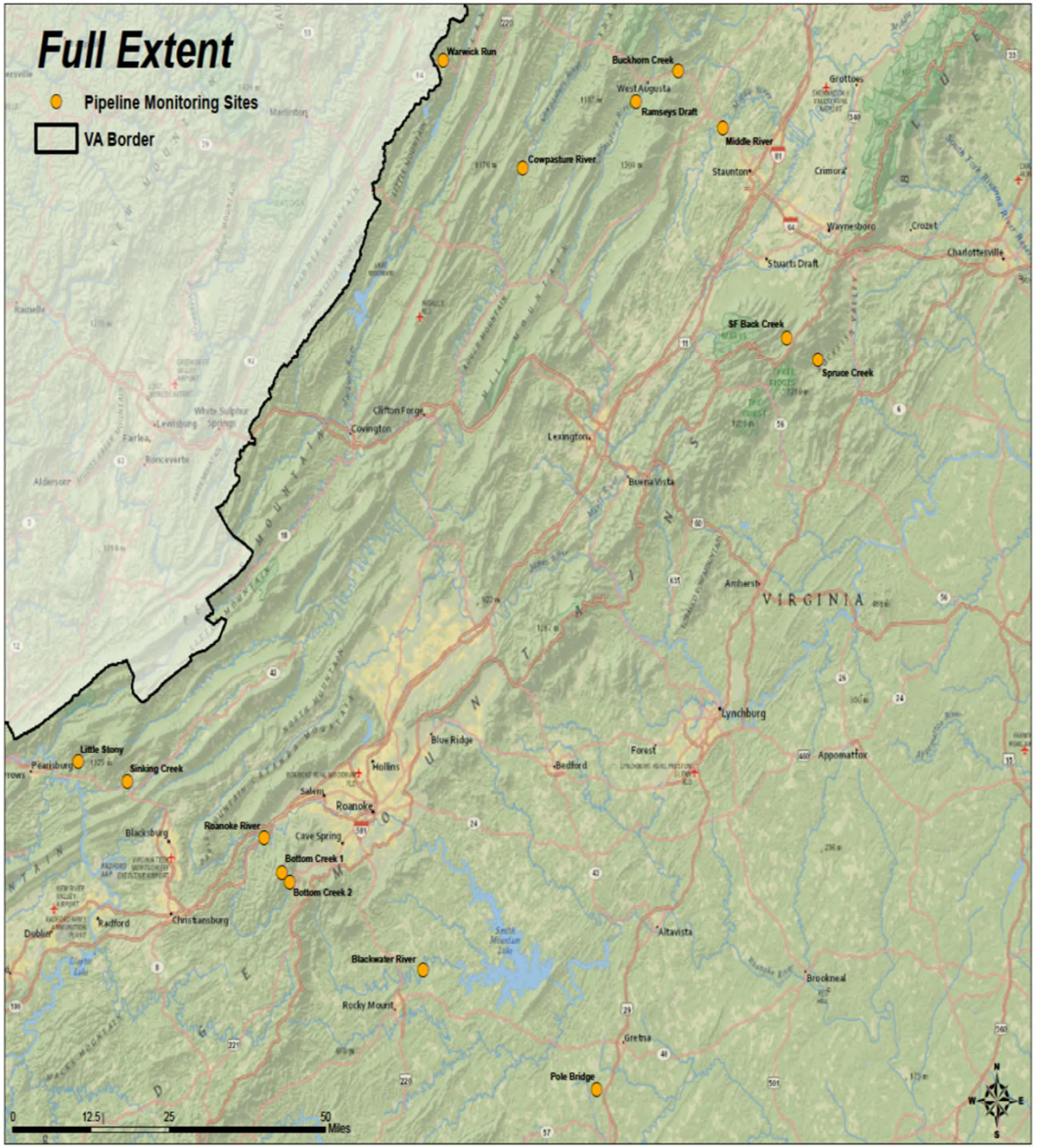

Water Quality Monitoring of the Construction of Natural Gas Pipelines in Virginia

