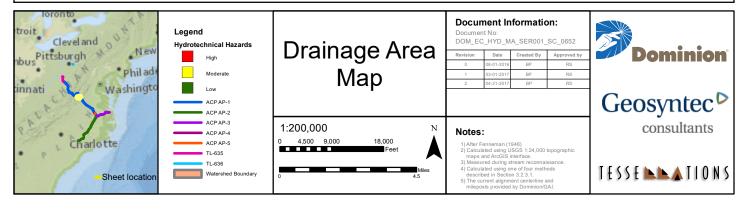
Direction: Right bank

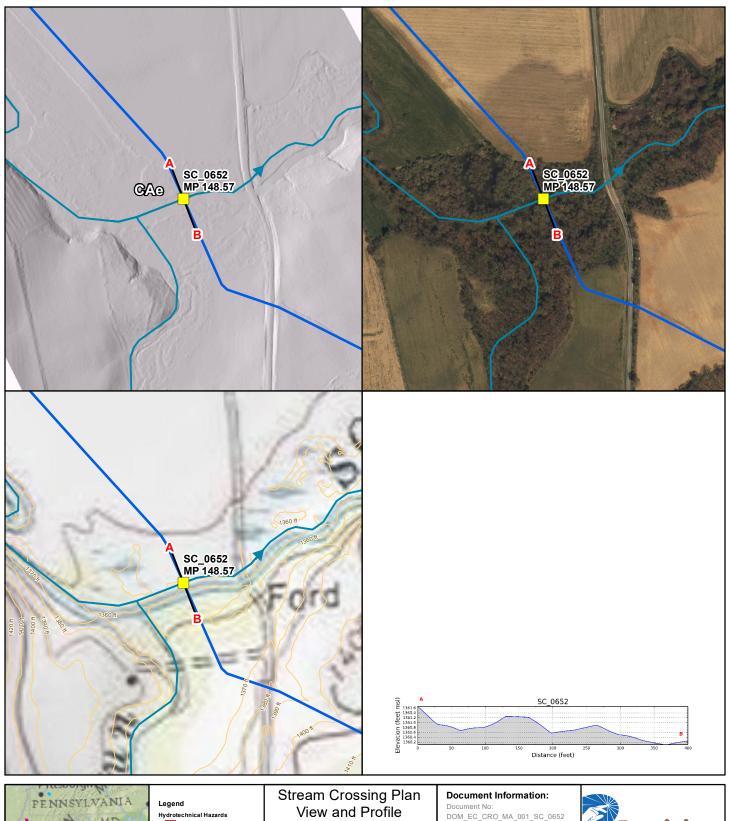
Description: View of meander upstream of cobble/gravel riffle in Photo where pool depth (below water) is 3.5 feet. Also noticeable in the photo is the terrace on the right bank.

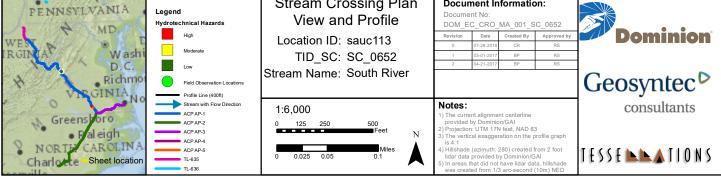




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0652	sauc113	AP-1	148.57	Virginia	Augusta	
	Attribute		Value			
	Stream Name		South River			
Ph	Physiographic Province ¹		Blue Ridge			
Drain	Drainage Area (square miles) ²		69.407			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³		47.5			
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴			0.086		
Propos	Proposed Construction Method ⁵		1) Flume 2) Dam and Pump			









TID	SC_0652	ACP Segment	AP-1
Stream Name	South River	MP	148.57
Survey Date	05-April-2016	Start Time	1115 hrs

- Bankfull channel width is 47.5 feet.
- Bankfull height is 1.5-feet and corresponds to the surrounding floodplain elevation.
- Stream crossing occurs at a riffle with a mid-channel bar which is focusing channel erosion along both the right and left banks.
- Stream crossing is about 350 feet upstream of Patton Farm Rd. (State Highway 634) where eight approximately 3-foot diameter culverts comprise the road crossing which acts as a grade control for the upstream segment of stream.
- Stream bed comprised predominantly of sand and silt/clay.
- Riparian buffer on right bank is a mature forested wetland over five river widths wide. The left bank riparian buffer is approximately four river widths wide and is largely an herbaceous wetland comprised of patchy and less mature trees.
- Additional information on stream crossing is available on stream reconnaissance form.

