

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date: 14-May-16

Stream Name: Slate River

Crossing ID: SC\_0435

## 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:** 33.7'

**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 =** 80 %

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

**Bank Characteristic**

**Bank Material**

**Left Bank**

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

**Right Bank**

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

**Layer Material**

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

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

**Bank Height**

8-10'

8-10'

**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\_0435, Slate River at MP 197.91 (AP-1)

Photograph 1

Date: 14 May 2016

Direction: looking upstream

Description: Relatively confined laterally by thick riparian buffer and bedrock upstream.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record

Geosyntec  
consultants

**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0435, Slate River at MP 197.91 (AP-1)

Photograph 2

Date: 14 May 2016

Direction: looking across stream, flow to the right

Description: Approximate banks heights of 6.5' in vicinity of crossing. Well established riparian buffer across floodplain.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0435, Slate River at MP 197.91 (AP-1)

Photograph 3

Date: 14 May 2016

Direction: looking  
downstream

Description: in channel  
debris at exit of deep pool  
and meander. Scour  
present near debris. Sand  
point bar shown at bottom  
of photo.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0435, Slate River at MP 197.91 (AP-1)

Photograph 4

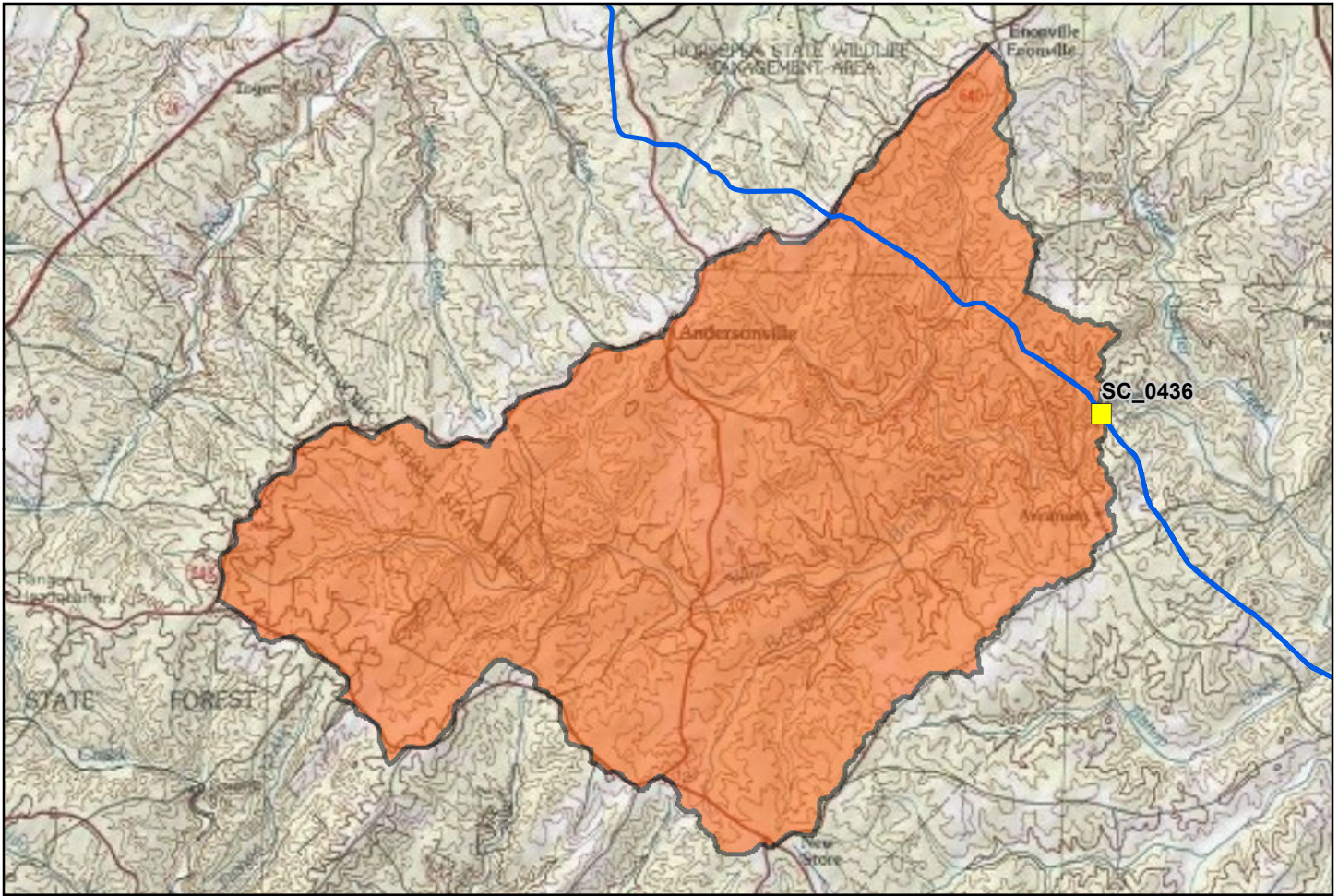
Date: 14 May 2016

Direction: looking across stream, flow to the right

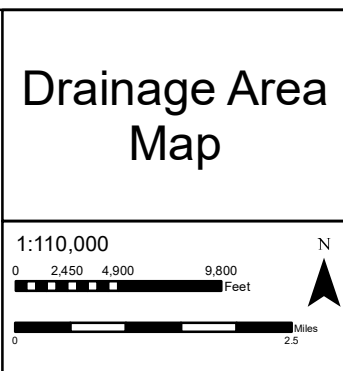
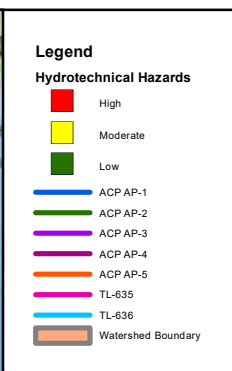
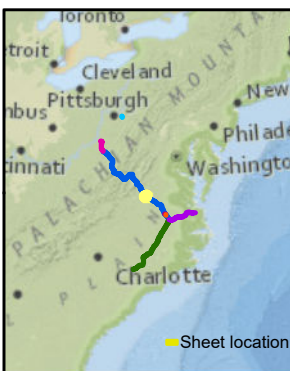
Description: Deep pool > 10' upstream of pipeline crossing. Bedrock outcropping affecting hydraulics visible across stream at apex of meander bend.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0436	sbul009	AP-1	205.08	Virginia	Buckingham
Attribute			Value		
Stream Name			Willis River		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			21.228		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			25		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.265		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

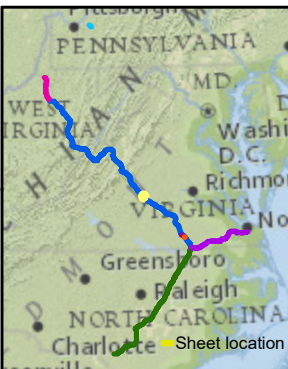
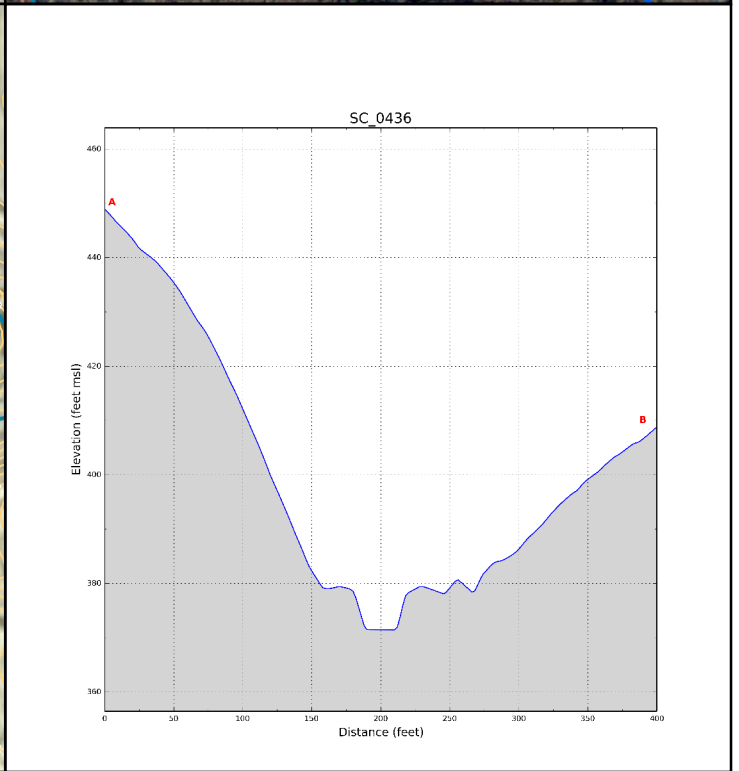
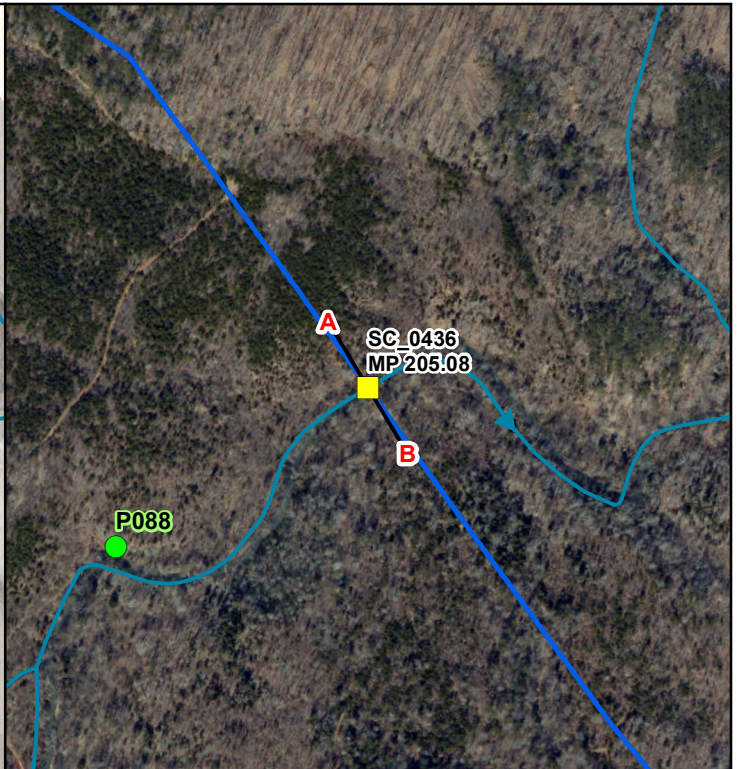
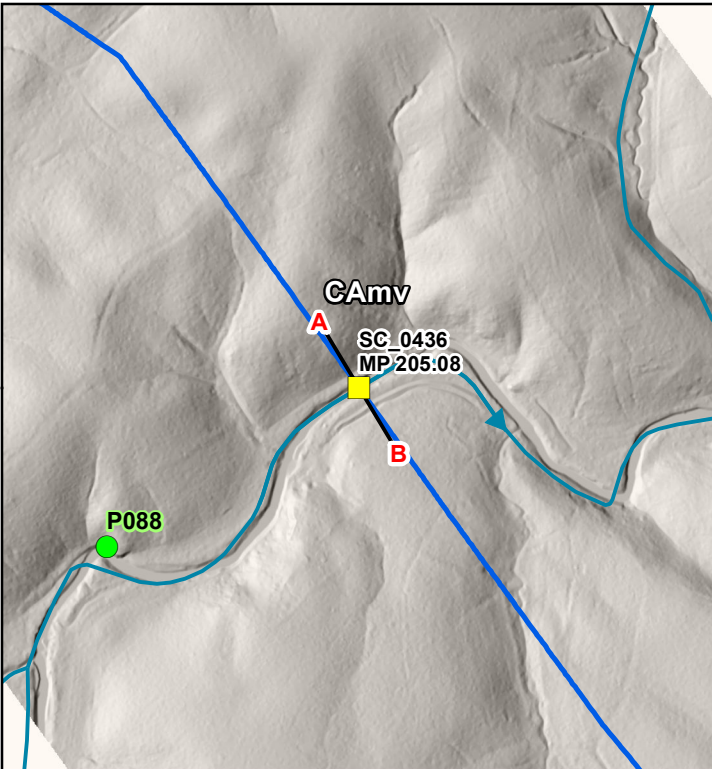
Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0436

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)**

- 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: sbul009  
TID\_SC: SC\_0436  
Stream Name: Willis 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\_0436

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 ASSOCIATES**

<b>TID</b>	SC_0436	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Willis River	<b>MP</b>	205.08
<b>Survey Date</b>	14-May-2016	<b>Start Time</b>	1315 hrs

- River has a riffle-pool morphology in a terraced alluvial valley of the Piedmont.
- River is relatively straight at crossing with mid-channel bars and beaver dams present in channel near upstream tributary confluence.
- Bedrock outcropping observed in channel.
- Channel bed comprised of sand, fine to coarse gravel, and some cobbles (4 to 6 inches).
- Stream banks composed of fine-grained silt/clay with some sand and gravel.
- Top of bank (terrace) heights vary from 6 to 8 feet high and are banks are steeply sloped into channel with trees slumping into channel from bank toe erosion.
- Recent high flows left debris within 1-foot of top of bank.
- Well established deciduous riparian buffer on right bank and a younger deciduous riparian buffer on the left bank.
- Bankfull channel width is 25 feet and bankfull depth is approximately 2 feet.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Due to bedrock at channel bed it is recommended to bury pipeline in bedrock. Sag bends should be located at least one channel width from both banks.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	14-May-16	Stream Name:	Willis River
Crossing ID:	SC_0436		

## 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 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 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 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 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 type="checkbox"/> None
<input checked="" type="checkbox"/> Occasional
<input type="checkbox"/> Frequent
<input 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:** 25.0'

**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  Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

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

**Layer Material**

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

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

**Bank Height**

3-8'

6-8'

**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\_0436, Willis River at MP 205.08 (AP-1)

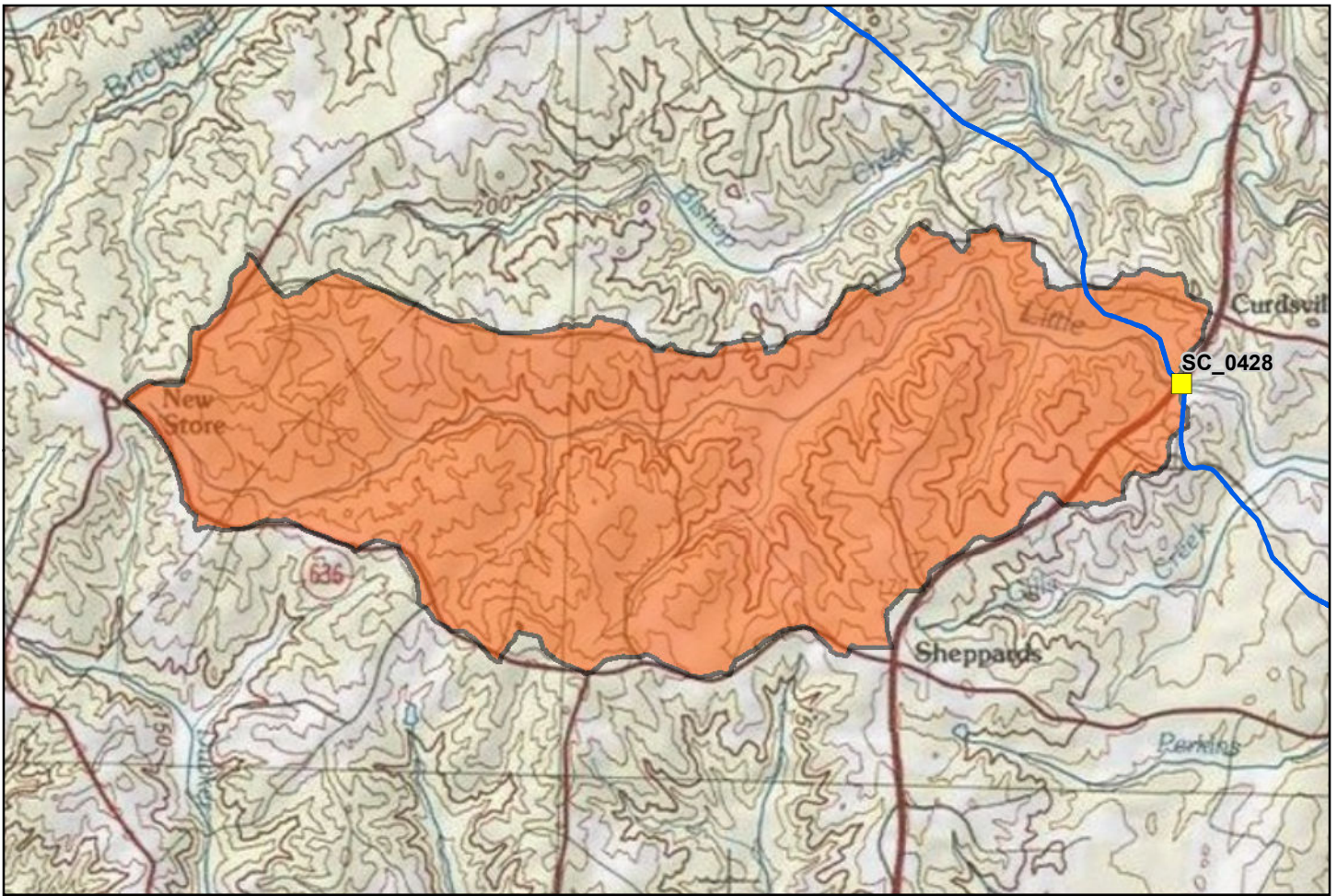
Photograph 1

Date: 14 May 2016

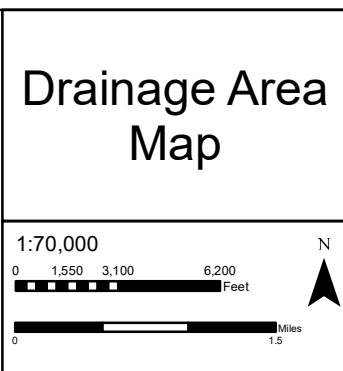
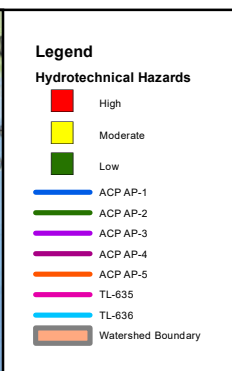
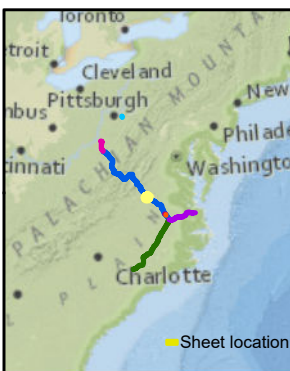
Direction: looking upstream

Description: formation of mid channel bar and signs of beaver activity near tributary entering from the left bank. Thick, well established riparian buffer off both banks.