Jason R. Hill, Emma V. Jones, Drew Garey, Sandra Mueller, Tara Wyrick

VCU

USGS
science for a changing world

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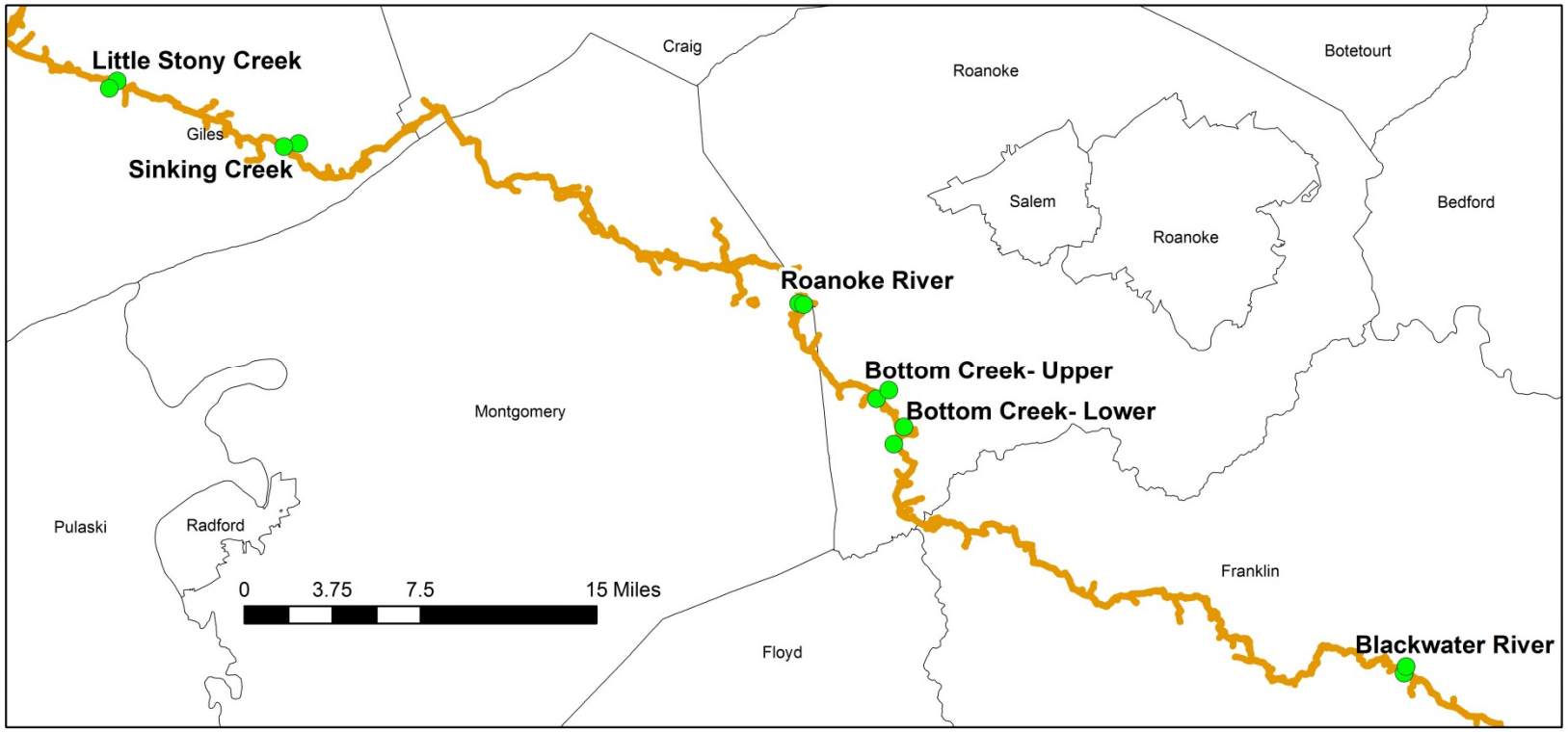
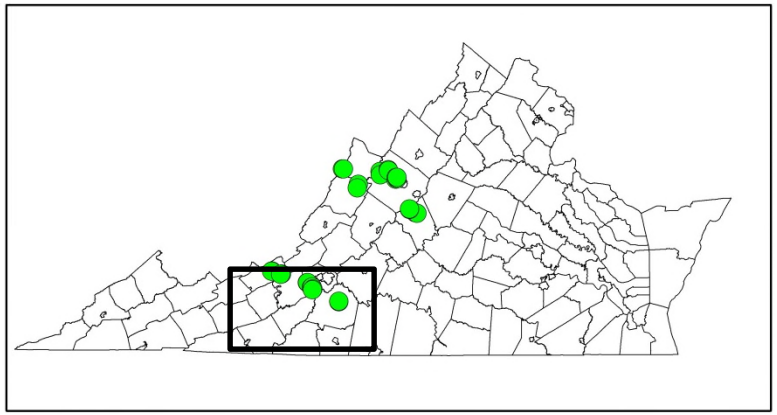
MVP Monitoring Sites





MVP Footprint

CONMON Sites

N

DEQ Pipeline Monitoring Plan: https://www.deq.virginia.gov/Pipelines/WaterMonitoringPlanforPipelines.aspx

VDEQ, VCU, USGS Monitoring Partnership

VDEQ

- **Genus Level Macroinvertebrates (200 count)**
- **Rapid Bioassessment Protocol Habitat (qualitative)**
- **Relative Bed Stability (quantitative)**

USGS

- **Continuous Monitoring (YSI)**
- **DO, pH, Specific Conductivity, Temperature, Turbidity (every 5 min)**
- **https://waterdata.usgs.gov/va/nwis/rt**