Evaluate scour depth for pipeline burial depth. Lateral migration does not appear to be a significant hazard on the right bank, but does pose a moderate hazard along the left bank. Begin sag bends at edge of farmers field and riparian buffer on left bank and at least one river width from the right bank river bank.

Stream Reconnaissance (Based on Thorne, 1998) Section 1 - Site Description

ı			
Date:	5-Apr-16	Stream Name:	South River
Crossing ID:	SC_0652		
	Section 2	- - Region and Valley D	escription
Part 1: Watersh			
Land Use	Vegetation	Valley Side Features	Failure Locations
Natural	None	X None	XX None
Agricultural	Grass	Occasional	Away from river
Urban	X Pasture	Frequent	Along river
Suburban	Crops	•	
Rural	Shrubs		
Industrial	Deciduous Forest/trees		
X Cattle grazin	g Coniferous Forest/trees		
Part 3: Floodpla	in		
Floodplain Widt		Vegetation	Riparian Buffer Strip
None	Natural	None	None
1 < river widt	ths Agricultural	Grass	< 1 river width
1-5 river wid	ths Urban	X Pasture	1-5 river widths
5-10 river wi		Orchards	X > 5 river widths
X > 10 river wid		Crops	
	Industrial	Shrubs	. //
	Mining	X Deciduous Fo	
	X Cattle grazing	Coniferous F	orest/trees
Part 4: Vertical	Confinement		
Terraces	Levees	Levee Location	
X None	X None	Along channel ba	nk
Left bank	Natural	Set back < 1 rive	rwidth
Right bank	Constructed	Set back > 1 rive	rwidth
Dani E. Latanal E	aladan at Ohannal ta Vallan		
Planform	Relation of Channel to Valley Meander Chara	notoristics	
Straight	X Mild bends	icteristics	
X Meandering	Moderate be	ends	
Braided	Tight bends		
Anastomose			
Engineered	C6		
	.		
	Section 3 - Chai	nnel Description (sele	ct all that apply)
Part 6: Channel	Description (select all that appl	v)	
Bed Controls	Control Types		Control Types Other
None	None	X None	X None Debris
X Occasional	Bedrock	Occasional	Bedrock Mining
Frequent	Boulders	Frequent	Boulders Reservoir
Confined		Confined	Knickpoint
`400! +-			
`400' to Road crossing			
with culverts			

Flow Habit X Perennial Flashy perennial Intermittent Ephemeral Part 7: Bed Sedime Bed Material Clay X Silt X Sand Gravel	Channel Width: M-B Classification Cascade or step- X Plane, pool-riffle, Braided Part Description (select all and a select	pool dune-ripple that apply) <u>Bar</u> Material <u>E</u>	Bar Vegetation X None Grasses Reeds/shrubs Trees	Bar Width None Narrow Moderate 30' Wide
Cobbles	Diagonal bars			
Boulders Bedrock	Irregular/combination Braided	Percent san	d in bed = 90	Minor Aquatic% Beds
Fine Sand	Section 4	- Bank Survey (select all	that apply)	
Bank Characteristi	c <u>Lef</u> t Bank	Burik Gui vey (Select un	Right Bank	
Bank Material	X Clay Silt Gravel Cobbles Boulders Bedrock		X Clay Silt Gravel Cobbles Boulders Bedrock	
Layer Material	No layers X Cohesive Sand Gravel Cobbles Boulders		No layers X Cohesive Sand Gravel Cobbles Boulders	
Bank Height		1.5'	1.5	,
Bank Slope	X Steep Moderate Shallow	9	X Steep Moderate Shallow	
Bank Vegetation	None Grasses/annuals X Reeds/shrubs Trees: NO Falling trees? Y Tree density spar Tree health good tree ages your tree diversity Y	d poor	Tree density Tree health	
Bank Erosion and Failure Location	Iocation of erosion X outside meander bend X inside meander bend opposite bar or obstru general	geotechnical	location of erosion outside meande inside meande opposite bar of X general	der bend X fluvial geotechnical

Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0652, South River at MP 148.57 (AP-1)

Photograph 1 (IMG_0003)

Date: 05-April-2016

Direction: Downstream

Description: Low gradient stream channel and stream bed comprised of silt and sand. Midchannel bars from highfine sediment load in channel direct the flow along both banks contributing to erosion of the banks and falling trees on both banks. The riparian buffer on the right bank is greater than five river widths (mature forested wetland) and four river widths on left bank (herbaceous and immature forested wetland). Bank height is about 1.5 ft high and comprised of fine-grained soils.



Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0652, South River at MP 148.57 (AP-1)

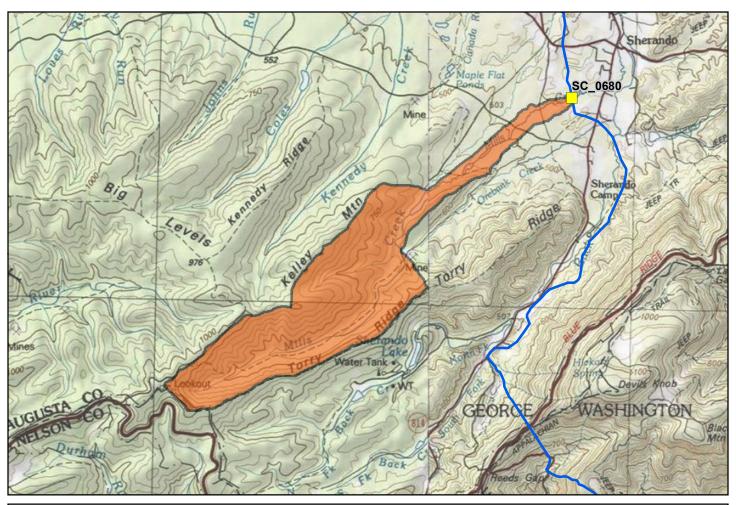
Photograph 2 (IMG_0004)

Date: 05-April-2016

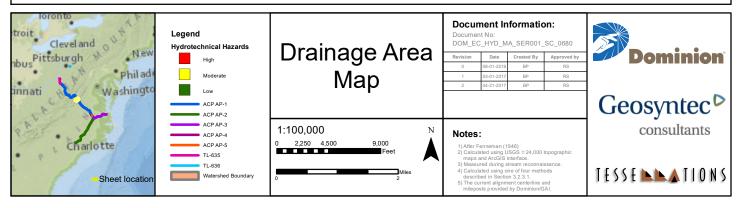
Direction: From right bank looking at left bank

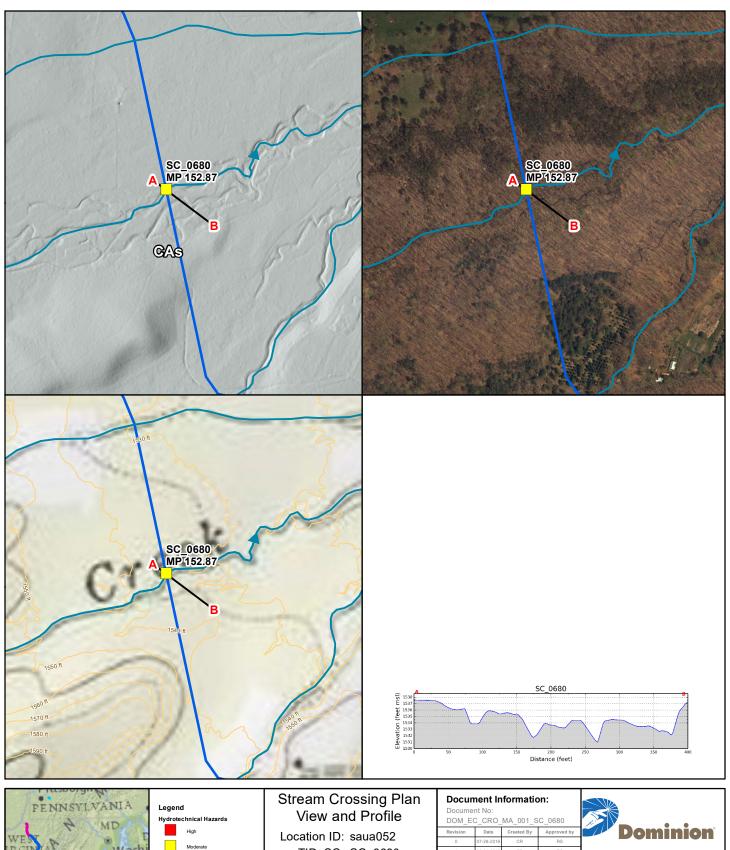
Description: Upstream side of Patton Farm Rd. (State Highway 634) where eight 3-ft diameter culverts convey the South River low flow conditions. The Culvert crossing is approximately 350 feet downstream of the stream crossing provides grade control for channel upstream.

