

<b>TID</b>	SC_0767	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Hodges Draft	<b>MP</b>	112.60
<b>Survey Date</b>	07-April-2016	<b>Start Time</b>	1545 hrs

- Stream is within a debris flow deposit (hummocky terrain) with current flow confined but there is geomorphic evidence of secondary branching during flooding.
- Floodplain is approximately four channel widths wide on right bank and is over 10 channel widths on the left bank.
- Bankfull channel width is 26 feet and bankfull depth is 2 feet.
- Steep densely forested slope less than 50 yards from right bank.
- Width of riparian buffer on left bank varies and is about 100-ft wide at location of 2016.04.25\_Rev10\_Update\_Geosyntec.
- Bedrock outcrops within stream channel about 50 ft upstream has a strike and dip of N49°E 88°SE.
- FIAT 131 Superbrava with Virginia license plate registration dating 1986 is lodged in trees, which is an indication of potential for flooding with high velocity.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Given debris flow hazard bury pipeline into bedrock with at least 1.5-foot of cover above the crown from valley wall on right bank through the extent of the riparian buffer on the left bank.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	8-Apr-16	Stream Name:	Hodges Draft
Crossing ID:	SC_0767		

## Section 2 - Region and Valley Description

### Part 1: Watershed

#### Land Use

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input checked="" type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

#### Vegetation

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input checked="" type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

#### Valley Side Features

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Occasional
<input type="checkbox"/> Frequent

#### Failure Locations

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

#### Floodplain Width

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> 5-10 river widths
<input checked="" type="checkbox"/> > 10 river widths

#### Land Use

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input checked="" type="checkbox"/> Cattle grazing

#### Vegetation

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

#### Riparian Buffer Strip

<input type="checkbox"/> None
<input checked="" type="checkbox"/> < 1 river width on left bank
<input type="checkbox"/> 1-5 river widths
<input checked="" type="checkbox"/> > 5 river widths on right bank

### Part 4: Vertical Confinement

#### Terraces

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Left bank
<input type="checkbox"/> Right bank

#### Levees

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

#### Levee Location

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

#### Planform

<input type="checkbox"/> Straight
<input checked="" type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

#### Meander Characteristics

<input checked="" type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input type="checkbox"/> Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

#### Bed Controls

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input checked="" type="checkbox"/> Confined

#### Control Types

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

#### Width Controls

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input checked="" type="checkbox"/> Frequent
<input type="checkbox"/> Confined

#### Control Types

<input type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input checked="" type="checkbox"/> Boulders

#### Other

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 26.0'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-ripple, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

<b>Bed Material</b>	<b>Bar Types</b>	<b>Bar Material</b>	<b>Bar Vegetation</b>	<b>Bar Width</b>
<input type="checkbox"/> Clay	<input checked="" type="checkbox"/> None	<input type="checkbox"/> Silt	<input type="checkbox"/> None	<input type="checkbox"/> None
<input type="checkbox"/> Silt	<input type="checkbox"/> Alternate bars	<input type="checkbox"/> Sand	<input type="checkbox"/> Grasses	<input type="checkbox"/> Narrow
<input type="checkbox"/> Sand	<input type="checkbox"/> Point bars	<input type="checkbox"/> Gravel	<input type="checkbox"/> Reeds/shrubs	<input type="checkbox"/> Moderate
<input type="checkbox"/> Gravel	<input type="checkbox"/> Mid-channel bars	<input type="checkbox"/> Cobbles	<input type="checkbox"/> Trees	<input type="checkbox"/> Wide
<input type="checkbox"/> Cobbles	<input type="checkbox"/> Diagonal bars			
<input type="checkbox"/> Boulders	<input type="checkbox"/> Irregular/combination			
<input checked="" type="checkbox"/> Bedrock	<input type="checkbox"/> Braided			

Percent sand in bed = \_\_\_\_\_ %

**Section 4 - Bank Survey (select all that apply)**

<b>Bank Characteristic</b>	<b>Left Bank</b>	<b>Right Bank</b>		
<b>Bank Material</b>	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input checked="" type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input checked="" type="checkbox"/> Boulders <input type="checkbox"/> Bedrock		
<b>Layer Material</b>	<input checked="" type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders	<input checked="" type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders		
<b>Bank Height</b>	----	----		
<b>Bank Slope</b>	<input checked="" type="checkbox"/> Steep <input type="checkbox"/> Moderate <input type="checkbox"/> Shallow	<input checked="" type="checkbox"/> Steep <input type="checkbox"/> Moderate <input type="checkbox"/> Shallow		
<b>Bank Vegetation</b>	<input type="checkbox"/> None <input type="checkbox"/> Grasses/annuals <input checked="" type="checkbox"/> Reeds/shrubs <input checked="" type="checkbox"/> Trees: Falling trees? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/> None <input type="checkbox"/> Grasses/annuals <input checked="" type="checkbox"/> Reeds/shrubs <input checked="" type="checkbox"/> Trees: Falling trees? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N		
<b>Bank Erosion and Failure Location</b>	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0767, Hodges Draft at MP 112.60 (AP-1)

Photograph 1  
(074.jpg)

Date: 07-April-2016

Direction: Upstream

Description: View of hummocky terrain on the right bank of the stream indicative of debris flow deposits. Also steep slope to the right of the stream.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0767, Hodges Draft at MP 112.60 (AP-1)

Photograph 2  
(IMG\_008.jpg)

Date: 07-April-2016

Direction: Downstream

Description: View of rock  
outcrop near stream  
crossing



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0767, Hodges Draft at MP 112.60 (AP-1)

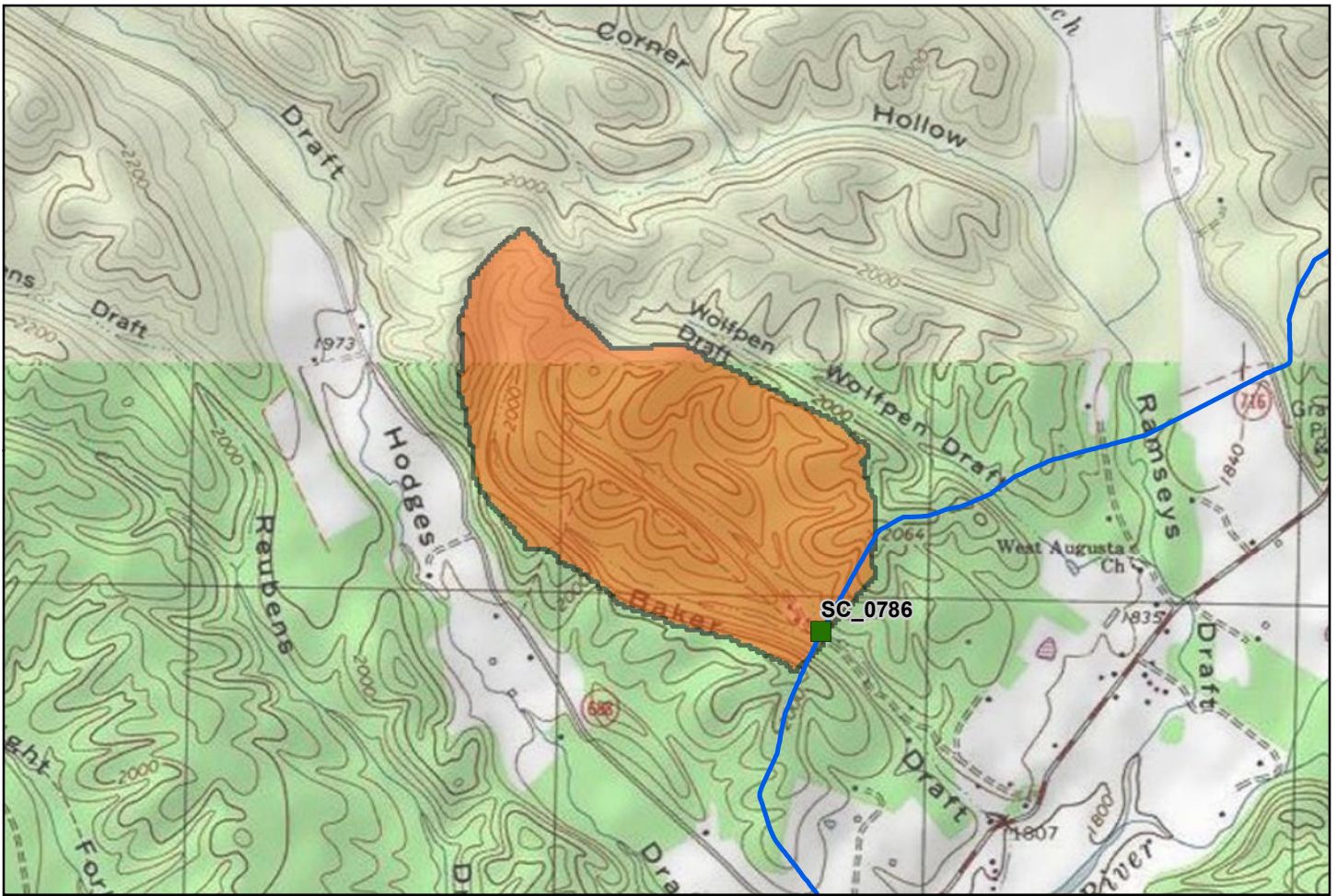
Photograph 3  
(075.jpg)

Date: 07-April-2016

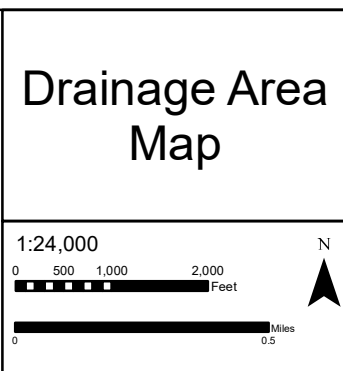
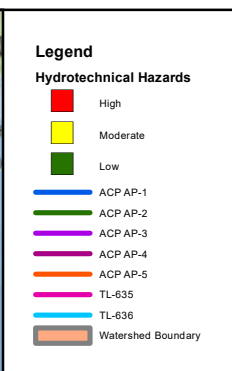
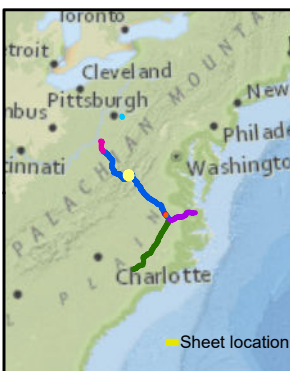
Direction: Downstream

Description: FIAT 131 Superbrava vehicle logged in trees indicative of the strength of the stream during flood stages. Last registration on vehicle license plate is 1986. Arrow point to survey flag.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0786	saua437	AP-1	113.07	Virginia	Augusta
Attribute			Value		
Stream Name			Baker Draft		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			0.294		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			10		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			1.699		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0786

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

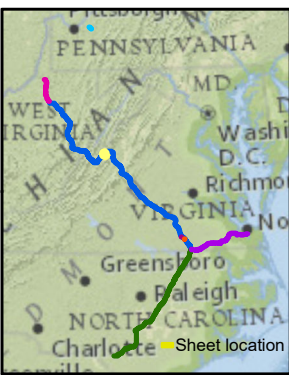
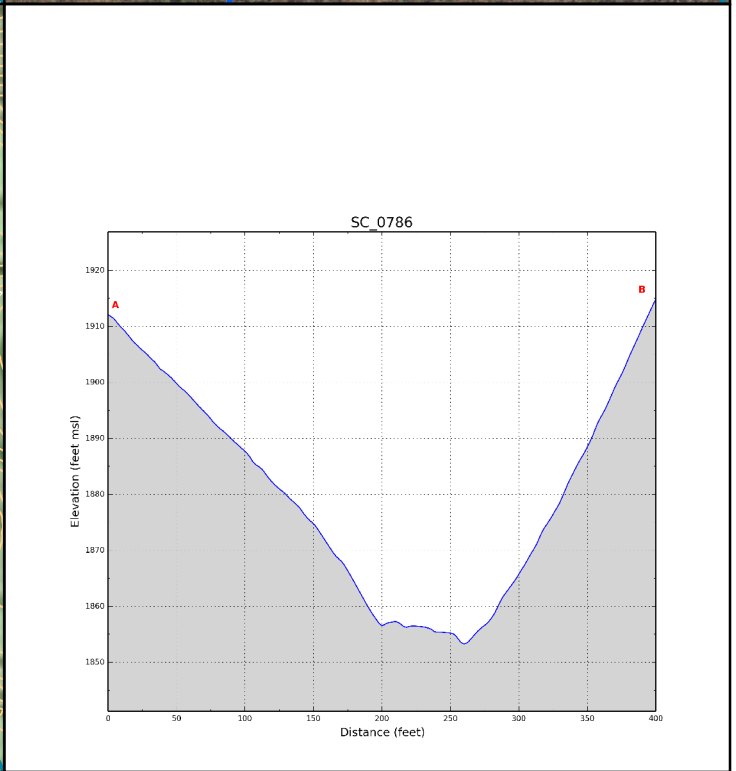
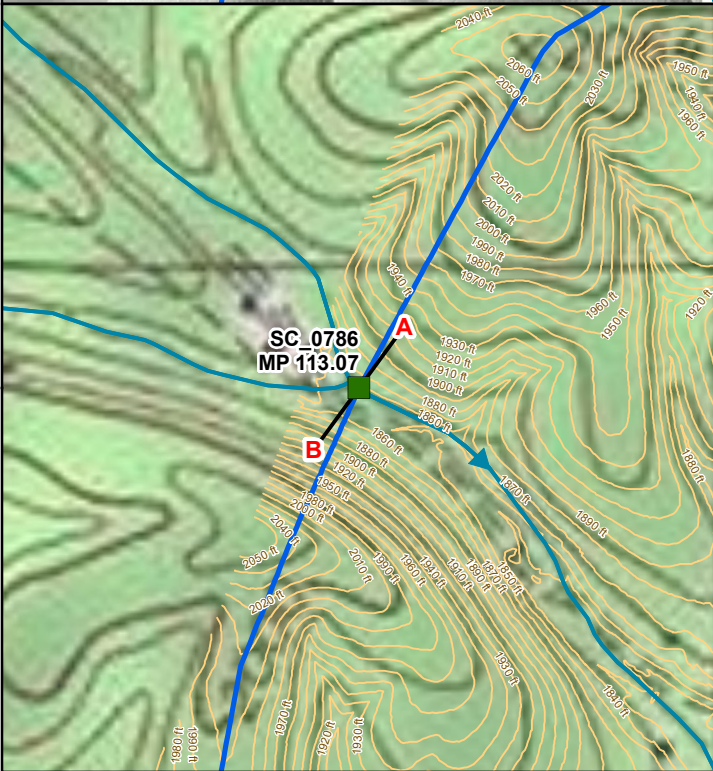
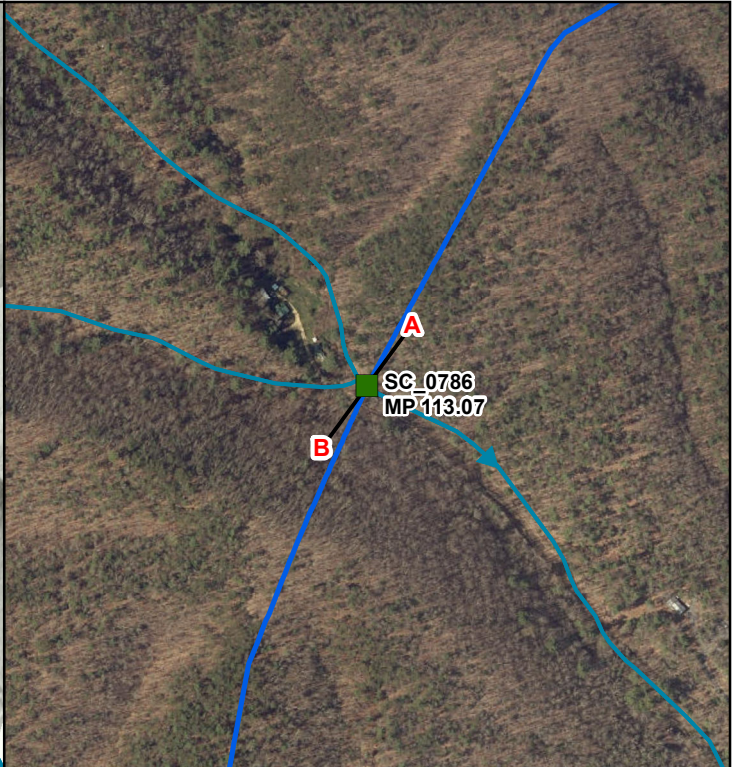
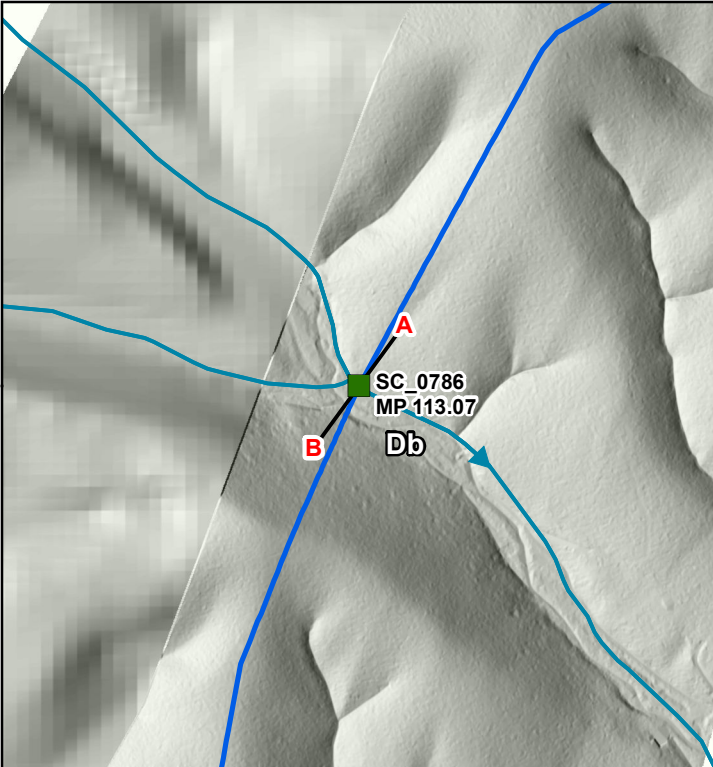
**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.

**Dominion**

**Geosyntec**  
consultants

**TESSE CONSULTANTS**



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations
- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: sau437  
TID\_SC: SC\_0786  
Stream Name: Baker Draft

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0786

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- The current alignment centerline provided by Dominion/GAI
- Projection: UTM 17N feet, NAD 83
- The vertical exaggeration on the profile graph is 4:1
- Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED



<b>TID</b>	SC_0786	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Baker Draft	<b>MP</b>	113.07
<b>Survey Date</b>	07-April-2016	<b>Start Time</b>	1435 hrs

- Stream surveyed at location of 2016.04.25\_Rev10\_Update\_Geosyntec.
- Bankfull channel width is 10 feet and located within a very narrow forested valley confined on the right bank by a steep slope and bedrock outcrops.
- Bed comprises mostly gravel and few cobble-sized laminar and subangular particles, as well as, bedrock.
- Bedrock outcrop identified few yards upstream and downstream of crossing with a strike and dip of N30°E 75°NW.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Bury pipeline into bedrock with at least 1.5-foot of cover above the crown from valley wall valley wall.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	7-Apr-16	Stream Name:	Baker Draft
Crossing ID:	SC_0786		

## Section 2 - Region and Valley Description

### Part 1: Watershed

#### Land Use

<input checked="" type="checkbox"/>	Natural
<input type="checkbox"/>	Agricultural
<input type="checkbox"/>	Urban
<input type="checkbox"/>	Suburban
<input type="checkbox"/>	Rural
<input type="checkbox"/>	Industrial
<input type="checkbox"/>	Cattle grazing

### Part 2: River Valley Conditions

#### Vegetation

<input type="checkbox"/>	None
<input type="checkbox"/>	Grass
<input type="checkbox"/>	Pasture
<input type="checkbox"/>	Crops
<input checked="" type="checkbox"/>	Shrubs
<input checked="" type="checkbox"/>	Deciduous Forest/trees
<input type="checkbox"/>	Coniferous Forest/trees

#### Valley Side Features

<input type="checkbox"/>	None
<input type="checkbox"/>	Occasional
<input checked="" type="checkbox"/>	Frequent

#### Failure Locations

<input checked="" type="checkbox"/>	None
<input type="checkbox"/>	Away from river
<input type="checkbox"/>	Along river

### Part 3: Floodplain

#### Floodplain Width

<input type="checkbox"/>	None
<input type="checkbox"/>	1 < river widths
<input type="checkbox"/>	1-5 river widths
<input type="checkbox"/>	5-10 river widths
<input checked="" type="checkbox"/>	> 10 river widths

#### Land Use

<input checked="" type="checkbox"/>	Natural
<input type="checkbox"/>	Agricultural
<input type="checkbox"/>	Urban
<input type="checkbox"/>	Suburban
<input type="checkbox"/>	Rural
<input type="checkbox"/>	Industrial
<input type="checkbox"/>	Mining
<input type="checkbox"/>	Cattle grazing

#### Vegetation

<input type="checkbox"/>	None
<input type="checkbox"/>	Grass
<input type="checkbox"/>	Pasture
<input type="checkbox"/>	Orchards
<input type="checkbox"/>	Crops
<input checked="" type="checkbox"/>	Shrubs
<input checked="" type="checkbox"/>	Deciduous Forest/trees
<input type="checkbox"/>	Coniferous Forest/trees

#### Riparian Buffer Strip

<input type="checkbox"/>	None
<input type="checkbox"/>	< 1 river width
<input type="checkbox"/>	1-5 river widths
<input checked="" type="checkbox"/>	> 5 river widths

### Part 4: Vertical Confinement

#### Terraces

<input type="checkbox"/>	None
<input checked="" type="checkbox"/>	Left bank
<input type="checkbox"/>	Right bank

#### Levees

<input checked="" type="checkbox"/>	None
<input type="checkbox"/>	Natural
<input type="checkbox"/>	Constructed

#### Levee Location

<input type="checkbox"/>	Along channel bank
<input type="checkbox"/>	Set back < 1 river width
<input type="checkbox"/>	Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

#### Planform

<input checked="" type="checkbox"/>	Straight
<input type="checkbox"/>	Meandering
<input type="checkbox"/>	Braided
<input type="checkbox"/>	Anastomosed
<input type="checkbox"/>	Engineered

#### Meander Characteristics

<input type="checkbox"/>	Mild bends
<input type="checkbox"/>	Moderate bends
<input type="checkbox"/>	Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

#### Bed Controls

<input type="checkbox"/>	None
<input type="checkbox"/>	Occasional
<input type="checkbox"/>	Frequent
<input checked="" type="checkbox"/>	Confined

#### Control Types

<input type="checkbox"/>	None
<input checked="" type="checkbox"/>	Bedrock
<input type="checkbox"/>	Boulders

#### Width Controls

<input type="checkbox"/>	None
<input type="checkbox"/>	Occasional
<input type="checkbox"/>	Frequent
<input checked="" type="checkbox"/>	Confined
	<i>On RB</i>

#### Control Types

<input type="checkbox"/>	None
<input checked="" type="checkbox"/>	Bedrock
<input type="checkbox"/>	Boulders

#### Other

<input type="checkbox"/>	Debris
<input type="checkbox"/>	Mining
<input type="checkbox"/>	Reservoir
<input type="checkbox"/>	Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 10.0'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