VCU

- **Fish Community Data**
- **NRSA methods 40 x channel width (150 m min and 800 m max)**
- **Wild trout streams – Three pass depletion (density estimate)**

Monitoring Objectives

1. Immediate: Initial detection of construction effects.
   - Continuous water quality monitoring.
   - Automated data analysis.
     - Documentation of key water quality events.
     - Turbidity monitoring system.
2. Long-term Weight-of-evidence approach to evaluating effects.
   - Months-long record of continuous water quality data: potential <u>causes</u> of degradation.
   - Fish, macroinvertebrates, quantitative physical habitat: <u>consequences</u> of degradation.
   - Are initial effects likely to be "permanent" or are they transient?
   - Selected Site(s) with High Ecological Value

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USGS
Roanoke River

Bottom Creek

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Notification Parameters For Turbidity

1) Difference between stations at low-turbidity sites. For streams with median background turbidity <= 40 ntu, a notification will be triggered if the downstream station turbidity is equal or greater than 6 ntu higher than the upstream turbidity for at least 30 minutes within the download window.
2) Difference between stations at high-turbidity sites. For streams with median background turbidity > 40 ntu, a notification will be triggered if the downstream station turbidity is equal or greater than 15% higher than the upstream turbidity for at least 30 minutes within the download window.
3) Based on absolute values. A notification will be triggered if turbidity exceeds a benchmark value set between the 90th and 99th percentile of background turbidity values collected at that station for at least 30 minutes within the download window. Site specific values for this trigger are currently being developed. This notification may be triggered at either the upstream or downstream station, regardless of the turbidity of the other station on that water body.

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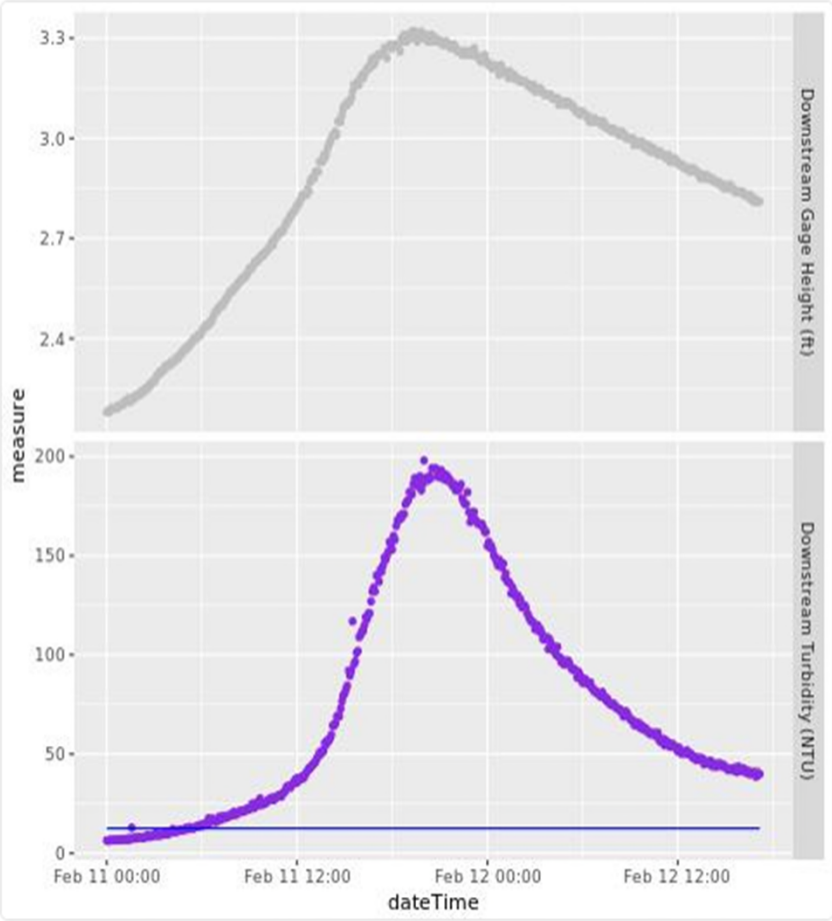
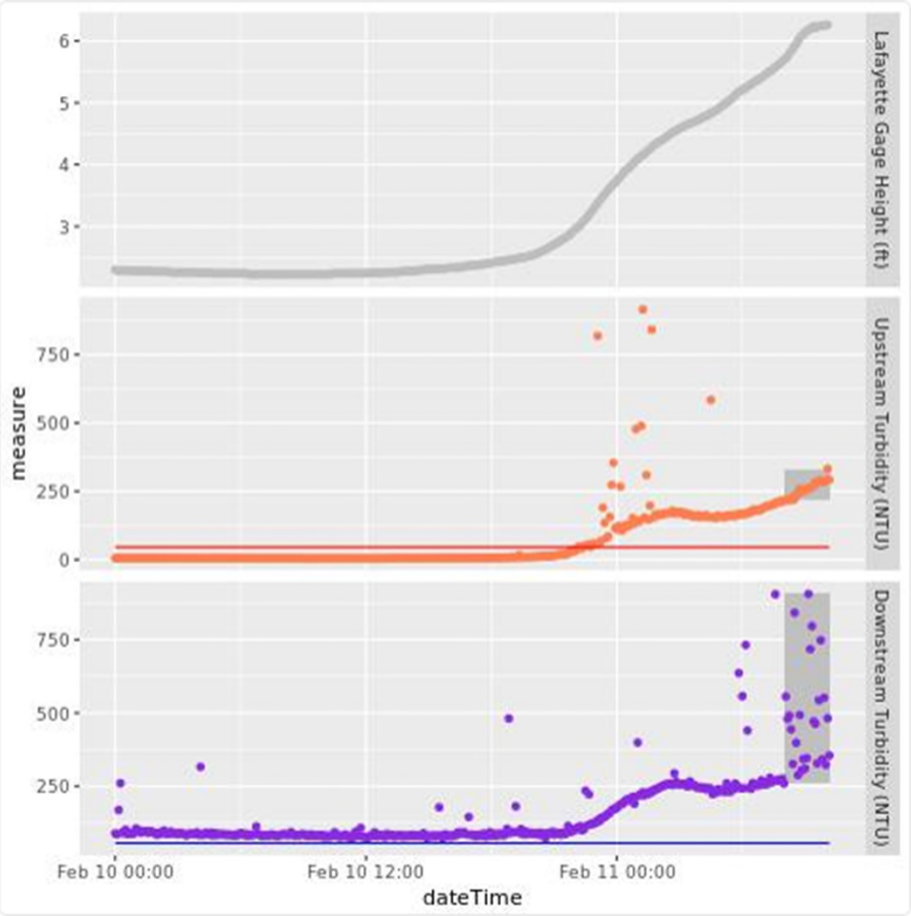
Turbidity monitoring system