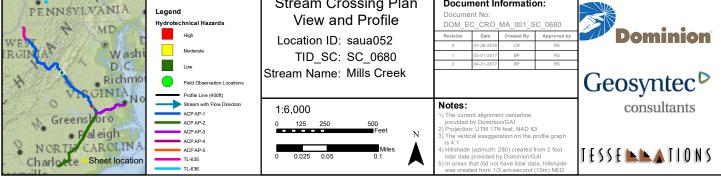




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0680	saua052	AP-1	152.87	Virginia	Augusta	
	Attribute		Value			
	Stream Name		Mills Creek			
Ph	Physiographic Province ¹		Blue Ridge			
Drain	Drainage Area (square miles) ²		4.391			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³		22			
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴			1.653		
Propos	Proposed Construction Method ⁵			1) Flume 2) Dam and Pump		









TID	SC_0680	ACP Segment	AP-1
Stream Name	Mills Creek	MP	152.87
Survey Date	27-Sep-2016	Start Time	1420 hrs

- Stream observed approximately 0.75-miles upstream of pipeline crossing in densely forested area.
- Stream observed along a 1500-ft long stretch.
- Riffle-pool morphology.
- BFW = 22 feet, BFD (maximum) = 1.8 feet.
- Stream was dry at the time of the survey, which allowed observation and measurement of stream bed morphology.
- Stream bed comprises gravel and cobble-sized particle with most particle sizes between 60 and 90 mm.

Evaluate scour depth for pipeline burial depth. Conduct lateral migration evaluation to set location of sag bends.

Stream Reconnaissance (Based on Thorne, 1998)

Section 1 - Site Description

	Mills Creek	Stream Name:	27-Sep-16	Date:			
			SC_0680	Crossing ID:			
Section 2 - Region and Valley Description							
	escription			Part 1: Watershed			
	Failure Locations X None Away from river Along river	Valley Side Features X None Occasional Frequent	Vegetation None Grass Pasture Crops Shrubs X Deciduous Forest/trees	Land Use X Natural Agricultural Urban Suburban Rural Industrial Cattle grazing			
		Vegetation None Grass Pasture Orchards Crops Shrubs X Deciduous Formula Coniferous Formu	h Land Use X Natural hs Agricultural Urban Otths Suburban	Part 3: Floodplain Floodplain Width None 1 < river widths 1-5 river widths 5-10 river width X > 10 river width			
			Confinement	Part 4: Vertical Co			
	width	Levee Location Along channel ba Set back < 1 river Set back > 1 river	LeveesX NoneNaturalConstructed	Terraces X None Left bank Right bank			
		ends	elation of Channel to Valley Meander Chara Mild bends X Moderate be Tight bends	Part 5: Lateral Rel Planform Straight X Meandering Braided Anastomosed Engineered			
Section 3 - Channel Description (select all that apply)							
	Control Types X None Bedrock Boulders Other Debris Mining Reservoir	Width Controls X None Occasional Frequent	Description (select all that apple Control Types X None Bedrock Boulders	Bed Controls X None Occasional Frequent			
	None < 1 river width 1-5 river widths x > 5 river widths orest/trees orest/trees orest/trees orest/trees Other X None Bedrock Mining	None Grass Pasture Orchards Crops Shrubs Deciduous Fracteristics Along channel based set back < 1 river Set back > 1 river Controls Midth Controls X None Occasional	X Natural Agricultural Urban Suburban Rural Industrial Mining Cattle grazing Confinement Levees X None Natural Constructed Mild bends X Moderate be Tight bends Tight bends Control Types X None Bedrock Bedrock Natural Constructed Control Types X None Bedrock Regional Regional	None 1 < river widths 1-5 river widths 5-10 river width X > 10 river width X > 10 river width A None Left bank Right bank Part 5: Lateral Rel Planform Straight X Meandering Braided Anastomosed Engineered Part 6: Channel De Bed Controls X None Occasional			