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0428	sbuk037	AP-1	209.48	Virginia	Buckingham
Attribute			Value		
Stream Name			Little Willis River		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			7.124		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			10.6		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.430		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0428

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:**

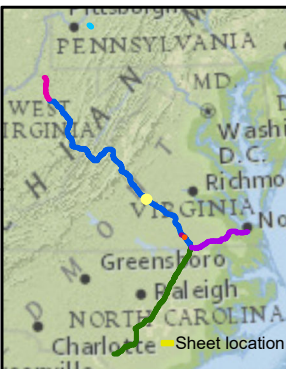
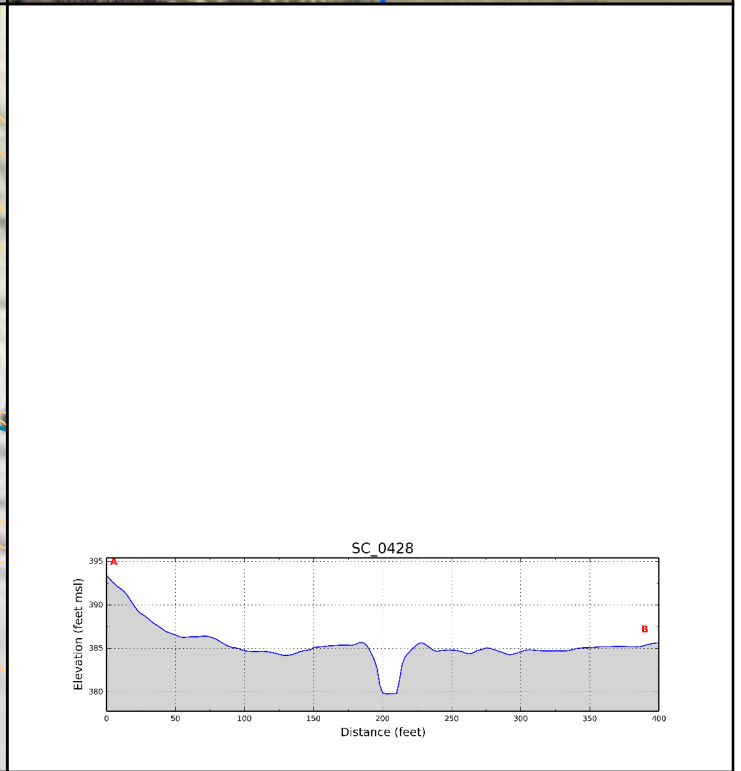
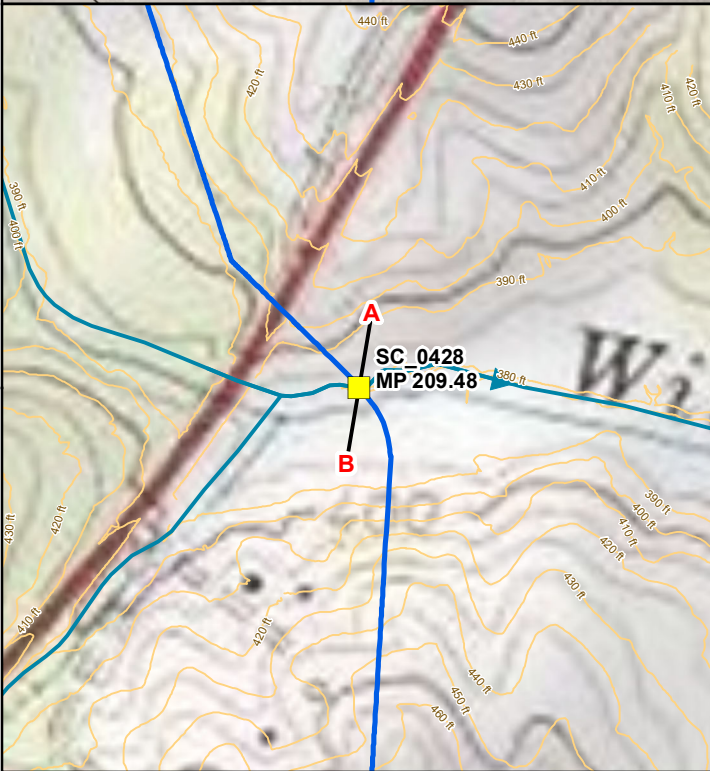
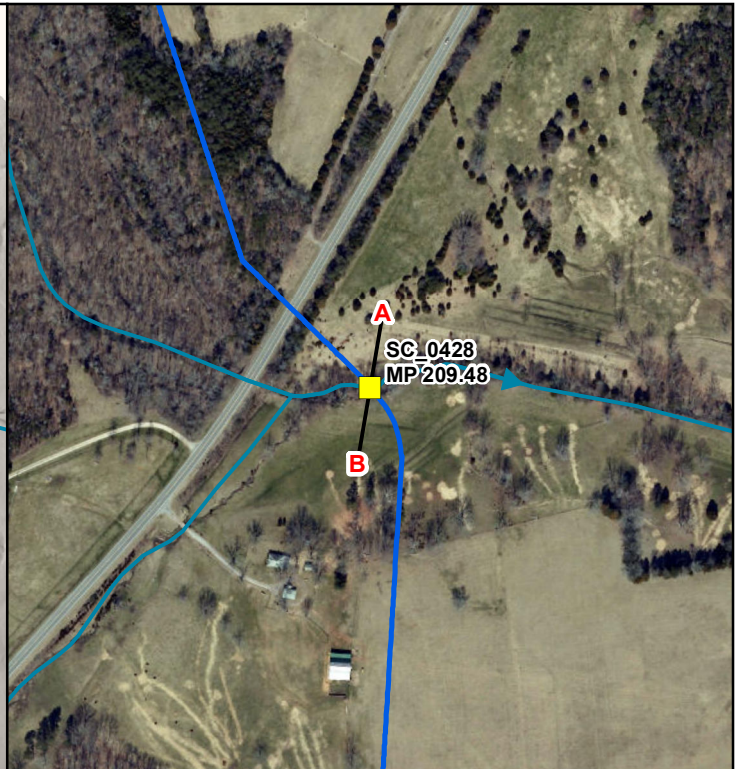
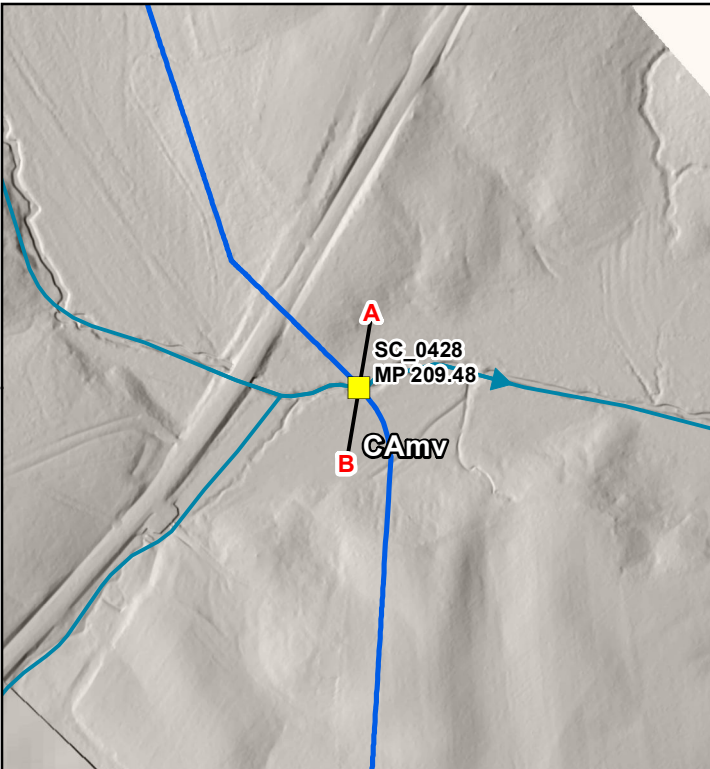
- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.

**Dominion**

Geosyntec  
consultants

TESSE





**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: sbuk037  
 TID\_SC: SC\_0428  
 Stream Name: Little Willis 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\_0428

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_0428	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Little Willis River	<b>MP</b>	209.48
<b>Survey Date</b>	14-May-2016	<b>Start Time</b>	1425 hrs

- River has low gradient meanders in a terraced alluvial valley and river has a riffle-pool morphology.
- Pool depths near woody debris are approximately 1.7 feet deep below water surface.
- Point bars observed along with transverse bars.
- Channel bed comprised of sand and gravel.
- Stream banks composed of fine-grained silt/clay with some sand and gravel.
- Top of bank (terrace) heights vary from 5 to 6 feet high.
- Deciduous riparian buffer varies from one to three channel widths along left bank and less than one channel width along right bank.
- Stream morphology influenced by fallen trees and woody debris.
- Agricultural floodplain used for pasture.
- Bankfull channel width is 10.6 feet and bankfull depth is approximately 1.5 feet.
  - Top of bank width (floodplain terrace) is 28 feet.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Evaluate scour depth for pipeline burial depth and armor. Sag bends should be located at least two channel widths from both top of banks.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	14-May-16	Stream Name:	Little Willis River
Crossing ID:	SC_0428		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input type="checkbox"/> Natural
<input checked="" type="checkbox"/> Agricultural
<input type="checkbox"/> Urban
<input type="checkbox"/> Suburban
<input checked="" 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 checked="" 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 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 checked="" type="checkbox"/> Grass
<input type="checkbox"/> Pasture
<input type="checkbox"/> Orchards
<input checked="" type="checkbox"/> Crops
<input type="checkbox"/> Shrubs
<input 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 RB
<input checked="" type="checkbox"/> 1-5 river widths on LB
<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 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 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:** 10.6'

**M-B Classification**

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

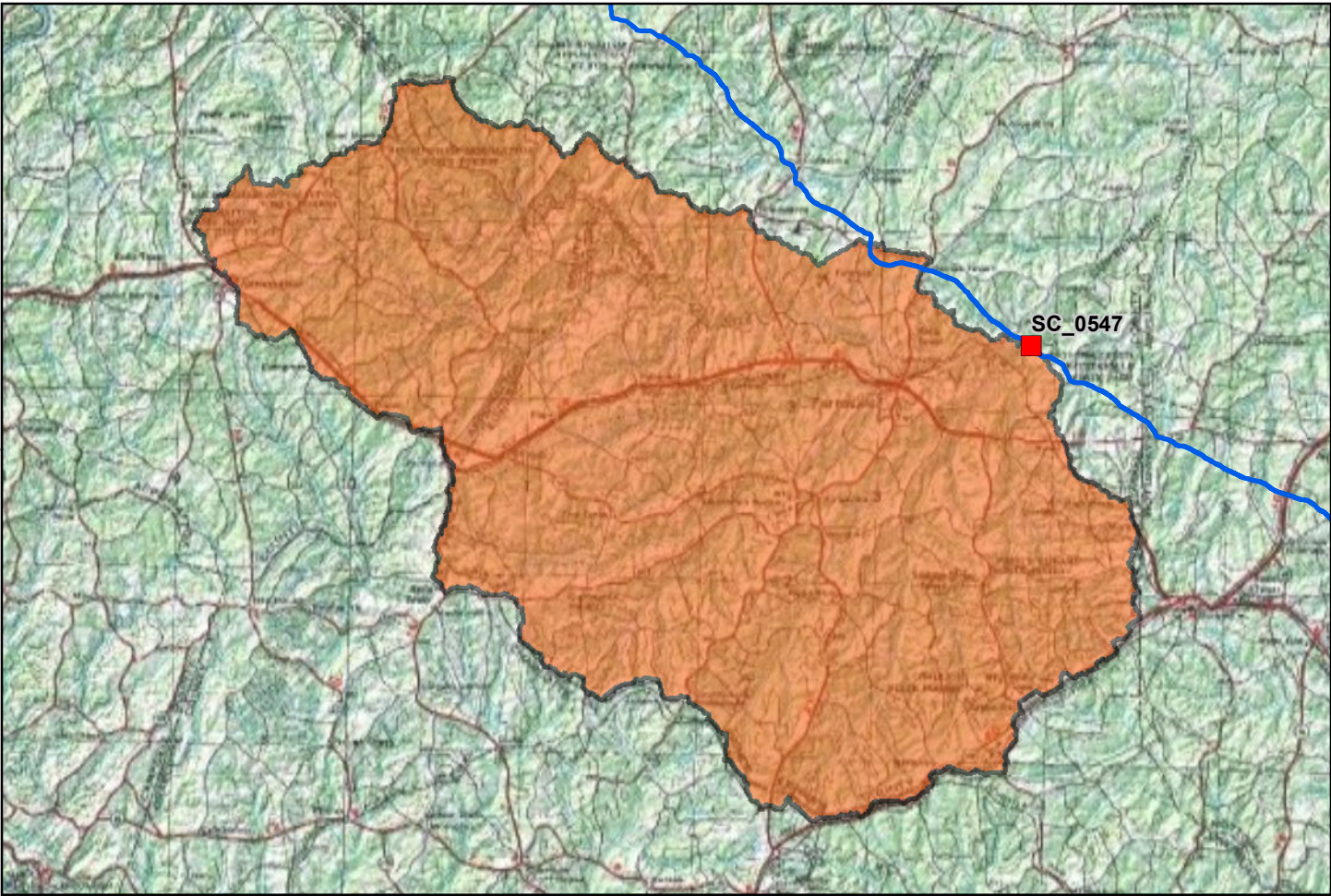
**Part 7: Bed Sediment Description (select all that apply)**

- |  |  |  |  |                                   |
|--|--|--|--|-----------------------------------|
| <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   |
| <input checked="" 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 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 type="checkbox"/> Bedrock           | <input type="checkbox"/> Braided               |  |  |                                   |

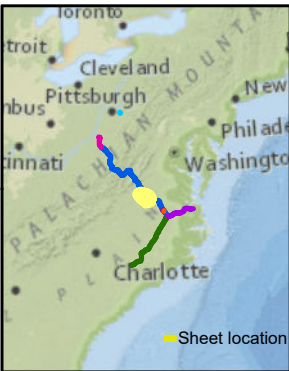
Percent sand in bed = 50-70% %

**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 checked="" type="checkbox"/> SAND <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input type="checkbox"/> Clay <input type="checkbox"/> Silt <input checked="" type="checkbox"/> SAND <input type="checkbox"/> Gravel <input 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>	~6'	~6'		
<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 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 type="checkbox"/> mature <input type="checkbox"/> old tree diversity <input type="checkbox"/> Y <input checked="" type="checkbox"/> N	<input type="checkbox"/> None <input type="checkbox"/> Grasses/annuals <input checked="" type="checkbox"/> Reeds/shrubs <input type="checkbox"/> Trees: Falling trees? <input type="checkbox"/> Y <input checked="" type="checkbox"/> N Tree density <input checked="" type="checkbox"/> sparse <input 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 type="checkbox"/> Y <input checked="" 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



TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0547	scuk011	AP-1	220.76	Virginia	Cumberland
Attribute			Value		
Stream Name			Appomattox River		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			470.655		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			75		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.035		
Proposed Construction Method <sup>5</sup>			Cofferdam		



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low

- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636
- Watershed Boundary

## Drainage Area Map

1:500,000

0 11,250 22,500 45,000

Feet

0 12

Miles

N

**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0547

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



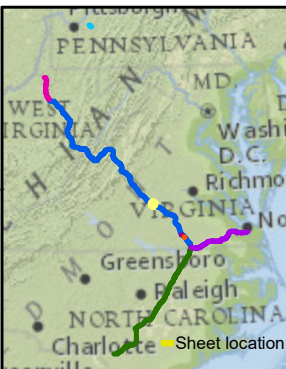
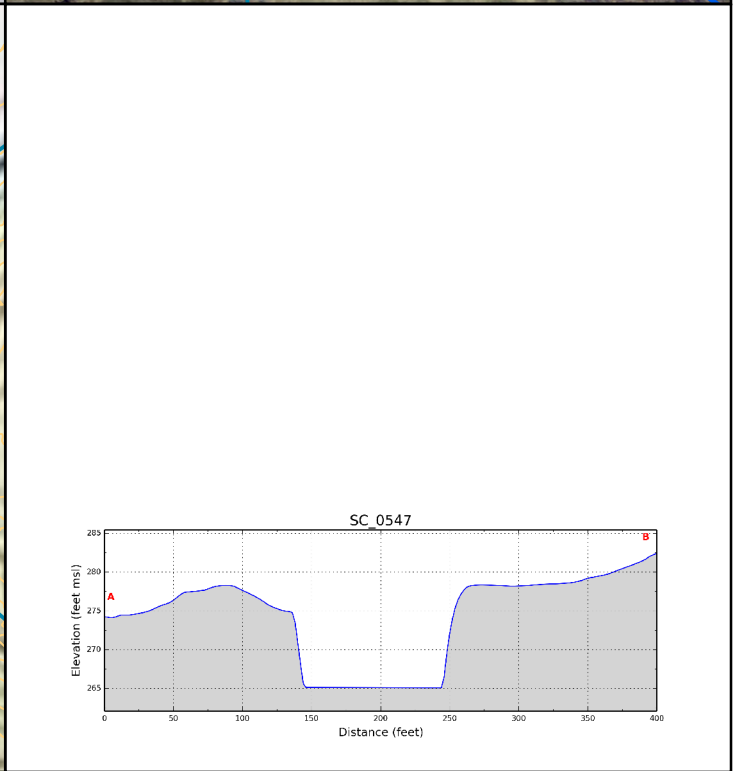
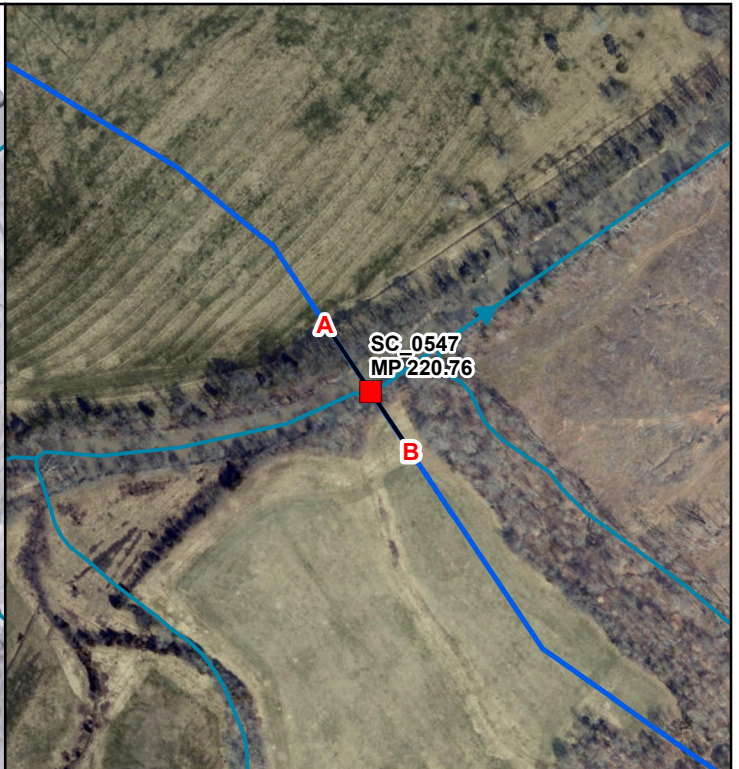
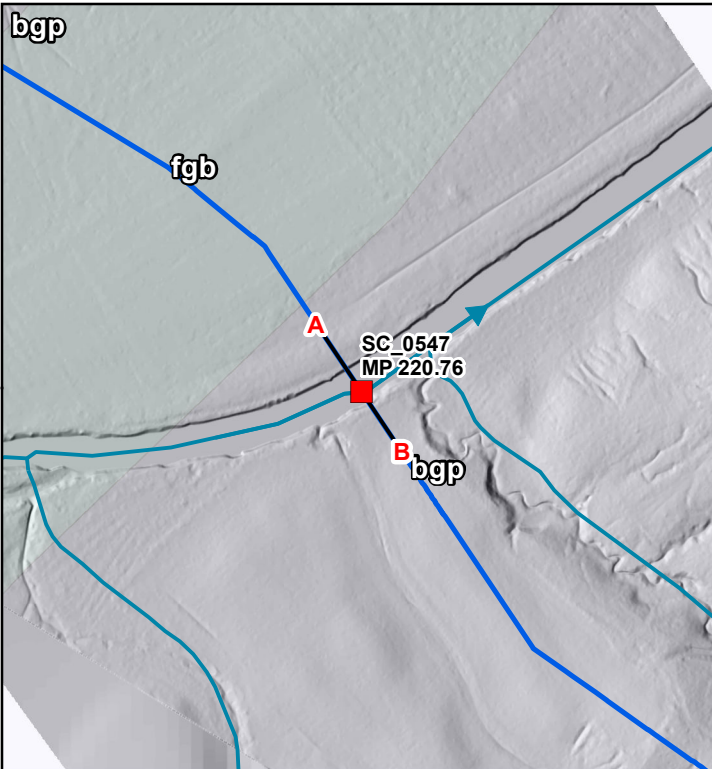
Geosyntec

consultants



TESSEMAATIONS





**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low
- Field Observation Locations

**Profile Line (400ft)**

- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636

**Stream with Flow Direction**

- > Stream with Flow Direction

### Stream Crossing Plan View and Profile

Location ID: scuk011  
 TID\_SC: SC\_0547  
 Stream Name: Appomattox 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\_0547

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_0547	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Appomattox River	<b>MP</b>	220.76
<b>Survey Date</b>	14-May-2016	<b>Start Time</b>	1632 hrs

- Turbid water during survey did not allow detailed investigation of channel bed characteristics
- Stream banks composed of silt, clay and some sand.
- Steep stream banks with top of bank (terrace) heights approximately 10 to 12 feet.
- Agricultural floodplain beyond both banks.
- Mature deciduous riparian buffer less than one channel width both banks
- Bankfull channel width is approximately 75 feet.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Evaluate scour depth for pipeline burial depth. Sag bend placement to be assessed in phase 3.