- |                                             |                                                |                                  |                                       |                                   |
|---------------------------------------------|------------------------------------------------|----------------------------------|---------------------------------------|-----------------------------------|
| <b>Bed Material</b>                         | <b>Bar Types</b>                               | <b>Bar Material</b>              | <b>Bar Vegetation</b>                 | <b>Bar Width</b>                  |
| <input type="checkbox"/> Clay               | <input checked="" type="checkbox"/> None       | <input type="checkbox"/> Silt    | <input type="checkbox"/> None         | <input type="checkbox"/> None     |
| <input type="checkbox"/> Silt               | <input type="checkbox"/> Alternate bars        | <input type="checkbox"/> Sand    | <input type="checkbox"/> Grasses      | <input type="checkbox"/> Narrow   |
| <input type="checkbox"/> Sand               | <input type="checkbox"/> Point bars            | <input type="checkbox"/> Gravel  | <input type="checkbox"/> Reeds/shrubs | <input type="checkbox"/> Moderate |
| <input checked="" type="checkbox"/> Gravel  | <input type="checkbox"/> Mid-channel bars      | <input type="checkbox"/> Cobbles | <input type="checkbox"/> Trees        | <input type="checkbox"/> Wide     |
| <input checked="" type="checkbox"/> Cobbles | <input type="checkbox"/> Diagonal bars         |                                  |                                       |                                   |
| <input type="checkbox"/> Boulders           | <input type="checkbox"/> Irregular/combination |                                  |                                       |                                   |
| <input checked="" type="checkbox"/> Bedrock | <input type="checkbox"/> Braided               |                                  |                                       |                                   |
- Percent sand in bed = \_\_\_\_\_ %

**Section 4 - Bank Survey (select all that apply)**

Bank Characteristic	Left Bank	Right Bank
<b>Bank Material</b>	<input checked="" type="checkbox"/> Clay <input checked="" type="checkbox"/> Silt <input checked="" type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input checked="" type="checkbox"/> Bedrock
<b>Layer Material</b>	<input type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders	<input type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders
<b>Bank Height</b>	0.9	----
<b>Bank Slope</b>	<input type="checkbox"/> Steep <input type="checkbox"/> Moderate <input checked="" type="checkbox"/> Shallow	<input checked="" type="checkbox"/> Steep <input type="checkbox"/> Moderate <input type="checkbox"/> Shallow
<b>Bank Vegetation</b>	<input type="checkbox"/> None <input type="checkbox"/> Grasses/annuals <input checked="" type="checkbox"/> Reeds/shrubs <input checked="" type="checkbox"/> Trees: Falling trees? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/> None <input type="checkbox"/> Grasses/annuals <input type="checkbox"/> Reeds/shrubs <input checked="" type="checkbox"/> Trees: Falling trees? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
<b>Bank Erosion and Failure Location</b>	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical
	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0786, Baker Draft at MP 113.07 (AP-1)

Photograph 1  
(068.jpg)

Date: 07-April-2016

Direction: Downstream

Description: Stream runs within narrow valley (notice left valley wall in background) and against steep slope of right valley wall. Angular and subangular gravel and cobble-sized particles in stream bed.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0786, Baker Draft at MP 113.07 (AP-1)

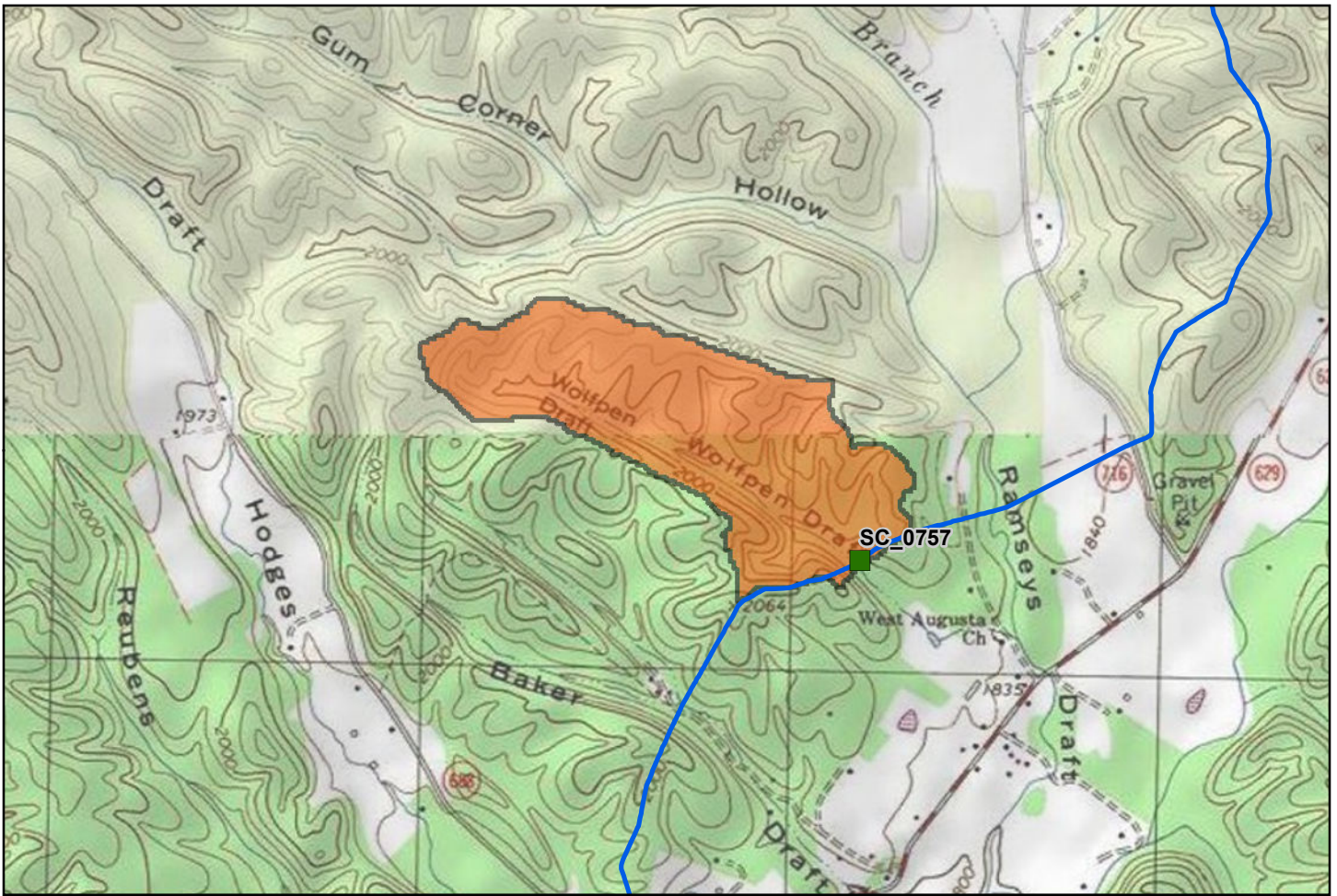
Photograph 2  
(063.jpg)

Date: 07-April-2016

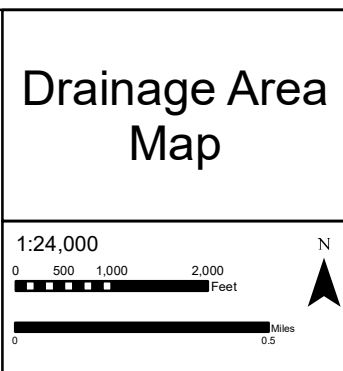
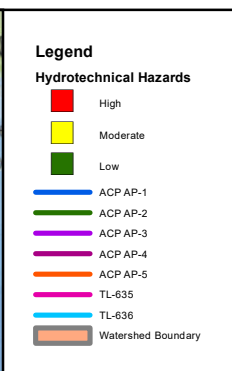
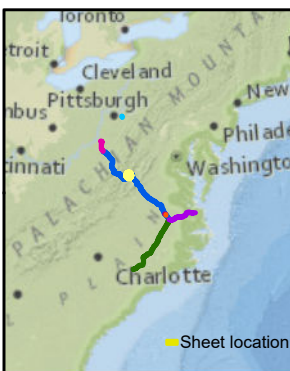
Direction: Upstream

Description: View of anastomosing of stream upstream and bedrock on stream bed (red arrow).





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0757	saua410	AP-1	113.33	Virginia	Augusta
Attribute			Value		
Stream Name			Wolfpen Draft		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			0.192		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			6.5		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			1.679		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0757

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

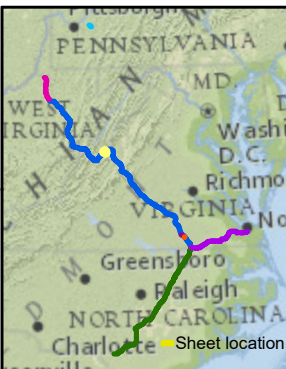
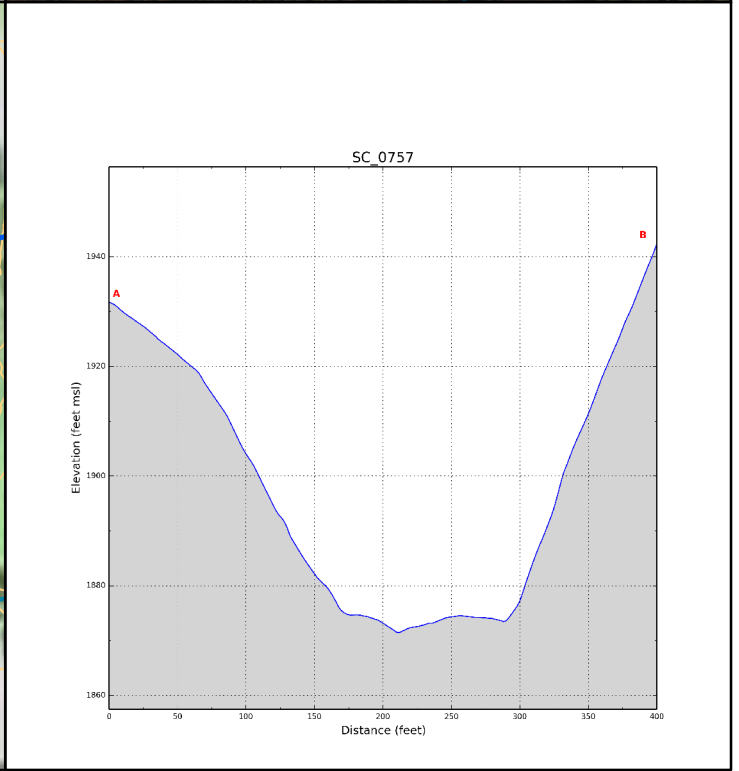
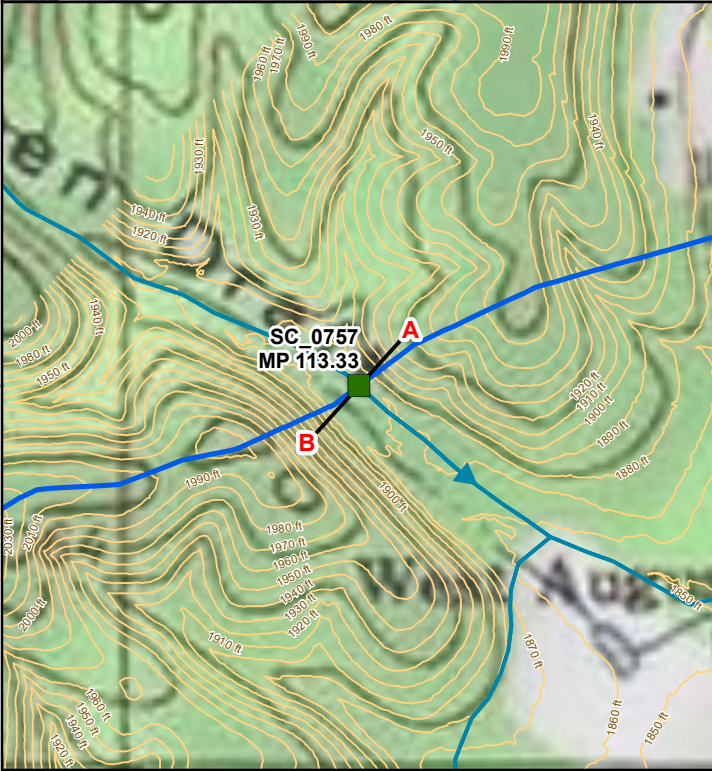
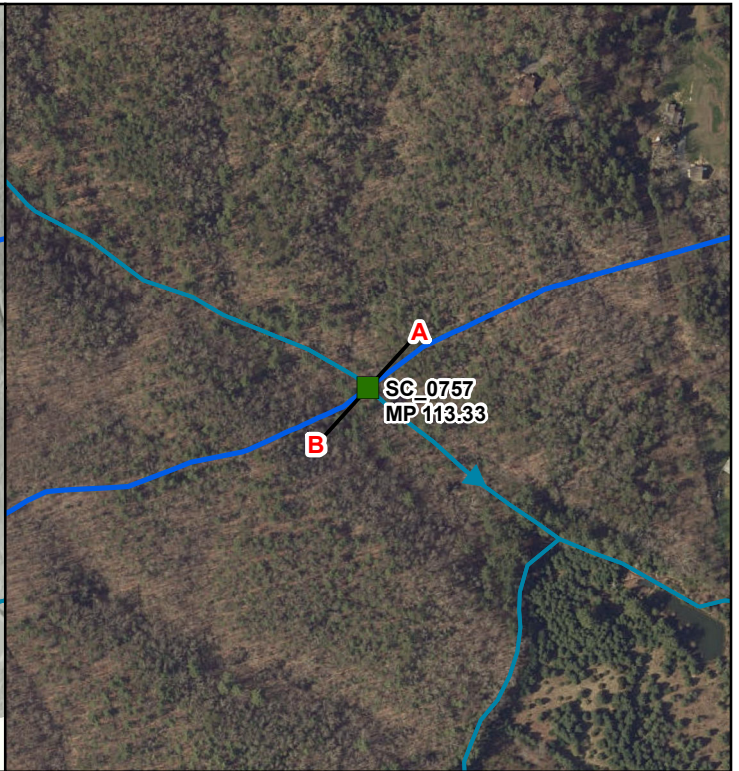
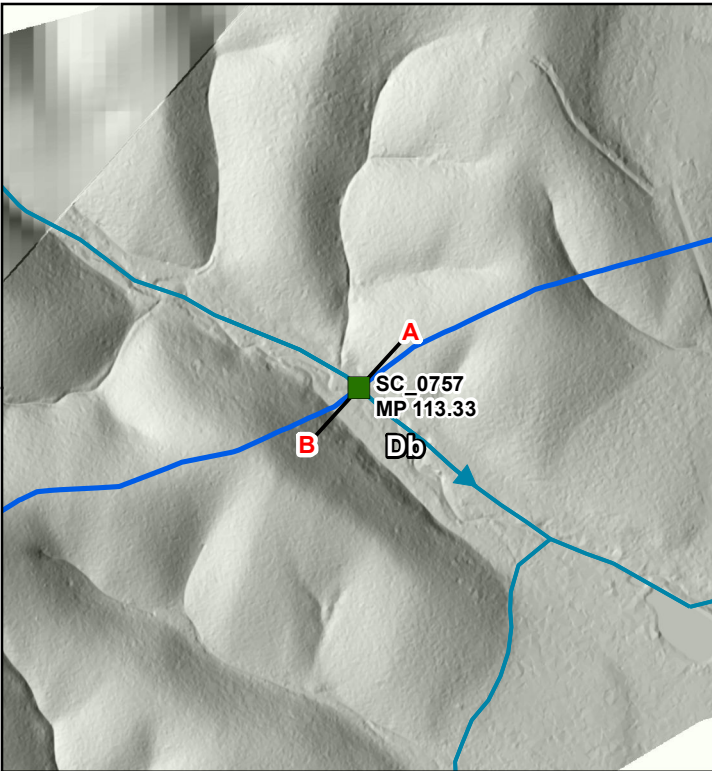
**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAI.

**Dominion**

**Geosyntec**  
consultants

**TESSE CONSULTANTS**



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations

**Profile Line (400ft)**

- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: sau410  
TID\_SC: SC\_0757  
Stream Name: Wolfpen Draft

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0757

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- The current alignment centerline provided by Dominion/GAI
- Projection: UTM 17N feet, NAD 83
- The vertical exaggeration on the profile graph is 4:1
- Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

**Dominion**

**Geosyntec**  
consultants

**TESSELLATIONS**

<b>TID</b>	SC_0757	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Wolfpen Draft	<b>MP</b>	113.33
<b>Survey Date</b>	07-April-2016	<b>Start Time</b>	1345 hrs

- Stream surveyed at 38.24701N 79.34076W.
- Bankfull channel width is 6.5 feet and bankfull depth is 1.1 feet.
- Stream crossing located within a narrow and densely forested terraced alluvial valley.
- Stream bed comprised mostly of gravel and few cobble-sized laminar and subangular particles.
- Bedrock outcrop identified approximately 200 yards upstream, but bedrock is suspected to be shallow at crossing.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Given channel migration potential, it is recommended to bury pipeline into bedrock with at least 1.5-foot of cover above the crown from valley wall on right bank to valley wall.



# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:

Stream Name:

Crossing ID:

## Section 2 - Region and Valley Description

### Part 1: Watershed

#### Land Use

- Natural
- Agricultural
- Urban
- Suburban
- Rural
- Industrial
- Cattle grazing

### Part 2: River Valley Conditions

#### Vegetation

- None
- Grass
- Pasture
- Crops
- Shrubs
- Deciduous Forest/trees
- Coniferous Forest/trees

#### Valley Side Features

- None
- Occasional
- Frequent

#### Failure Locations

- None
- Away from river
- Along river

### Part 3: Floodplain

#### Floodplain Width

- None
- 1 < river widths
- 1-5 river widths
- 5-10 river widths
- > 10 river widths

#### Land Use

- Natural
- Agricultural
- Urban
- Suburban
- Rural
- Industrial
- Mining
- Cattle grazing

#### Vegetation

- None
- Grass
- Pasture
- Orchards
- Crops
- Shrubs
- Deciduous Forest/trees
- Coniferous Forest/trees

#### Riparian Buffer Strip

- None
- < 1 river width
- 1-5 river widths
- > 5 river widths

### Part 4: Vertical Confinement

#### Terraces

- None
- Left bank
- Right bank

#### Levees

- None
- Natural
- Constructed

#### Levee Location

- Along channel bank
- Set back < 1 river width
- Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

#### Planform

- Straight
- Meandering
- Braided
- Anastomosed
- Engineered

#### Meander Characteristics

- Mild bends
- Moderate bends
- Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

#### Bed Controls

- None
- Occasional
- Frequent
- Confined

#### Control Types

- None
- Bedrock
- Boulders

#### Width Controls

- None
- Occasional
- Frequent
- Confined

#### Control Types

- None
- Bedrock
- Boulders

#### Other

- Debris
- Mining
- Reservoir
- Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 6.5

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

**Bed Material**

- Clay
- Silt
- Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

**Bar 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

**Bar Width**

- None
- Narrow
- Moderate
- Wide

**Percent sand in bed =** \_\_\_\_\_ %

**Section 4 - Bank Survey (select all that apply)**

**Bank Characteristic**

**Bank Material**

**Left Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Layer Material**

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

**Bank Height**

1.1

3.0'

**Bank Slope**

- Steep
- Moderate
- Shallow

- Steep
- Moderate
- Shallow

**Bank Vegetation**

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

**Bank Erosion and Failure Location**

- location of erosion
  - outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
  - fluvial
  - geotechnical

- location of erosion
  - outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
  - fluvial
  - geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0757, Wolfpen Draft at MP 113.33 (AP-1)

Photograph 1  
(043.jpg)

Date: 07-April-2016

Direction: Upstream

Description: View of slope on right bank and gravel and cobble-sized laminar and subangular particles on stream bed.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0757, Wolfpen Draft at MP 113.33 (AP-1)

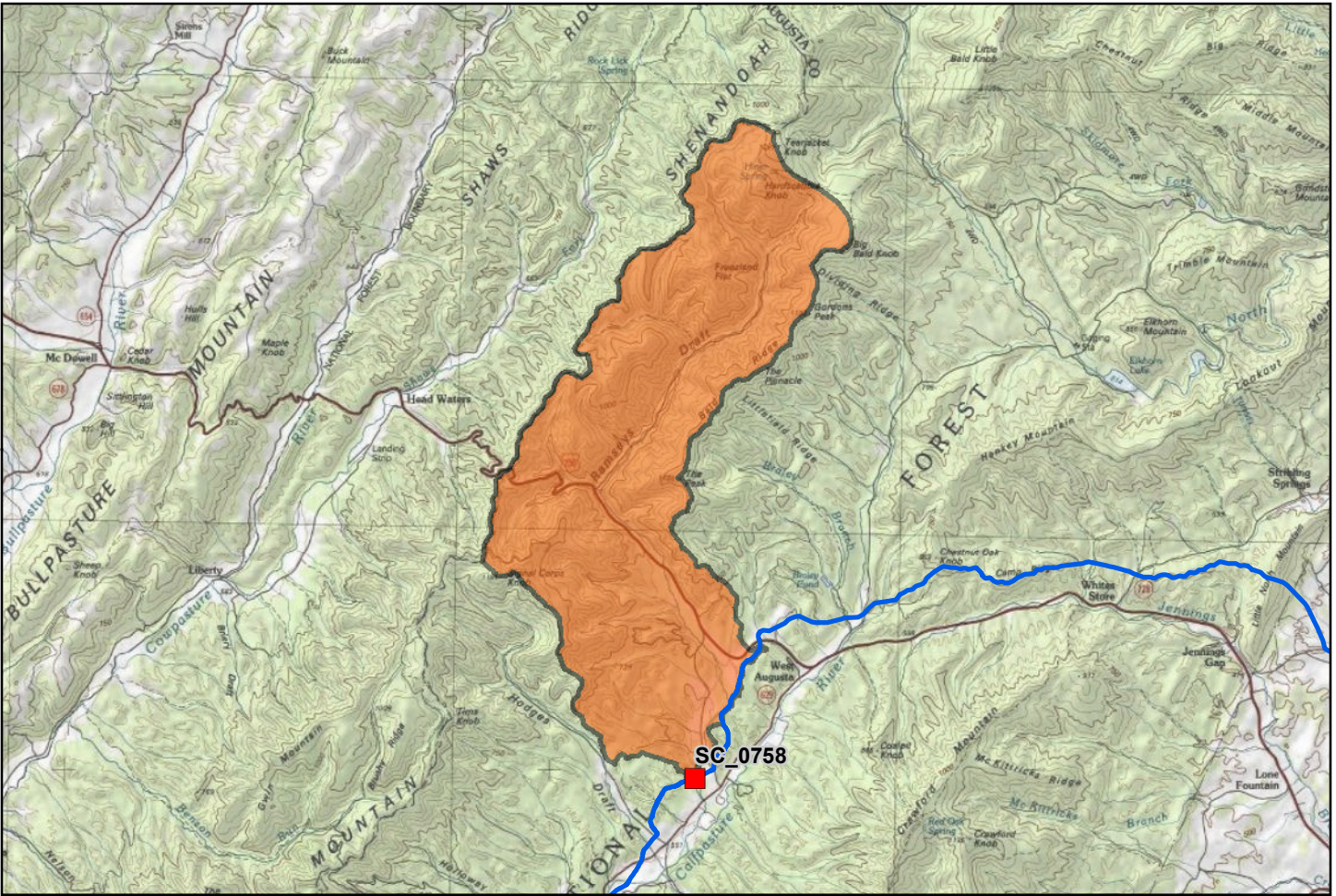
Photograph 2  
(056.jpg)