Flow Habit Perennial	Channel Width:	22'		
Flashy perennial X Intermittent Ephemeral	M-B Classification Cascade or step-p X Plane, pool-riffle, of Braided			
Bed Material B	Description (select all thar Types None Alternate bars Point bars Mid-channel bars Diagonal bars Irregular/combination Braided	Bar Material Silt Sand Gravel Cobbles	Bar Vegetation None Grasses Reeds/shrubs Trees d in bed = <5	Bar Width None Narrow Moderate Wide
Bank Characteristic	Left Bank	Bank Garvey (Sciest an	Right Bank	
Bank Material	X Clay X Silt X Sand X Gravel Cobbles Boulders Bedrock		X Clay X Silt X Sand X Gravel Cobbles Boulders Bedrock	
Layer Material	X No layers Cohesive Sand Gravel Cobbles Boulders		X No layers Cohesive Sand Gravel Cobbles Boulders	
Bank Height		3'	3'	
Bank Slope	Steep X Moderate Shallow		Steep X Moderate Shallow	
Vegetation Fa	None Grasses/annuals Reeds/shrubs Trees: alling trees? X Y ree density spars ree health X good ree ages X young ree diversity X Y	poor	Tree density Tree health tree ages X yo	X Y N sparse X dense
	cation of erosion outside meander bend inside meander bend opposite bar or obstructions.	geotechnical	Iocation of erosion X outside meander inside meander opposite bar or general	r bend geotechnical

GEOSYNTEC CONSULTANTS Photographic Record

Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0680, Mills Creek at MP 152.87 (AP-1)

Photograph 1 (IMG_1149.JPG)

Date: 27 September 2016

Direction: Upstream

Description: View of coarse gravel and cobblelined Mills Creek (dry) surveyed about 0.75 miles upstream of pipeline crossing. Stream is located in densely forested floodplain.



Photograph 2 (IMG_1155.JPG)

Date: 27 September 2016

Direction: Downstream

Description: View of pool where thalweg is 1.5 ft deeper than channel edge at bank toe.



GEOSYNTEC CONSULTANTS Photographic Record

Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0680, Mills Creek at MP 152.87 (AP-1)

Photograph 3 (IMG_1157.JPG)

Date: 27 September 2016

Direction: Downstream

Description: View of erosion around tree roots on the right bank and progressive migration to the right. Channel is located on a historic alluvial fan and is showing signs of lateral and vertical migration.



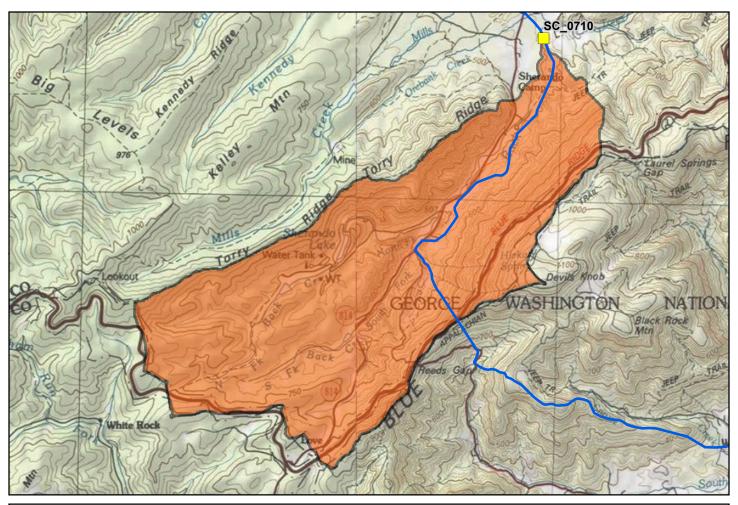
Photograph 4 (IMG_1159.JPG)