# 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:** 75.0'

**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  SAND
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

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

**Layer Material**

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

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

**Bank Height**

10-12'

10-12'

**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

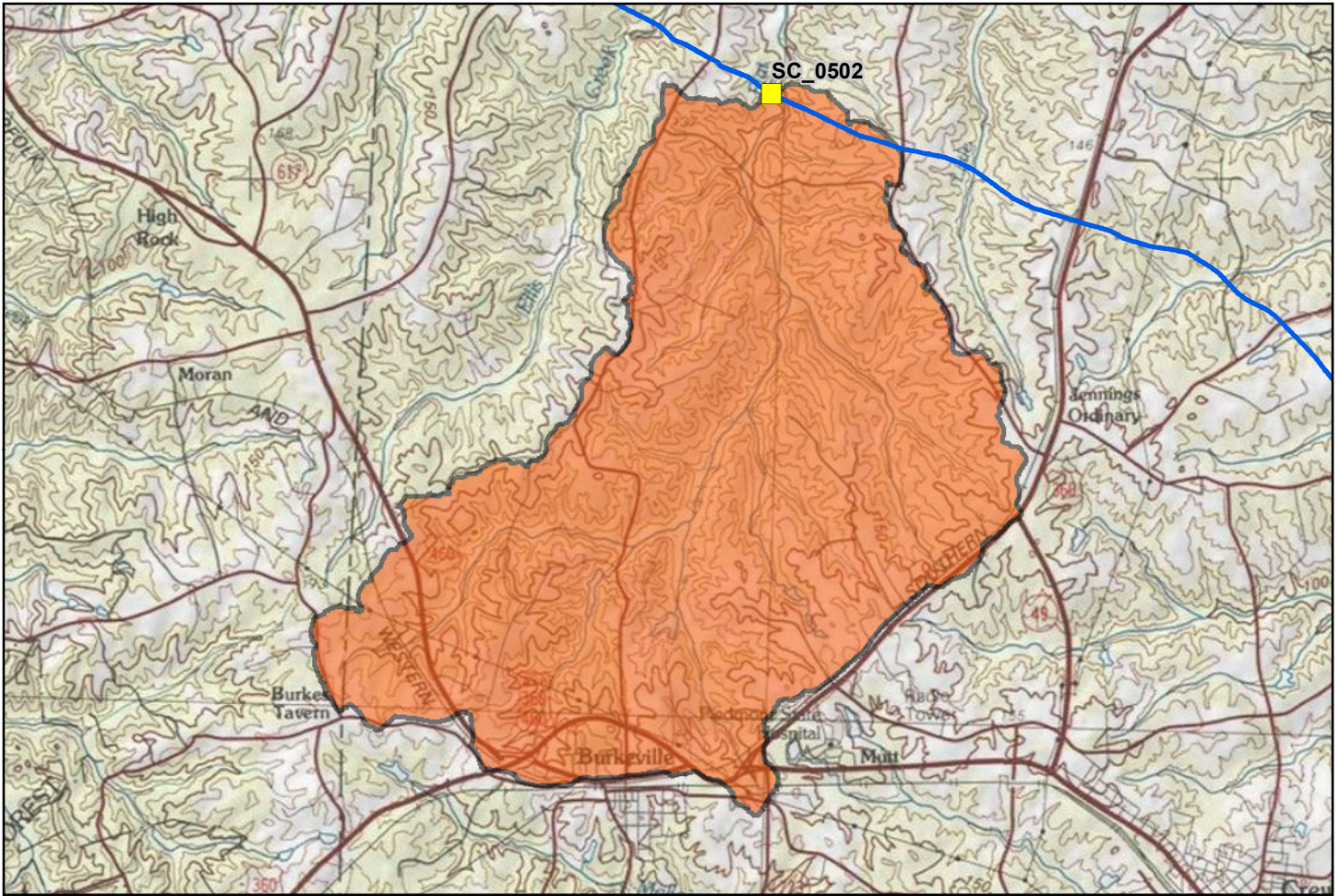
- None
- Grasses/annuals
- Reeds/shrubs
- Trees:
  - Falling trees?  Y  N
  - Tree density  sparse  dense
  - Tree health  good  poor
  - tree ages  young  mature  old
  - tree diversity  Y  N

**Bank Erosion and Failure Location**

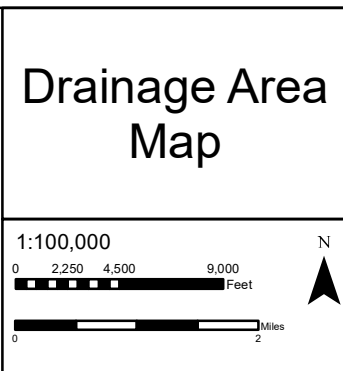
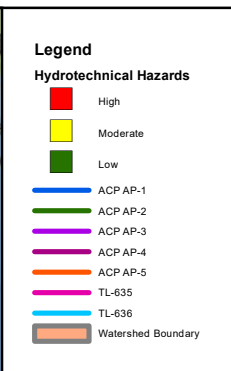
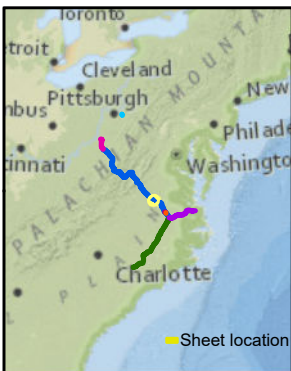
- location of erosion
- outside meander bend
  - inside meander bend
  - opposite bar or obstruction
  - general
- type of erosion
- fluvial
  - geotechnical

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





TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0502	snok008	AP-1	229.22	Virginia	Nottoway
Attribute			Value		
Stream Name			Flat Creek		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			14.026		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			44		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.212		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0502

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:**

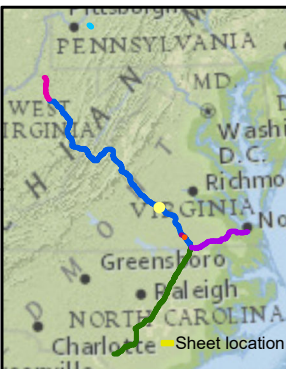
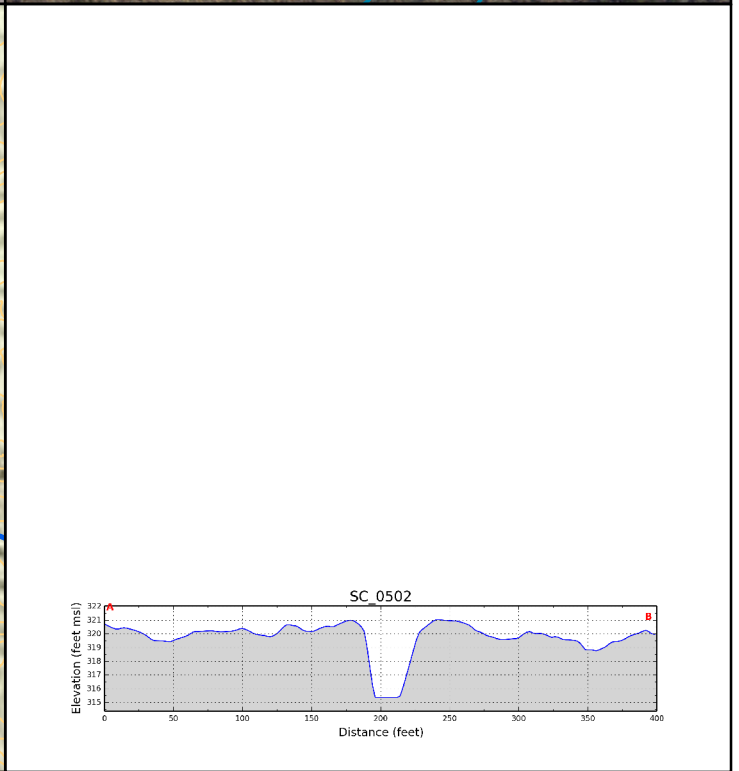
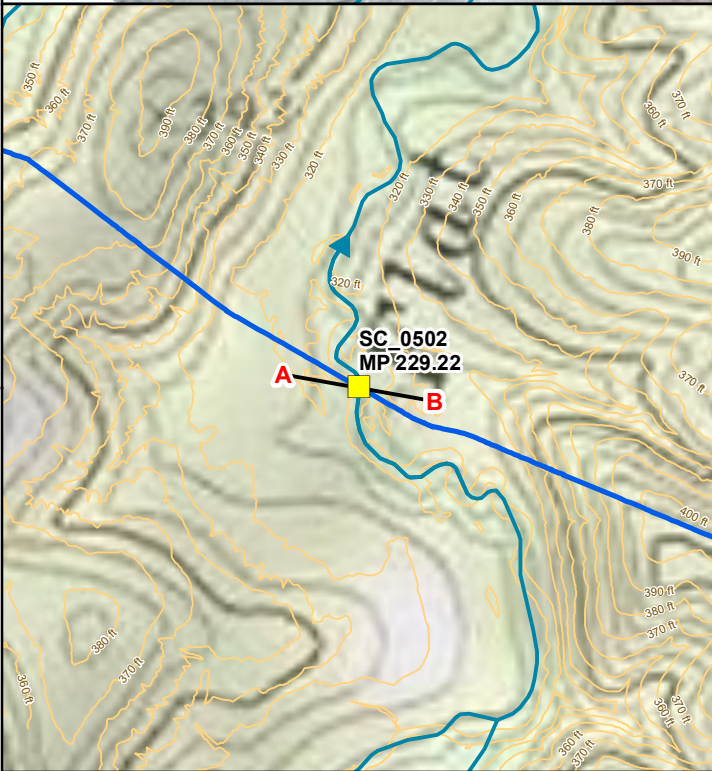
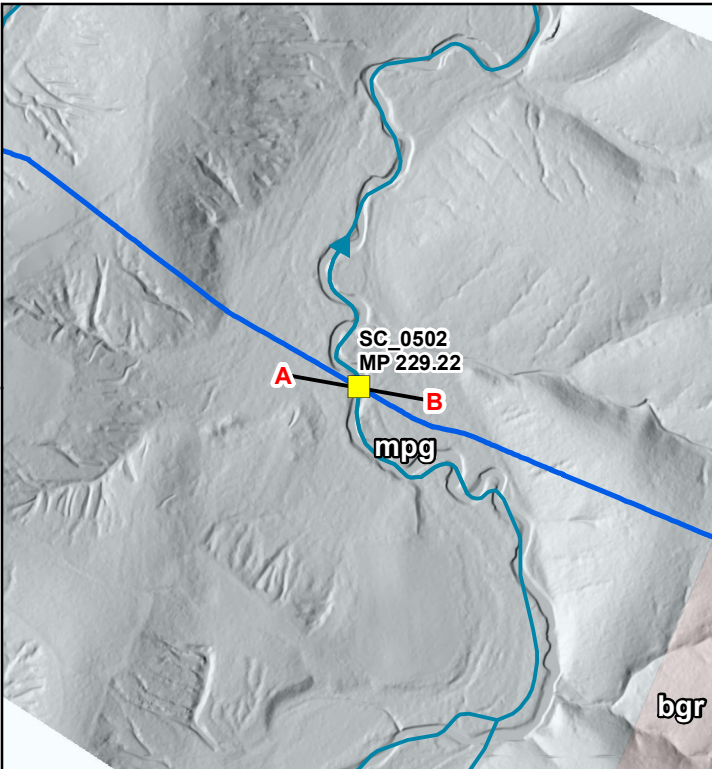
- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAI.

**Dominion**

**Geosyntec**  
consultants

**TESSEMAATIONS**





**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: snok008  
TID\_SC: SC\_0502  
Stream Name: Flat Creek

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\_0502

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 ASSOCIATES**

<b>TID</b>	SC_0502	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Flat Creek	<b>MP</b>	229.22
<b>Survey Date</b>	26-Sep-2016	<b>Start Time</b>	1600 hrs

- Given difficulty of access at pipeline crossing, we surveyed the stream 1.4 miles downstream from pipeline crossing and next to State Road 307. Stream surveyed just downstream of bridge crossing.
- BFW = 44 feet, BFD (maximum) = 3.8 feet
- Riffle-pool morphology.
- Right bank terrace is about 6.5-ft high and left bank is about 5-ft high.
- Stream bed comprised of medium sand.
- Vegetation in floodplain comprised of young and mature trees and shrubs.

**Recommendation:**

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



# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	26-Sep-16	Stream Name:	Flat Creek
Crossing ID:	SC_0502		

## 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 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 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 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 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 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 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:** 44'

**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 =** 80-100 %

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

**Bank Characteristic**

**Bank Material**

**Left Bank**

- Clay
- Silt SAND FINE
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

- Clay
- Silt SAND FINE
- Gravel
- Cobbles
- Boulders
- Bedrock

**Layer Material**

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

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

**Bank Height**

5'

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

GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0502 Flat Creek at MP 229.22 (AP-1)

Photograph 1  
(IMG\_1101.JPG)

Date: 26 September 2016

Direction: Downstream

Description: View of densely vegetated banks and floodplain. Fallen trees in the channel from bank erosion.



Photograph 2  
(IMG\_3915.JPG)

Date: 26 September 2016

Direction: Upstream

Description: View of mid channel bar and survey location approximately 1.1 miles downstream of pipeline crossing. Stream bed comprises sand.





GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0502 Flat Creek at MP 229.22 (AP-1)

Photograph 3  
(IMG\_3919.JPG)

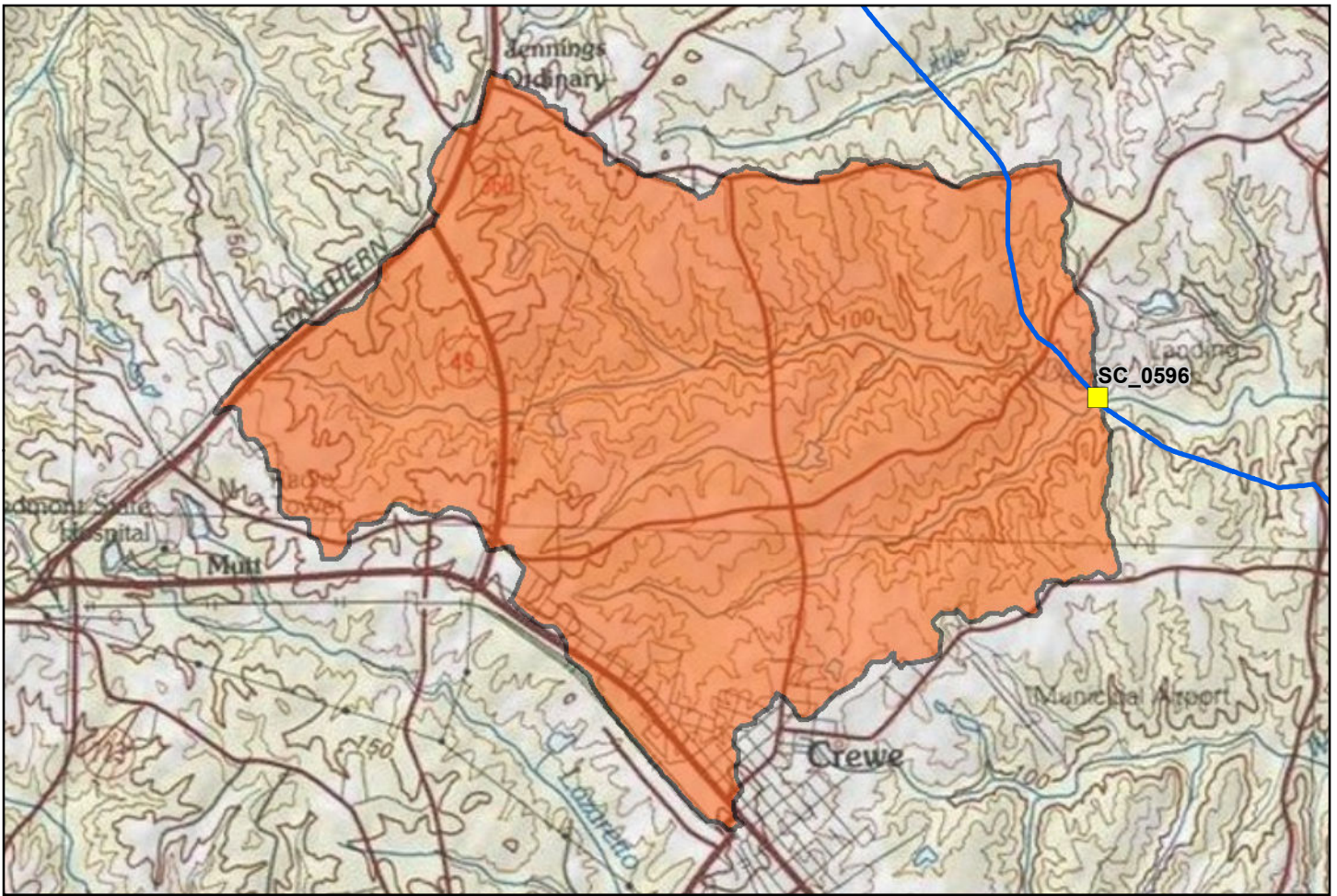
Date: 26 September 2016

Direction: Towards right  
bank from left bank

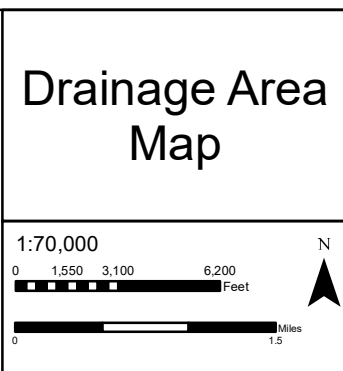
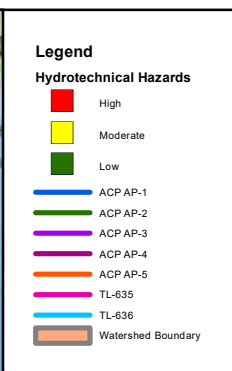
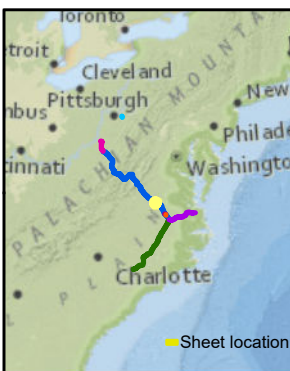
Description: View of  
steep, 6.5-ft high right  
bank terrace providing  
lateral confinement  
(downstream of control  
provided by bridge).  
Bankfull depth  
(maximum) on left bank  
was measured at 3.8 ft.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0596	snok100	AP-1	236.04	Virginia	Nottoway
Attribute			Value		
Stream Name			Deep Creek		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			9.207		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			18.5		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.088		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0596