Date: 07-April-2016

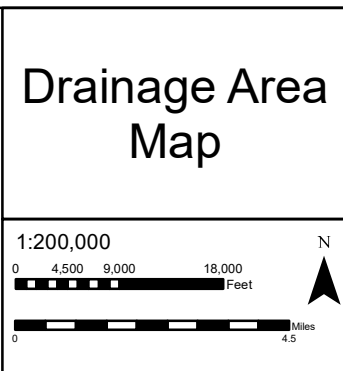
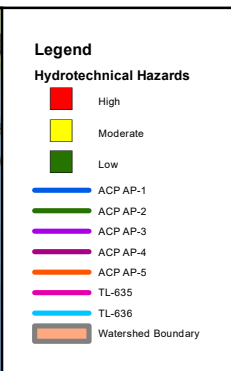
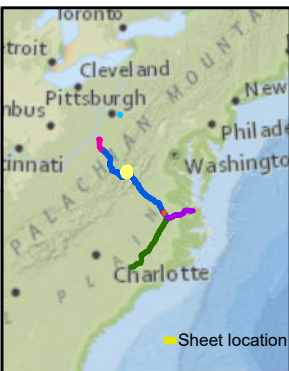
Direction: Upstream

Description: View of narrow valley from left valley wall.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0758	saua405	AP-1	113.48	Virginia	Augusta
Attribute			Value		
Stream Name			Ramseys Draft		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			20.952		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			41		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.806		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



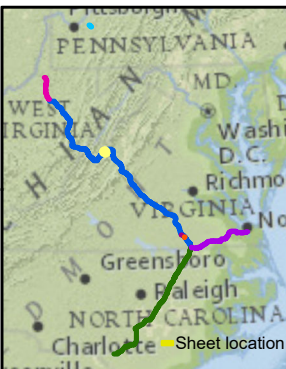
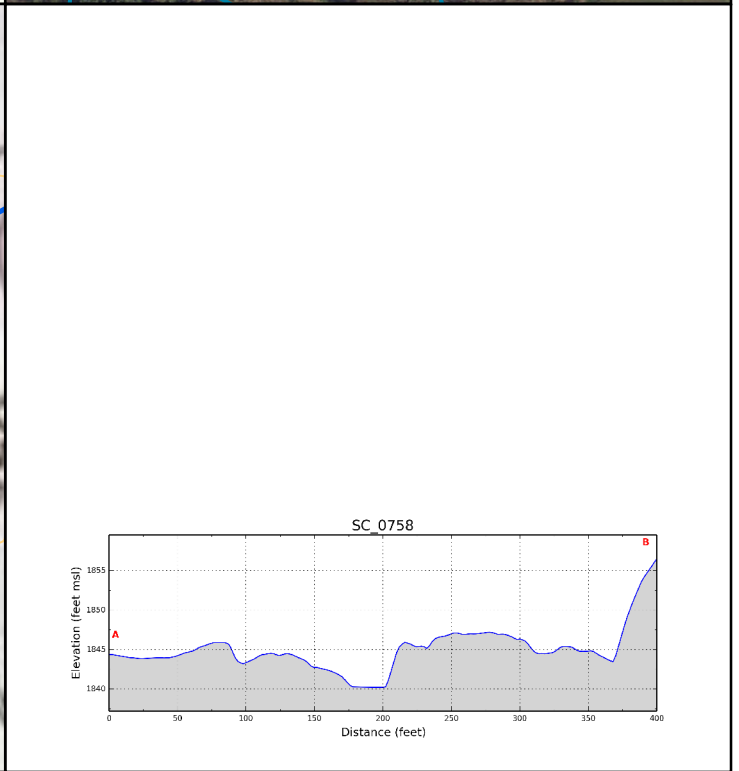
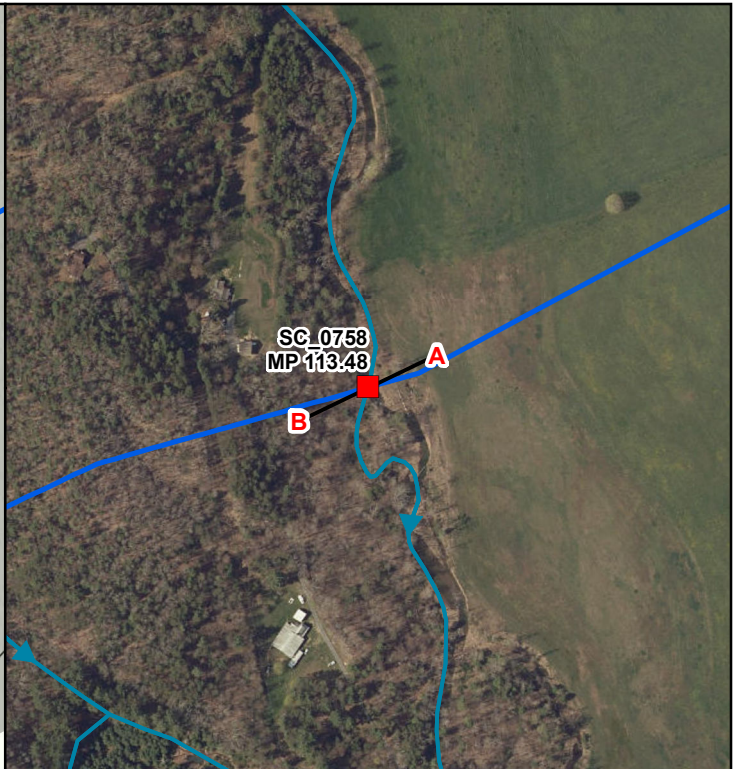
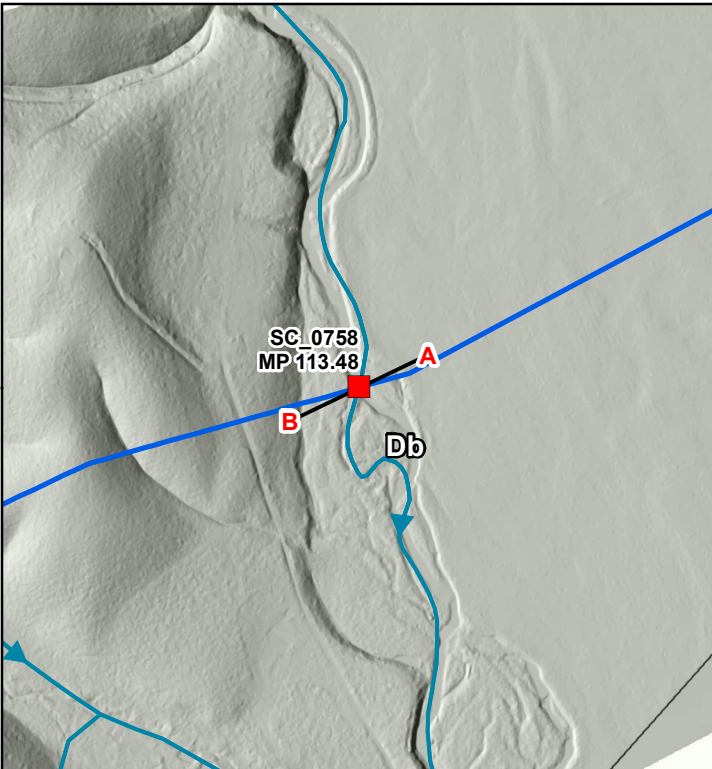
**Document Information:**

Document No: DOM\_EC\_HYD\_MA\_SER001\_SC\_0758

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations

**Profile Line (400T)**

- Stream Line with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: sau405  
TID\_SC: SC\_0758  
Stream Name: Ramseys Draft

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0758

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) The current alignment centerline provided by Dominion/GAI
- 2) Projection: UTM 17N feet, NAD 83
- 3) The vertical exaggeration on the profile graph is 4:1
- 4) Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- 5) In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

**Dominion**

**Geosyntec**  
consultants

**TESSE** CONSULTANTS

<b>TID</b>	SC_0758	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Ramsey's Draft	<b>MP</b>	113.48
<b>Survey Date</b>	07-April-2016	<b>Start Time</b>	1220 hrs

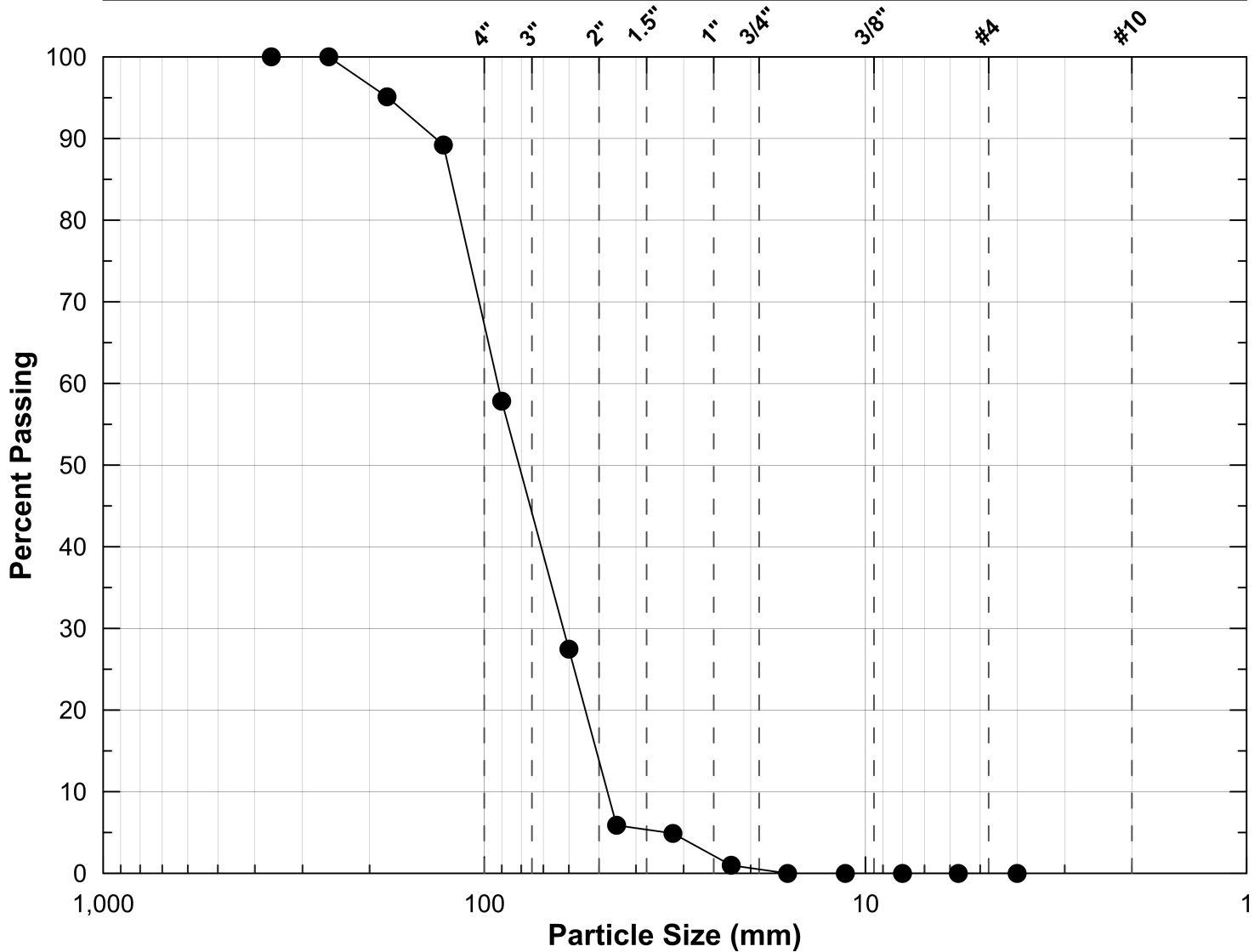
- Stream surveyed at 38.24824N 79.33643W.
- Riffle-pool stream morphology.
- Pool depths downstream of riffles approximately 2.8 feet to 3.6 feet.
- Downstream head cuts with approximately 220 feet between headcuts.
- Longitudinal channel slopes estimated in the field at 1.5-3% (upstream), 3% (downstream).
- Bankfull channel width is 41 feet.
- Floodplain terrace on right bank is approximately 5-foot high.
- Bed comprised of cobbles and gravel with few boulders. Wolman Pebble Count conducted; D<sub>50</sub> is 81 mm (small cobble).
- No riparian buffer on left bank, but stream runs on the edge of an agricultural field.
- Left bank slope is shallow and connected to floodplain. Riparian buffer on right bank comprises a dense, young deciduous trees and shrubs.
- Man-made obstruction (spoil pile/levee) about 30 yards downstream at bend, presumably to protect land loss due to erosion.
- 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 landowner will likely ensure that stream stays within current channel. Left bank sag bend should be placed at least two stream widths from existing left bank. Right bank sag bend should be located at valley wall due to channel avulsion potential and lateral and vertical geomorphic instability of stream.

# Wolman Pebble Count at SC\_0758

Boulders	Cobbles	Gravel				Sand	
		coarse		fine		coarse	medium





# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	7-Apr-16	Stream Name:	Ramsey's Draft
Crossing ID:	SC_0758		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" type="checkbox"/> Natural <i>RB</i>
<input checked="" type="checkbox"/> Agricultural <i>LB</i>
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input checked="" type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

**Valley Side Features**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent

**Failure Locations**

<input type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

**Floodplain Width**

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> 5-10 river widths
<input checked="" type="checkbox"/> > 10 river widths

**Land Use**

<input type="checkbox"/> Natural
<input checked="" type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input checked="" type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

**Riparian Buffer Strip**

<input checked="" type="checkbox"/> None <i>On Left Bank</i>
<input type="checkbox"/> < 1 river width
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

**Terraces**

<input type="checkbox"/> None
<input type="checkbox"/> Left bank
<input checked="" type="checkbox"/> Right bank

**Levees**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

**Levee Location**

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

**Planform**

<input type="checkbox"/> Straight
<input checked="" type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

**Meander Characteristics**

<input checked="" type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input type="checkbox"/> Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

**Bed Controls**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input checked="" type="checkbox"/> Boulders

**Width Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Other**

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 41'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

- |                                              |                                                |                                             |                                                  |                                   |
|----------------------------------------------|------------------------------------------------|---------------------------------------------|--------------------------------------------------|-----------------------------------|
| <b>Bed Material</b>                          | <b>Bar Types</b>                               | <b>Bar Material</b>                         | <b>Bar Vegetation</b>                            | <b>Bar Width</b>                  |
| <input type="checkbox"/> Clay                | <input type="checkbox"/> None                  | <input type="checkbox"/> Silt               | <input type="checkbox"/> None                    | <input type="checkbox"/> None     |
| <input type="checkbox"/> Silt                | <input type="checkbox"/> Alternate bars        | <input type="checkbox"/> Sand               | <input type="checkbox"/> Grasses                 | <input type="checkbox"/> Narrow   |
| <input type="checkbox"/> Sand                | <input checked="" type="checkbox"/> Point bars | <input checked="" type="checkbox"/> Gravel  | <input checked="" type="checkbox"/> Reeds/shrubs | <input type="checkbox"/> Moderate |
| <input type="checkbox"/> Gravel              | <input type="checkbox"/> Mid-channel bars      | <input checked="" type="checkbox"/> Cobbles | <input type="checkbox"/> Trees                   | <input type="checkbox"/> Wide     |
| <input checked="" type="checkbox"/> Cobbles  | <input type="checkbox"/> Diagonal bars         |                                             |                                                  |                                   |
| <input checked="" type="checkbox"/> Boulders | <input type="checkbox"/> Irregular/combination |                                             |                                                  |                                   |
| <input type="checkbox"/> Bedrock             | <input type="checkbox"/> Braided               |                                             |                                                  |                                   |
- Percent sand in bed = <10 %

**Section 4 - Bank Survey (select all that apply)**

Bank Characteristic	Left Bank	Right Bank
<b>Bank Material</b>	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input checked="" type="checkbox"/> Boulders <input type="checkbox"/> Bedrock
<b>Layer Material</b>	<input type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders	<input type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders
<b>Bank Height</b>	2'	5'
<b>Bank Slope</b>	<input type="checkbox"/> Steep <input type="checkbox"/> Moderate <input checked="" type="checkbox"/> Shallow	<input checked="" type="checkbox"/> Steep <input type="checkbox"/> Moderate <input type="checkbox"/> Shallow
<b>Bank Vegetation</b>	<input type="checkbox"/> None <input checked="" type="checkbox"/> Grasses/annuals <input type="checkbox"/> Reeds/shrubs <input type="checkbox"/> Trees: NO Falling trees? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input type="checkbox"/> dense Tree health <input type="checkbox"/> good <input type="checkbox"/> poor tree ages <input type="checkbox"/> young <input type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/> None <input checked="" type="checkbox"/> Grasses/annuals <input checked="" type="checkbox"/> Reeds/shrubs <input checked="" type="checkbox"/> Trees: Falling trees? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
<b>Bank Erosion and Failure Location</b>	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical
	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0758, Ramsey's Draft at MP 113.48 (AP-1)

Photograph 1  
(IMG\_0639.jpg)

Date: 07-April-2016

Direction: Downstream

Description: Stream bed comprising cobbles with  $D_{50} = 81 \text{ mm}$  (3.2"). No riparian buffer on left bank. Left bank slope is shallow and connected to flood plain. Man-made obstruction (red arrow) about 30 yards downstream.



PHASE 2 - RAPID STREAM RECONNAISSANCE

Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0758, Ramsey's Draft at MP 113.48 (AP-1)

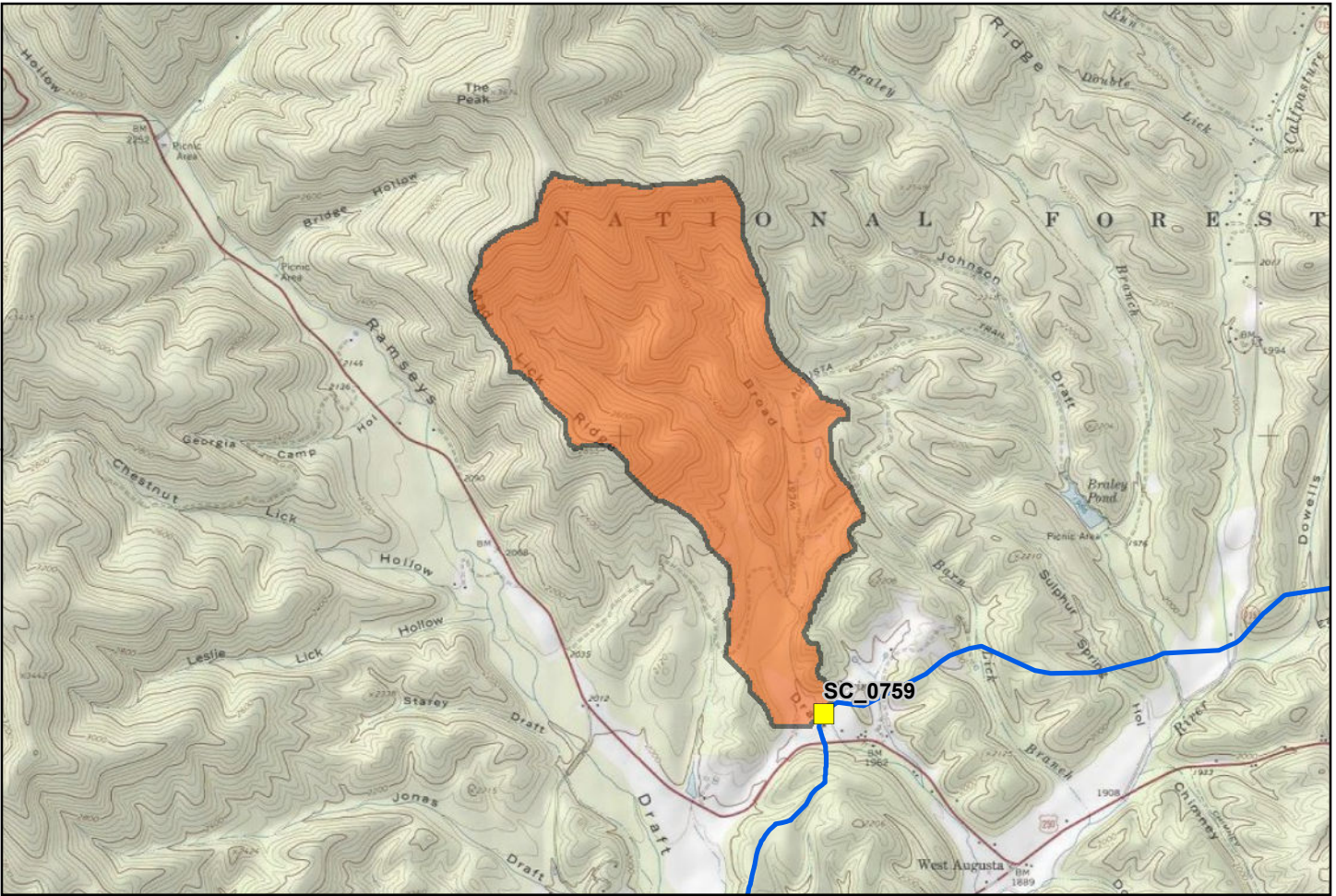
Photograph 2  
(035.jpg)

Date: 07-April-2016

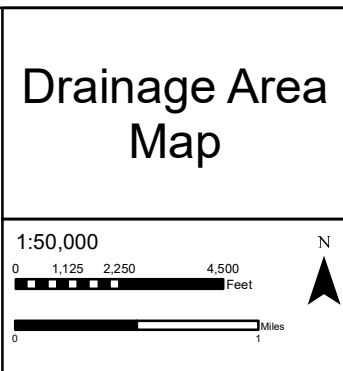
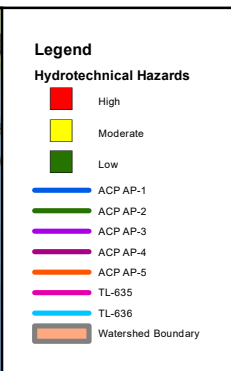
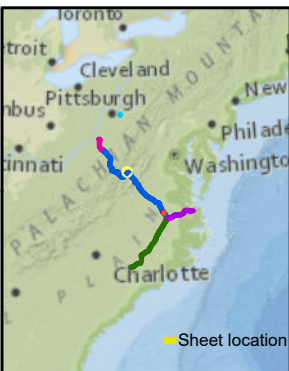
Direction: Upstream

Description: Dense deciduous forest riparian buffer on right bank. Occasional boulders on stream.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0759	nhd_va_o_001	AP-1	115.29	Virginia	Augusta
Attribute			Value		
Stream Name			Broad Draft		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			1.267		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			12		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			1.667		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



