Fryingpan Creek, Pigg River, Poplar Branch, Beaverdam Creek TMDL

Technical Advisory Committee Meeting #1

Pre-TMDL meeting

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Katie Shoemaker, Wetland Studies and Solutions, Inc.

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Agenda

- **Introductions:**
  Name, Organization, Watershed of interest, goals for these watersheds
- **Introduce the DEQ's water quality improvement process**
- **Review stressor identification for each watershed of interest**
- **Discussion on each watershed**
- **Next Steps**

What does a Technical Advisory Committee do?

- **Represents the watershed community**
- **Shares information on:**
  - Historic and current land use
  - Future development
  - Previous and planned restoration projects
  - Local monitoring efforts
  - Key stakeholder groups and contacts
- **Reviews data related to:**
  - Pollutants responsible for biological impairment
  - Pollutant sources
  - Pollutant reduction scenarios

DEQ's Water Wheel

Best Management Practices

Implement Control Measures

Sewage Treatment Plant upgrades

Watershed Plans

Biomonitoring

Lake Monitoring

Stream Monitoring

Water Quality Monitoring

Water Quality Standards

TMDL Study

TMDL Studies

Stressor Identification

Stakeholder Participation

Assessment- Evaluate data

305 (b) WQA Report

303 (d) Impaired Waters List- "Dirty Water List"

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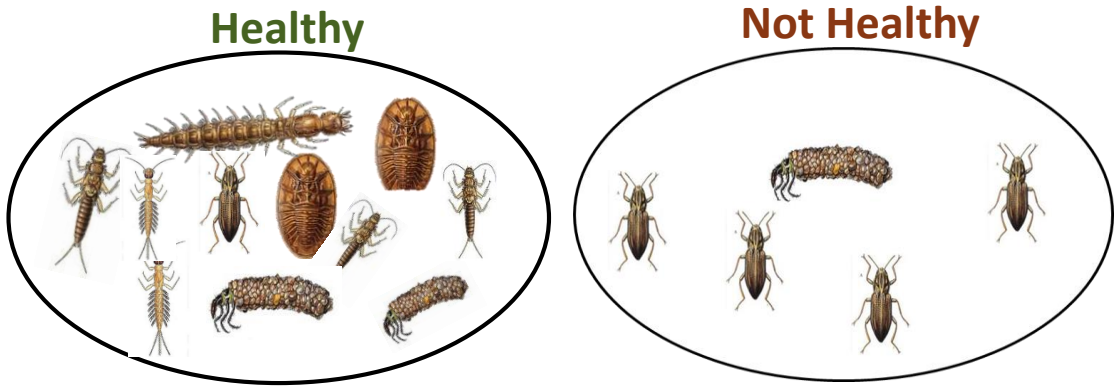
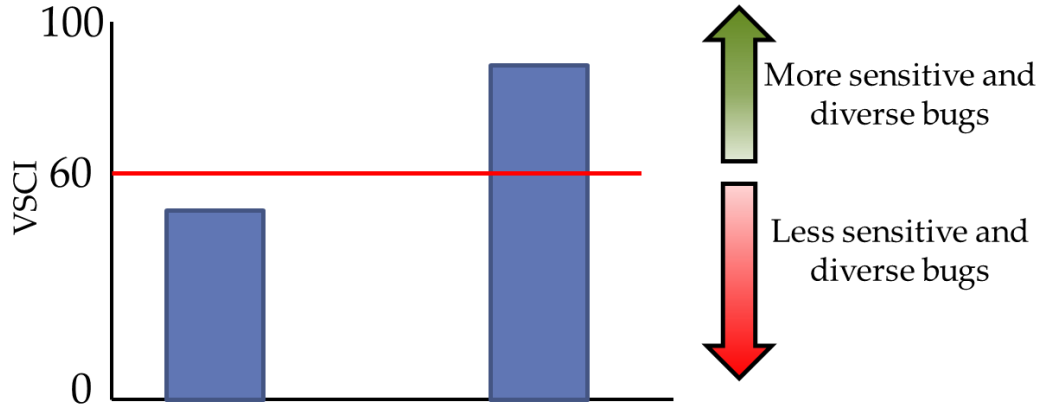
Assessment of benthic impairments

- Water bugs represent a longer term picture of water quality than water samples.