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:**

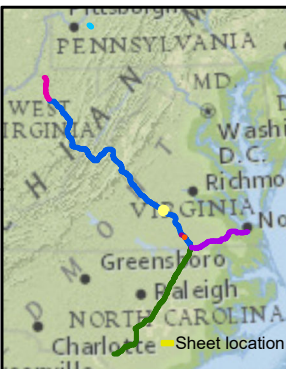
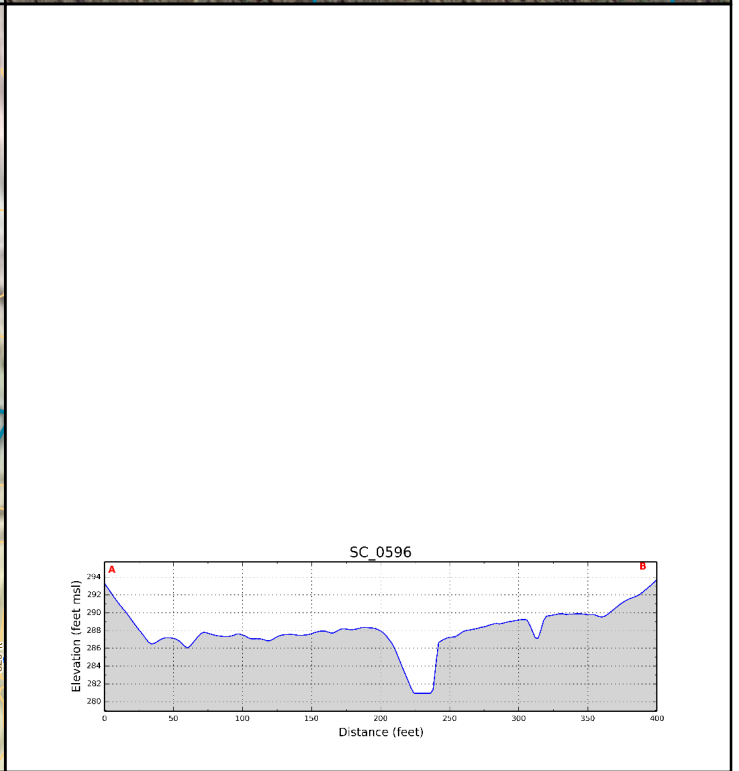
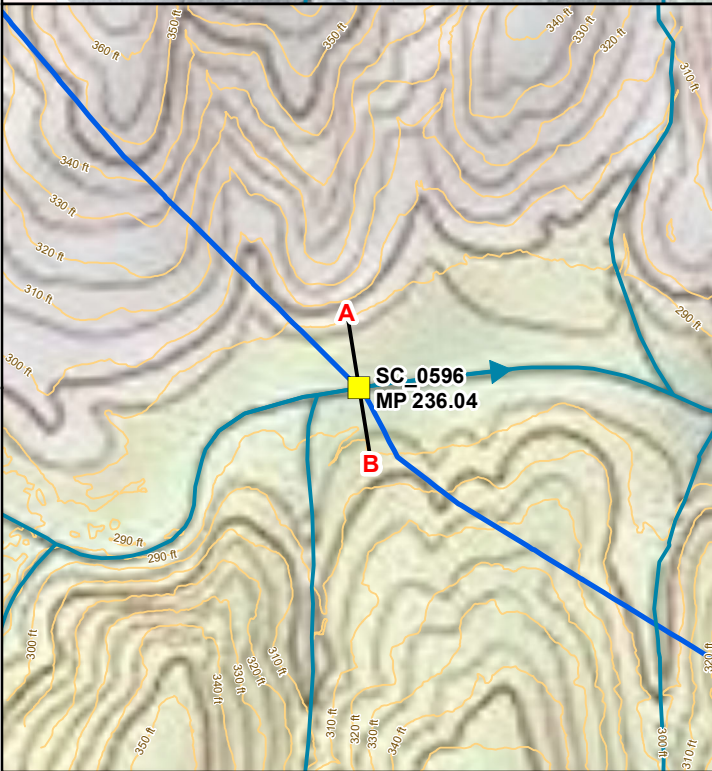
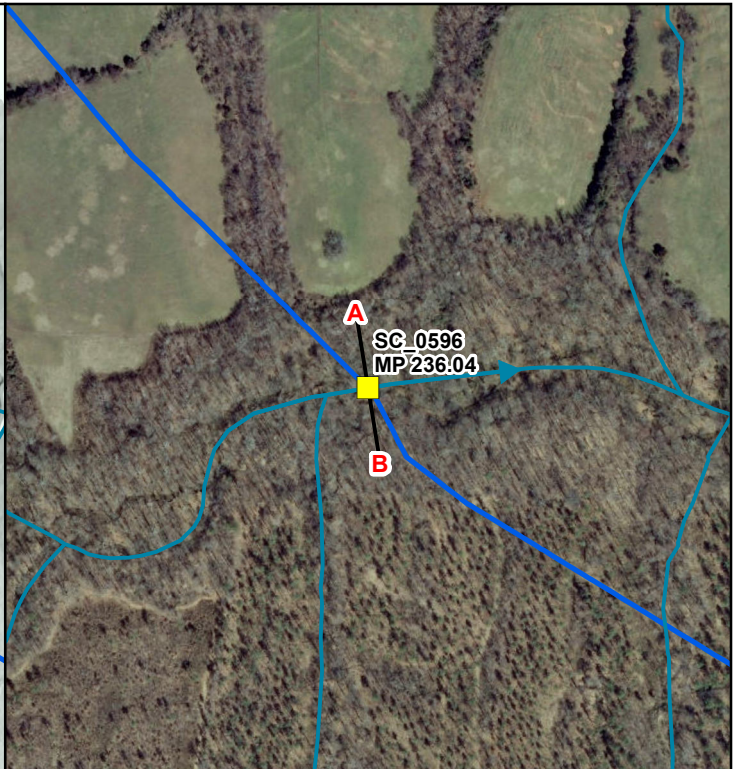
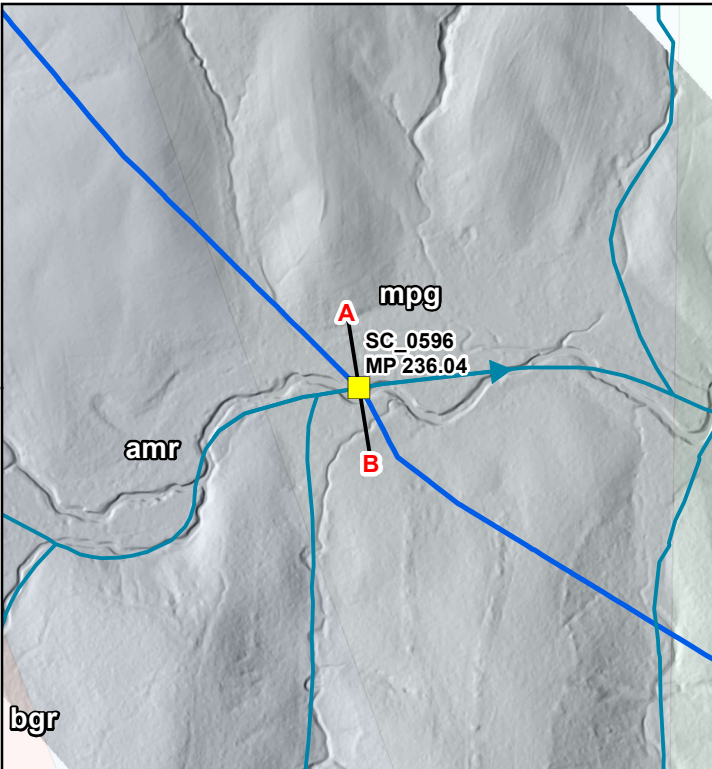
- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.

**Dominion**

Geosyntec  
consultants

TESSE





**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: snok100  
TID\_SC: SC\_0596  
Stream Name: Deep Creek

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\_0596

Revision	Date	Created By	Approved by
0	07-28-2016	CR	RS
1	03-01-2017	EP	RS
2	04-21-2017	EP	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_0596	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Deep Creek	<b>MP</b>	236.04
<b>Survey Date</b>	15-May-2016	<b>Start Time</b>	0910 hrs

- Stream has low gradient meanders in a terraced alluvial valley and stream has a dune-ripple morphology.
- Pool depths of approximately 1.7 feet below water surface were observed.
- Channel bed comprised of sand with some medium to fine gravel.
- Stream is showing evidence of vertical instability through abandoned point bars which have become inner terraces within floodplain terrace which is approximately 6.5 feet above the channel bottom.
- Stream banks composed of stratified layers of sand (top layer) and clay (lower layer) with interface between layers at approximately 3 feet above channel bottom (about half of top of bank height).
- Mature deciduous riparian buffer on both banks; agricultural floodplain beyond left bank riparian buffer.
  - Root mats extending into channel helping to limit erosion of steep stream banks.
  - Approximately 3 to 4 feet of horizontal scour under stream bank at outside bend at crossing location.
- Debris in channel includes fallen trees which result in localized scour holes.
- Bankfull channel width is 18.5 feet and bankfull depth is approximately 1.6 feet.
- Approximately 31-foot width from top of banks terraces
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Evaluate scour depth for pipeline burial depth. Sag bend placement to be determined in phase 3.

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	15-May-16	Stream Name:	Deep Creek
Crossing ID:	SC_0596		

## 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 checked="" 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 checked="" 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 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 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 checked="" type="checkbox"/> Cattle grazing

**Vegetation**

<input type="checkbox"/> None
<input type="checkbox"/> Grass
<input checked="" 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 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 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 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:** 18.5

**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 checked="" type="checkbox"/> None	<input type="checkbox"/> None	
<input type="checkbox"/> Silt	<input type="checkbox"/> Alternate bars	<input checked="" type="checkbox"/> Sand	<input type="checkbox"/> Grasses	<input type="checkbox"/> Narrow	
<input checked="" type="checkbox"/> Sand	<input checked="" type="checkbox"/> Point bars	<input type="checkbox"/> Gravel	<input type="checkbox"/> Reeds/shrubs	<input checked="" type="checkbox"/> Moderate	1<to about
<input type="checkbox"/> Gravel	<input type="checkbox"/> Mid-channel bars	<input type="checkbox"/> Cobbles	<input type="checkbox"/> Trees	<input type="checkbox"/> Wide	trier width
<input 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 = 100 %

**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 checked="" type="checkbox"/> Silt <input checked="" type="checkbox"/> SAND <input type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input type="checkbox"/> Clay <input checked="" type="checkbox"/> Silt <input checked="" type="checkbox"/> SAND <input type="checkbox"/> Gravel <input 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>	<u>6-7'</u>	<u>6-7'</u>
<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\_0596, Deep Creek at MP 236.04 (AP-1)

Photograph 1

Date: 15 May 2016

Direction: looking  
upstream

Description: well established riparian buffer out across entire floodplain to edge of agricultural field off left bank. Minor debris in channel.



PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0596, Deep Creek at MP 236.04 (AP-1)

Photograph 2

Date: 15 May 2016

Direction: looking  
downstream

Description: Moderate to steep banks on outside bends in particular. Right bank riparian roots helping to prevent lateral migration, approximately 3-4' of under scour at right bank. Sand point bar with upper portion beginning to form terrace.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record

Geosyntec  
consultants

**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0596, Deep Creek at MP 236.04 (AP-1)

Photograph 3

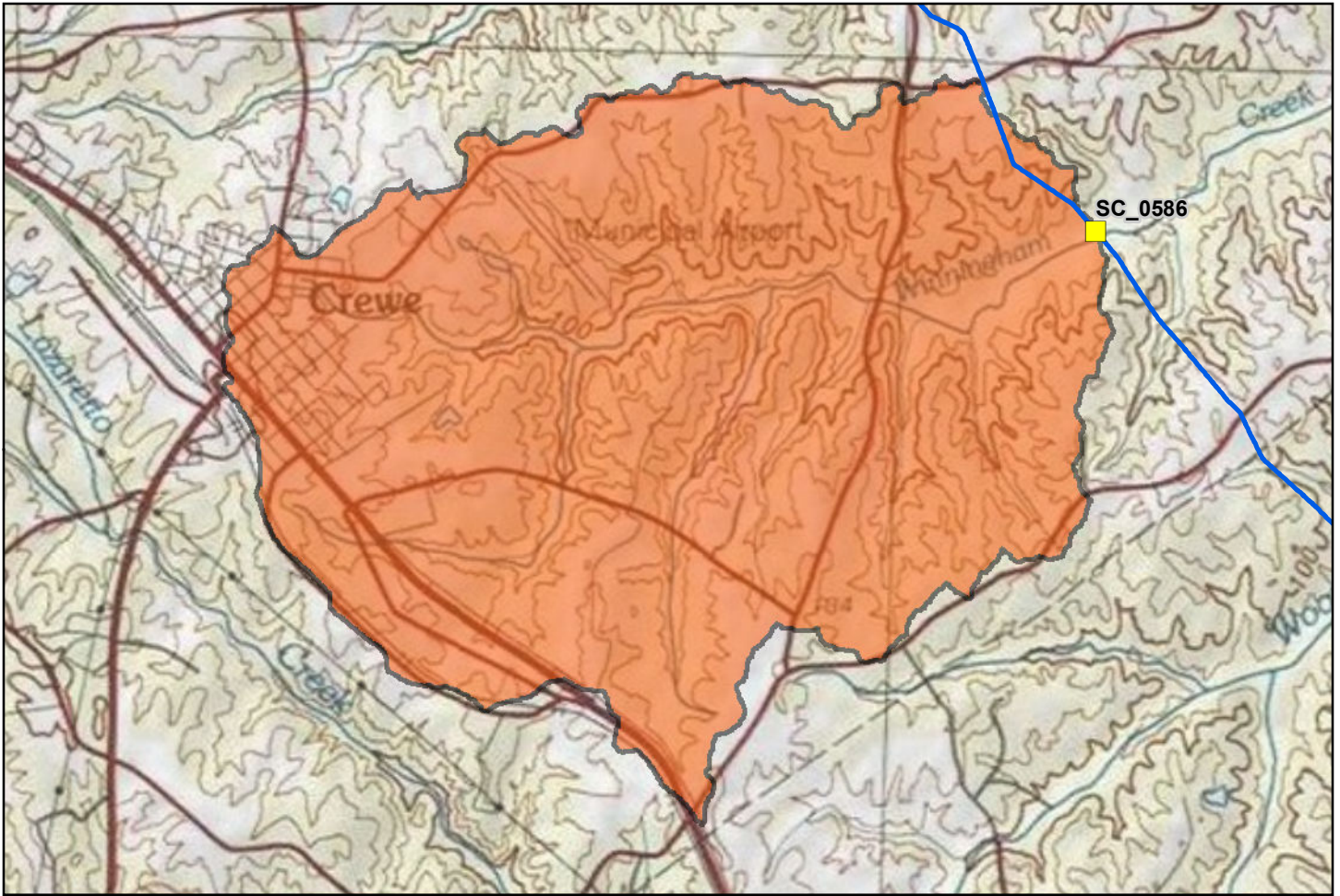
Date: 15 May 2016

Direction: looking  
downstream

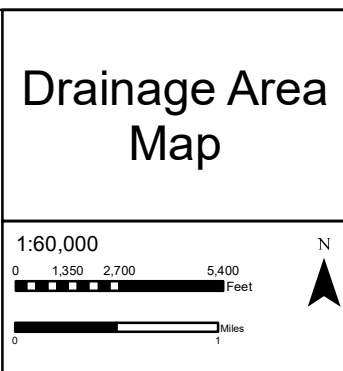
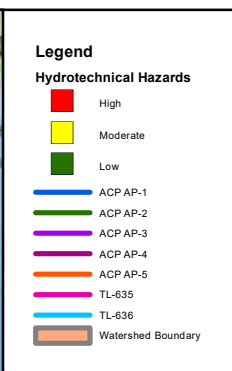
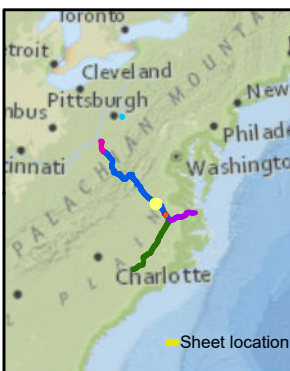
Description: channel  
incision indicating  
vertical instability and  
signs of slow lateral  
migration (undercut  
banks, etc.).







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0586	snok011	AP-1	238.63	Virginia	Nottoway
Attribute			Value		
Stream Name			Winingham Creek		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			7.856		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			Not wadeable		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.290		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0586

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

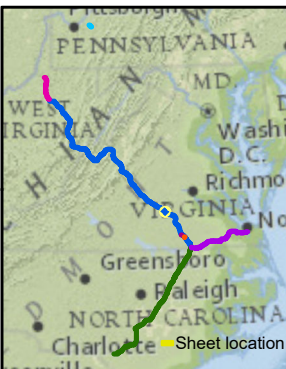
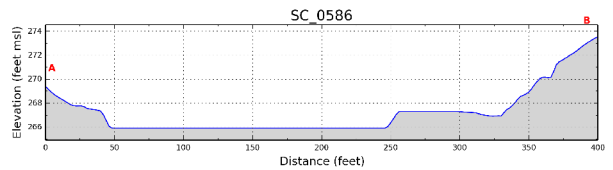
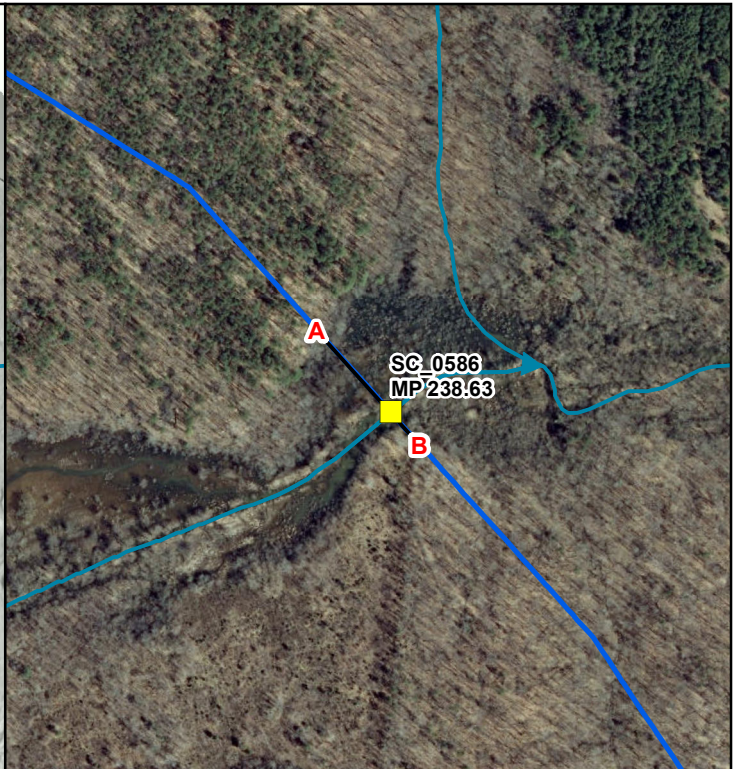
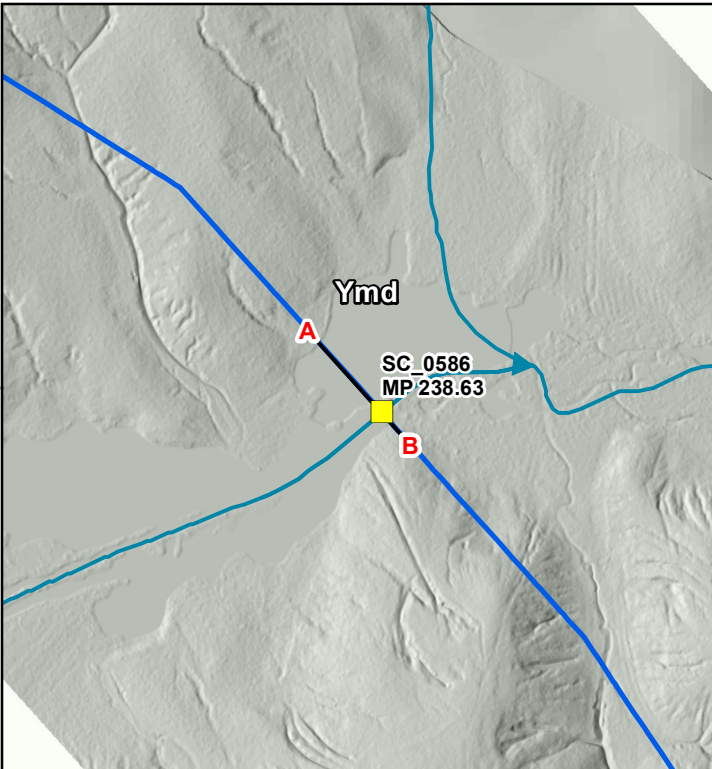
**Notes:**

- 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: snok011  
TID\_SC: SC\_0586  
Stream Name: Winningham Creek

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\_0586

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_0586	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Winningham Creek	<b>MP</b>	238.63
<b>Survey Date</b>	15-May-2016	<b>Start Time</b>	1110 hrs

- Wide wetland floodplain with well-established deciduous riparian buffer
- Wetland also contains mature trees and dense herbaceous vegetation.
- Laterally confined by valley walls and wetland.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Evaluate scour potential depth for pipeline burial depth and maintain burial depth across wetland/floodplain. Replacement of wetland vegetation at channel bank with wetland sod mats is recommended to maintain stable crossing of stream as well as the wetland post-construction.



# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	15-May-16	Stream Name:	Winningham Creek
Crossing ID:	SC_0586		

## 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 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 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 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 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 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:** Not wadeable

**M-B Classification**

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

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

Water to turbid to characterize bed

- |                                   |  |                                  |                                       |                                   |
|-----------------------------------|--|----------------------------------|---------------------------------------|-----------------------------------|
| <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 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 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 type="checkbox"/> Gravel <input type="checkbox"/> Cobbles <input type="checkbox"/> Boulders <input type="checkbox"/> Bedrock	<input checked="" type="checkbox"/> Clay <input checked="" type="checkbox"/> Silt <input type="checkbox"/> Gravel <input 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>	----	----		
<b>Bank Slope</b>	<input type="checkbox"/> Steep <input type="checkbox"/> Moderate <input checked="" type="checkbox"/> Shallow	<input type="checkbox"/> Steep <input type="checkbox"/> Moderate <input checked="" 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

Geosyntec  
consultants

**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0586, Winningham Creek at MP 238.63 (AP-1)

Photograph 1

Date: 15 May 2016

Direction: looking across  
wetland

Description: wetland  
floodplain and riparian  
vegetation well  
established and mature.  
Upstream valley  
confinement.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record

Geosyntec  
consultants

**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0586, Winningham Creek at MP 238.63 (AP-1)

Photograph 2

Date: 15 May 2016

Direction: looking across  
wetland

Description: wide  
wetland floodplain.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record

Geosyntec  
consultants

**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0586, Winningham Creek at MP 238.63 (AP-1)

Photograph 3

Date: 15 May 2016

Direction: looking across  
wetland

Description: thick  
vegetated matts and  
mature trees across  
wetland.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0586, Winningham Creek at MP 238.63 (AP-1)

Photograph 4

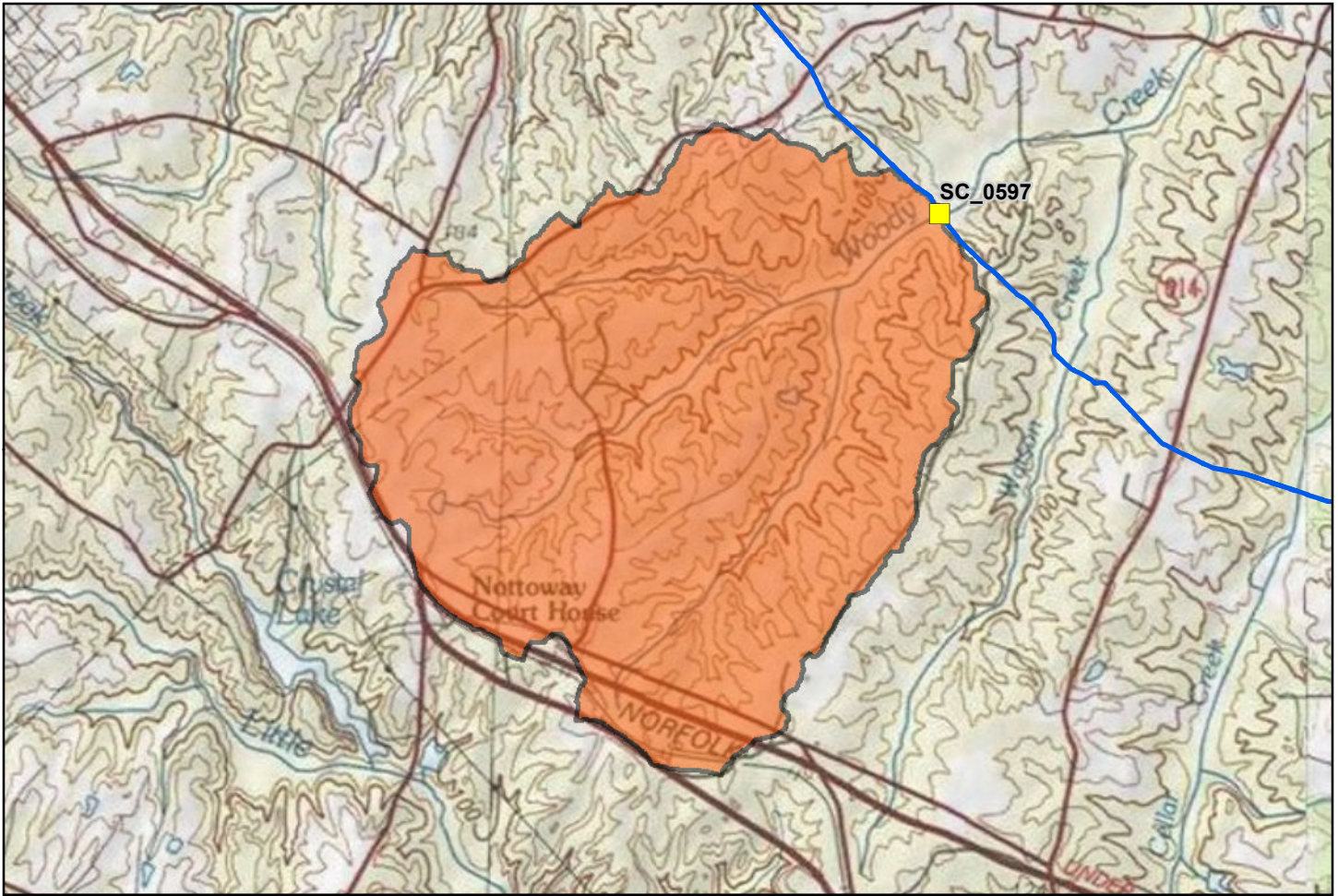
Date: 15 May 2016

Direction: looking across  
wetland

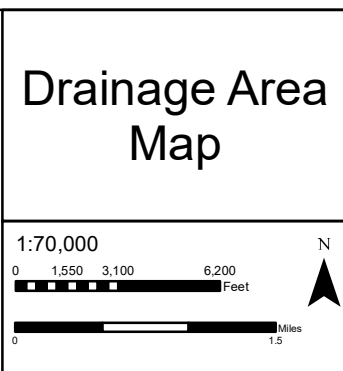
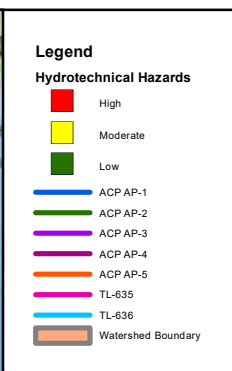
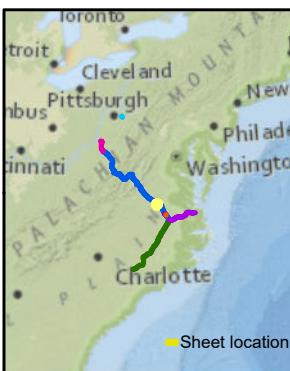
Description: edge of  
wetland topographically  
confined. Well  
established riparian buffer  
outside and at edge of  
wetland.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0597	snok019	AP-1	240.61	Virginia	Nottoway
Attribute			Value		
Stream Name			Woody Creek		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			6.542		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			22		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.292		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0597

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:**

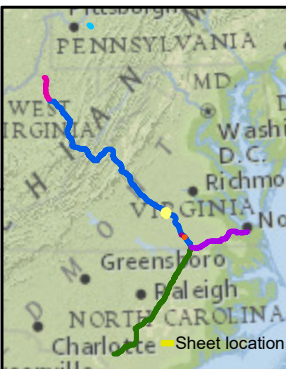
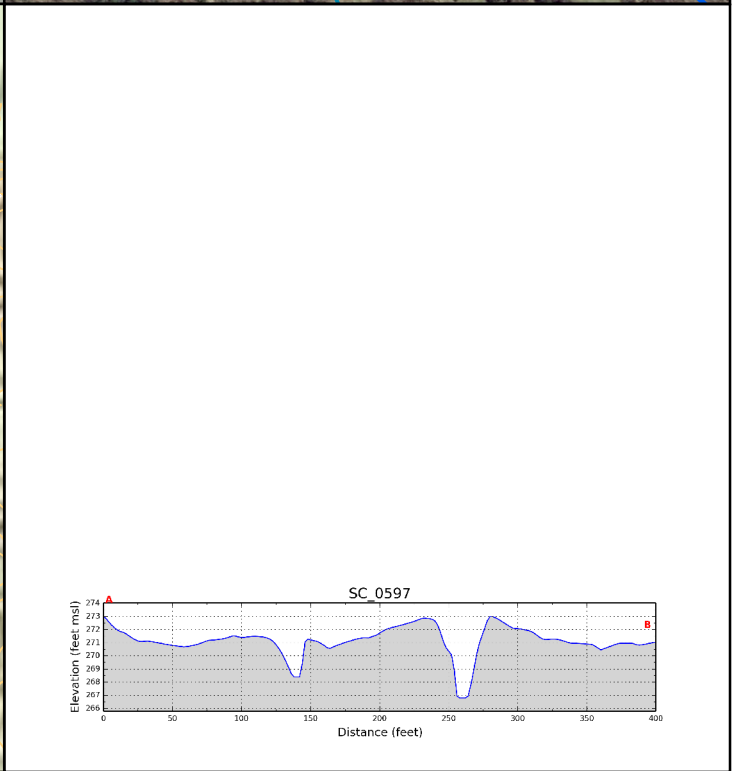
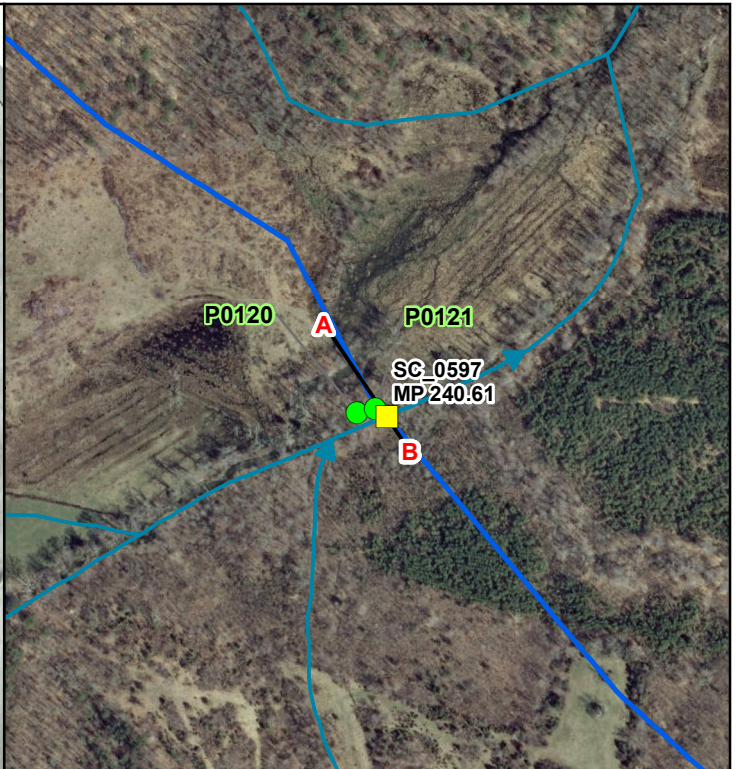
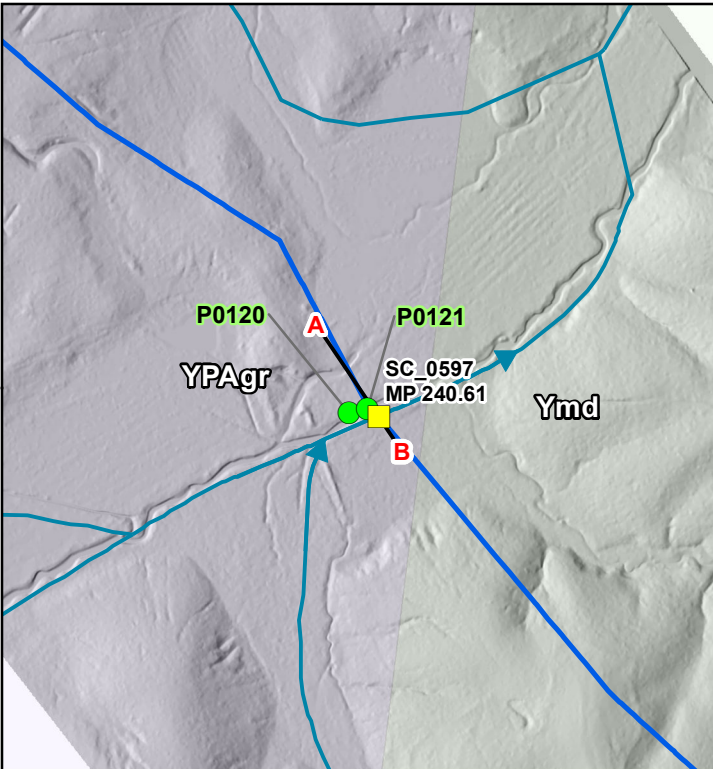
- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.

**Dominion**

**Geosyntec**  
consultants

**TESSE**





**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: snok019  
TID\_SC: SC\_0597  
Stream Name: Woody Creek

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\_0597

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_0597	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Woody Creek	<b>MP</b>	240.61
<b>Survey Date</b>	26-Sep-2016	<b>Start Time</b>	1340 hrs

- Stream crossing is located about 200-ft downstream of 5-ft high beaver dam.
- BFW = 22 feet, BFD (maximum) = 1.8 feet.
- Terrace is approximately 4-ft high and banks are generally near vertical, especially where the stream meanders into floodplain terrace.
- Stream bed comprised of medium sand.
- Stream is laterally confined by valley on the right bank.
- Vegetation in floodplain comprises young and mature trees and shrubs. Riparian forest on left bank was mature and wide, while left bank had a narrow-forested buffer.

**Recommendation:**

Evaluate scour depth for pipeline burial depth. Conduct lateral migration evaluation to set location of sag bends. Field recommendation is to bury pipeline two channel widths beyond left bank and one channel width beyond right bank.



# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	26-Sep-16	Stream Name:	Woody Creek
Crossing ID:	SC_0597		

## 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 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 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 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 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

BEAVER SWAMP

## 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:** 22'

**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 SAND
- Gravel
- Cobbles
- Boulders
- Bedrock

**Right Bank**

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

**Layer Material**

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

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

**Bank Height**

4'

4'

**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



GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0597, Woody Creek at MP 240.61 (AP-1)

Photograph 1  
(IMG\_1094.JPG)

Date: 26 September 2016

Direction: Upstream

Description: View of the stream and vegetated banks, with 5-ft high beaver dam in the background



Photograph 2  
(IMG\_1097.JPG)

Date: 26 September 2016

Direction: Upstream

Description: Panoramic view of the 4.5-ft high beaver dam and wetland upstream of the pipeline crossing





GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0597, Woody Creek at MP 240.61 (AP-1)

Photograph 3  
(IMG\_1098.JPG)

Date: 26 September 2016

Direction: Downstream

Description: View of stream at crossing. Arrow shows the survey tape. Measured bankfull width and depth (maximum) was 22 ft and 1.8 ft, respectively.



Photograph 4  
(IMG\_1099.JPG)

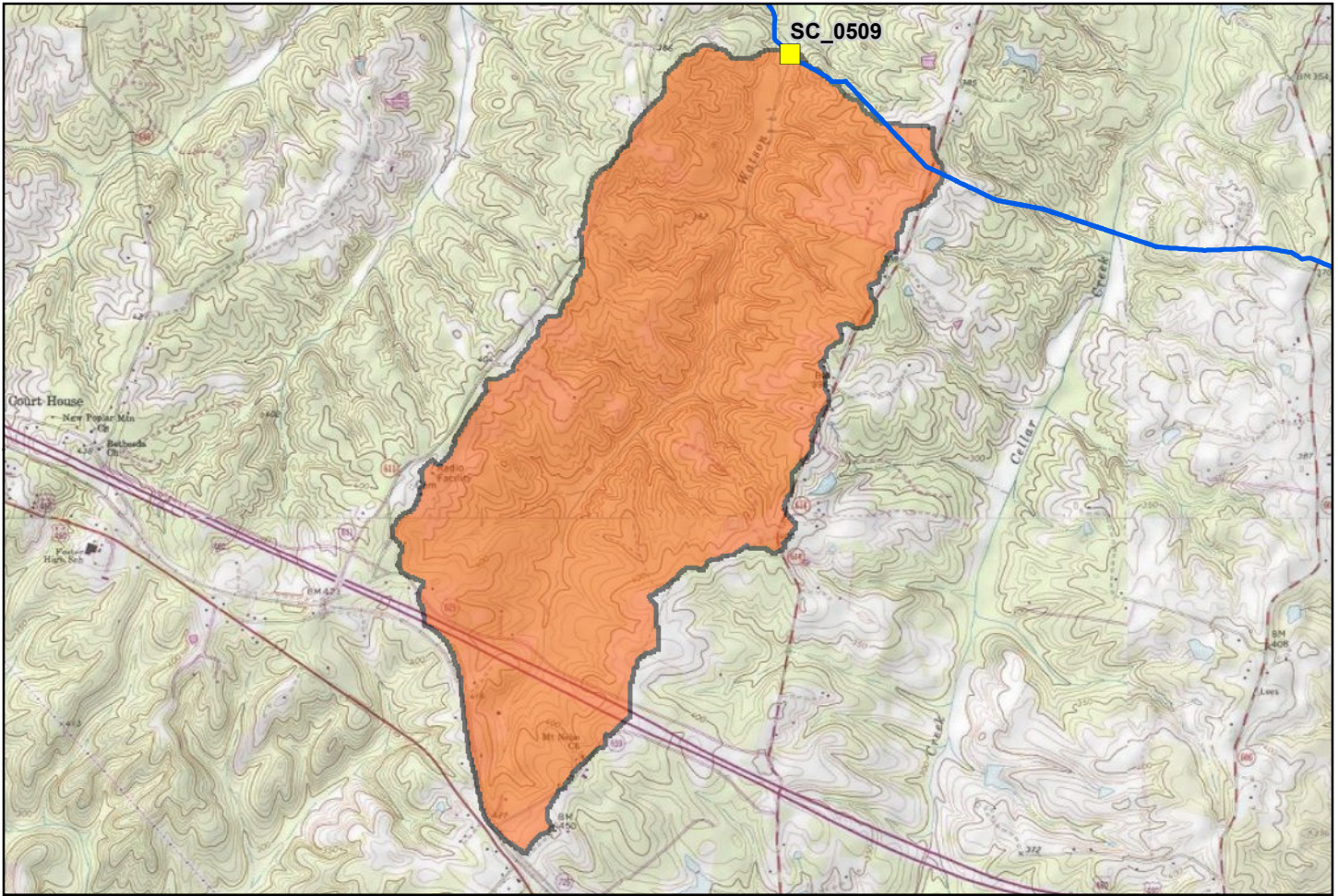
Date: 26 September 2016

Direction: Upstream

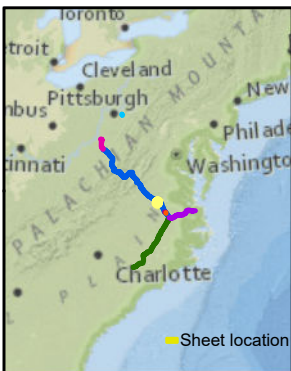
Description: Photo shows the progressive, but relatively slow right bank migration that is undercutting the mature trees. Stream bed comprised of sand. Channel appears to have excess sand; possible sign of aggradation.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0509	snoc101	AP-1	241.58	Virginia	Nottoway
Attribute			Value		
Stream Name			Watson Creek		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			2.580		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			8.5		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.300		
Proposed Construction Method <sup>5</sup>			Dam and Pump		