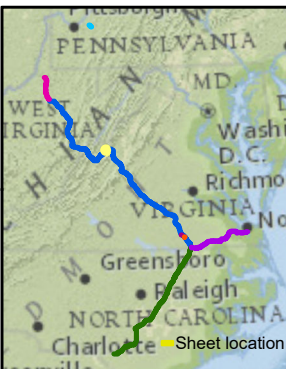
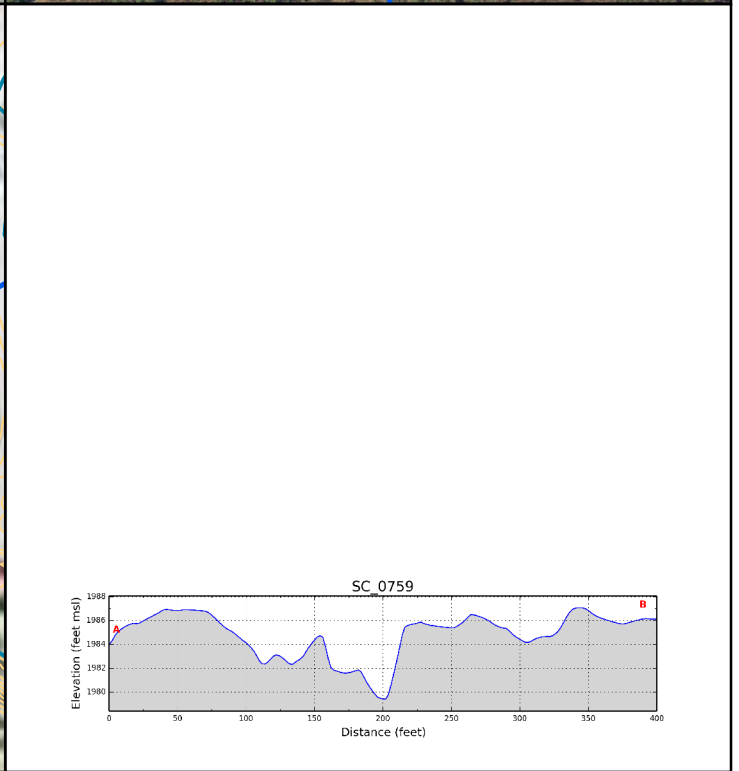
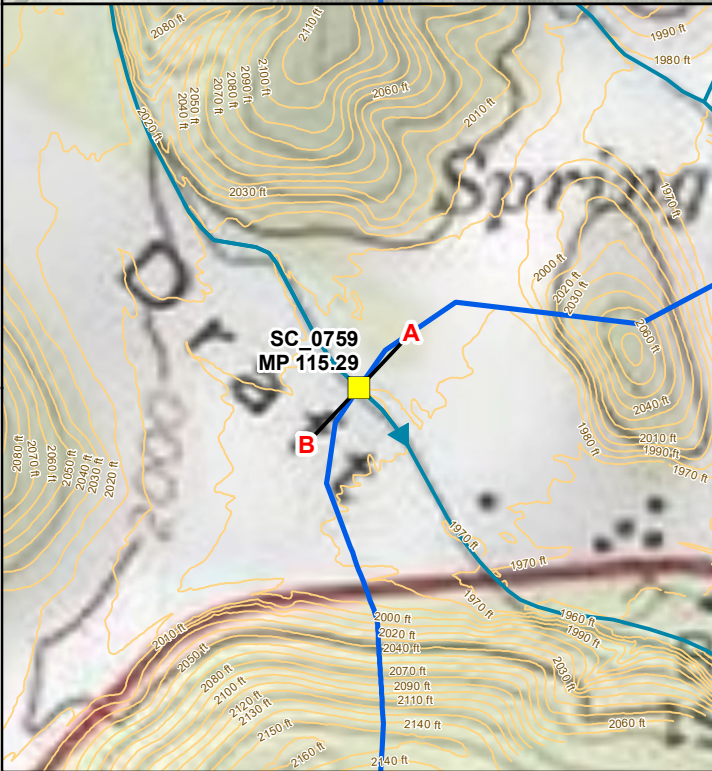
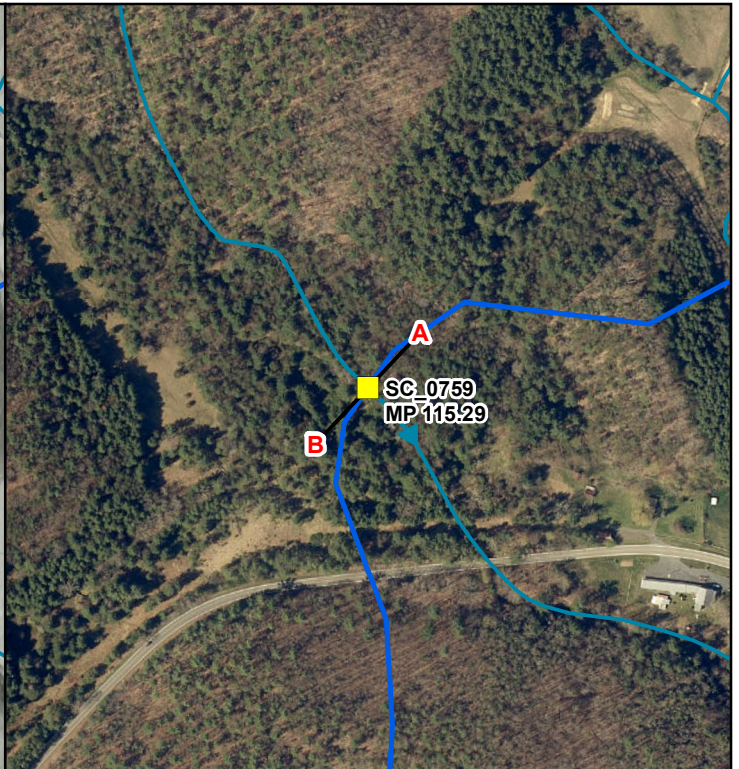
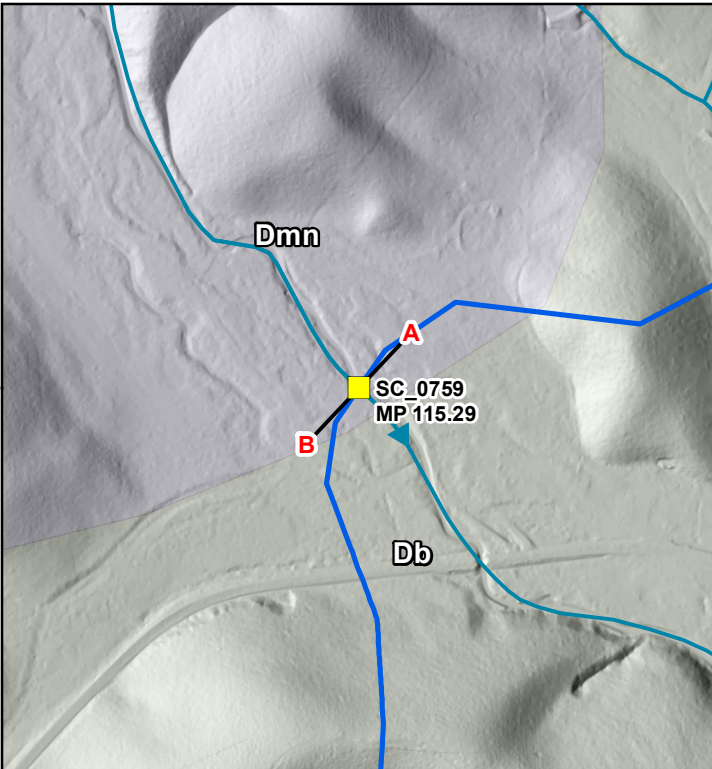
**Document Information:**

Document No: DOM\_EC\_HYD\_MA\_SER001\_SC\_0759

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAI.



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations

**Stream and Profile Information**

- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

**Stream Crossing Plan View and Profile**

Location ID: nhd\_va\_o\_001  
 TID\_SC: SC\_0759  
 Stream Name: Broad Draft

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0759

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) The current alignment centerline provided by Dominion/GAI
- 2) Projection: UTM 17N feet, NAD 83
- 3) The vertical exaggeration on the profile graph is 4:1
- 4) Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- 5) In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

<b>TID</b>	SC_0759	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Broad Draft	<b>MP</b>	115.29
<b>Survey Date</b>	06-April-2016	<b>Start Time</b>	1215 hrs

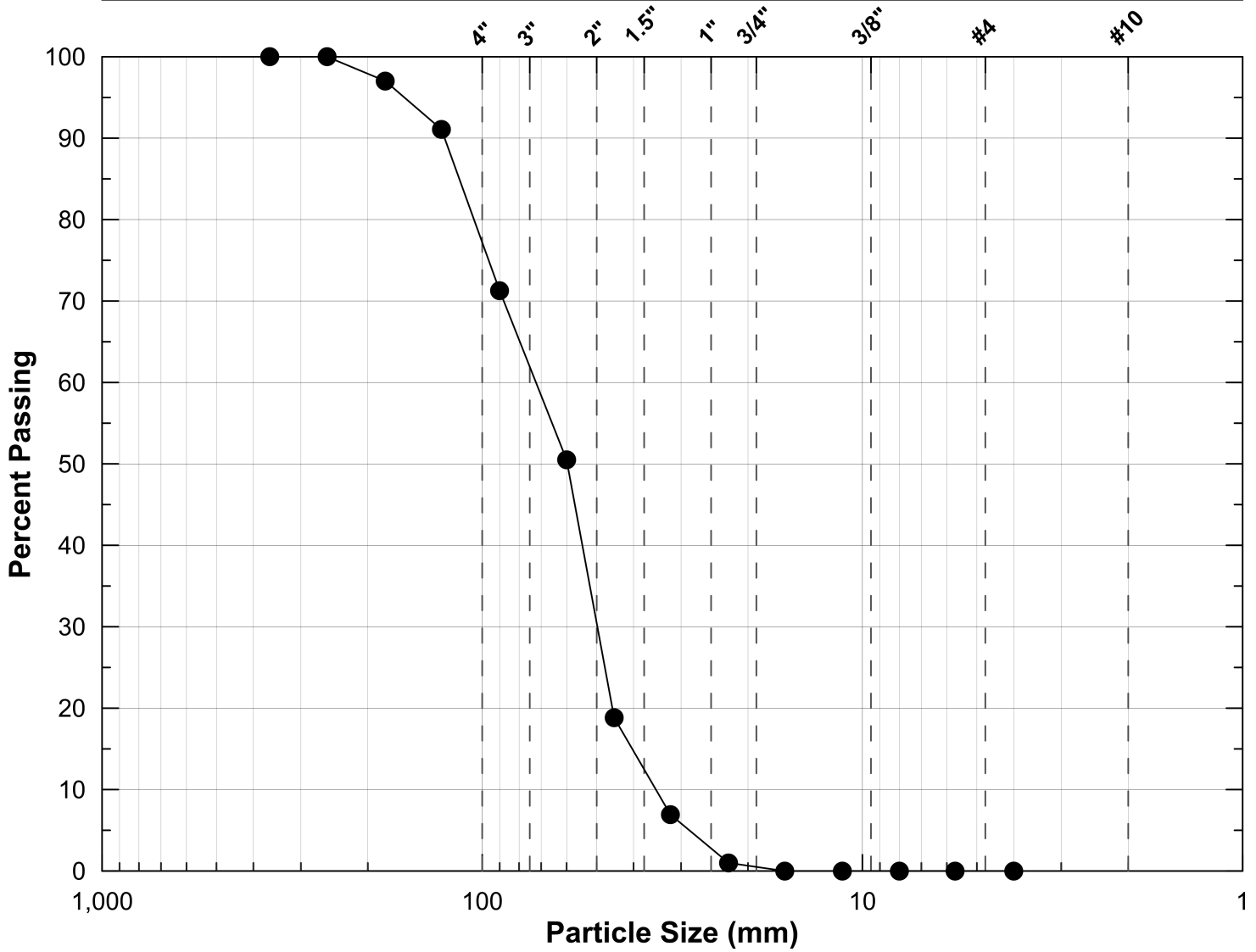
- Channel is incised within historic debris flow deposits with a bankfull channel width of 12 feet.
- Top of bank height was approximately 4.9 feet, while bankfull depth was 1.5 feet.
- Step-pool morphology with sub-angular to sub-rounded coarse gravel and cobble substrate.
- Steep longitudinal channel slope estimated in the field at 3.25%
- Stream located in dense deciduous and coniferous forest.
- Relic channel identified in floodplain beyond left bank.
- Conducted Wolman Pebble Count on riffle;  $D_{50}$  is 60 mm.
- Shale outcrop with strike and dip of  $S59^{\circ}W 87^{\circ}$  is located approximately 100 feet upstream of pipeline crossing.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

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

# Wolman Pebble Count at SC\_0759

Boulders	Cobbles	Gravel				Sand	
		coarse		fine		coarse	medium





# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	6-Apr-16	Stream Name:	Broad Draft
Crossing ID:	SC_0759		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Valley Side Features**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent

**Failure Locations**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

**Floodplain Width**

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input checked="" type="checkbox"/> 1-5 river widths
<input type="checkbox"/> 5-10 river widths
<input type="checkbox"/> > 10 river widths

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Riparian Buffer Strip**

<input type="checkbox"/> None
<input type="checkbox"/> < 1 river width
<input type="checkbox"/> 1-5 river widths
<input checked="" type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

**Terraces**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Left bank
<input checked="" type="checkbox"/> Right bank

**Levees**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

**Levee Location**

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

**Planform**

<input checked="" type="checkbox"/> Straight
<input type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

**Meander Characteristics**

<input checked="" type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input type="checkbox"/> Tight bends

*F3 Channel*

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

**Bed Controls**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input checked="" type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Bedrock
<input checked="" type="checkbox"/> Boulders

**Width Controls**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input checked="" type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input checked="" type="checkbox"/> Boulders

**Other**

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 12.0'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

<b>Bed Material</b>	<b>Bar Types</b>	<b>Bar Material</b>	<b>Bar Vegetation</b>	<b>Bar Width</b>	
<input type="checkbox"/> Clay	<input type="checkbox"/> None	<input type="checkbox"/> Silt	<input type="checkbox"/> None	<input type="checkbox"/> None	
<input type="checkbox"/> Silt	<input type="checkbox"/> Alternate bars	<input type="checkbox"/> Sand	<input type="checkbox"/> Grasses	<input type="checkbox"/> Narrow	
<input type="checkbox"/> Sand	<input type="checkbox"/> Point bars	<input type="checkbox"/> Gravel	<input type="checkbox"/> Reeds/shrubs	<input checked="" type="checkbox"/> Moderate	<i>River Width</i>
<input type="checkbox"/> Gravel	<input checked="" type="checkbox"/> Mid-channel bars	<input checked="" type="checkbox"/> Cobbles	<input checked="" type="checkbox"/> Trees	<input type="checkbox"/> Wide	
<input checked="" type="checkbox"/> Cobbles	<input type="checkbox"/> Diagonal bars				
<input checked="" type="checkbox"/> Boulders	<input type="checkbox"/> Irregular/combination				
<input type="checkbox"/> Bedrock	<input type="checkbox"/> Braided				

Percent sand in bed = <10 %

*1.5 to 1.8' Boulder S12k*

**Section 4 - Bank Survey (select all that apply)**

<b>Bank Characteristic</b>	<b>Left Bank</b>	<b>Right Bank</b>
<b>Bank Material</b>	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input checked="" type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input checked="" type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input checked="" type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input checked="" type="checkbox"/> Boulders <input type="checkbox"/> Bedrock
<b>Layer Material</b>	<input checked="" type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders	<input checked="" type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders
<b>Bank Height</b>	4.9	4.9
<b>Bank Slope</b>	<input checked="" type="checkbox"/> Steep <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Shallow	<input checked="" type="checkbox"/> Steep <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Shallow
<b>Bank Vegetation</b>	<input type="checkbox"/> None <input type="checkbox"/> Grasses/annuals <input type="checkbox"/> Reeds/shrubs <input type="checkbox"/> Trees: Falling trees? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/> None <input type="checkbox"/> Grasses/annuals <input type="checkbox"/> Reeds/shrubs <input type="checkbox"/> Trees: Falling trees? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input checked="" type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
<b>Bank Erosion and Failure Location</b>	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical
	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0759, Broad Draft at MP 115.29 (AP-1)

Photograph 1  
(IMG\_0028.jpg)

Date: 06-April-2016

Direction: Upstream

Description: Stream located in dense deciduous forest within banks about 2.5-ft high. Sub-angular to sub-rounded coarse gravel and cobble sized particles. Shale outcrop identified about 100 feet upstream of pipeline crossing (red arrow).



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0759, Broad Draft at MP 115.29 (AP-1)

Photograph 2  
(IMG\_0622.jpg)

Date: 06-April-2016

Direction: Downstream

Description: Notice approximately 5-ft high banks incised into floodplain.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0759, Broad Draft at MP 115.29 (AP-1)

Photograph 3  
(049.jpg)

Date: 06-April-2016

Direction: Downstream

Description: Panoramic view of current stream and relic stream channel on the left.



PHASE 2 - RAPID STREAM RECONNAISSANCE

Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0759, Broad Draft at MP 115.29 (AP-1)

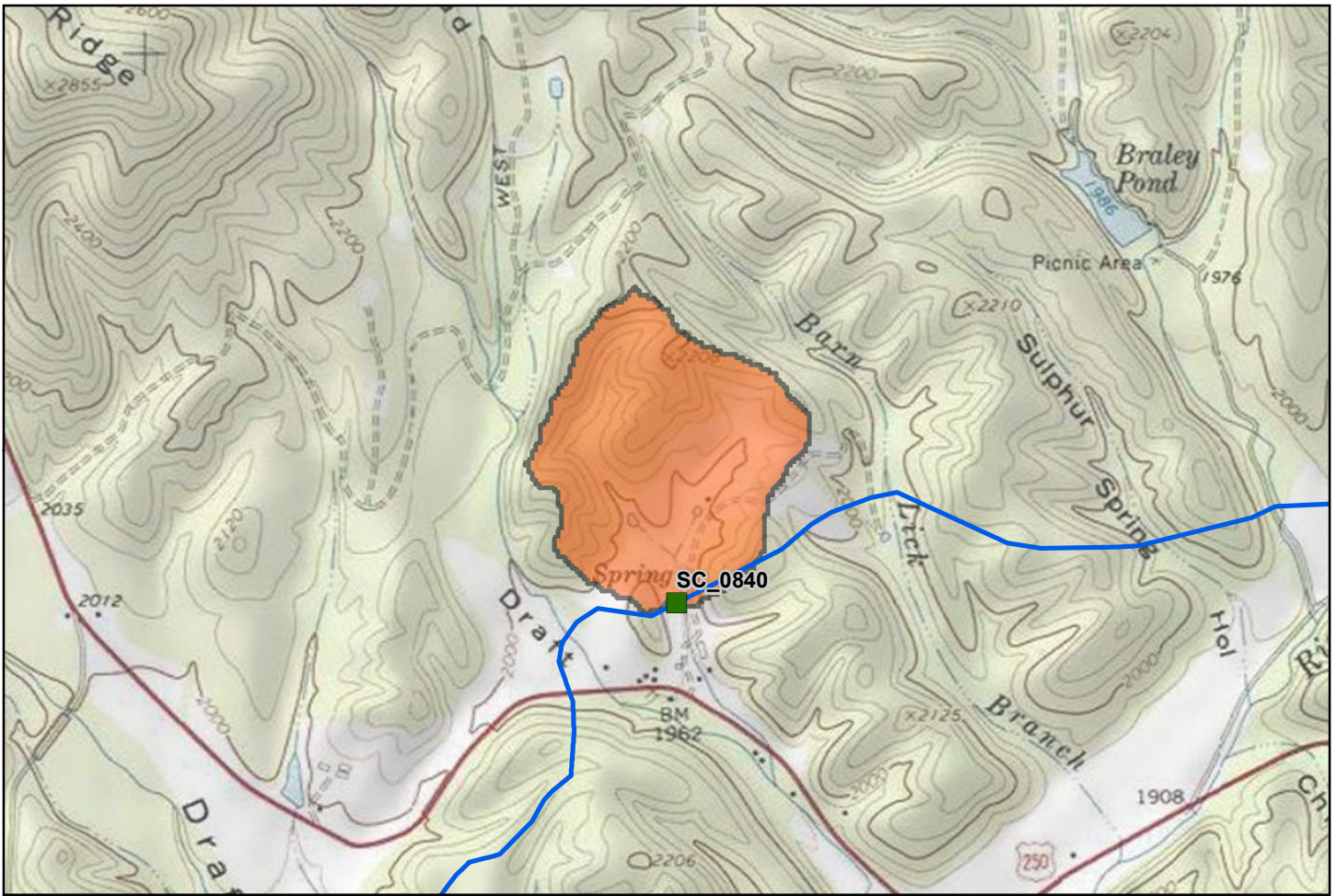
Photograph 4  
(054.jpg)

Date: 06-April-2016

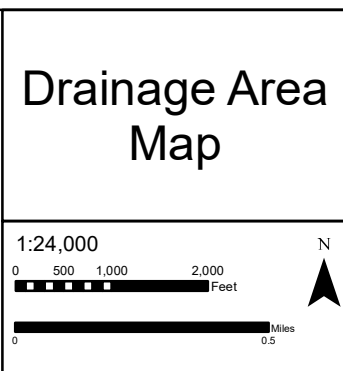
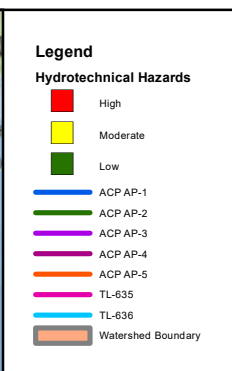
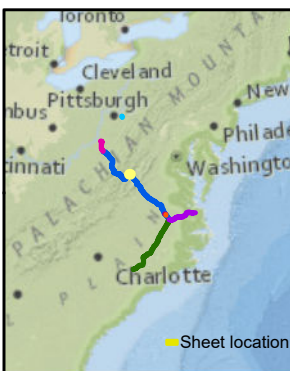
Direction: Downstream

Description: Closer view  
of bedrock outcrop in  
stream.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0840	saub105	AP-1	115.47	Virginia	Augusta
Attribute			Value		
Stream Name			UNT to Broad Draft		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			0.165		
Flow Regime			Intermittent		
Measured Bank Full Width (ft) <sup>3</sup>			2.2		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			8.046		
Proposed Construction Method <sup>5</sup>			1) Flume 2) Dam and Pump		