Notification: Absolute 99th percentile

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Turbidity monitoring system



Notification: Upstream vs downstream 40% increase

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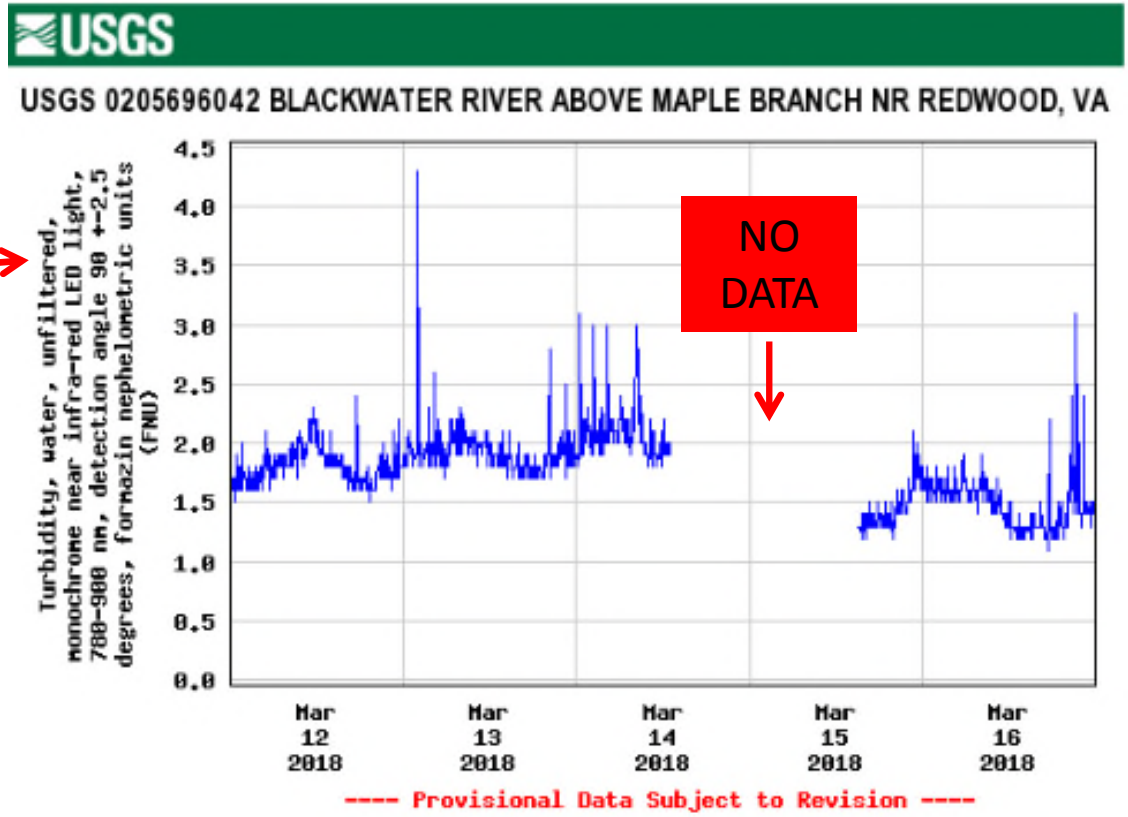
Turbidity monitoring system