Date: 27 September 2016

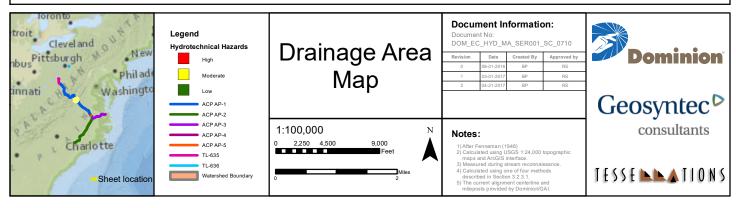
Direction: Downstream

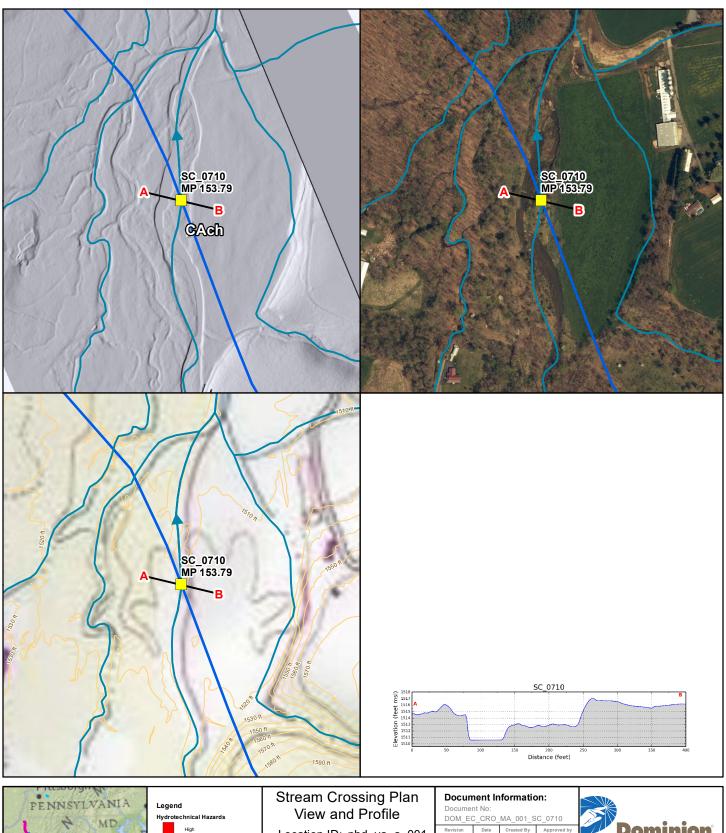
Description: Scour at tight (close to 90-degrees) bend where we measured about 2.6 ft of scour from the gravel channel bed (riffle immediately upstream).

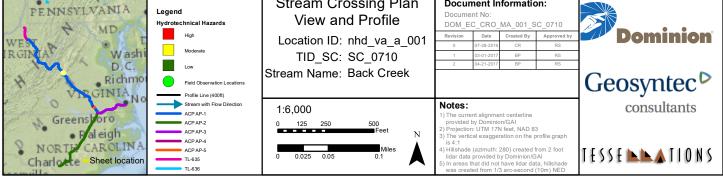




TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0710	nhd_va_a_001	AP-1	153.79	Virginia	Augusta	
	Attribute			Value		
	Stream Name			Back Creek		
Ph	Physiographic Province ¹		Blue Ridge			
Drain	Drainage Area (square miles) ²		13.729			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³		25			
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴		0.494			
Propos	Proposed Construction Method ⁵			1) Flume 2) Dam and Pump		









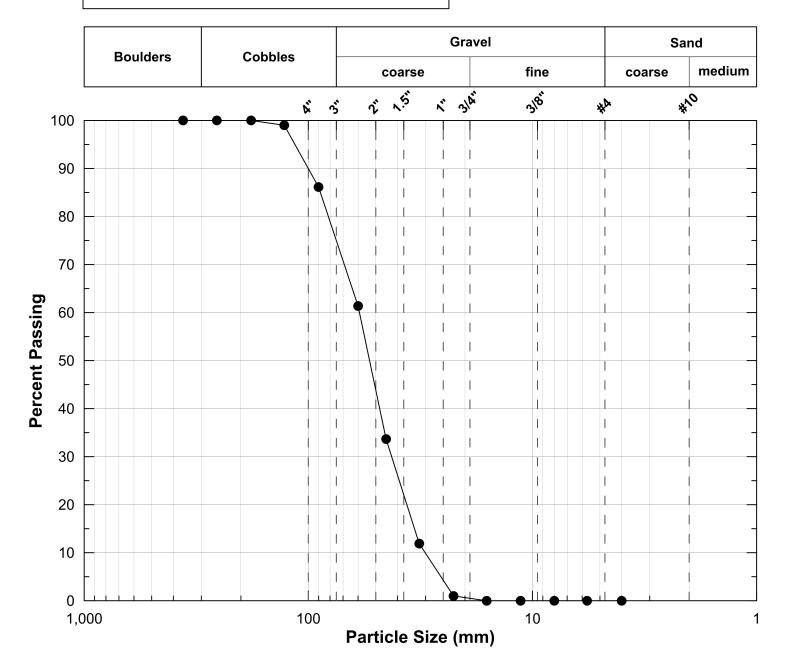
TID	SC_0710	ACP Segment	AP-1
Stream Name	Back Creek	MP	153.79
Survey Date	13-May-2016	Start Time	0910 hrs