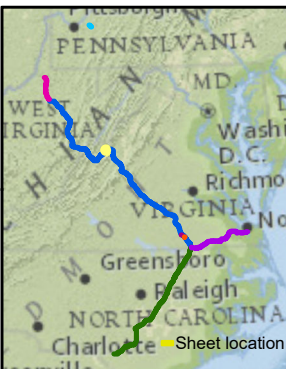
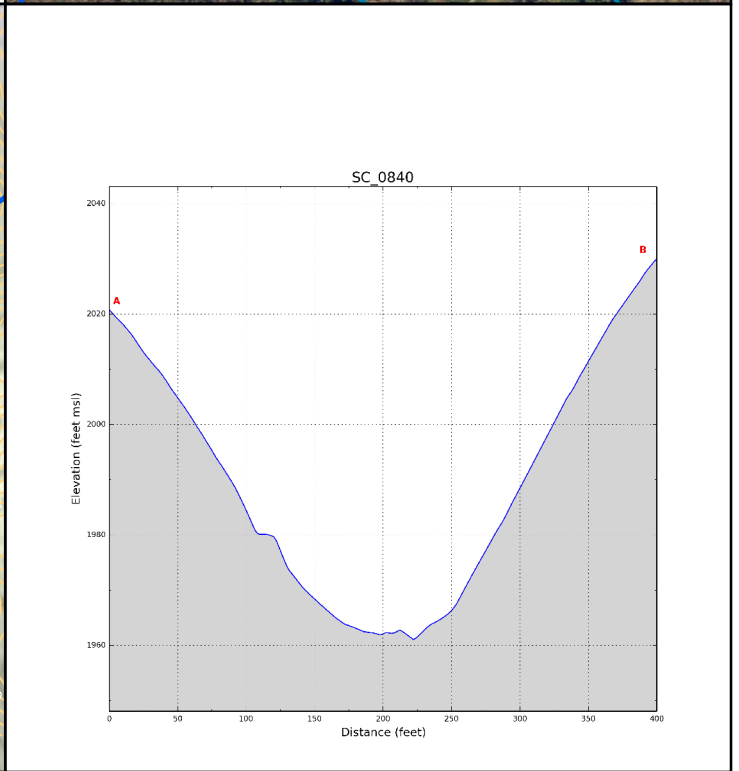
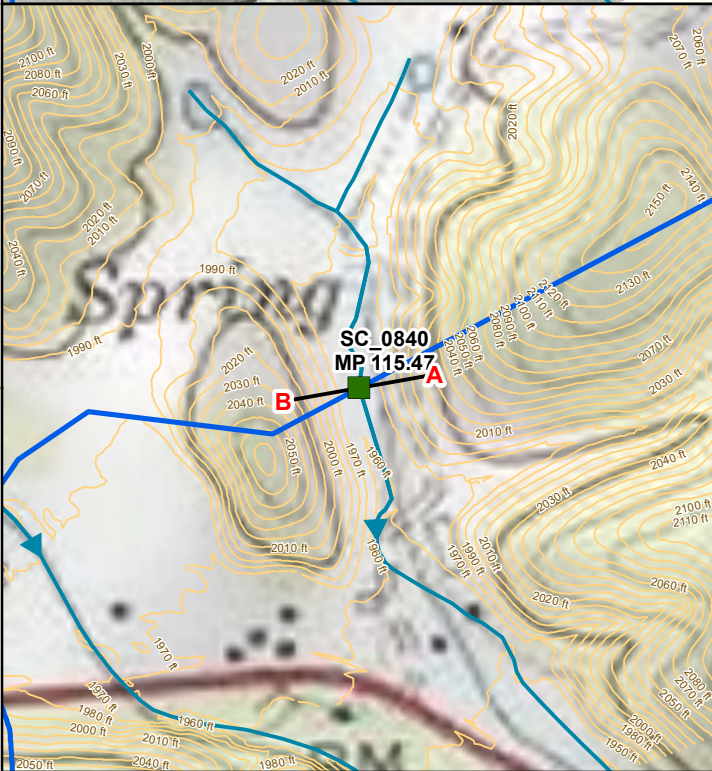
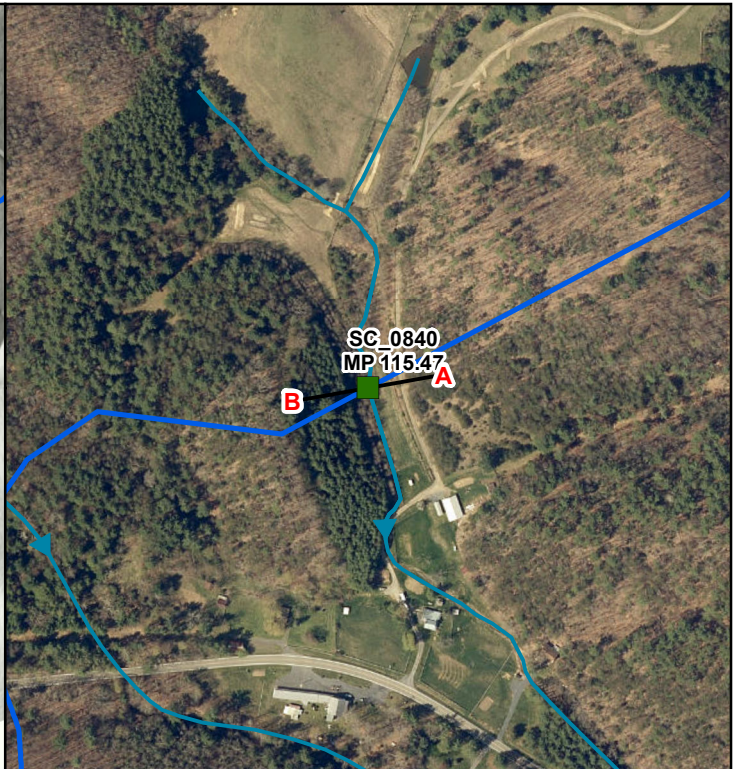
**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0840

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAI.



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations

**Profile Line (400ft)**

- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: saub105  
 TID\_SC: SC\_0840  
 Stream Name: UNT to Broad Draft

**1:6,000**

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0840

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- The current alignment centerline provided by Dominion/GAI
- Projection: UTM 17N feet, NAD 83
- The vertical exaggeration on the profile graph is 4:1
- Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

**Dominion**

**Geosyntec**  
consultants

**TESSE** CONSULTANTS



<b>TID</b>	SC_0840	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	UNT to Broad Draft	<b>MP</b>	115.47
<b>Survey Date</b>	06-April-2016	<b>Start Time</b>	1000 hrs

- Very small stream with a bankfull channel width of 2.2 feet with a stiff clay stream bed.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

No further studies required due to low hazard rating. Use typical pipeline burial procedures.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	6-Apr-16	Stream Name:	UNT to Broad Draft
Crossing ID:	SC_0840		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input checked="" type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Valley Side Features**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input checked="" type="checkbox"/> Frequent

**Failure Locations**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

**Floodplain Width**

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> 5-10 river widths
<input checked="" type="checkbox"/> > 10 river widths

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Riparian Buffer Strip**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> < 1 river width
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

**Terraces**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Left bank
<input checked="" type="checkbox"/> Right bank

**Levees**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

**Levee Location**

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

**Planform**

<input type="checkbox"/> Straight
<input checked="" type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

**Meander Characteristics**

<input type="checkbox"/> Mild bends
<input checked="" type="checkbox"/> Moderate bends
<input type="checkbox"/> Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

**Bed Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Width Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Other**

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 2.2'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

**Bed Material**

- Clay
- Silt
- Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

**Bar 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

**Bar Width**

- None
- Narrow
- Moderate
- Wide

**Percent sand in bed =** <10 %

**Section 4 - Bank Survey (select all that apply)**

**Bank Characteristic**

**Bank Material**

**Left Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Layer Material**

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

**Bank Height**

0.6

0.6

**Bank Slope**

- Steep
- Moderate
- Shallow

- Steep
- Moderate
- Shallow

**Bank Vegetation**

- None
  - Grasses/annuals
  - Reeds/shrubs
  - Trees:
- |                |                                 |                                 |                              |
|----------------|---------------------------------|---------------------------------|------------------------------|
| Falling trees? | <input type="checkbox"/> Y      | <input type="checkbox"/> N      |                              |
| Tree density   | <input type="checkbox"/> sparse | <input type="checkbox"/> dense  |                              |
| Tree health    | <input type="checkbox"/> good   | <input type="checkbox"/> poor   |                              |
| tree ages      | <input type="checkbox"/> young  | <input type="checkbox"/> mature | <input type="checkbox"/> old |
| tree diversity | <input type="checkbox"/> Y      | <input type="checkbox"/> N      |                              |

- None
  - Grasses/annuals
  - Reeds/shrubs
  - Trees:
- |                |                                          |                                            |                              |
|----------------|------------------------------------------|--------------------------------------------|------------------------------|
| Falling trees? | <input type="checkbox"/> Y               | <input checked="" type="checkbox"/> N      |                              |
| Tree density   | <input type="checkbox"/> sparse          | <input checked="" type="checkbox"/> dense  |                              |
| Tree health    | <input checked="" type="checkbox"/> good | <input type="checkbox"/> poor              |                              |
| tree ages      | <input type="checkbox"/> young           | <input checked="" type="checkbox"/> mature | <input type="checkbox"/> old |
| tree diversity | <input checked="" type="checkbox"/> Y    | <input type="checkbox"/> N                 |                              |

**Bank Erosion and Failure Location**

- |                                                      |                                             |
|------------------------------------------------------|---------------------------------------------|
| location of erosion                                  | type of erosion                             |
| <input type="checkbox"/> outside meander bend        | <input checked="" type="checkbox"/> fluvial |
| <input type="checkbox"/> inside meander bend         | <input type="checkbox"/> geotechnical       |
| <input type="checkbox"/> opposite bar or obstruction |                                             |
| <input checked="" type="checkbox"/> general          |                                             |

- |                                                      |                                             |
|------------------------------------------------------|---------------------------------------------|
| location of erosion                                  | type of erosion                             |
| <input type="checkbox"/> outside meander bend        | <input checked="" type="checkbox"/> fluvial |
| <input type="checkbox"/> inside meander bend         | <input type="checkbox"/> geotechnical       |
| <input type="checkbox"/> opposite bar or obstruction |                                             |
| <input checked="" type="checkbox"/> general          |                                             |

PHASE 2 - RAPID STREAM RECONNAISSANCE

Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0840, UNT to Broad Draft at MP 115.47 (AP-1)

Photograph 1  
(IMG\_0030.jpg)

Date: 06-April-2016

Direction: Downstream

Description: Stream located in a narrow pasture meadow. Stream bed is comprised of stiff clay. Stream width at bankfull is 2.2 ft.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0840, UNT to Broad Draft at MP 115.47 (AP-1)

Photograph 2  
(IMG\_1300.jpg)

Date: 06-April-2016

Direction: Upstream

Description: Riparian area on right bank is young and left bank is a wet meadow.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0840, UNT to Broad Draft at MP 115.47 (AP-1)

Photograph 3  
(027.jpg)

Date: 06-April-2016

Direction: Upstream

Description: Stream crossing meadow from right to left upstream of pipeline crossing



PHASE 2 - RAPID STREAM RECONNAISSANCE

Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0840, UNT to Broad Draft at MP 115.47 (AP-1)

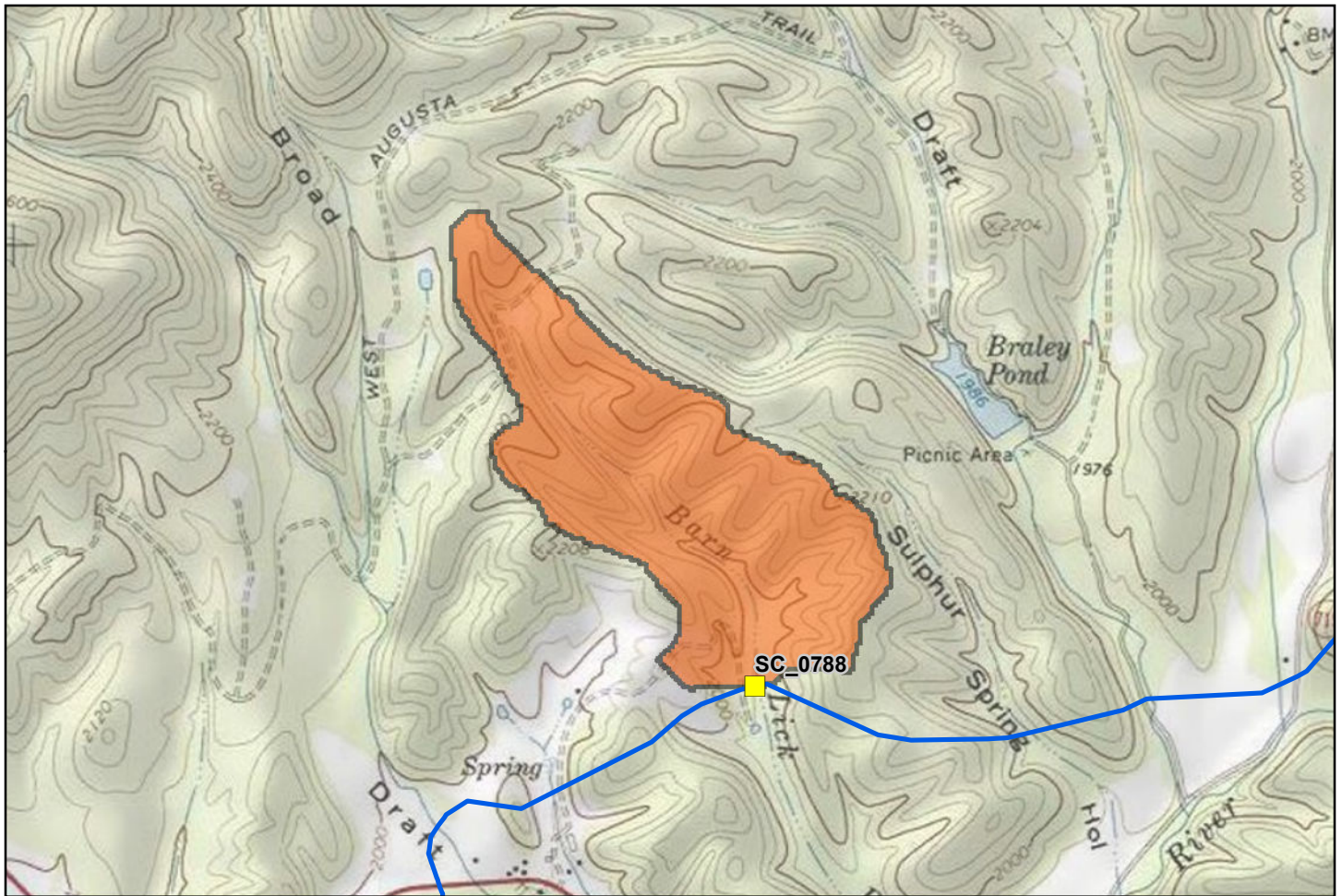
Photograph 4  
(026.jpg)

Date: 06-April-2016

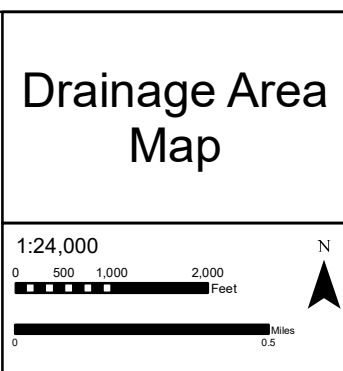
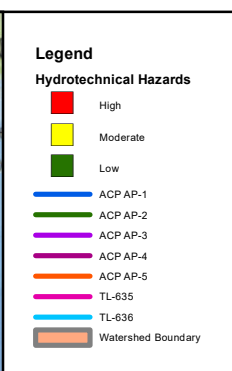
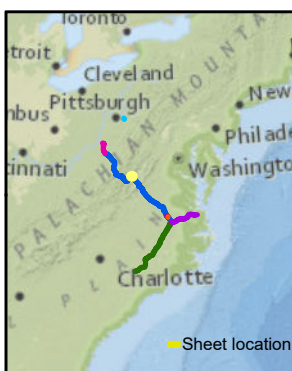
Direction: Downstream

Description: Closer view  
of stiff clay in stream bed.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0788	saua436	AP-1	115.82	Virginia	Augusta
Attribute			Value		
Stream Name			Barn Lick Branch		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			0.253		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			6.5		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			1.895		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

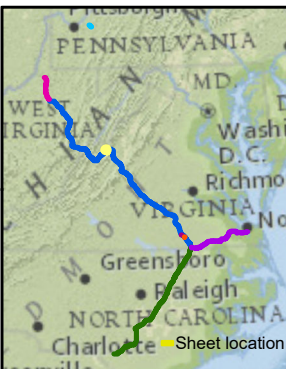
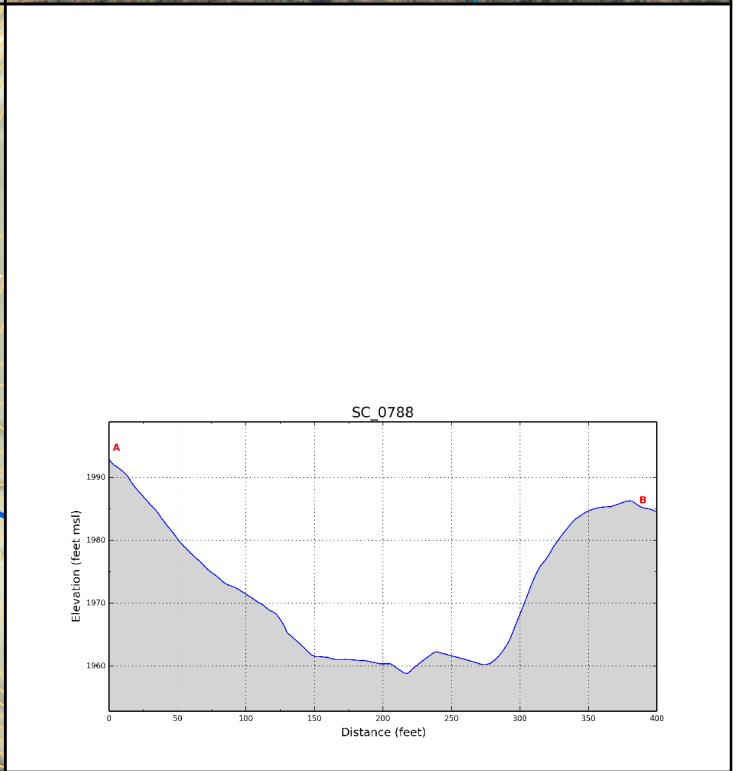
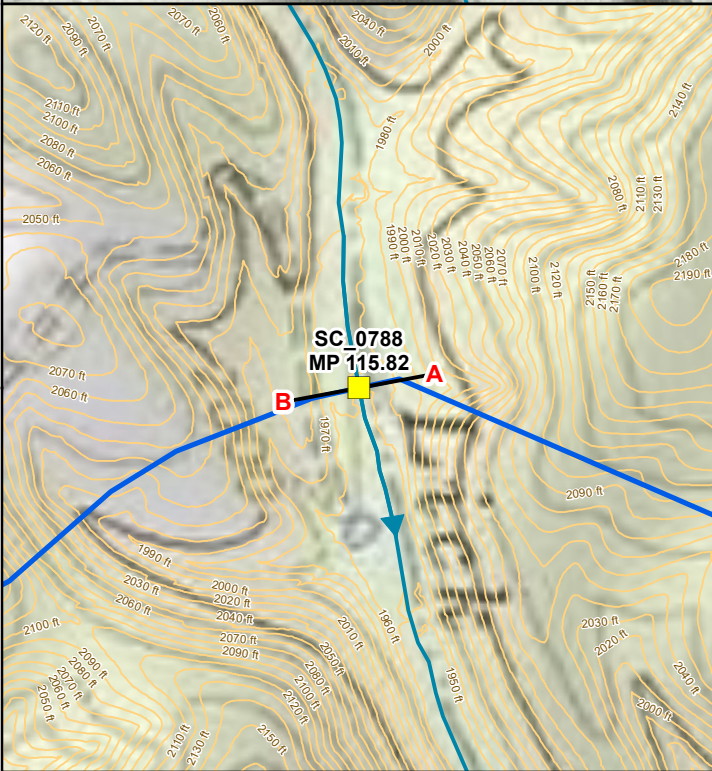
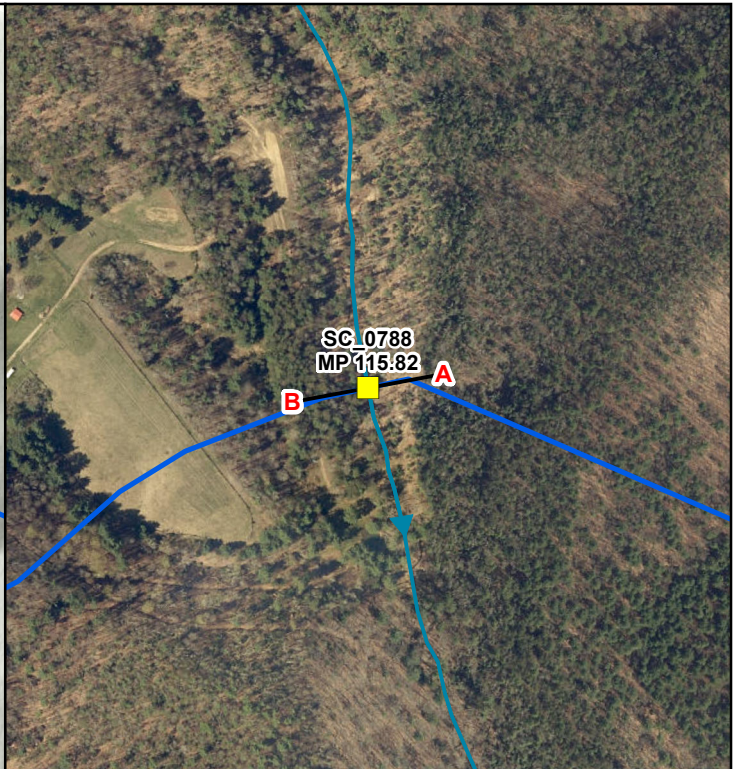
Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0788

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAI.





**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations
- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: sau436  
TID\_SC: SC\_0788  
Stream Name: Barn Lick Branch

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0788

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- The current alignment centerline provided by Dominion/GAI
- Projection: UTM 17N feet, NAD 83
- The vertical exaggeration on the profile graph is 4:1
- Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

**Dominion**

**Geosyntec**  
consultants

**TESSE ASSOCIATES**

<b>TID</b>	SC_0788	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Barn Lick Branch	<b>MP</b>	115.82
<b>Survey Date</b>	06-April-2016	<b>Start Time</b>	1030 hrs

- Bankfull channel width is 6.5 feet and bankfull depth is 1.1 feet.
- Stream channel meanders actively within a terraced alluvial valley where its meandering belt width is approximately 88 feet and meander wavelength varies from 90 feet (upstream of crossing) and 150 feet (downstream of crossing)
- Evidence of relic stream channels shows potential for avulsion and lateral migration.
  - Signs of fluvial activity across entire floodplain
- Stream located in a mixed deciduous and coniferous forest.
  - Upstream tree ring count of approximately 100 indicating old age
- Shale outcrop identified about 100 yards upstream of pipeline crossing with a strike and dip of S85°E 33°.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Due to meander migration across floodplain it is recommended that sag bends be placed at each valley edge and pipeline be buried in bedrock due to its close proximity to the surface. No further studies required due to low hazard rating.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	6-Apr-16	Stream Name:	Barn Lick Branch
Crossing ID:	SC_0788		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Valley Side Features**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Occasional
<input type="checkbox"/> Frequent

**Failure Locations**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

**Floodplain Width**

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> 5-10 river widths
<input checked="" type="checkbox"/> > 10 river widths

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Riparian Buffer Strip**

<input type="checkbox"/> None
<input type="checkbox"/> < 1 river width
<input type="checkbox"/> 1-5 river widths
<input checked="" type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

**Terraces**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Left bank
<input checked="" type="checkbox"/> Right bank

**Levees**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

**Levee Location**

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

**Planform**

<input type="checkbox"/> Straight
<input type="checkbox"/> Meandering
<input checked="" type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

**Meander Characteristics**

<input type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input checked="" type="checkbox"/> Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

**Bed Controls**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input checked="" type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Width Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Other**

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

*Upstream  
bedrock  
outcrop  
on stream*

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 6.5'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

**Bed Material**

- Clay
- Silt
- Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

**Bar 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

**Bar Width**

- None
- Narrow
- Moderate
- Wide

**Percent sand in bed =** <10 %

**Section 4 - Bank Survey (select all that apply)**

**Bank Characteristic**

**Bank Material**

**Left Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Layer Material**

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

**Bank Height**

2.5'

2.5'

**Bank Slope**

- Steep
- Moderate
- Shallow

- Steep
- Moderate
- Shallow

**Bank Vegetation**

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

**Bank Erosion and Failure Location**

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0788, Barn Lick Branch at MP 115.82 (AP-1)

Photograph 1  
(044.jpg)

Date: 06-April-2016

Direction: Downstream

Description: Stream bed with angular to subangular cobble and gravel-sized particles in braided stream with tight meanders. Stream within Dense deciduous forest.