**Legend**

**Hydrotechnical Hazards**

- High
- Moderate
- Low

- ACP AP-1
- ACP AP-2
- ACP AP-3
- ACP AP-4
- ACP AP-5
- TL-635
- TL-636
- Watershed Boundary

## Drainage Area Map

1:50,000

0 1,125 2,250 4,500

Feet

0 1

Miles

N

**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0509

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:**

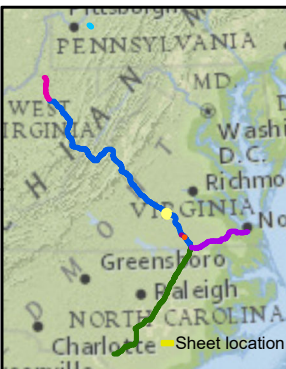
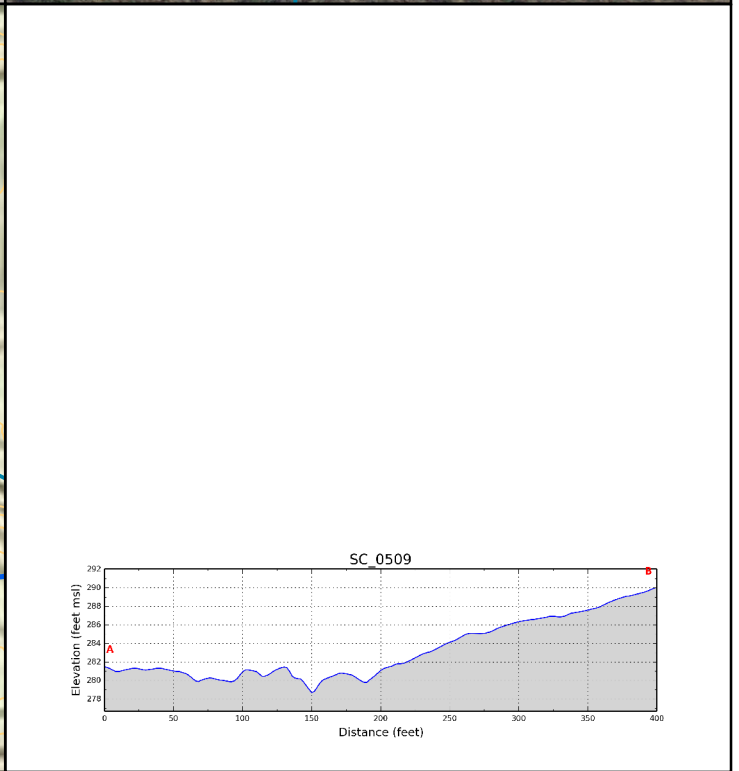
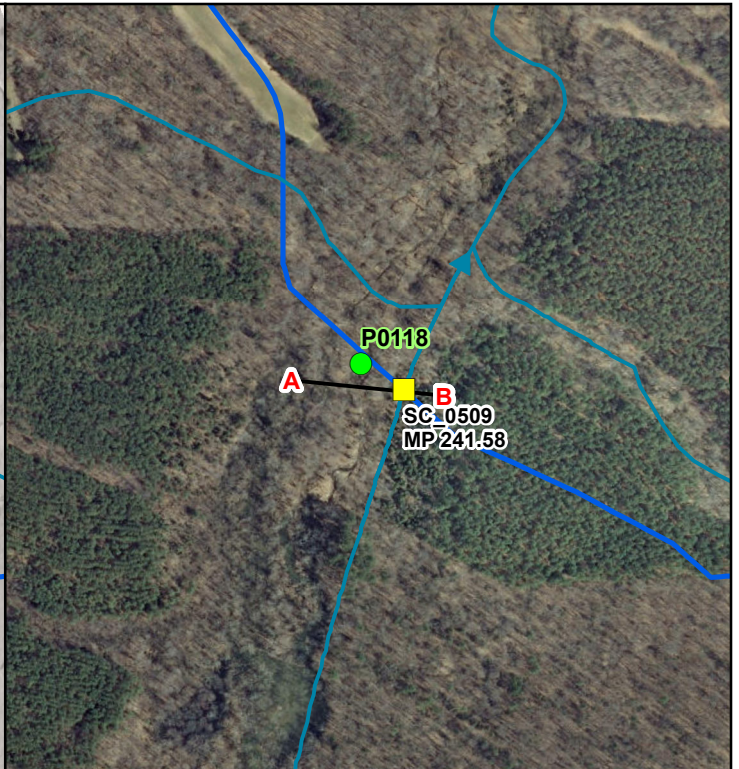
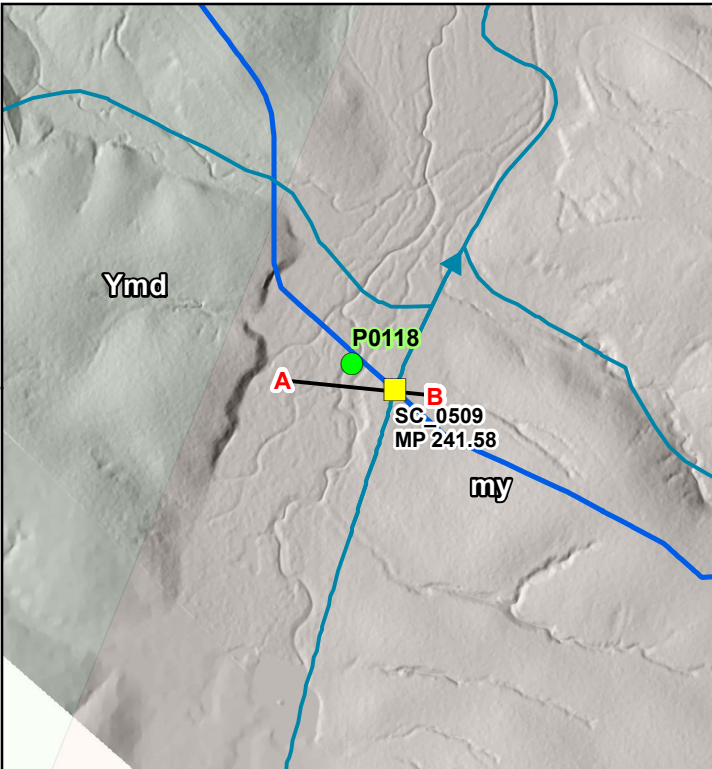
- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAI.

**Dominion**

**Geosyntec**  
consultants

**TESSEMA**





**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: snoc101  
 TID\_SC: SC\_0509  
 Stream Name: Watson Creek

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\_0509

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_0509	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Watson Creek	<b>MP</b>	241.58
<b>Survey Date</b>	26-Sep-2016	<b>Start Time</b>	1230 hrs

- Riffle-pool morphology.
- Broad floodplain at pipeline crossing contains one primary wetted channel with multiple secondary channels (dry at time of survey) within floodplain that show signs of receiving flow during higher stages.
- Main wetted channel bankfull dimensions: BFW = 8.5 feet, BFD = 1 foot.
- Measured stream dimensions does not reflect size of watershed due to presence of multiple channels in valley.
- Stream banks are 2.5 to 3-ft high at top of floodplain.
- Stream bed comprises medium and coarse sand underlain by stiff clay.
- One-foot headcut observed 300 feet downstream of pipeline crossing and active incision of the bed evident in channel.
- Vertical and lateral stability of stream is very poor.
- Vegetation in floodplain comprises young and mature trees and shrubs.
- Observed beaver activity.

**Recommendation:**

Evaluate scour depth for pipeline burial depth. Conduct lateral migration evaluation to set location of sag bends. Field recommendation is to bury from valley wall to valley wall due to multiple channels in floodplain.



## Stream Reconnaissance (Based on Thorne, 1998)

### Section 1 - Site Description

Date:	26-Sep-16	Stream Name:	Watson Creek
Crossing ID:	SC_0509		

### 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 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 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 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 type="checkbox"/> Mild bends
<input checked="" 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 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:** 8.5'

**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 =** 80 %

**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'

**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



GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0509, Watson Creek at MP 241.58 (AP-1)

Photograph 1  
(IMG\_1083)

Date: 26 September 2016

Direction: Downstream

Description: View of main stream showing steep right bank that is densely vegetated with grasses and shrubs. Stream bed comprises medium and coarse sand underlain by stiff clay. Stream does not reflect size of watershed due to presence of multiple channels in valley.



Photograph 2  
(IMG\_1084.JPG)

Date: 26 September 2016

Direction: Upstream

Description: View of breached beaver dam.





GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0509, Watson Creek at MP 241.58 (AP-1)

Photograph 3  
(IMG\_1086)

Date: 26 September 2016

Direction: Downstream

Description: One of the dry secondary channels within the floodplain that was identified.



Photograph 4  
(IMG\_3887.JPG)

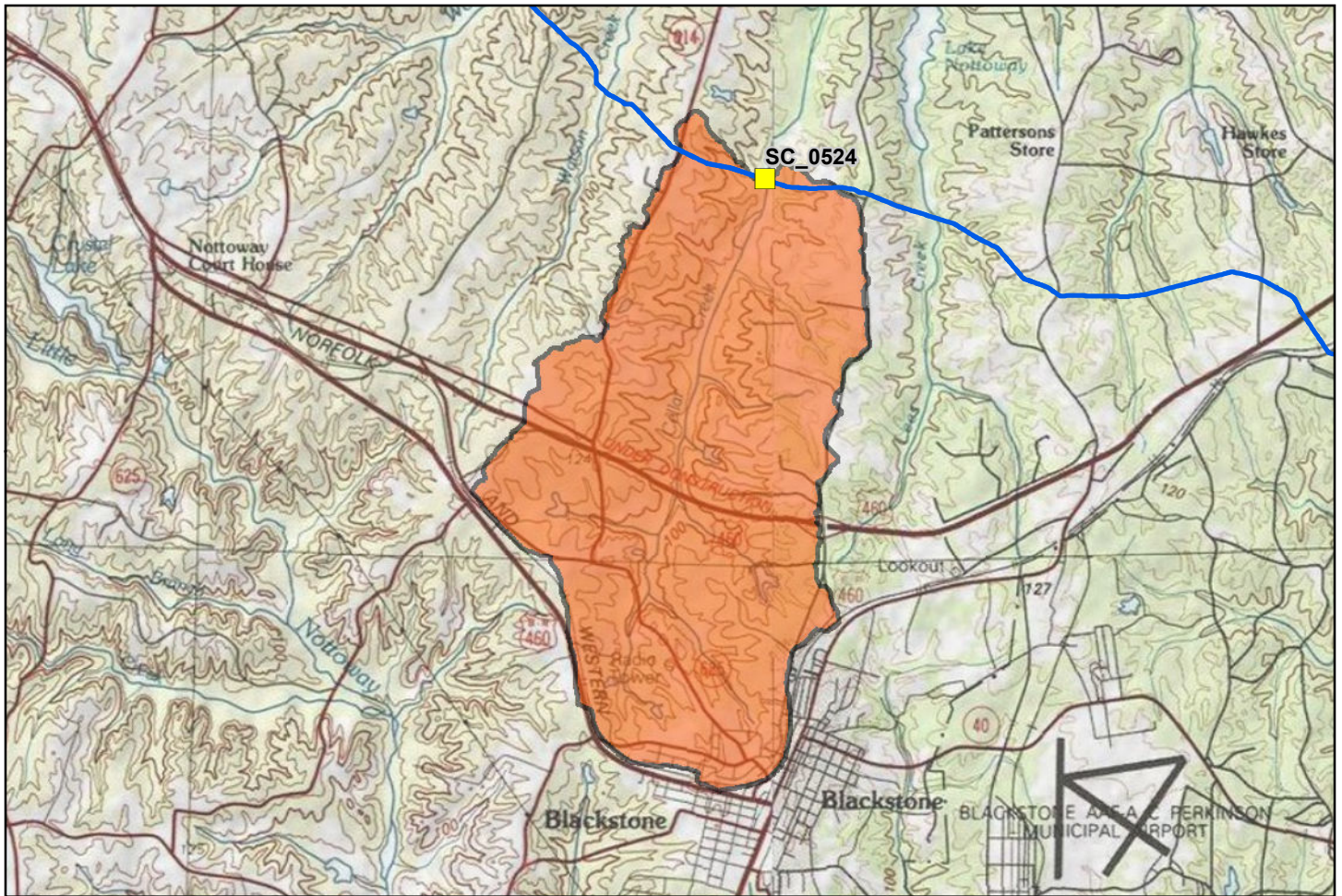
Date: 26 September 2016

Direction: Downstream

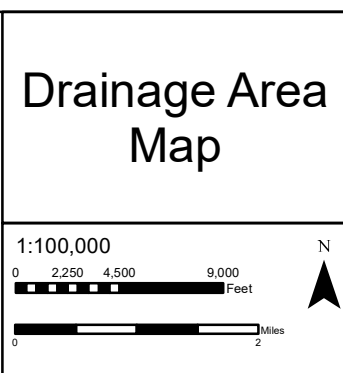
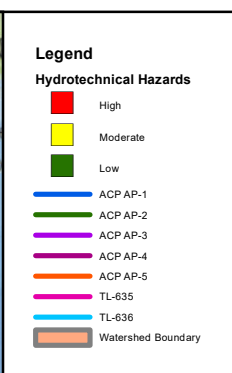
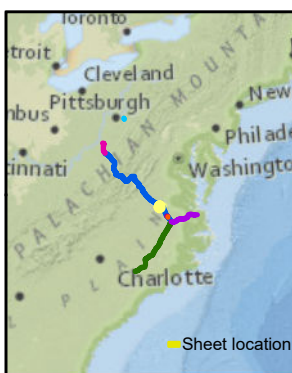
Description: View showing wider floodplain with valley wall in the background. One-foot headcut observed downstream and active incision of the bed evident in channel segment pictured.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0524	snoc003	AP-1	242.91	Virginia	Nottoway
Attribute			Value		
Stream Name			Cellar Creek		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			8.031		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			23		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.250		
Proposed Construction Method <sup>5</sup>			Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0524

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:**

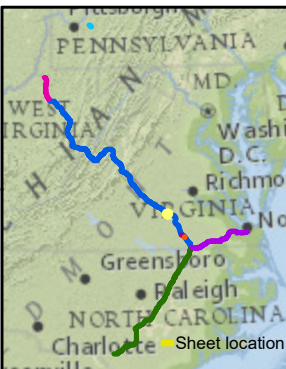
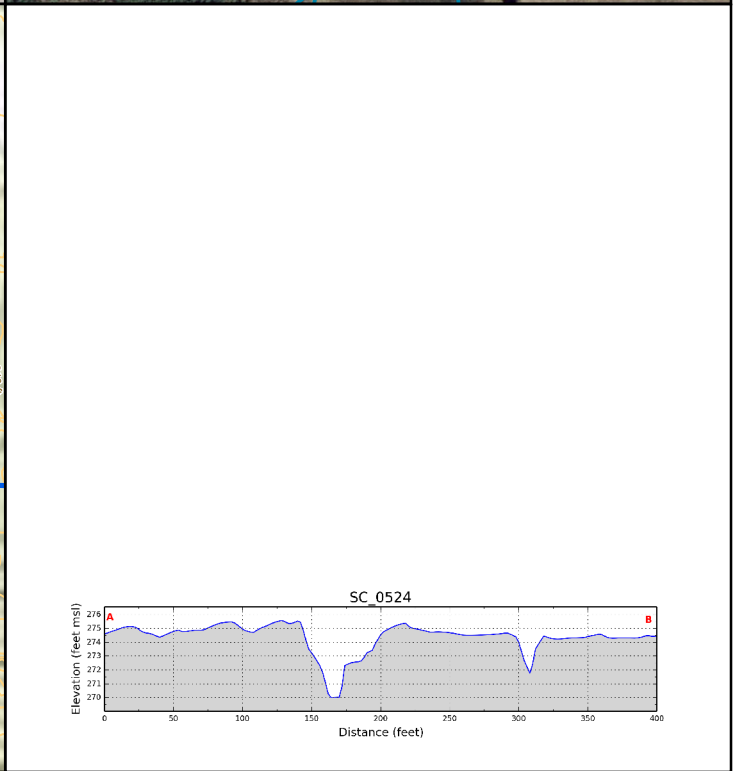
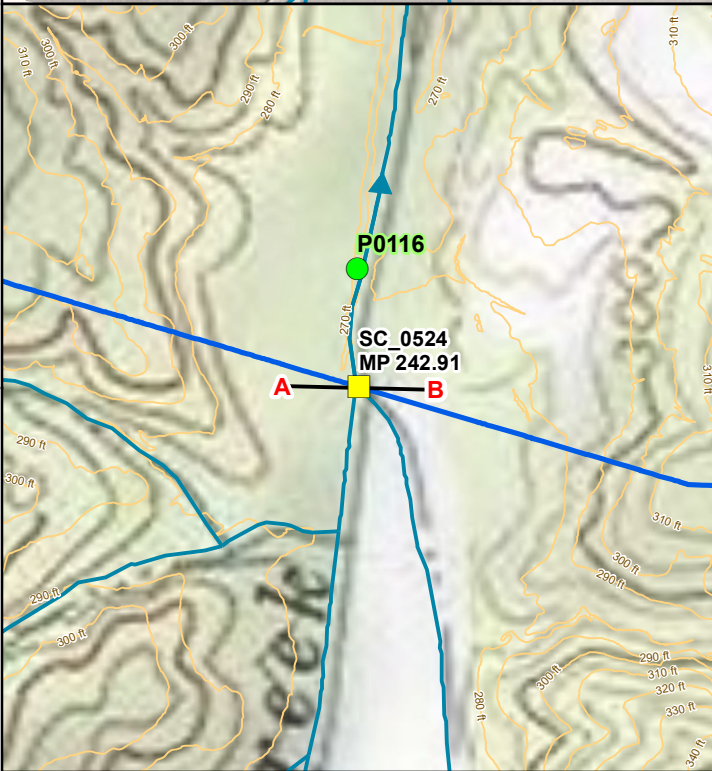
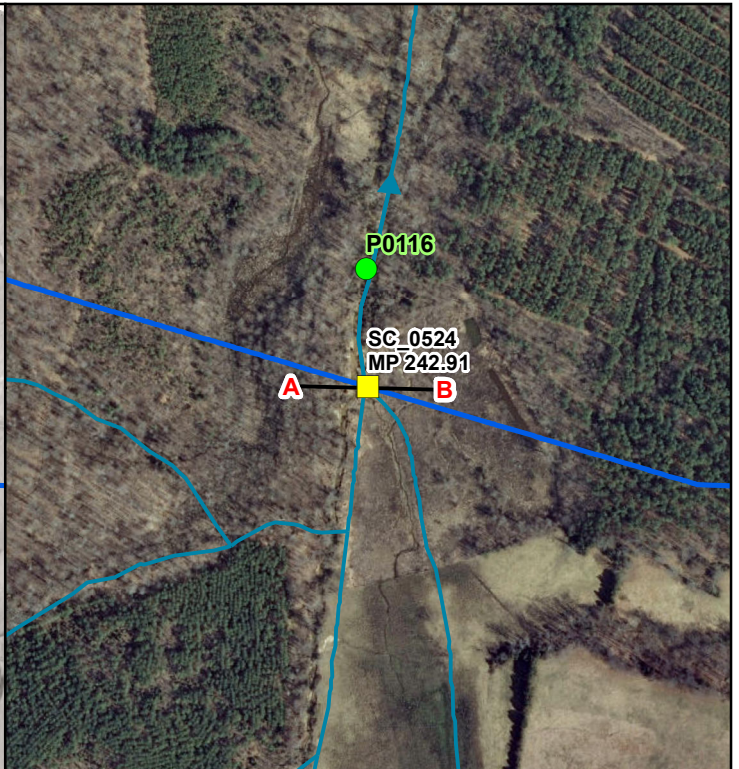
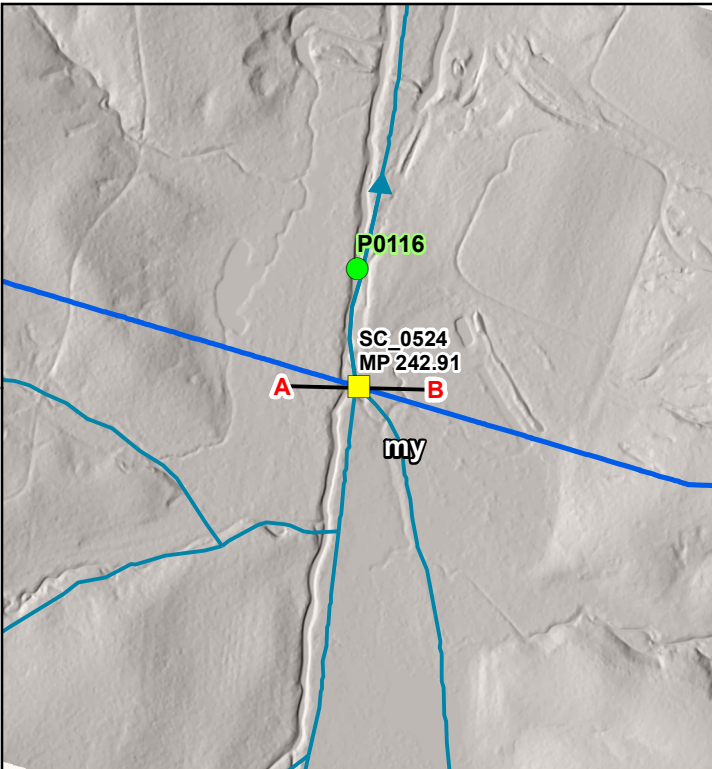
- 1) After Fenneman (1946)
- 2) Calculated using USGS 1:24,000 topographic maps and ArcGIS interface.
- 3) Measured during stream reconnaissance.
- 4) Calculated using one of four methods described in Section 3.2.3.1.
- 5) The current alignment centerline and mileposts provided by DominionGAL.