TurbidityMS @TurbidityM... · 55m
Blackwater River
upstreamNoTurbidityData
waterdata.usgs.gov/va/nwis/uv?per...
UID: 1521133994.3791

TurbidityMS @TurbidityMo... · 1h
Blackwater River
upstreamNoTurbidityData
waterdata.usgs.gov/va/nwis/uv?per...
UID: 1521130394.1224

TurbidityMS @TurbidityMo... · 2h
Blackwater River
upstreamNoTurbidityData
waterdata.usgs.gov/va/nwis/uv?per...
UID: 1521126794.3747



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Elevated Turbidity Events

- Events that made it through computer and human filter

- Sinking Creek (Giles Co., MVP)- 1 event
  April 11, 2018

- Bottom Creek (Roanoke Co., MVP) - 1 event
  May 25-27, 2018

- Blackwater River (Franklin Co., MVP)- 3 events
  June 13-15, June 26-27, and Aug. 3, 2018

Immediately following each event, DEQ inspectors conducted site visits to determine if construction was the cause.

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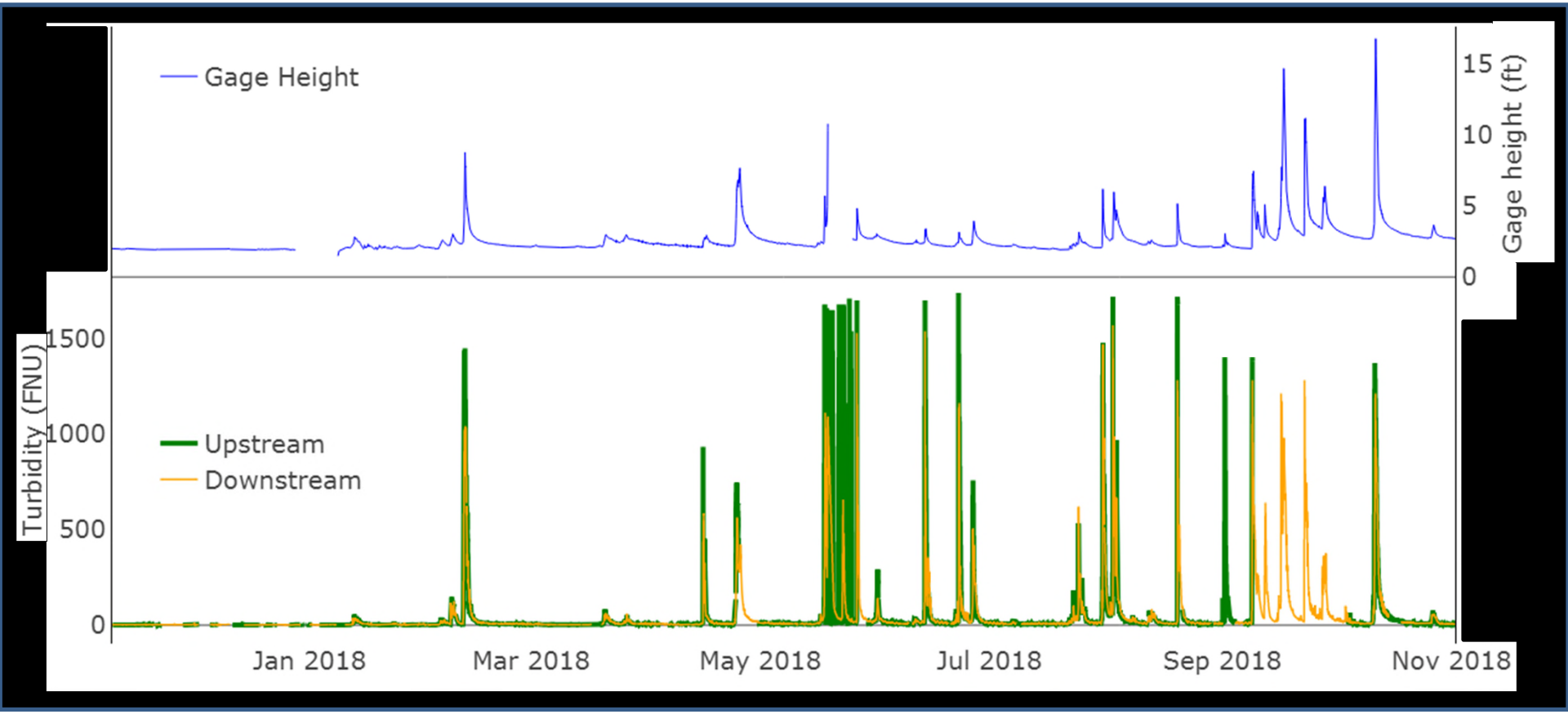
Blackwater River