PHASE 2 - RAPID STREAM RECONNAISSANCE

Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0788, Barn Lick Branch at MP 115.82 (AP-1)

Photograph 2  
(037.jpg)

Date: 06-April-2016

Direction: Downstream

Description: Notice laminar and angular and subangular gravel and cobble-sized particles in stream bed



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0788, Barn Lick Branch at MP 115.82 (AP-1)

Photograph 3  
(032.jpg)

Date: 06-April-2016

Direction: Upstream

Description: numerous  
felled trees along stream.  
Pipeline alignment at  
orange tape (red arrow)



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0788, Barn Lick Branch at MP 115.82 (AP-1)

Photograph 4  
(042.jpg)

Date: 06-April-2016

Direction: Upstream

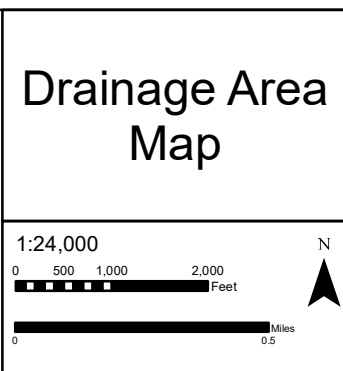
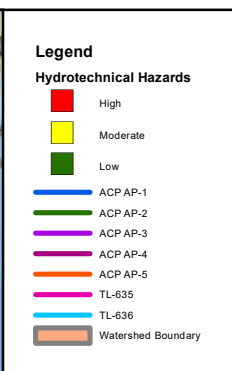
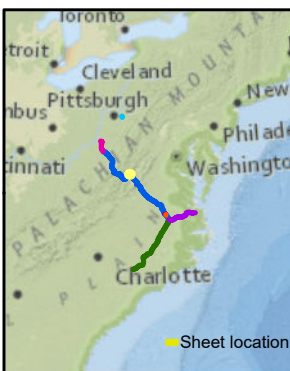
Description: Rock outcrop located approximately 100 yards upstream from pipeline crossing. Also notice valley wall following the left bank.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0841	saub109	AP-1	116.28	Virginia	Augusta
Attribute			Value		
Stream Name			Sulphur Spring Hollow		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			0.144		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			10.5		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			2.215		
Proposed Construction Method <sup>5</sup>			Dam and Pump		



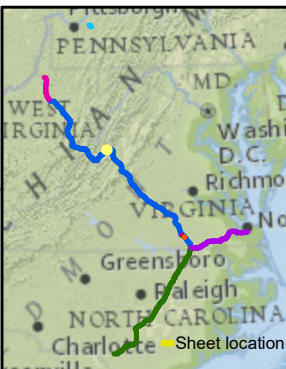
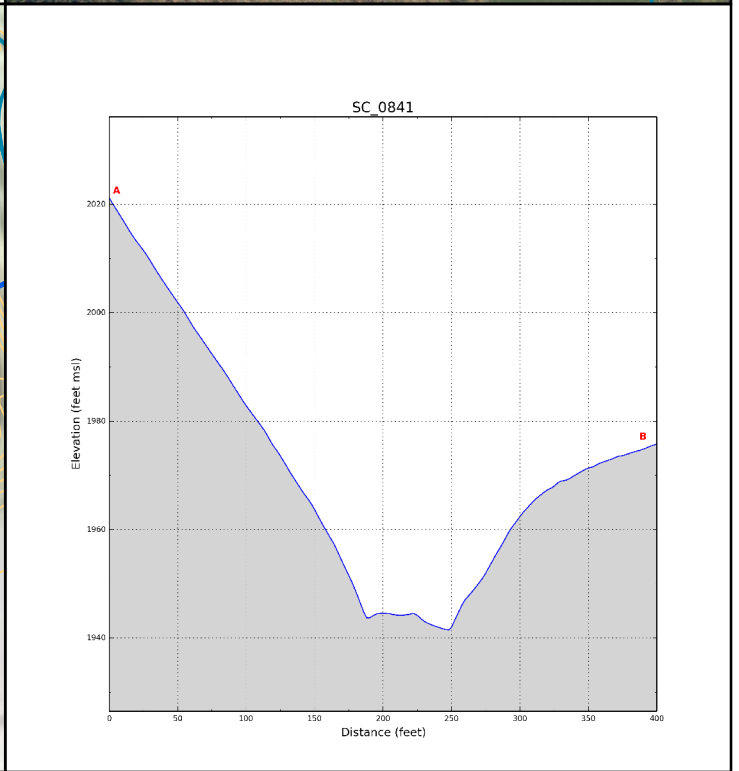
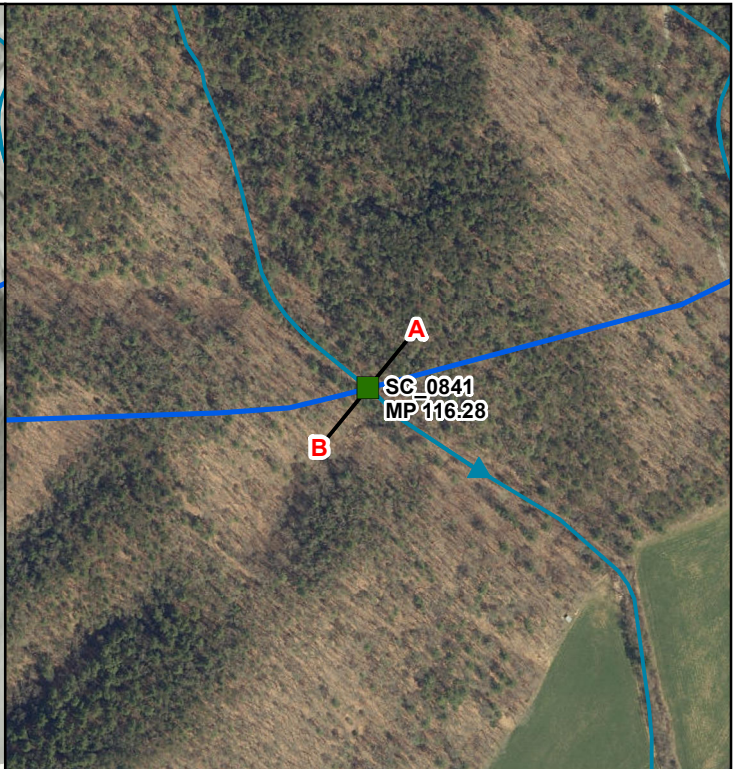
**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0841

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAI.



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations
- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: saub109  
TID\_SC: SC\_0841  
Stream Name: Sulphur Spring Hollow

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No: DOM\_EC\_CRO\_MA\_001\_SC\_0841

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- The current alignment centerline provided by Dominion/GAI
- Projection: UTM 17N feet, NAD 83
- The vertical exaggeration on the profile graph is 4:1
- Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

<b>TID</b>	SC_0841	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Sulphur Spring Hollow	<b>MP</b>	116.28
<b>Survey Date</b>	06-April-2016	<b>Start Time</b>	0900 hrs

- Relatively small meandering stream in a terraced alluvial valley with a bankfull width of 10.5 feet and bankfull depths of approximately 1.2 feet. Floodplain terrace heights off both banks are approximately 3 feet.
- Meandering stream with tight bends.
  - Meander wavelength is approximately 70 feet and belt width is approximately 60 feet.
- Stream is within dense mixed forest of deciduous and coniferous trees.
- Bedrock identified on stream bed with a strike and dip of N65°E 24°.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

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

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	6-Apr-16	Stream Name:	Sulphur Spring Hollow
Crossing ID:	SC_0841		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Valley Side Features**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input checked="" type="checkbox"/> Frequent

**Failure Locations**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

**Floodplain Width**

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> 5-10 river widths
<input checked="" type="checkbox"/> > 10 river widths

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Riparian Buffer Strip**

<input type="checkbox"/> None
<input type="checkbox"/> < 1 river width
<input type="checkbox"/> 1-5 river widths
<input checked="" type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

**Terraces**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Left bank
<input checked="" type="checkbox"/> Right bank

**Levees**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

**Levee Location**

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

**Planform**

<input type="checkbox"/> Straight
<input checked="" type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

**Meander Characteristics**

<input type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input checked="" type="checkbox"/> Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

**Bed Controls**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input checked="" type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Width Controls**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input checked="" type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Other**

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 10.5'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

**Bed Material**

- Clay
- Silt
- Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

**Bar 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

**Bar Width**

- None
- Narrow
- Moderate
- Wide

1 river width

Percent sand in bed = <10 %

**Section 4 - Bank Survey (select all that apply)**

**Bank Characteristic**

**Bank Material**

**Left Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Layer Material**

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

**Bank Height**

3

3.1

**Bank Slope**

- Steep
- Moderate
- Shallow

- Steep
- Moderate
- Shallow

**Bank Vegetation**

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

**Bank Erosion and Failure Location**

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general

- type of erosion
- fluvial
  - geotechnical

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0841, Sulphur Spring Hollow at MP 116.28 (AP-1)

Photograph 1  
(IMG\_0022)

Date: 06-April-2016

Direction: Downstream

Description: Stream located in dense deciduous forest within narrow valley. Rock outcrops noticeable on stream bed (red arrows). Valley wall (left bank) noticeable.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0841, Sulphur Spring Hollow at MP 116.28 (AP-1)

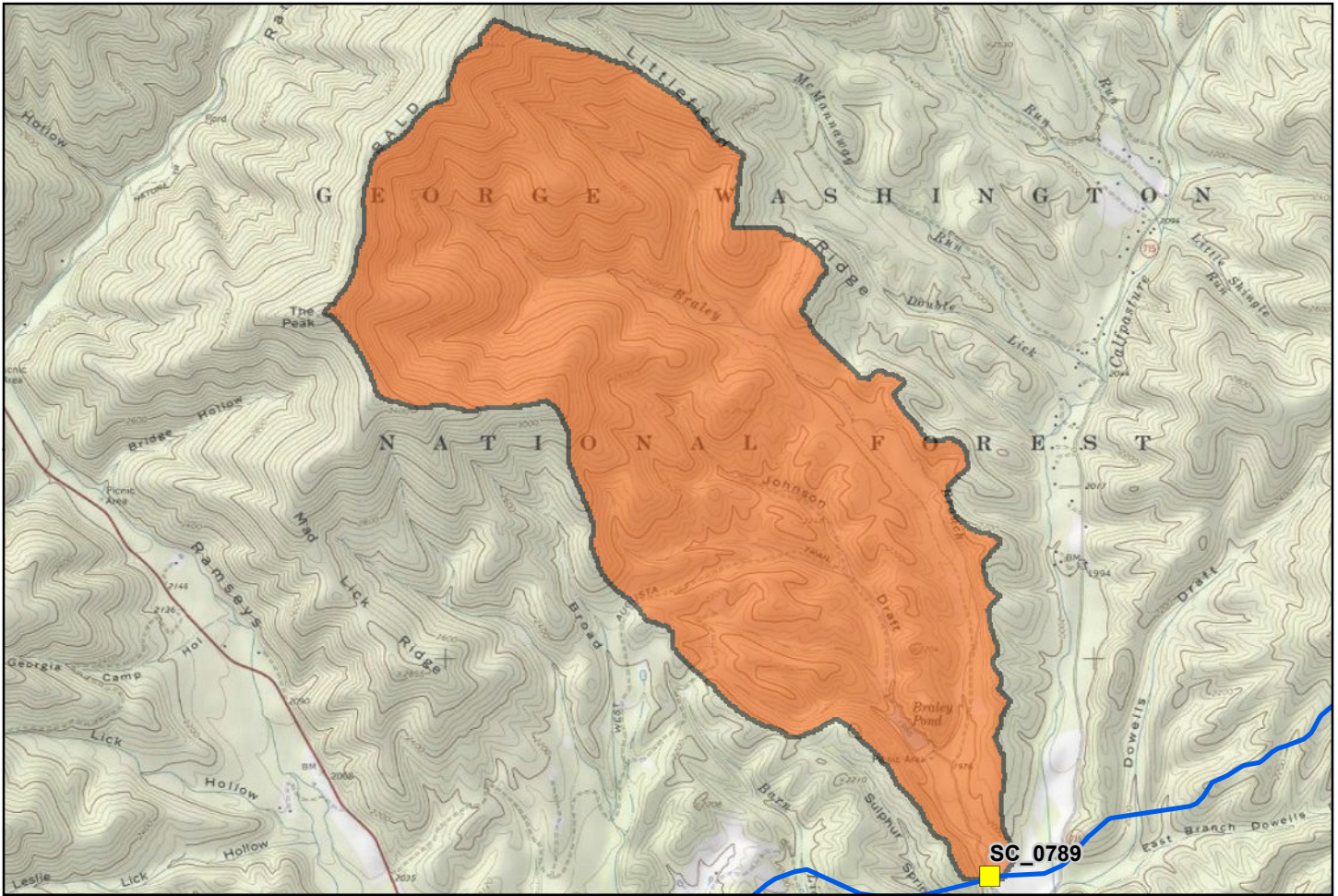
Photograph 2  
(IMG\_0023)

Date: 06-April-2016

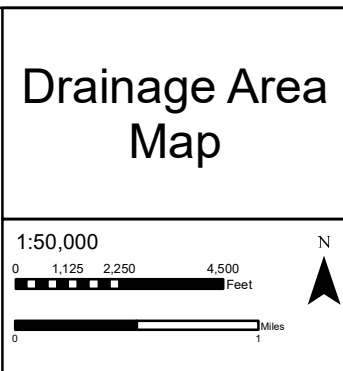
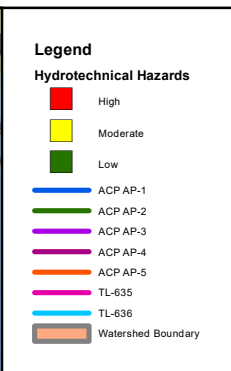
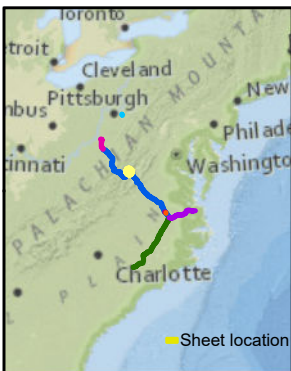
Direction: Downstream

Description: View of pipeline alignment (orange tags on trees) and valley wall. Notice angular cobble and gravel-sized particles on stream bed.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0789	saua435	AP-1	116.49	Virginia	Augusta
Attribute			Value		
Stream Name			Braley Banch		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			3.233		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			23.2		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.787		
Proposed Construction Method <sup>5</sup>			1) Flume 2) Dam and Pump		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0789

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.



**Dominion**

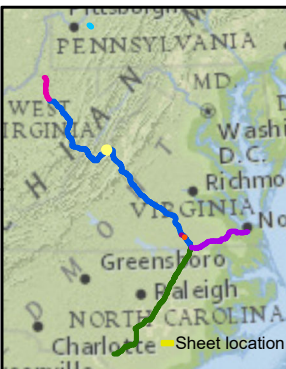
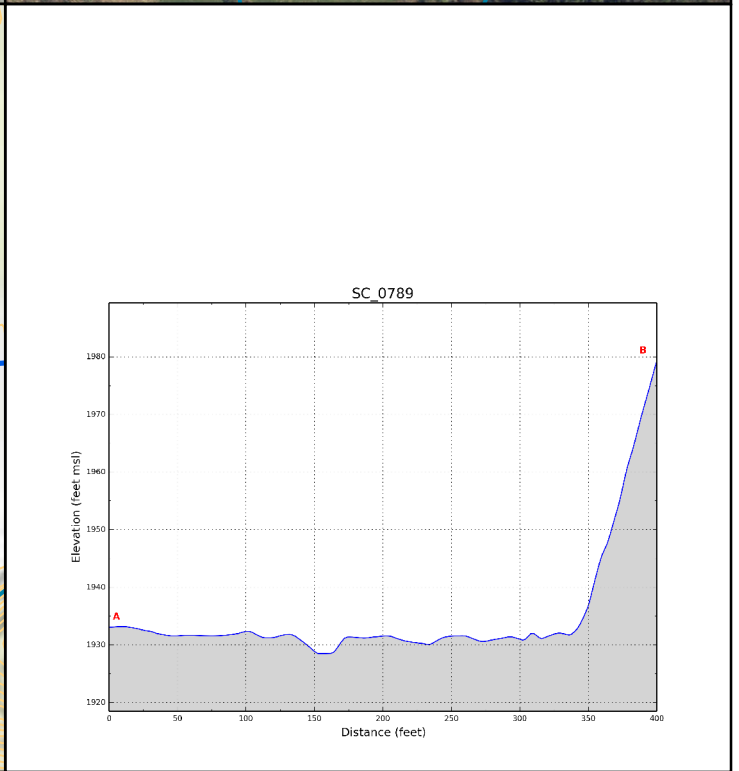
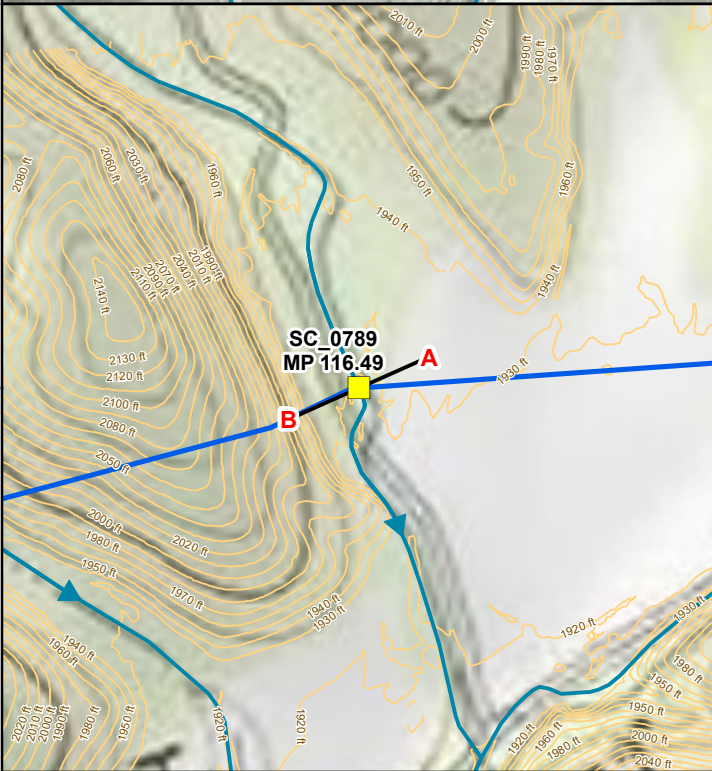
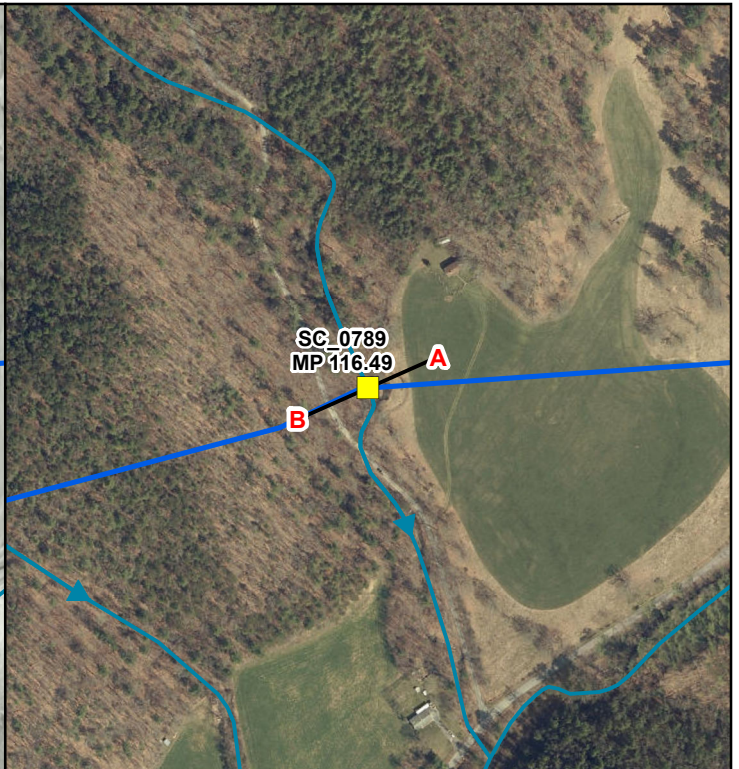
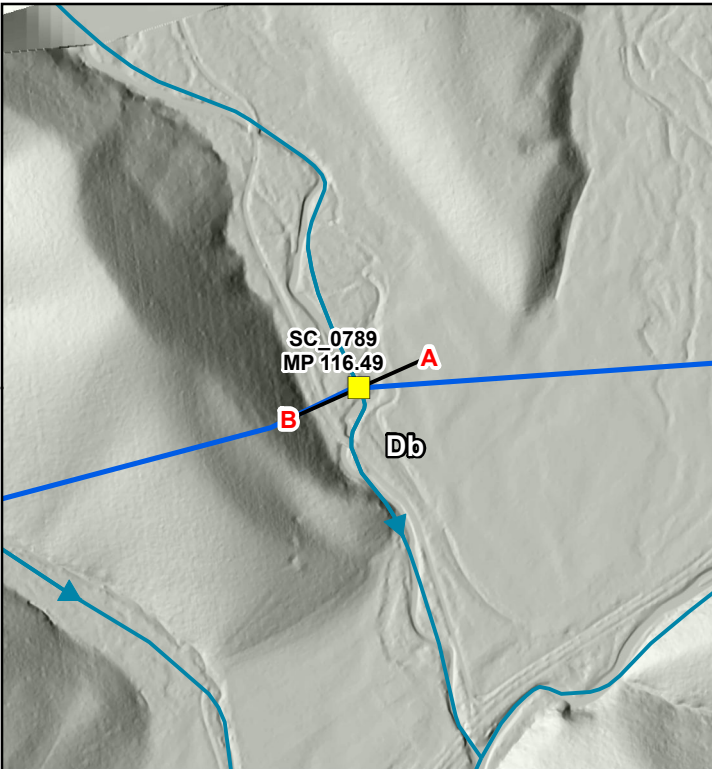


**Geosyntec**  
consultants



**TESSELLATIONS**





**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations
- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: sau435  
TID\_SC: SC\_0789  
Stream Name: Braley Banch

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0789

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) The current alignment centerline provided by Dominion/GAI
- 2) Projection: UTM 17N feet, NAD 83
- 3) The vertical exaggeration on the profile graph is 4:1
- 4) Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- 5) In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

**Dominion**

**Geosyntec**  
consultants

**TESSELLATIONS**

<b>TID</b>	SC_0789	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Braley Branch	<b>MP</b>	116.49
<b>Survey Date</b>	08-April-2016	<b>Start Time</b>	1000 hrs