**Dominion**

**Geosyntec**  
consultants

**TESSEMAATIONS**





**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: snoc003  
TID\_SC: SC\_0524  
Stream Name: Cellar Creek

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\_0524

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_0524	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Cellar Creek	<b>MP</b>	242.91
<b>Survey Date</b>	26-Sep-2016	<b>Start Time</b>	1055 hrs

- Stream was surveyed at a riffle approximately 300-ft downstream of pipeline crossing due to difficulty accessing actual crossing location.
- Riffle-pool morphology.
- BFW = 23 feet, BFD (maximum) = 1.8 feet
- Terrace height (both banks) = 3.1 feet.
- Stream is entrenched within near vertical banks that are comprised of sand, silt, and clay.
- Stream has been historically straightened and has developed mild low-flow sinuosity within entrenched banks.
- Stream meanders more farther downstream from pipeline crossing and is expected to continue up into survey reach.
- Stream bed comprised of coarse sand and fine gravel.
- Well established riparian buffers on both banks.
- Pool depth at felled tree in the middle of the stream is 1.2 feet below water surface.
- Beaver activity was observed.

**Recommendation:**

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

# Stream Reconnaissance (Based on Thorne, 1998)

## Section 1 - Site Description

Date:	26-Sep-16	Stream Name:	Cellar Creek
Crossing ID:	SC_0524		

## Section 2 - Region and Valley Description

### Part 1: Watershed

**Land Use**

<input checked="" 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"/> Cattle grazing

### Part 2: River Valley Conditions

**Vegetation**

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

#### Land Use

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

#### Levee Location

<input checked="" 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

ALTERNATION LATERAL BARS

## 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:** 23'

**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 LATERAL
- 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 1/3 TO 1/2
- Wide

**Percent sand in bed =** 80-90 %

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

**Bank Characteristic**

**Bank Material**

**Left Bank**

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

**Right Bank**

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

**Layer Material**

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

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

**Bank Height**

3.1'

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

GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0524, Cellar Creek at MP 242.91 (AP-1)

Photograph 1  
(IMG\_1073.JPG)

Date: 26 September 2016

Direction: Downstream

Description: View of Cellar Creek approximately 300 ft downstream of crossing showing 3.1-ft high steep banks and lateral bar comprising coarse sand and fine gravel.



Photograph 2  
(IMG\_1074.jpg)

Date: 26 September 2016

Direction: Upstream

Description: Large woody debris (tree) in the stream where we measured a pool depth of 1.2 ft (below base flow water surface) on the sandy bottom of the stream.





GEOSYNTEC CONSULTANTS  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0524, Cellar Creek at MP 242.91 (AP-1)

Photograph 3  
(IMG\_1076.JPG)

Date: 26 September 2016

Direction: Downstream

Description: View of 3-ft high left bank that is comprised of clayey sand. Banks are densely vegetated by young trees.



Photograph 4  
(IMG\_3883.JPG)

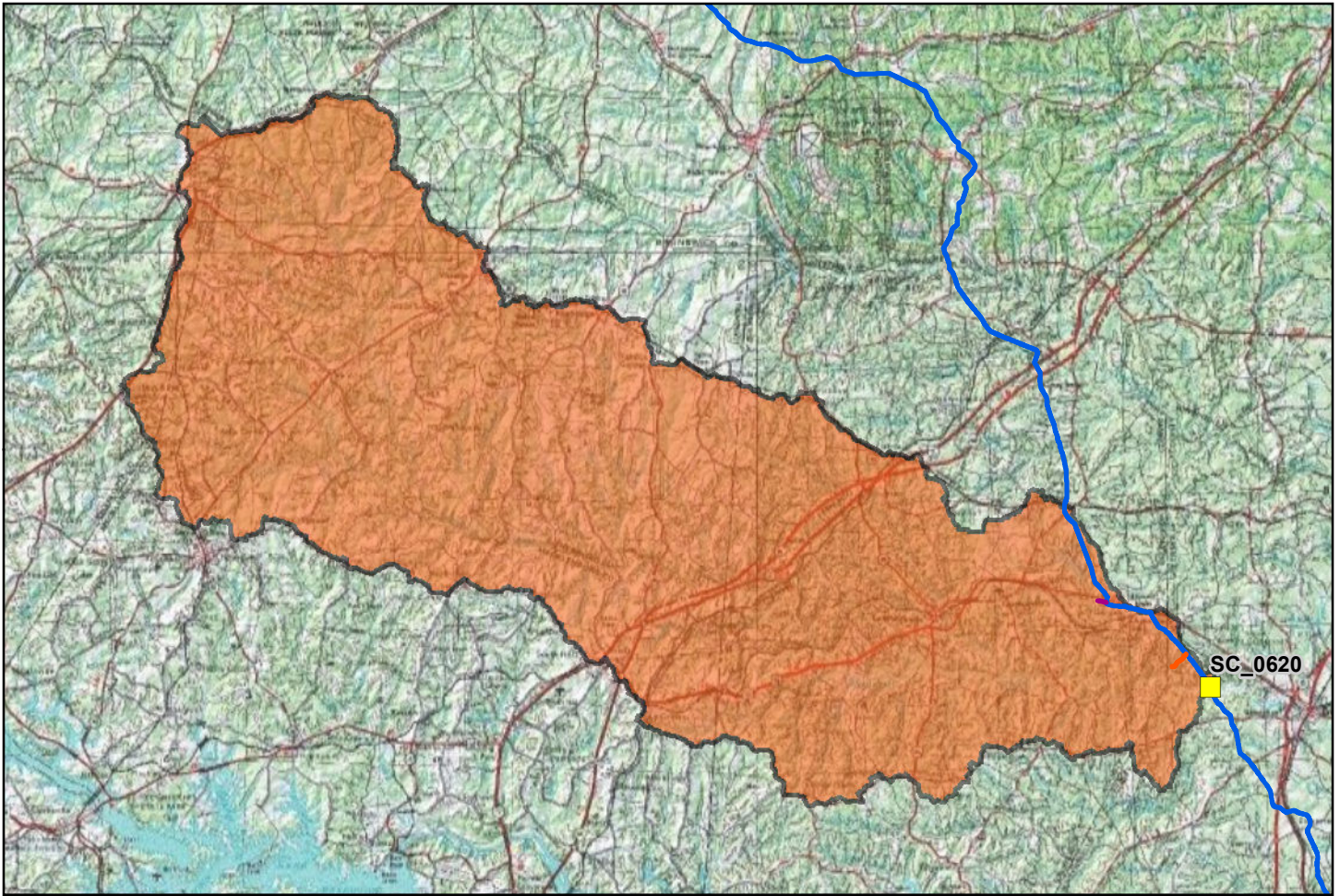
Date: 26 September 2016

Direction: Upstream

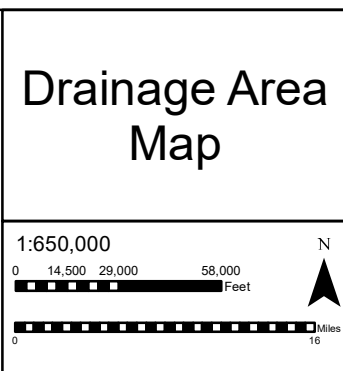
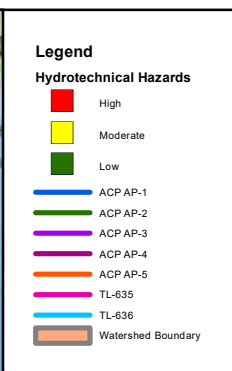
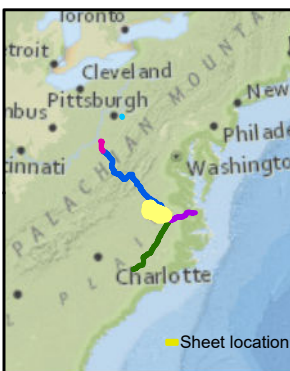
Description: View of entrenched, straight stream (evidence of historic channel modification). Channel begins to meander more further downstream which is anticipated to progress upstream.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0620	sgra007	AP-1	286.35	Virginia	Greensville
Attribute			Value		
Stream Name			Meherrin River		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			736.858		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			Not wadeable		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.017		
Proposed Construction Method <sup>5</sup>			Cofferdam		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0620

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

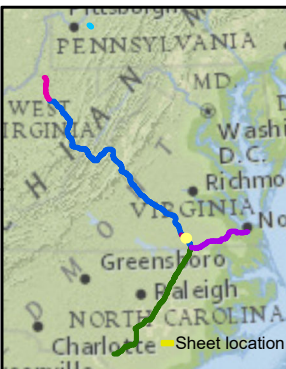
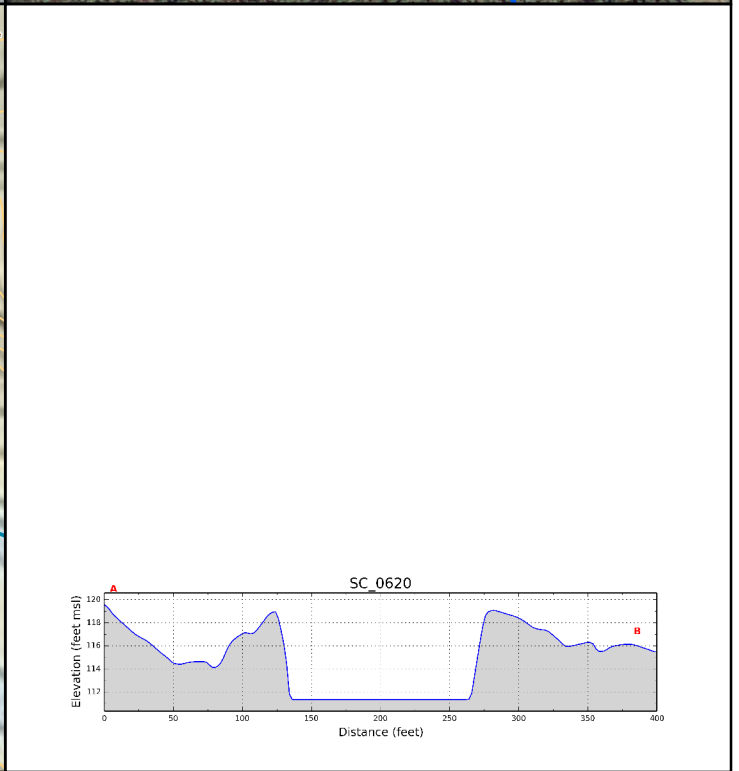
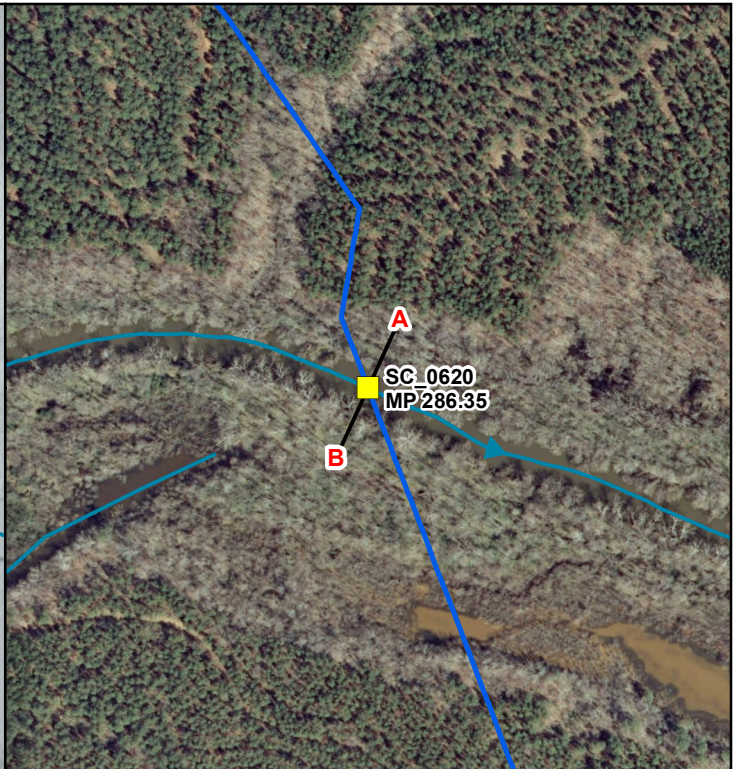
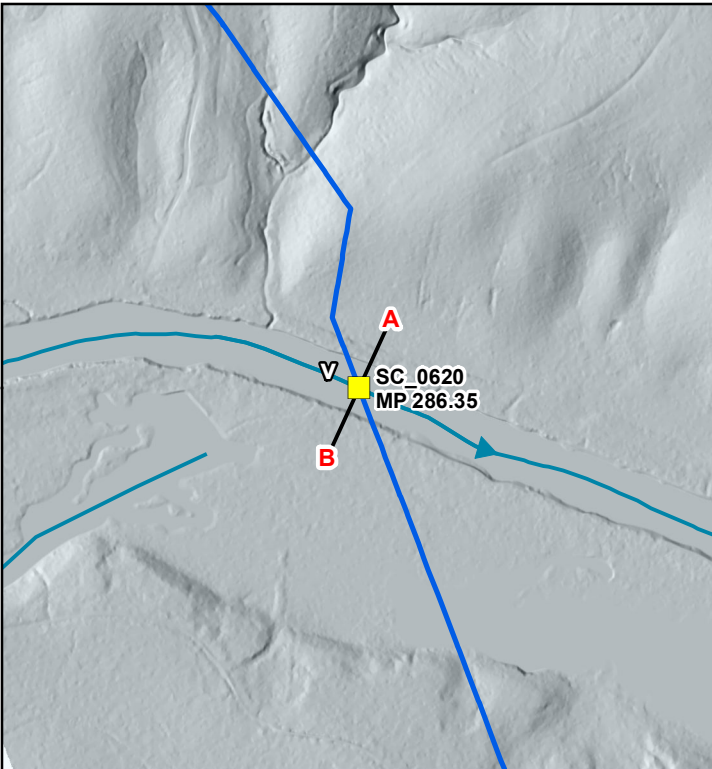
**Notes:**

- 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 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: sgra007  
TID\_SC: SC\_0620  
Stream Name: Meherrin 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\_0620

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_0620	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Meherrin River	<b>MP</b>	286.35
<b>Survey Date</b>	15-May-2016	<b>Start Time</b>	1430 hrs

- River has a low-gradient, dune-ripple morphology, but river is fairly straight in vicinity of crossing.
- Channel bed unable to be surveyed due to turbid water and depth.
- Presence of minor debris and small wood on left bank.
- Floodplain and river confined along left bank by valley wall.
- Mature deciduous riparian buffer along right bank throughout floodplain and riparian buffer is less than one channel width along left bank.
  - Previous oxbow cutoffs present in right bank floodplain.
- River banks comprised of silty clay with some sand.
- Steep banks with top of bank (terrace) height of approximately 7 feet.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Evaluate scour depth for pipeline burial depth. Sag bend placement to be determined in phase 3.