Data Links- Upstream Site: https://waterdata.usgs.gov/va/nwis/uv?site_no=0205696042
Downstream Site: https://waterdata.usgs.gov/va/nwis/uv/?site_no=0205696095

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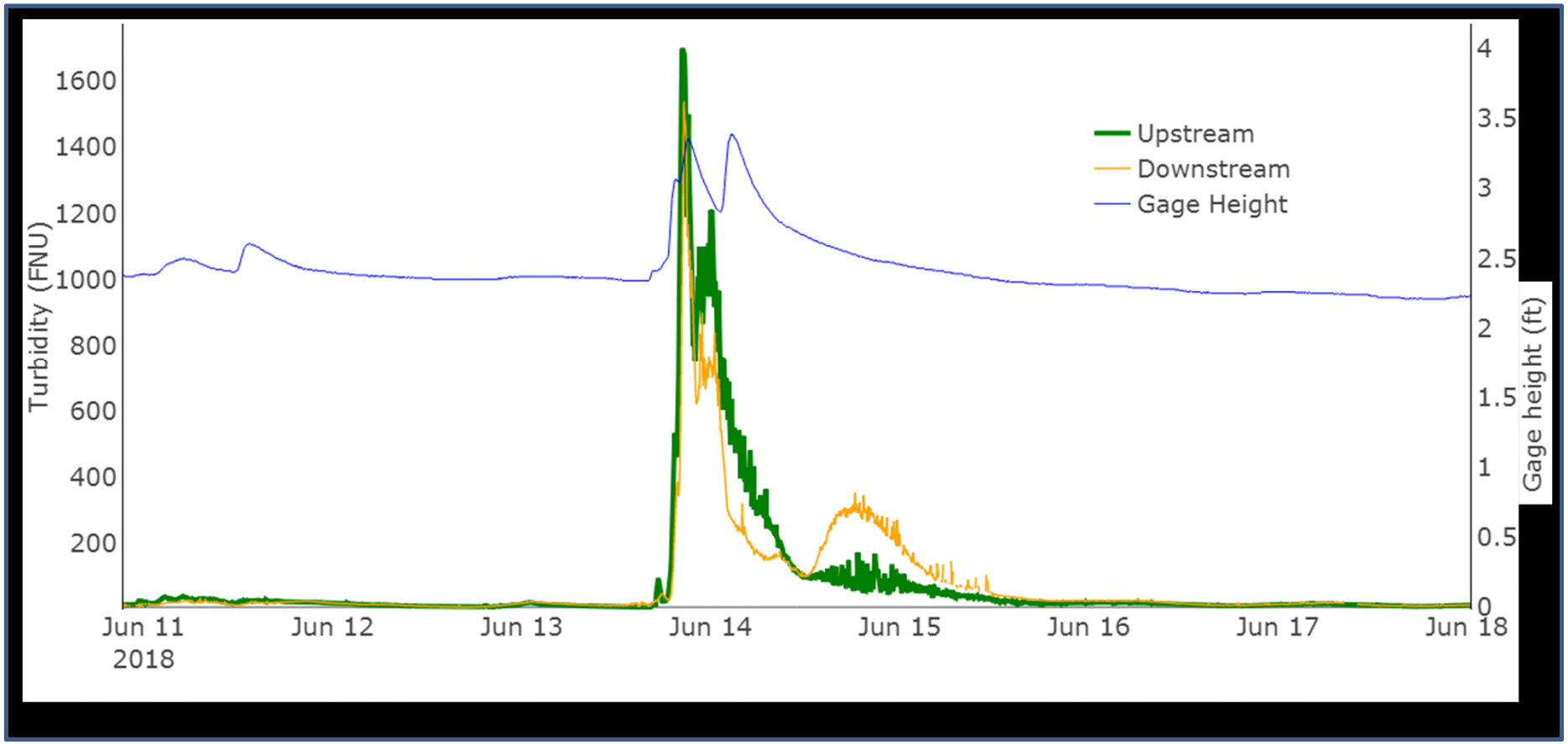
Blackwater River: June 13-15, 2018