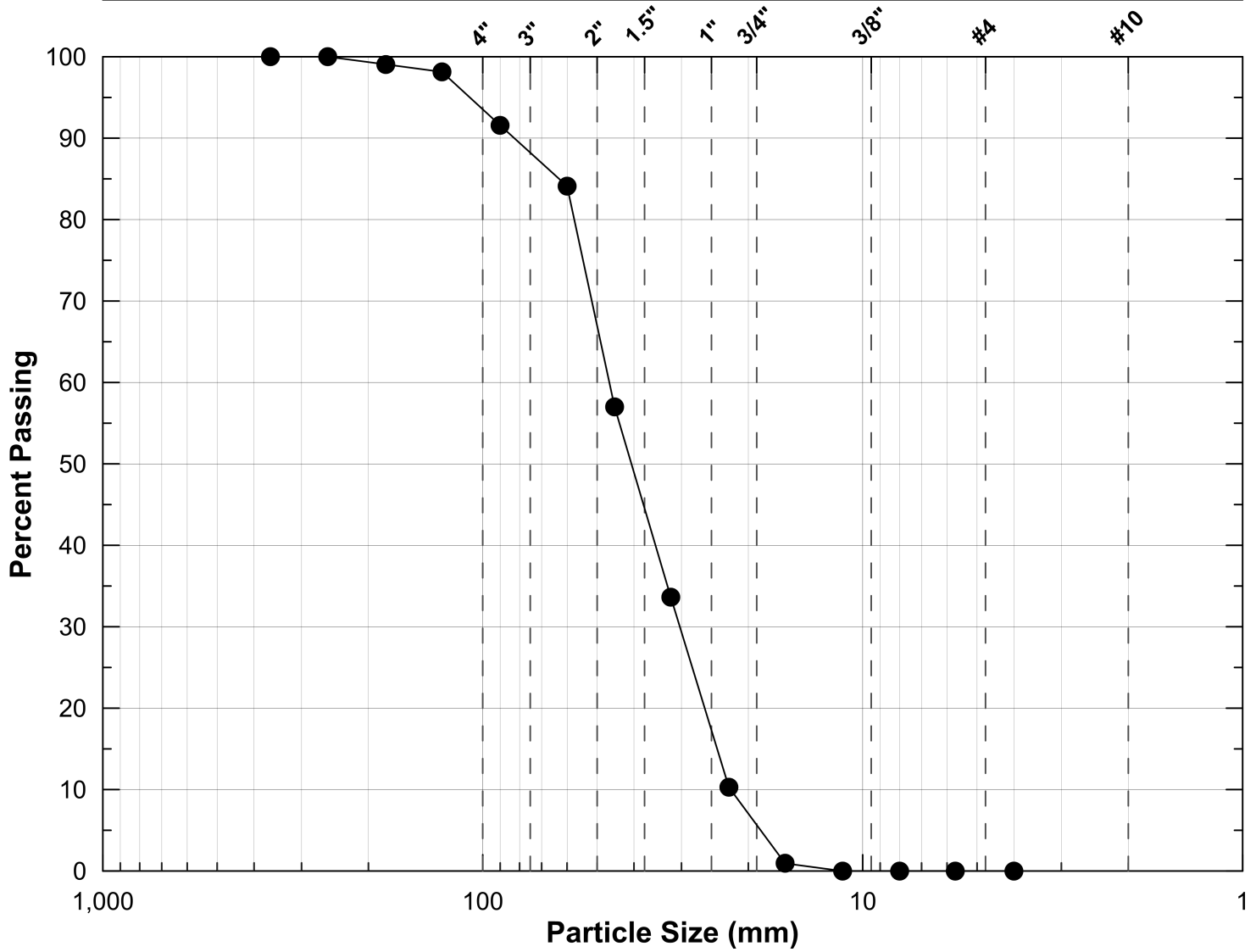
- Stream is confined on the right bank by gravel road and valley wall.
- Stream runs beneath road about 50 ft downstream of pipeline crossing through corrugated steel culvert protected with rip rap (approximately 4-foot diameter).
- Dense deciduous forest on right bank.
- Cattle grazing land on left bank with relatively thin riparian buffer that is one to two stream widths. Signs of active bank protection using gabions at bend.
- Bankfull channel width is 23.2 feet and bankfull depth is 1.8 feet.
- Meander belt width is 150 ft. Meander wavelength is approximately 225 feet.
- Riffle-pool stream morphology with mid-channel bar comprised of cobbles, emerging transverse bar near gabion protected left bank. Gabions actively failing due to erosion left bank meander bend).
- Secondary channel in floodplain and signs of fluvial activity in floodplain.
- Numerous felled trees on stream created localized scour pools
  - Pool depths approximately 2.7 feet below water surface.
- Headcuts identified within channel illustrating vertical instability in stream.
- Cobble and gravel sized stream bed. Wolman Pebble Count conducted;  $D_{50}$  is 41 mm (coarse gravel).
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Evaluate scour depth for pipeline burial depth. Lateral migration hazard towards the left bank with thin riparian buffer to be accounted for through placement of sag bends approximately three to four channel widths from left bank. Place sag bends within right bank riparian buffer approximately two to three channel widths from right bank.

# Wolman Pebble Count at SC\_0789

Boulders	Cobbles	Gravel		Sand	
		coarse	fine	coarse	medium



# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	8-Apr-16	Stream Name:	Braley Branch
Crossing ID:	SC_0789		

## Section 2 - Region and Valley Description

### Part 1: Watershed

#### Land Use

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input checked="" type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

#### Vegetation

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

#### Valley Side Features

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input checked="" type="checkbox"/> Frequent

#### Failure Locations

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

#### Floodplain Width

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input checked="" type="checkbox"/> 5-10 river widths
<input type="checkbox"/> > 10 river widths

#### Land Use

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input checked="" type="checkbox"/> Cattle grazing

#### Vegetation

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input checked="" type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

#### Riparian Buffer Strip

<input type="checkbox"/> None
<input type="checkbox"/> < 1 river width
<input checked="" type="checkbox"/> 1-5 river widths
<input type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

#### Terraces

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Left bank
<input type="checkbox"/> Right bank

#### Levees

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

#### Levee Location

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

#### Planform

<input type="checkbox"/> Straight
<input checked="" type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

#### Meander Characteristics

<input checked="" type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input type="checkbox"/> Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

#### Bed Controls

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

#### Control Types

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

#### Width Controls

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

#### Control Types

<input type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

#### Other

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 23.2'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

**Bed Material**

- Clay
- Silt
- Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

**Bar 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

**Bar Width**

- None
- Narrow
- Moderate
- Wide

**Percent sand in bed =** < 10 %

**Section 4 - Bank Survey (select all that apply)**

**Bank Characteristic**

**Bank Material**

**Left Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Layer Material**

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

**Bank Height**

~2'

~2"

**Bank Slope**

- Steep
- Moderate
- Shallow

- Steep
- Moderate
- Shallow

**Bank Vegetation**

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

**Bank Erosion and Failure Location**

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE

Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0789, Braley Branch at MP 116.49 (AP-1)

Photograph 1  
(IMG\_0647.jpg)

Date: 08-April-2016

Direction: Upstream

Description: View of stream channel along a riffle comprising subangular and subrounded gravel and cobble-sized particles



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0789, Braley Branch at MP 116.49 (AP-1)

Photograph 2  
(IMG\_0649.jpg)

Date: 08-April-2016

Direction: Downstream

Description: View of gabion wall presumably built by landowner along left bank to mitigate erosion.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0789, Braley Branch at MP 116.49 (AP-1)

Photograph 3  
(IMG\_0650.jpg)

Date: 08-April-2016

Direction: Downstream

Description: View of  
culvert under road and  
riprap protection





PHASE 2 - RAPID STREAM RECONNAISSANCE

Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0789, Braley Branch at MP 116.49 (AP-1)

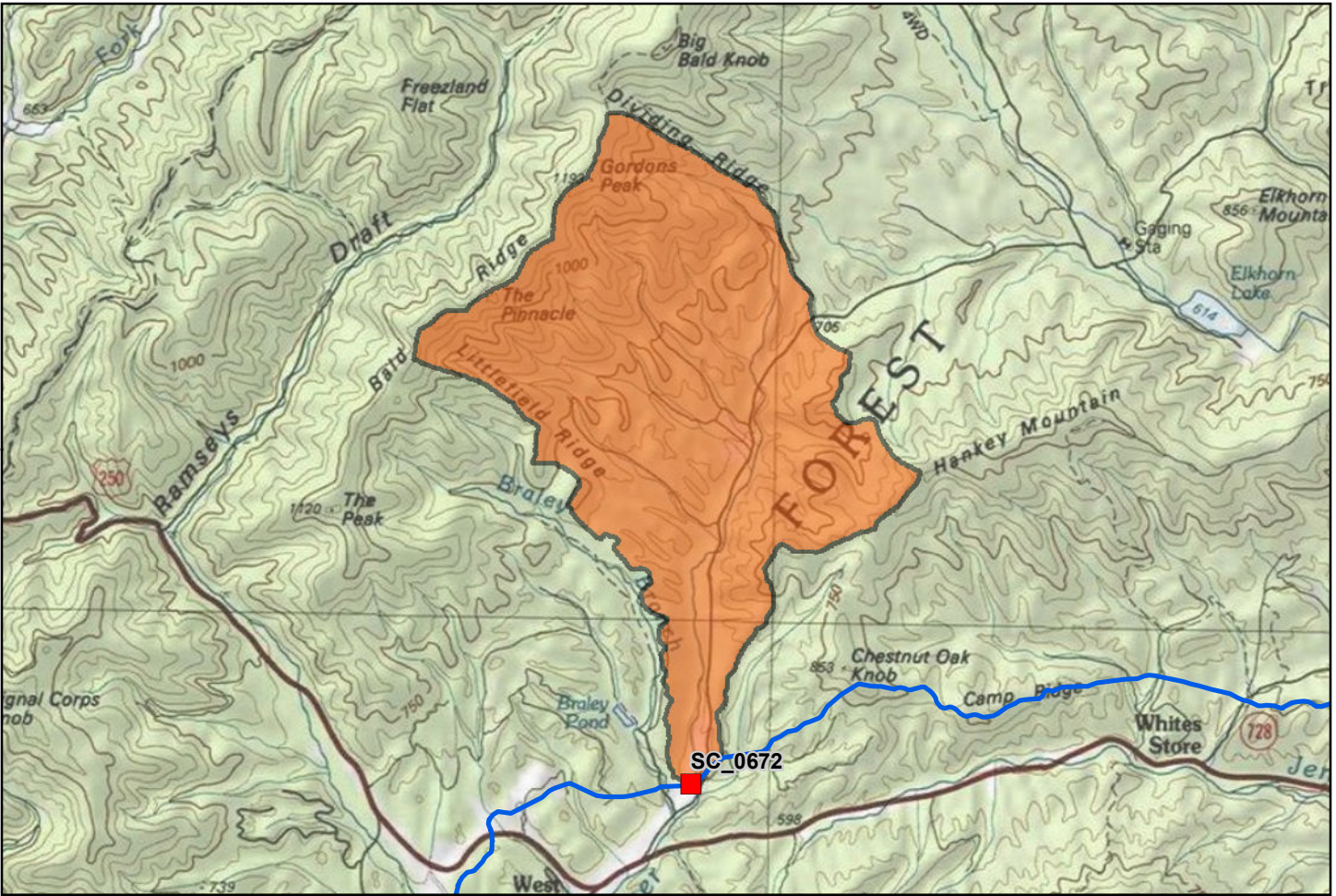
Photograph 4  
(021.jpg)

Date: 08-April-2016

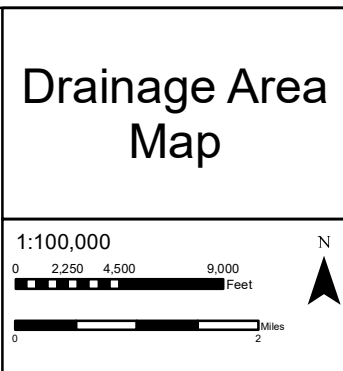
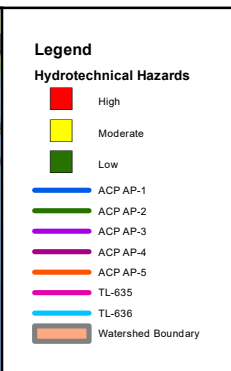
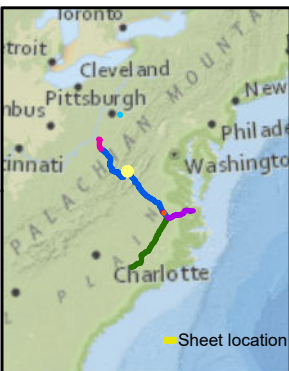
Direction: Downstream

Description: Mid channel bar approximately 60 yards upstream of pipeline crossing.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0672	saup004	AP-1	116.7	Virginia	Augusta
Attribute			Value		
Stream Name			Calfpasture River		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			6.846		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			18.5		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			1.058		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



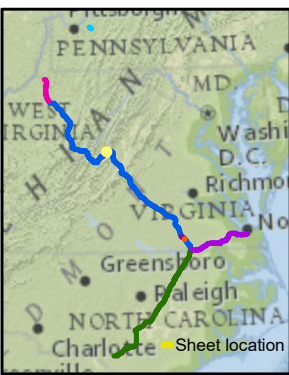
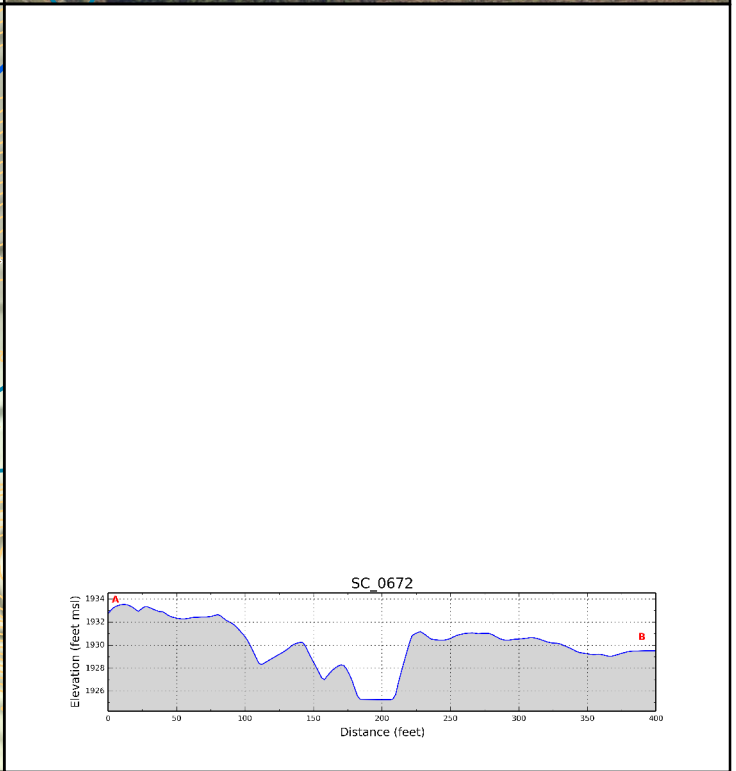
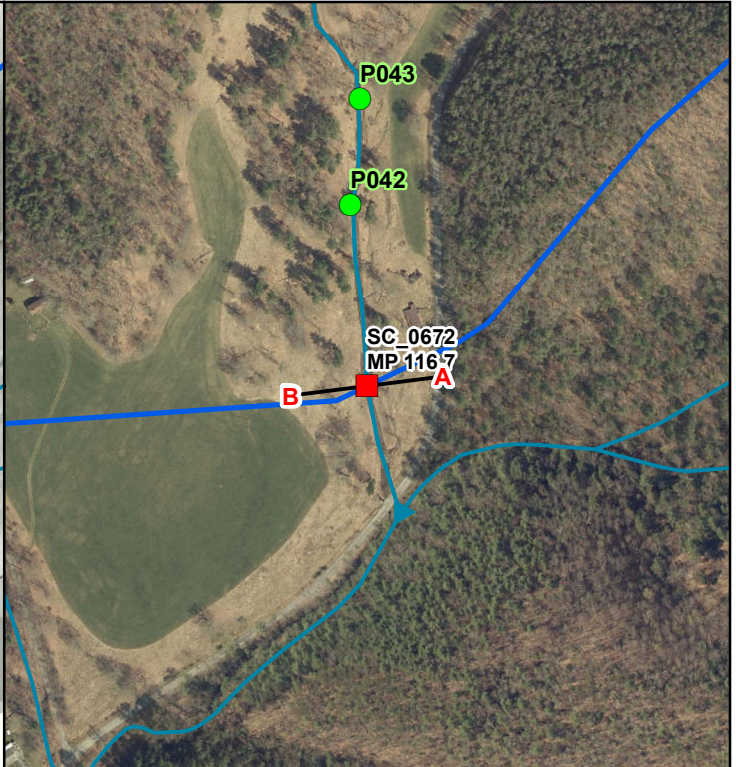
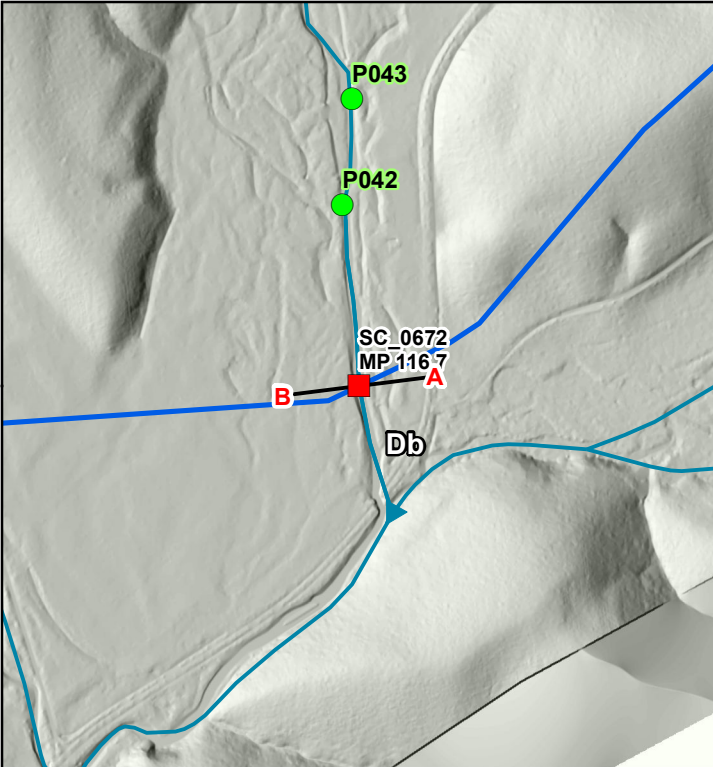
**Document Information:**

Document No: DOM\_EC\_HYD\_MA\_SER001\_SC\_0672

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations
- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: saup004  
TID\_SC: SC\_0672  
Stream Name: Calfpasture River

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No: DOM\_EC\_CRO\_MA\_001\_SC\_0672

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- The current alignment centerline provided by Dominion/GAI
- Projection: UTM 17N feet, NAD 83
- The vertical exaggeration on the profile graph is 4:1
- Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

**Dominion**

**Geosyntec**  
consultants

**TESSEMA SOLUTIONS**

<b>TID</b>	SC_0672	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Calfpasture River	<b>MP</b>	116.70
<b>Survey Date</b>	08-April-2016	<b>Start Time</b>	11:25

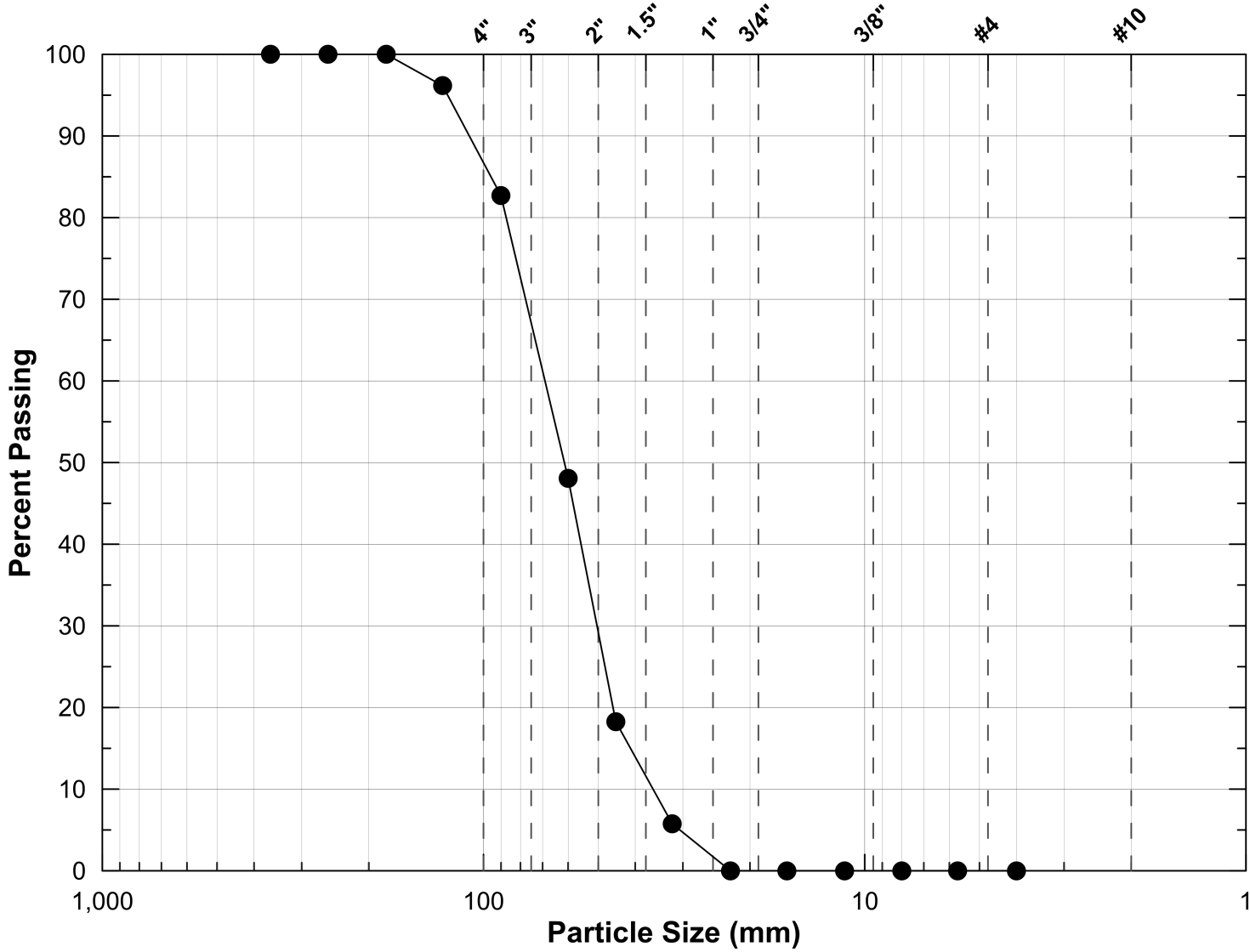
- Survey conducted at “new crossing” as described by Dominion representative at approximately 38.28229N 79.29424W.
- Crossing at a riffle in the river.
- Terraced on left bank with mid-channel bar.
- Bankfull channel width is 38.5 feet and bankfull depth is 2.41 feet.
- Distance from top of terrace on left bank to top of terrace on right bank is 75 feet.
- Right bank terrace height is 5.3 feet from right edge of water.
- Bed comprises cobbles with few boulders up to about 2-foot diameter. Wolman Pebble Count conducted;  $D_{50}$  is 62 mm (coarse gravel).
- Riparian buffer up to valley on right bank and about 1 river width along left bank.
- Hummocky terrain on right bank floodplain within riparian buffer with apparent prior stream channels containing large trees.
- Falling trees noticeable on both banks.
- Relic stream channel located about 100 feet upstream of crossing with deep scour pool (4 feet) at exit (within main channel and at outside of meander bend).
- River is meandering between the high terraces. Streambank erosion of the terraces at meanders appears to be slow.
- 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 beyond the existing left and right bank terraces. Place sag bends at a minimum of one river widths beyond each terrace bank.