- Stream possesses a riffle-pool morphology.
- Stream channel is comprised of point and mid-channel bars and upstream braids in channel.
- Cobble bed with gravels and sub-angular to rounded boulders.
- Wolman pebble count conducted; D50 is 53 mm (coarse gravel).
- Silty sand below armoring layer (approximately 4 inches) and within banks.
- Steeper banks on left bank, left bank height at crossing 4.7 feet.
- Deciduous riparian buffer that is greater than five channel widths on right bank and less than one on the right bank.
- Agricultural flood plain beyond right bank, with tributary entering right bank of main channel downstream of crossing.
- Wetland/heavily forested floodplain off left bank with tributary entering left bank of main channel just downstream of crossing (pipeline also crosses this tributary).
 - o Deep pool at confluence, greater than 5 pool depth below water surface.
 - o Beaver (dam materials) just downstream of confluence.
- Several head cuts observed above and below crossing location.
- Bankfull channel width is 25 feet and bankfull depth is 1.9 feet.
- Additional information on stream crossing is available on stream reconnaissance form.

Recommendation:

Evaluate scour depth for pipeline burial depth. Lateral migration does not appear to be a significant hazard as landowners will likely strive to maintain current stream course. Place sag bends outside of riparian buffer on right bank (approximately three river widths wide). Location of sag bend beyond left bank to be determined by additional investigation.

Wolman Pebble Count at SC_0710





Wolman Pebble Count

Stream Reconnaissance (Based on Thorne, 1998) Section 1 - Site Description

		•			
Date:	13-May-16	Stream Name:	Back Creek		
Crossing ID:	SC_0710				
-		- Region and Valley De	scription		
Part 1: Watershed Land Use	Part 2: River Valley Co Vegetation	nditions Valley Side Features	Failure Locations		
x Natural	None	x None	None		
Agricultural	Grass	Occasional	Away from river		
Urban Suburban	x Pasture Crops	Frequent	Along river		
x Rural	Shrubs				
Industrial	x Deciduous Forest/trees				
Cattle grazing	Coniferous Forest/trees				
Part 3: Floodplain					
Floodplain Width None	Land Use x Natural	Vegetation None	Riparian Buffer Strip None		
1 < river widths	x Agricultural	Grass	< 1 river width		
1-5 river widths	Urban	x Pasture	1-5 river widths		
5-10 river widths		Orchards	x > 5 river widths on left bnk		
x > 10 river widths	x Rural Industrial	x Crops Shrubs			
	Mining	x Deciduous For	est/trees		
	Cattle grazing	Coniferous Fo	rest/trees		
Part 4: Vertical Cor	nfinement				
Terraces	<u>Lev</u> ees	Levee Location			
x None	x None	Along channel ban			
Left bank Right bank	Natural Constructed	Set back < 1 river \ Set back > 1 river \			
Trigin bank	Constitucted	Oct back > 1 iiver (wati		
	tion of Channel to Valley				
Planform Straight	Meander Char Mild bends	acteristics			
x Meandering	x Moderate b	ends			
Braided	Tight bends				
Anastomosed					
Engineered					
Section 3 - Channel Description (select all that apply)					
Part 6: Channel Description (select all that apply)					
Bed Controls	Control Types	Width Controls C	ontrol Types Other		
x None	x None		None Debris		
Occasional Frequent	Bedrock Boulders	Occasional Frequent	Bedrock Mining Boulders Reservoir		
Confined		Confined	Knickpoint		
					

Flow Habit x Perennial Flashy perennial Intermittent Ephemeral Part 7: Bed Sedime Bed Material	Channel Width: M-B Classification Cascade or step-pulate pool-riffle Braided nt Description (select all to Bar Types	pool dune-ripple	Bar Vegetation	Bar Width
Clay Silt Sand x Gravel x Cobbles Boulders Bedrock	None Alternate bars Point bars Mid-channel bars Diagonal bars Irregular/combination Braided	Silt Sand Gravel Cobbles Percent sa	None x Grasses x Reeds/shrubs Trees nd in bed = <5	None Narrow Moderate river width X Wide
Bank Characteristic		- Bank Survey (select a	all that apply) Right Bank	
Bank Material	x Clay x Silt Gravel x Cobbles Boulders Bedrock		x Clay x Silt Gravel x Cobbles Boulders Bedrock	
Layer Material	x No layers Cohesive Sand Gravel Cobbles Boulders		x No layers Cohesive Sand Gravel Cobbles Boulders	
Bank Height		4.7'		
Bank Slope	x Steep Moderate Shallow	,	Steep Moderate x Shallow	
Bank Vegetation	None X Grasses/annuals X Reeds/shrubs X Trees: Falling trees? X Y Tree density spars Tree health x good tree ages x youngtree diversity X Y	poor	None x Grasses/annu Reeds/shrubs Trees: NO Falling trees? Tree density Tree health tree ages y tree diversity	
Bank Erosion and Failure Location	outside meander bend inside meander bend opposite bar or obstructions.	geotechnica	location of erosion outside meande inside meande opposite bar o general	der bend x fluvial geotechnical

Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0710, Back Creek at MP 153.79 (AP-1)

Photograph 1

Date: 13 May 2016

Direction: looking

upstream

Description: Deep pool and head cut below riffle, just downstream of crossing.



Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0710, Back Creek at MP 153.79 (AP-1)

Photograph 2

Date: 13 May 2016

Direction: looking across stream, flow to the right

Description: two tributary streams entering from left bank (from heavily forested floodplain) and right bank (from agricultural floodplain), both downstream of crossing.



Geosyntec Consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0710, Back Creek at MP 153.79 (AP-1)

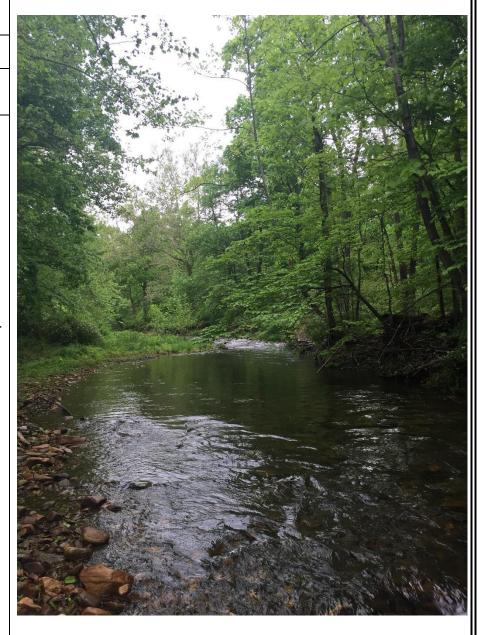
Photograph 3

Date: 13 May 2016

Direction: looking

upstream

Description: well established riparian buffer off left bank with tributary inlet entering from left bank at bottom of visible riffle section. Signs of beaver activity and deep depths in pool below riffle/ head cut.



Geosyntec consultants

Client: Atlantic Coast Pipeline Project Number: TXG0007

Subject Site: SC_0710, Back Creek at MP 153.79 (AP-1)

Photograph 4

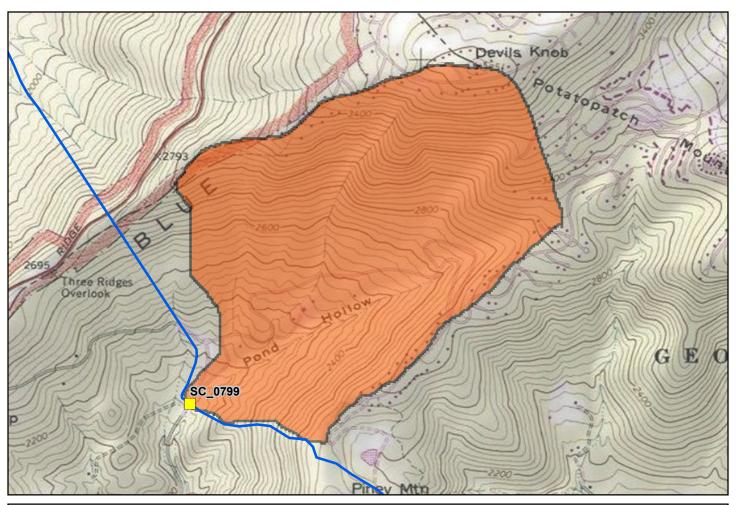
Date: 13 May 2016

Direction: looking downstream on tributary

stream

Description: one of two tributary streams entering back creek downstream of crossing. Flowing from agricultural floodplain, narrow riparian buffer visible on right bank of back creek, downstream of culvert.





TID	Unique ID	ACP Branch	Mile Post	State	County	
SC_0799	snea021	AP-1	158.91	Virginia	Nelson	
	Attribute			Value		
	Stream Name			Pond Hollow		
Ph	Physiographic Province ¹		Blue Ridge			
Drain	Drainage Area (square miles) ²		0.907			
	Flow Regime		Perennial			
Meas	Measured Bank Full Width (ft) ³		13.5			
Slope At Cros	Slope At Crossing Over 200ft Long Reach (%) ⁴		8.205			
Propos	Proposed Construction Method ⁵			1) Flume 2) Dam and Pump		