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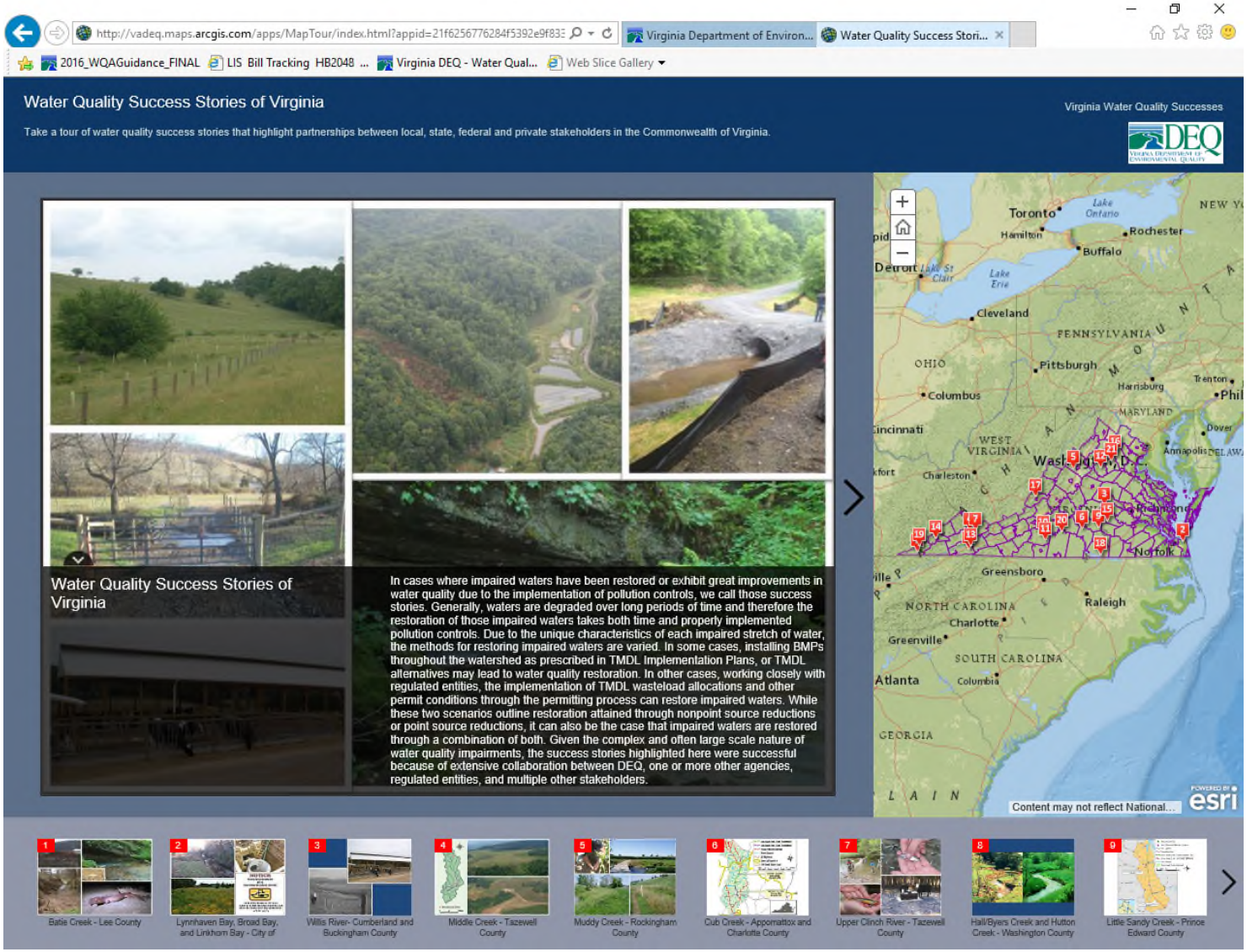
Fact Sheets and Story Boards – Pre-Construction



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Fact Sheets and Story Boards – Pre-Construction

Bottom Creek Data – 4ABTM010.26

Table 1. Temperature (Celsius) Data (n=>50,000)

Temp	4ABTM010.26
Min	0.0
25th	0.1
50th	3.8
75th	6.6
Max	14.7
Average	4.1

Table 2. Dissolved Oxygen (mg/L) Data (n=>50,000)

DO	4ABTM010.26
Min	9.2
25th	11.0
50th	11.6
75th	12.4
Max	14.0
Average	11.6

Table 3. pH Data (n=>50,000)

pH	4ABTM010.26
Min	6.8
25th	7.3
50th	7.4
75th	7.5
Max	7.8
Average	7.4

Table 4. Turbidity (NTU) Data (n=>50,000)

Turbidity	4ABTM010.26
Min	0.0
25th	0.0
50th	0.0
75th	0.0
Max	49.0
Average	0.5

Bottom Creek Data – 4ABTM009.25

Table 1. Temperature (Celsius) Data (n=>50,000)

Temp	4ABTM009.25
Min	0.0
25th	1.4
50th	4.3
75th	6.9
Max	14.9
Average	4.6

Table 2. Dissolved Oxygen (mg/L) Data (n=>50,000)

DO	4ABTM009.25
Min	8.6
25th	10.7
50th	11.4
75th	12.1
Max	13.1
Average	11.3

Table 3. pH Data (n=>50,000)

pH	4ABTM009.25
Min	6.1
25th	7.1
50th	7.2
75th	7.2
Max	7.4
Average	7.2

Table 4. Turbidity (NTU) Data (n=>50,000)