# 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:** Not wadeable

**M-B Classification**

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

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

Bed unable to be surveyed due to turbid water

**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 = ~ 60 %

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

**Bank Characteristic**

**Bank Material**

**Left Bank**

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

**Right Bank**

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

**Layer Material**

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

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

**Bank Height**

~7'

~7'

**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\_0620, Meherrin River at MP 286.35 (AP-1)

Photograph 1

Date: 15 May 2016

Direction: looking across stream, flow to the left

Description: Stream was surveyed from the left bank where the riparian buffer extends less than one river channel width and comprises young and mature trees.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0620, Meherrin River at MP 286.35 (AP-1)

Photograph 2

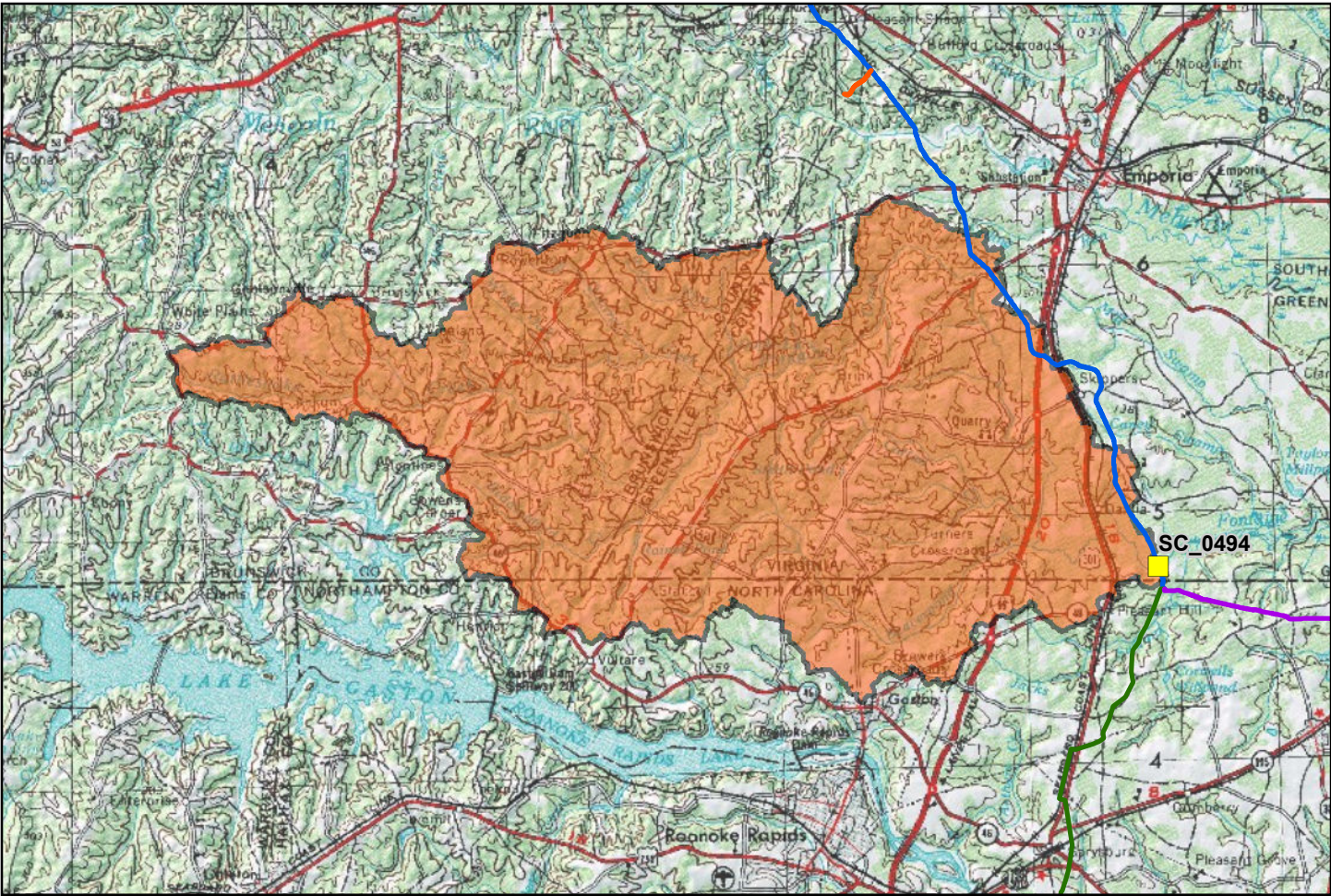
Date: 15 May 2016

Direction: looking across stream, flow to the left

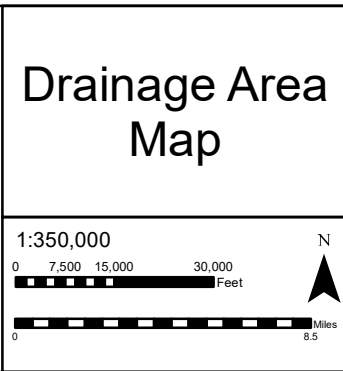
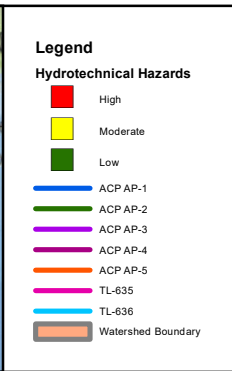
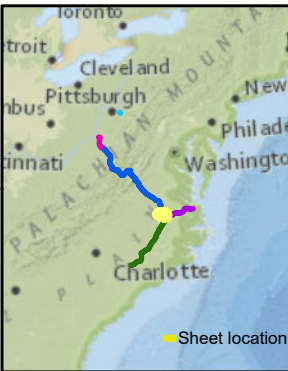
Description: Felled and falling trees were observed on both banks. The left bank comprises brown silt to lean clay with few sand.







TID	Unique ID	ACP Branch	Mile Post	State	County
SC_0494	sgro001	AP-1	299.62	Virginia	Greensville
Attribute			Value		
Stream Name			Fontaine Creek		
Physiographic Province <sup>1</sup>			Piedmont		
Drainage Area (square miles) <sup>2</sup>			168.516		
Flow Regime			Perennial		
Measured Bank Full Width (ft) <sup>3</sup>			Not wadeable		
Slope At Crossing Over 200ft Long Reach (%) <sup>4</sup>			0.013		
Proposed Construction Method <sup>5</sup>			1) Dam and Pump 2) Flume		



**Document Information:**

Document No:  
DOM\_EC\_HYD\_MA\_SER001\_SC\_0494

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

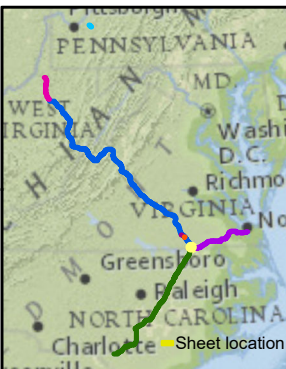
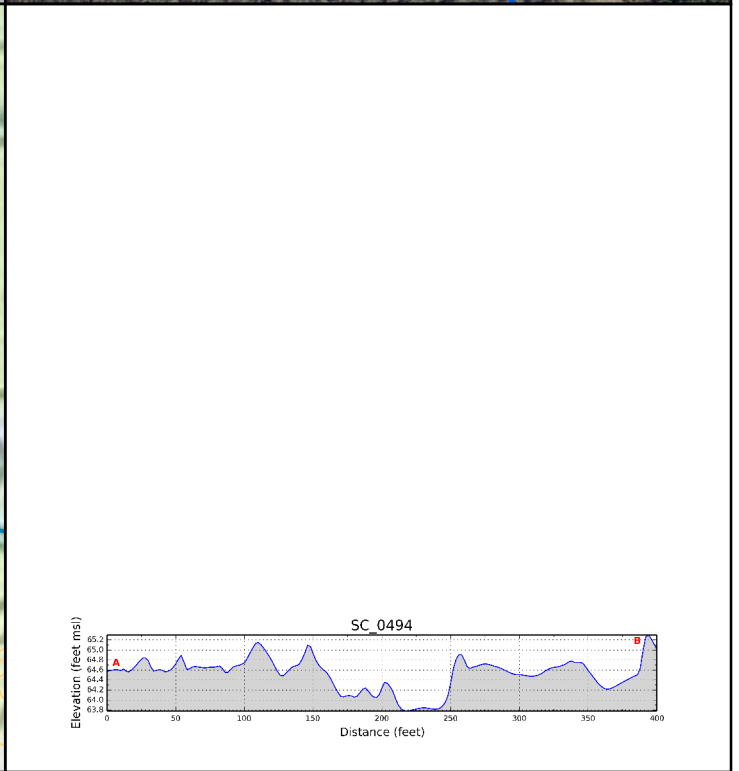
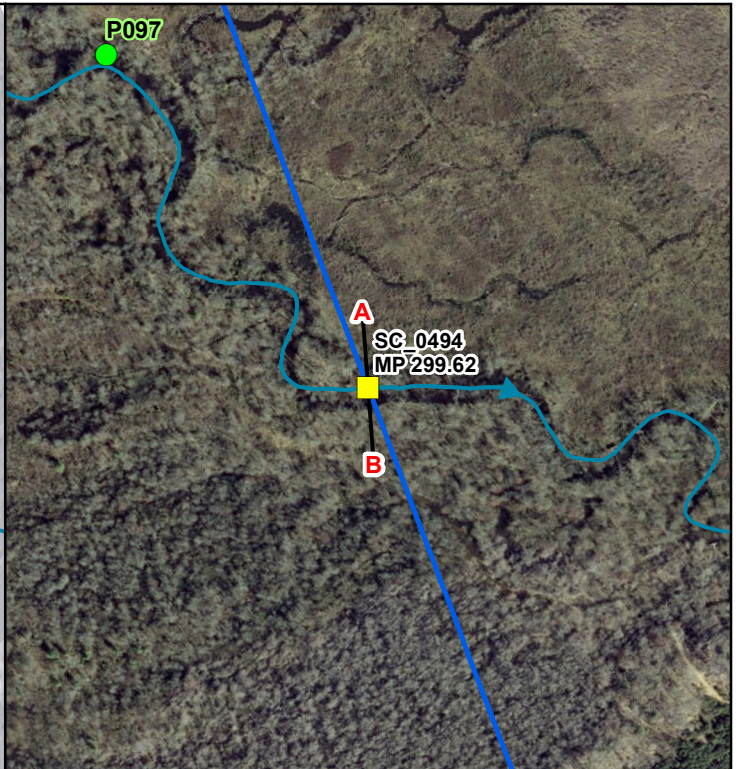
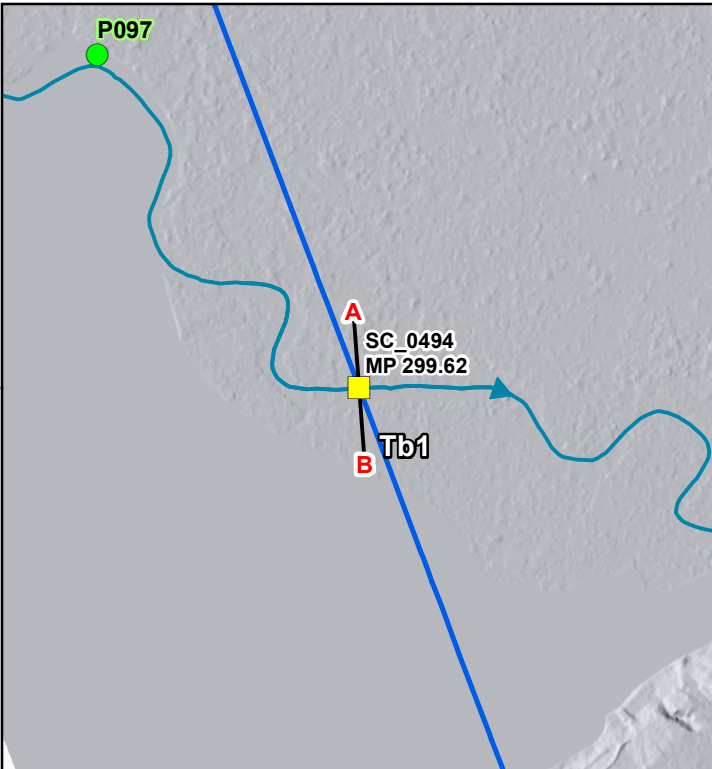
**Notes:**

- 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

TESSEMAATIONS





**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: sgro001  
 TID\_SC: SC\_0494  
 Stream Name: Fontaine Creek

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\_0494

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_0494	<b>ACP Segment</b>	AP-1
<b>Stream Name</b>	Fontaine Creek	<b>MP</b>	299.62
<b>Survey Date</b>	15-May-2016	<b>Start Time</b>	1700 hrs

- Wide wetland floodplain with well-established mature and dense deciduous riparian buffer.
- Humic acid/tannin colored water
- Multiple floodplain channels entering creek in vicinity of crossing.
- Presence of stagnant water and very slow flow within floodplain
- Bankfull channel width was approximately 30 to 40 feet.
- Pool depths of approximately 3.5 feet at meander bend.
- Many trees around bank slanted towards channel indicating slow fluvial undercutting erosion.
- Riparian buffer is mature helping to prevent migration.
- Additional information on stream crossing is available on stream reconnaissance form.

**Recommendation:**

Evaluate scour depth for pipeline burial depth. Sag bend placement to be determined in phase 3.

Replacement of wetland vegetation at channel bank with wetland sod mats is recommended to maintain stable crossing of stream as well as the wetland post-construction.

# 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:** Not wadeable

**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 = ~50 %

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

**Bank Characteristic**

**Bank Material**

**Left Bank**

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

**Right Bank**

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

**Layer Material**

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

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

**Bank Height**

1-2'

Not Measured

**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\_0494, Fontaine Creek at MP 299.62 (AP-1)

Photograph 1

Date: 15 May 2016

Direction: looking  
downstream

Description: well established and thick riparian buffer across entire floodplain. Multiple channels and areas of slow velocity. Riparian root mats are very well established and helping to maintain lateral confinement.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record



**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

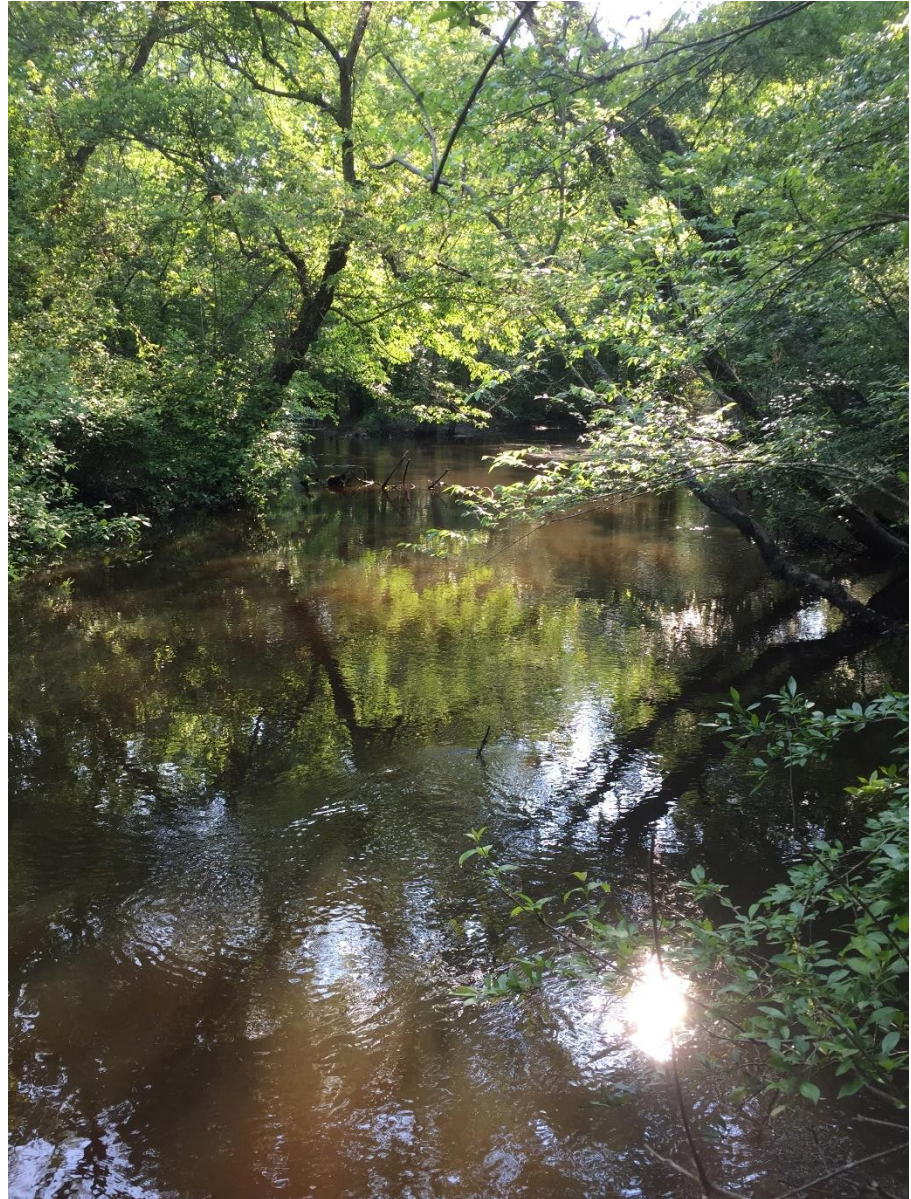
**Subject Site:** SC\_0494, Fontaine Creek at MP 299.62 (AP-1)

Photograph 2

Date: 15 May 2016

Direction: looking upstream

Description: direction of falling trees towards channel from both banks indicating slow fluvial erosion.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record

Geosyntec  
consultants

**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

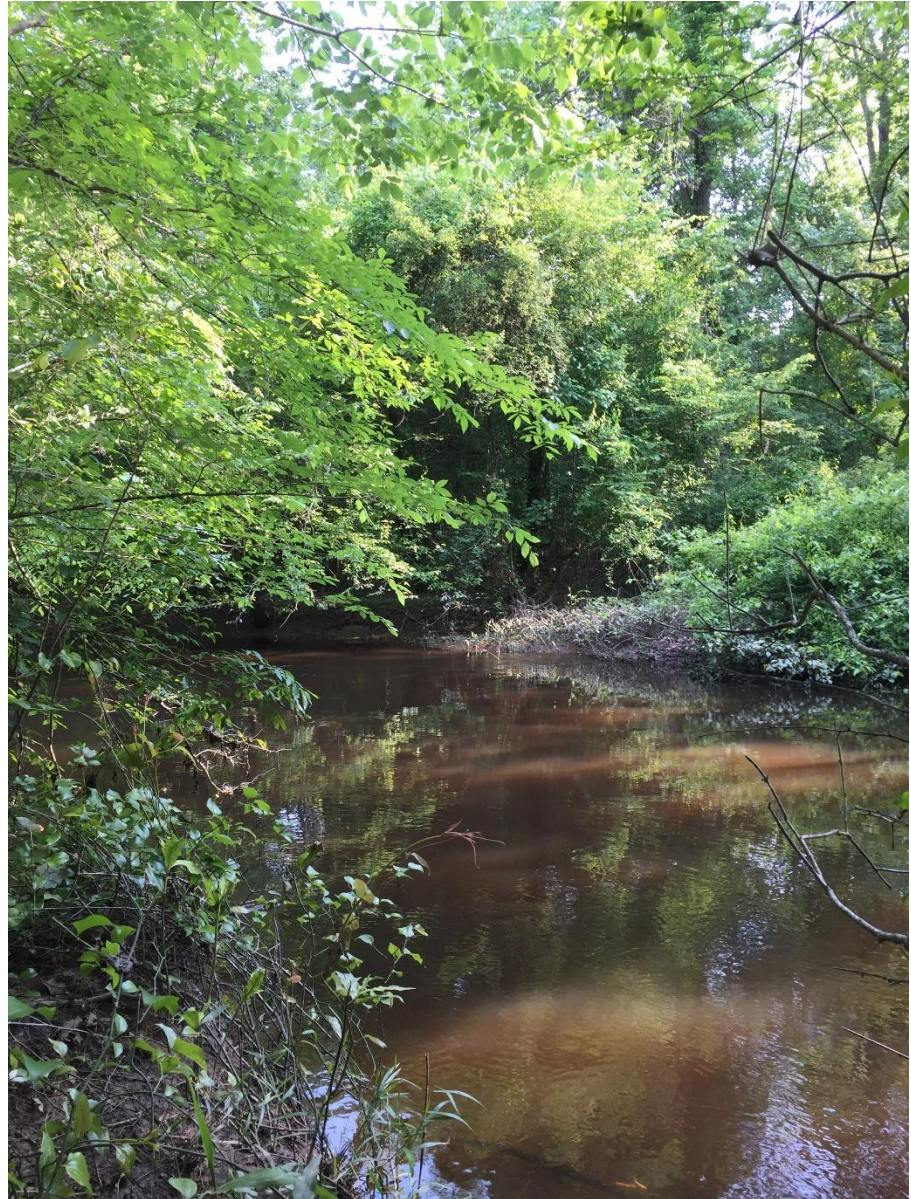
**Subject Site:** SC\_0494, Fontaine Creek at MP 299.62 (AP-1)

Photograph 3

Date: 15 May 2016

Direction: looking across  
stream, flow to the left

Description: Low bank  
height in silty/clayey  
soils.





PHASE 2 - RAPID STREAM RECONNAISSANCE  
Photographic Record

Geosyntec  
consultants

**Client:** Atlantic Coast Pipeline

**Project Number:** TXG0007

**Subject Site:** SC\_0494, Fontaine Creek at MP 299.62 (AP-1)

Photograph 4

Date: 15 May 2016

Direction: across  
floodplain wetlands

Description: beaver  
activity, areas of slow  
velocity/inundation and  
wetlands in vicinity of  
SC\_0494.