# Wolman Pebble Count at SC\_0672

Boulders	Cobbles	Gravel		Sand	
		coarse	fine	coarse	medium



# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	8-Apr-16	Stream Name:	Calfpasture River
Crossing ID:	SC_0672		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

**Valley Side Features**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent

**Failure Locations**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

**Floodplain Width**

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input checked="" type="checkbox"/> 5-10 river widths
<input type="checkbox"/> > 10 river widths

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input type="checkbox"/> Coniferous Forest/trees

**Riparian Buffer Strip**

<input type="checkbox"/> None
<input type="checkbox"/> < 1 river width
<input checked="" type="checkbox"/> 1-5 river widths
<input type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

**Terraces**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Left bank
<input type="checkbox"/> Right bank

**Levees**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Constructed

**Levee Location**

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input checked="" type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

**Planform**

<input checked="" type="checkbox"/> Straight
<input type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

**Meander Characteristics**

<input type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input type="checkbox"/> Tight bends

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

**Bed Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Width Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Other**

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 18.5'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-riffle, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

**Bed Material**

- Clay
- Silt
- Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

**Bar Types**

- None
- Alternate bars
- Point bars
- Mid-channel bars
- Diagonal bars
- Irregular/combination
- Braided
- Lateral

**Bar Material**

- Silt
- Sand
- Gravel
- Cobbles

**Bar Vegetation**

- None
- Grasses
- Reeds/shrubs
- Trees

**Bar Width**

- None
- Narrow
- Moderate
- Wide

**Percent sand in bed =** < 10 %

**Section 4 - Bank Survey (select all that apply)**

**Bank Characteristic**

**Bank Material**

**Left Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

- Clay
- Silt
- Gravel
- Cobbles
- Boulders
- Bedrock

**Layer Material**

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

- No layers
- Cohesive
- Sand
- Gravel
- Cobbles
- Boulders

**Bank Height**

----

5.3 from REW

**Bank Slope**

- Steep
- Moderate
- Shallow

- Steep
- Moderate
- Shallow

**Bank Vegetation**

- None
- Grasses/annuals
- Reeds/shrubs
- Trees: No
- Falling trees?  Y  N
- Tree density  sparse  dense
- Tree health  good  poor
- tree ages  young  mature  old
- tree diversity  Y  N

- None
- Grasses/annuals
- Reeds/shrubs
- Trees: Yes
- Falling trees?  Y  N
- Tree density  sparse  dense
- Tree health  good  poor
- tree ages  young  mature  old
- tree diversity  Y  N

**Bank Erosion and Failure Location**

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0672, Calfpasture River at MP 116.70 (AP-1)

Photograph 1  
(IMG\_0654)

Date: 09-April-2016

Direction: Looking  
upstream

Description: Evidence of  
bank erosion on left bank  
(right side of photo) and  
terracing.  
Note cobbles in stream.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0672, Calfpasture River at MP 116.70 (AP-1)

Photograph 2  
(IMG\_0655)

Date: 09-April-2016

Direction: Looking  
upstream

Description: Relic stream  
channel.  
Note that tree density in  
riparian buffer is sparse.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0672, Calfpasture River at MP 116.70 (AP-1)

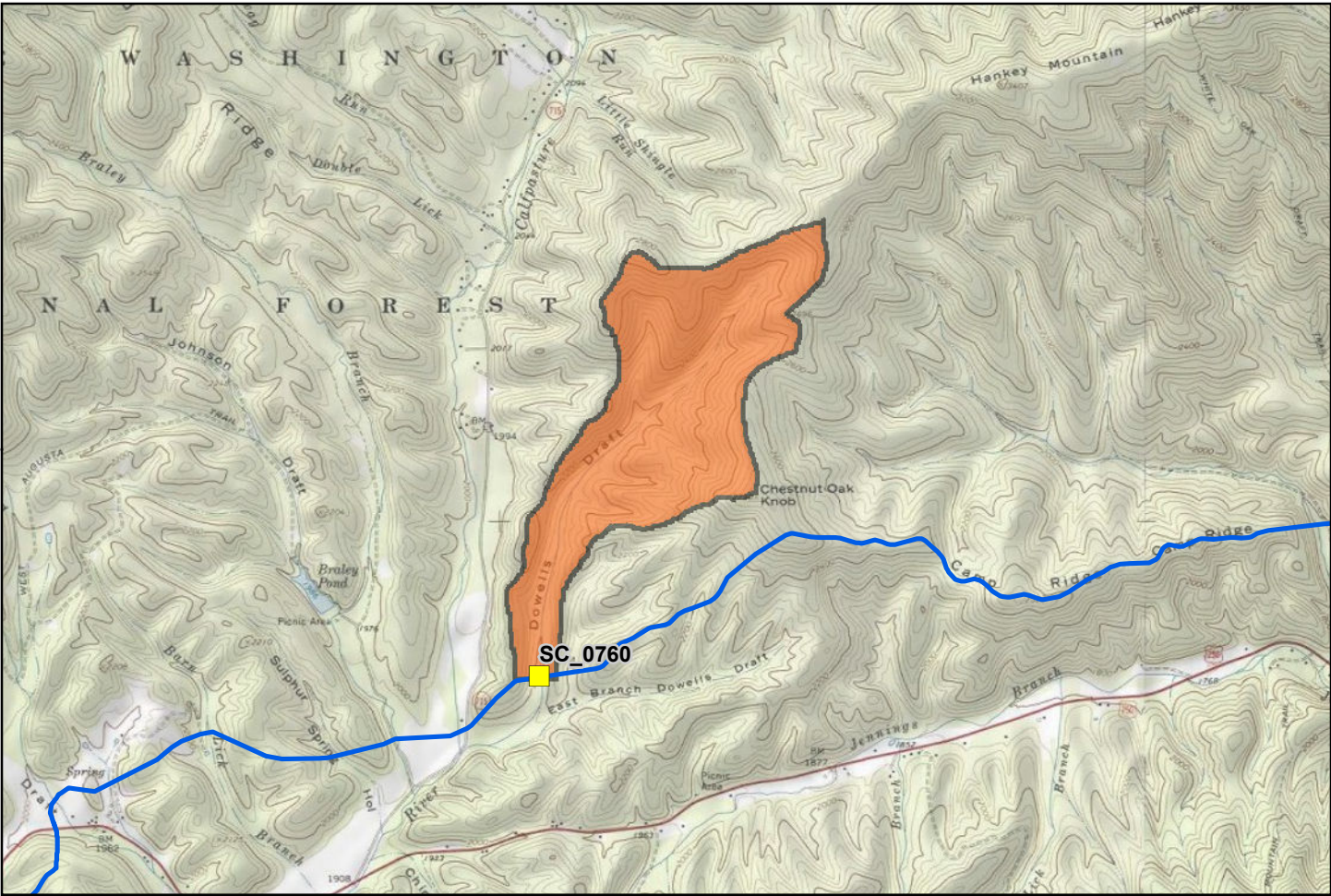
Photograph 3  
(IMG\_0656)

Date: 09-April-2016

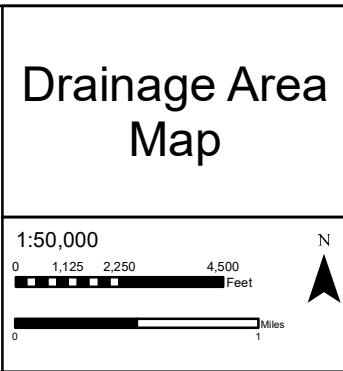
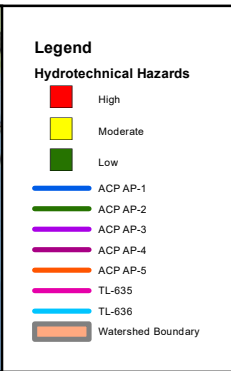
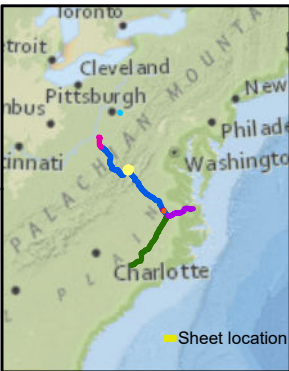
Direction: Looking  
downstream

Description: Evidence of  
fluvial erosion along left  
bank





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0760	saua416	AP-1	117.07	Virginia	Augusta
Attribute			Value		
Stream Name			Dowells Draft		
Physiographic Province <sup>1</sup>			Valley And Ridge		
Drainage Area (square miles) <sup>2</sup>			0.691		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			15.3		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			1.860		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0760

Revision	Date	Created By	Approved by
0	08-01-2016	BP	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

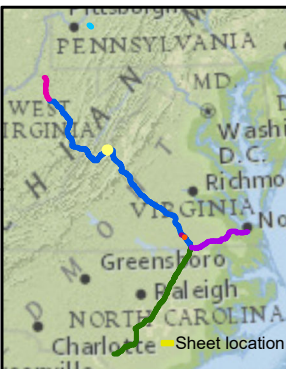
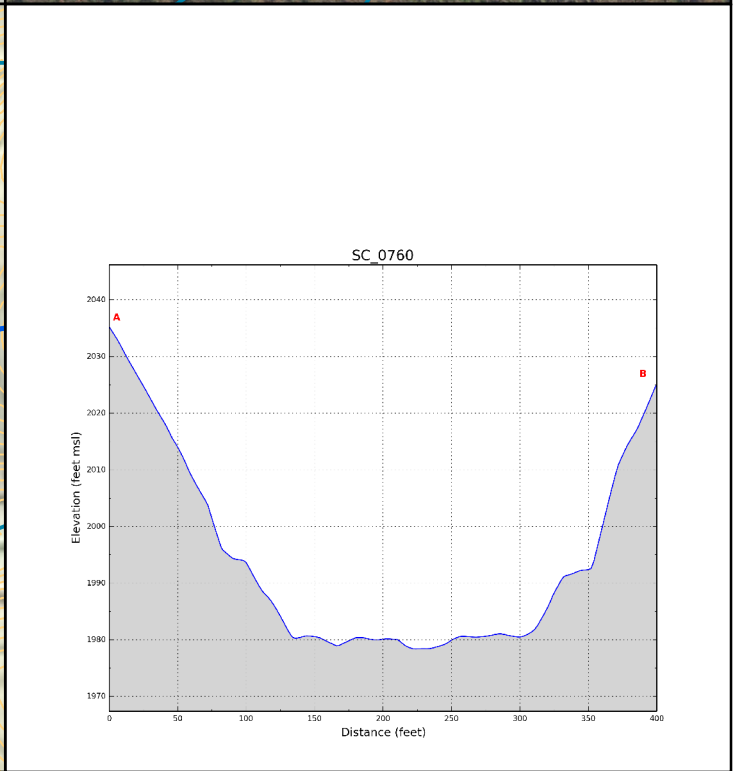
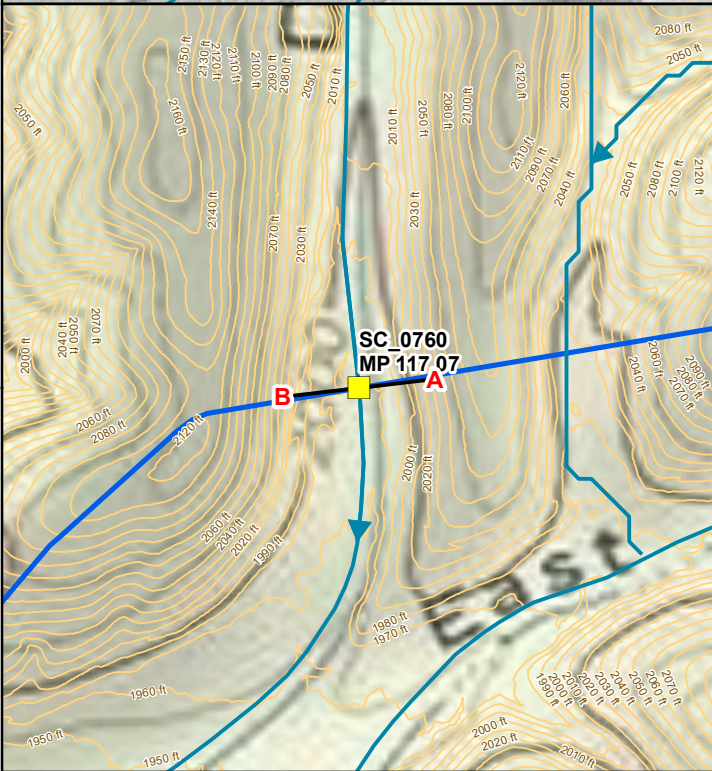
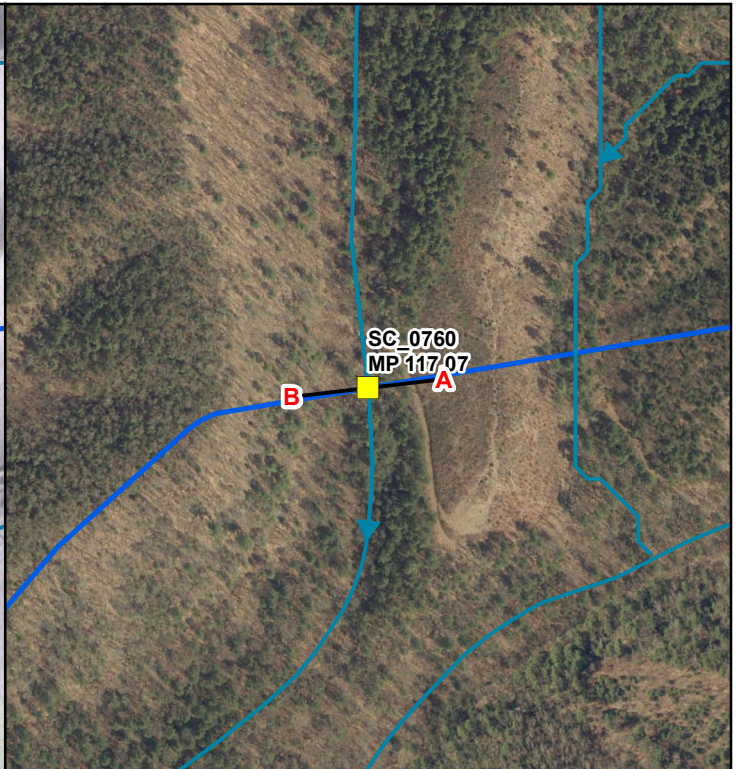
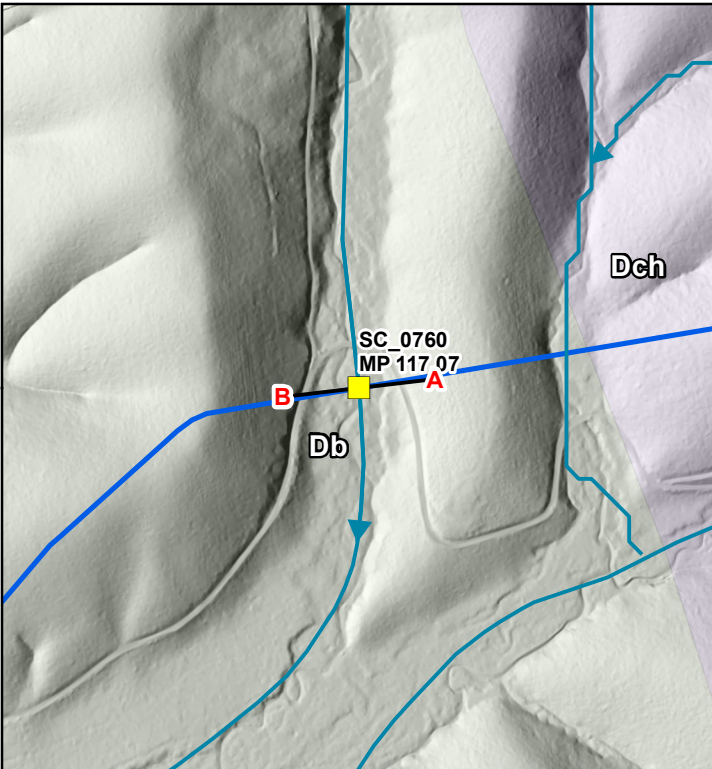
**Notes:**

- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.

**Dominion**

**Geosyntec**  
consultants

**TESSE CONSULTATIONS**



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations
- Profile Line (400ft)
- Stream with Flow Direction
- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

### Stream Crossing Plan View and Profile

Location ID: sau416  
TID\_SC: SC\_0760  
Stream Name: Dowells Draft

1:6,000

0 125 250 500 Feet

0 0.025 0.05 0.1 Miles

N

**Document Information:**

Document No:  
DOM\_EC\_CRO\_MA\_001\_SC\_0760

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	BP	RS
2	04-21-2017	BP	RS

**Notes:**

- The current alignment centerline provided by Dominion/GAI
- Projection: UTM 17N feet, NAD 83
- The vertical exaggeration on the profile graph is 4:1
- Hillshade (azimuth: 280) created from 2 foot lidar data provided by Dominion/GAI
- In areas that did not have lidar data, hillshade was created from 1/3 arc-second (10m) NED

**Dominion**

**Geosyntec**  
consultants

**TESSE** CONSULTANTS

<b>TID</b>	SC_0760	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Dowell's Draft	<b>MP</b>	117.07
<b>Survey Date</b>	06-April-2016	<b>Start Time</b>	1340 hrs

- Stream crossing located about 100 feet downstream of forest road crossing with culvert. Embankment is armored with rip-rap (i.e., 2-foot to 3-foot diameter boulders).
- Meandering riffle-pool morphology in a terraced alluvial valley which transitions to a bedrock step-pool stream morphology downstream of a significant 2-foot head cut approximately 250 feet downstream of stream crossing.
- Head cut has the potential to migrate upstream through stream crossing.
- Channel bankfull width is 15.3 feet and bankfull depth is 1.2 feet.
- Longitudinal channel slope estimated in the field at 2.88%
- Stream belt width is approximately 74 feet and meander wavelength is approximately 150 feet.
- Stream located in a mixed deciduous and coniferous forest.
- Right bank terrace height in vicinity of crossing is approximately 4.2 feet and the left bank terrace height of 2.5 feet.
- Stream bed material comprised of laminar, angular to sub angular, gravel and cobble-sized particles.
- Bedrock outcrop within stream approximately 250 ft downstream of pipeline crossing with a strike and dip of N59°E 35°.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

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.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	6-Apr-16	Stream Name:	Dowell's Draft
Crossing ID:	SC_0760		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Valley Side Features**

<input type="checkbox"/> None
<input type="checkbox"/> Occasional
<input checked="" type="checkbox"/> Frequent

**Failure Locations**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Away from river
<input type="checkbox"/> Along river

### Part 3: Floodplain

**Floodplain Width**

<input type="checkbox"/> None
<input type="checkbox"/> 1 < river widths
<input type="checkbox"/> 1-5 river widths
<input type="checkbox"/> 5-10 river widths
<input checked="" type="checkbox"/> > 10 river widths

**Land Use**

<input checked="" type="checkbox"/> Natural
<input type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input type="checkbox"/> Rural
<input type="checkbox"/> Industrial
<input type="checkbox"/> Mining
<input type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input checked="" type="checkbox"/> Deciduous Forest/trees
<input checked="" type="checkbox"/> Coniferous Forest/trees

**Riparian Buffer Strip**

<input type="checkbox"/> None
<input type="checkbox"/> < 1 river width
<input type="checkbox"/> 1-5 river widths
<input checked="" type="checkbox"/> > 5 river widths

### Part 4: Vertical Confinement

**Terraces**

<input type="checkbox"/> None
<input checked="" type="checkbox"/> Left bank
<input checked="" type="checkbox"/> Right bank

**Levees**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Natural
<input type="checkbox"/> Constructed

**Levee Location**

<input type="checkbox"/> Along channel bank
<input type="checkbox"/> Set back < 1 river width
<input type="checkbox"/> Set back > 1 river width

### Part 5: Lateral Relation of Channel to Valley

**Planform**

<input type="checkbox"/> Straight
<input checked="" type="checkbox"/> Meandering
<input type="checkbox"/> Braided
<input type="checkbox"/> Anastomosed
<input type="checkbox"/> Engineered

**Meander Characteristics**

<input type="checkbox"/> Mild bends
<input type="checkbox"/> Moderate bends
<input type="checkbox"/> Tight bends

*Bend radius ~4 widths*

## Section 3 - Channel Description (select all that apply)

### Part 6: Channel Description (select all that apply)

**Bed Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Width Controls**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input type="checkbox"/> Confined

**Control Types**

<input checked="" type="checkbox"/> None
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Boulders

**Other**

<input type="checkbox"/> Debris
<input type="checkbox"/> Mining
<input type="checkbox"/> Reservoir
<input type="checkbox"/> Knickpoint

**Flow Habit**

- Perennial
- Flashy perennial
- Intermittent
- Ephemeral

**Channel Width:** 15.3'

**M-B Classification**

- Cascade or step-pool
- Plane, pool-ripple, dune-ripple
- Braided

**Part 7: Bed Sediment Description (select all that apply)**

<b>Bed Material</b>	<b>Bar Types</b>	<b>Bar Material</b>	<b>Bar Vegetation</b>	<b>Bar Width</b>	
<input type="checkbox"/> Clay	<input type="checkbox"/> None	<input type="checkbox"/> Silt	<input checked="" type="checkbox"/> None	<input type="checkbox"/> None	
<input type="checkbox"/> Silt	<input type="checkbox"/> Alternate bars	<input type="checkbox"/> Sand	<input type="checkbox"/> Grasses	<input type="checkbox"/> Narrow	1 bend width
<input type="checkbox"/> Sand	<input checked="" type="checkbox"/> Point bars	<input checked="" type="checkbox"/> Gravel	<input type="checkbox"/> Reeds/shrubs	<input type="checkbox"/> Moderate	
<input checked="" type="checkbox"/> Gravel	<input type="checkbox"/> Mid-channel bars	<input checked="" type="checkbox"/> Cobbles	<input type="checkbox"/> Trees	<input type="checkbox"/> Wide	
<input checked="" type="checkbox"/> Cobbles	<input type="checkbox"/> Diagonal bars				
<input type="checkbox"/> Boulders	<input type="checkbox"/> Irregular/combination				
<input type="checkbox"/> Bedrock	<input type="checkbox"/> Braided				

Percent sand in bed = <10 %

**Section 4 - Bank Survey (select all that apply)**

<b>Bank Characteristic</b>	<b>Left Bank</b>	<b>Right Bank</b>
<b>Bank Material</b>	<input checked="" type="checkbox"/> Clay <input checked="" type="checkbox"/> Silt <input checked="" type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input checked="" type="checkbox"/> Clay <input checked="" type="checkbox"/> Silt <input checked="" type="checkbox"/> Gravel <input checked="" type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input type="checkbox"/> Bedrock
<b>Layer Material</b>	<input checked="" type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders	<input checked="" type="checkbox"/> No layers <input type="checkbox"/> Cohesive <input type="checkbox"/> Sand <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders
<b>Bank Height</b>	2.5'	4.2
<b>Bank Slope</b>	<input type="checkbox"/> Steep <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Shallow	<input type="checkbox"/> Steep <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Shallow
<b>Bank Vegetation</b>	<input type="checkbox"/> None <input checked="" type="checkbox"/> Grasses/annuals <input type="checkbox"/> Reeds/shrubs <input checked="" type="checkbox"/> Trees: Falling trees? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N	<input type="checkbox"/> None <input checked="" type="checkbox"/> Grasses/annuals <input type="checkbox"/> Reeds/shrubs <input checked="" type="checkbox"/> Trees: Falling trees? <input checked="" type="checkbox"/> Y <input type="checkbox"/> N Tree density <input type="checkbox"/> sparse <input checked="" type="checkbox"/> dense Tree health <input checked="" type="checkbox"/> good <input type="checkbox"/> poor tree ages <input checked="" type="checkbox"/> young <input checked="" type="checkbox"/> mature <input checked="" type="checkbox"/> old tree diversity <input checked="" type="checkbox"/> Y <input type="checkbox"/> N
<b>Bank Erosion and Failure Location</b>	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical
	location of erosion <input type="checkbox"/> outside meander bend <input type="checkbox"/> inside meander bend <input type="checkbox"/> opposite bar or obstruction <input checked="" type="checkbox"/> general	type of erosion <input checked="" type="checkbox"/> fluvial <input type="checkbox"/> geotechnical

PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0760 (Dowell's Draft at MP AP-1 117.07)

Photograph 1  
(IMG\_0624.jpg)

Date: 06-April-2016

Direction: Upstream

Description: View of embankment and culvert for forest road protected with rip rap