Turbidity	4ABTM009.25
Min	0.0
25th	0.3
50th	0.7
75th	1.5
Max	256.0
Average	2.4

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Fact Sheets and Story Boards – Pre-Construction

Table 5. Fish Community Data

Species	Count
Fantail Darter	36
Mountain Redbelly Dace	100
Rosyside Dace	228
Creek Chub	15
Eastern Blacknose Dace	33
Bluehead Chub	23
Crescent Shiner	2

Table 6. Macroinvertebrate Community Data

StationID	Date	VSCI
4ABTM010.26	10/30/2017	83.66

Table 7. Rapid Bioassessment Habitat Data

StationID	Date	Total Habitat
4ABTM010.26	10/30/2017	178

Table 8. Relative Bed Stability Data

StationID	Date	%Sand+Fines	LRBS
4ABTM010.26	10/30/2017	23.81	-0.64

Table 5. Fish Community Data

StationID	Date
4ABTM009.25	10/30/2017
Species	**Count**
Brook Trout	1
White Sucker	2
Rosyside Dace	64
Eastern Blacknose Dace	12
Bluehead Chub	33
Creek Chub	7
Crescent Shiner	14
Mountain Redbelly Dace	67
Fantail Darter	25
Central Stoneroller	1

Table 6. Macroinvertebrate Community Data

StationID	Date	VSCI
4ABTM009.25	10/30/2017	81.45

Table 7. Rapid Bioassessment Habitat Data

StationID	Date	Total Habitat
4ABTM009.25	10/30/2017	170

Table 8. Relative Bed Stability Data

StationID	Date	%Sand+Fines	LRBS
4ABTM009.25	10/30/2017	38.10	-0.83

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Fact Sheets and Story Boards – Pre-Construction

Pipeline Water Quality Monitoring Data Series

Upper Bottom Creek Stream Crossing - Fall 2017

Pre-construction Monitoring

Scientists from DEQ, the U.S. Geological Survey and Virginia Commonwealth University are monitoring water quality at a number of streams that will be crossed by the Mountain Valley Pipeline and Atlantic Coast Pipeline routes. Monitoring includes real-time continuous water quality monitoring for turbidity, temperature, specific conductance, dissolved oxygen and pH, identification of benthic macroinvertebrate and fish community assemblages, and quantitative physical habitat assessment.

This fact sheet summarizes pre-construction data collected from Upper Bottom Creek at sites upstream and downstream of the proposed pipeline crossing (DEQ sites 4ABTM012.47 and 4ABTM011.94, respectively; see our story map (link to story map coming soon). See our explanation of all water parameters, and literature references for methods described here (link to WQ explanations). For more information on DEQ's pipeline monitoring program see: https://www.deq.virginia.gov/Pipelines/WaterMonitoringPlanforPipelines.aspx or contact Andrew Garey (andrew.garey@deq.virginia.gov).

Water Quality Summary

Dissolved oxygen, pH, temperature, specific conductance, and turbidity presented in Table 1 were collected every 5 minutes from October 27, 2017 to December 15, 2017, before pipeline construction began in the watershed. Water quality conditions observed are typical for high-slope mountain streams in Virginia during the collection time; relatively low temperatures, turbidity and specific conductance, high dissolved oxygen, and near-neutral pH.

Table 1. Upper Bottom Creek water chemistry data collected approximately every 5 minutes from October 27, 2017 to December 15, 2017. Values are shown as mean (with minimum and maximum in parentheses).

	Upstream Site	Downstream Site	Monitoring benchmark
Temperature (°C)	6.1 (0.3-13)	5.7 (0-13.3)	Max. 20°C [1]
Dissolved Oxygen (mg/l)	10.5 (8.5-12.4)	10.9 (9-12.7)	Min. 6.0 [1]
pH (standard units)	6.9 (6.7-6.9)	7.0 (6.9-7.3)	6.0—9.0 [1]
Turbidity (FNU)	0.2 (0-6.4)	0.1 (0-9.5)	-- [2]
Specific Conductance (µS/cm)	22 (20-25)	27 (25-30)	Max. 350 [3]

1 9VAC25-260-50 (https://law.lis.virginia.gov/admincode/title9/agency25)

2 No criteria

3 http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityMonitoring/ProbabilisticMonitoring/Products/Stressor_Doc.zip

Next Steps

- Update DEQ website with data results.
  - Continuous monitoring now available (USGS)
  - Publish Fish, Macroinvertebrate, Habitat data and Pre-construction Factsheets (High level summaries)
- Publish StoryMap to share monitoring information in a public-friendly interface.
- Collect Post-construction data the fall after pipeline completion. Summarize all water quality parameters.

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Questions?

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Jason.Hill@deq.virginia.gov

http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/ProbabilisticMonitoring.aspx