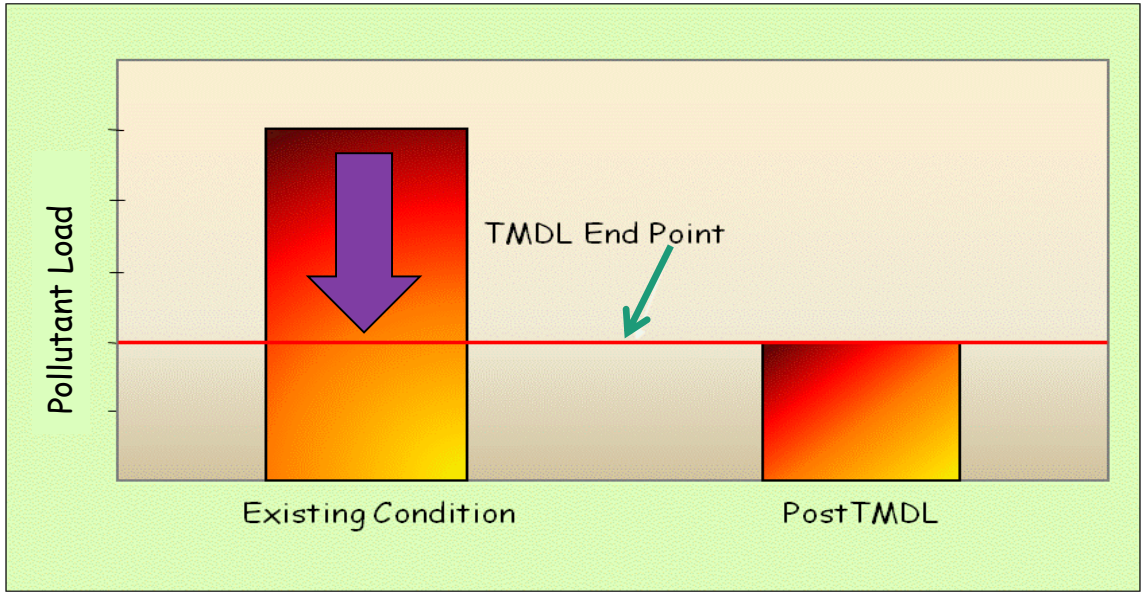


- Multi-metric index
- VSCI scores tell us that there is an impairment but not what the pollutant is…



TMDL Studies

- The Clean Water Act tasks DEQ to address impaired waters by conducting a Total Maximum Daily Load (TMDL) study.
  - The TMDL is the amount of pollutant that can enter a waterbody and still meet the water quality standard.
    - "Pollution diet"



- To identify the pollutant of concern, DEQ conducts a stressor identification.

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Stressor Analysis Process

- DEQ used EPA's CADDIS (Causal Analysis/Diagnosis Decision Information System) approach along with "Stressor Analysis in Virginia: Data Collection and Stressor Threshold" document (VADEQ 2017).

CADDIS Approach:
Causal analysis of candidate stressor that could be causing alterations to the community. The strength of evidence is summed to identify a most likely stressor.

Stressor Thresholds:
Compares water quality data between the stream of interest with statistical thresholds derived from probabilistic data.

Sediment measured by:
TSS
Total Habitat scores
LRBS

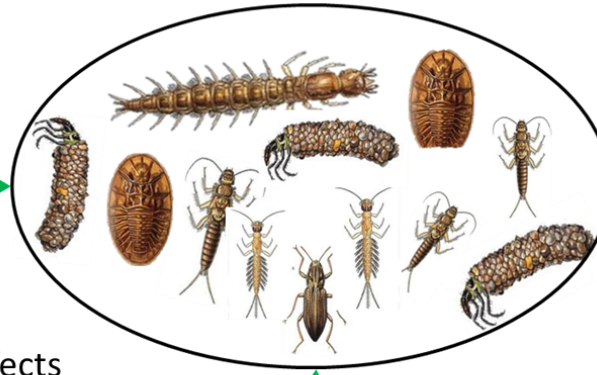
pH
DO
Dissolved Metals
Temperature
Toxins
Conductivity

Total Phosphorus
Total Nitrogen
Organic Matter

Indirect Effects

Habitat

Direct Effects



Indirect Effects

Food Resources

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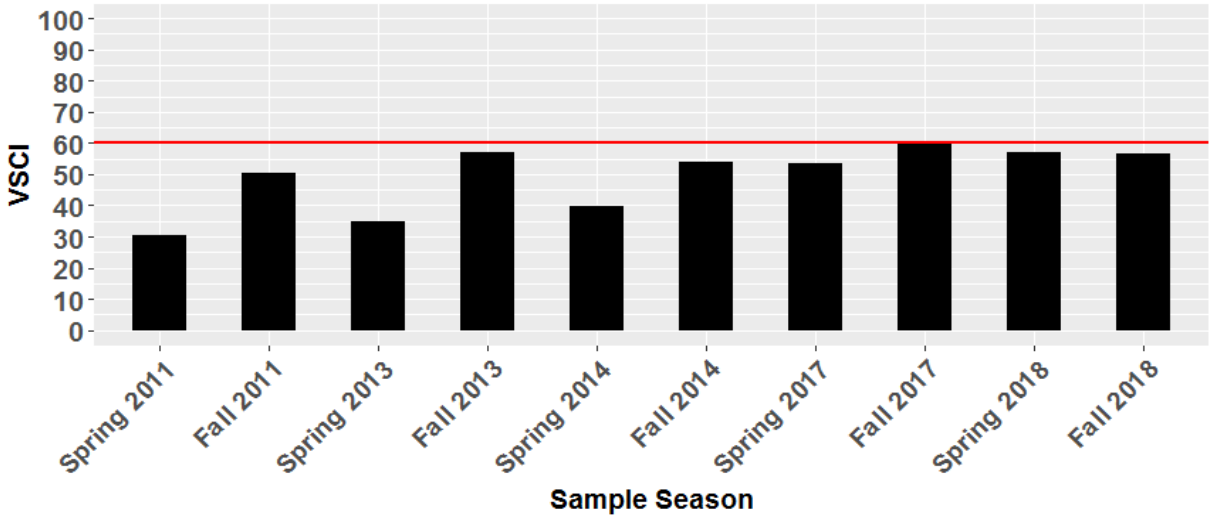
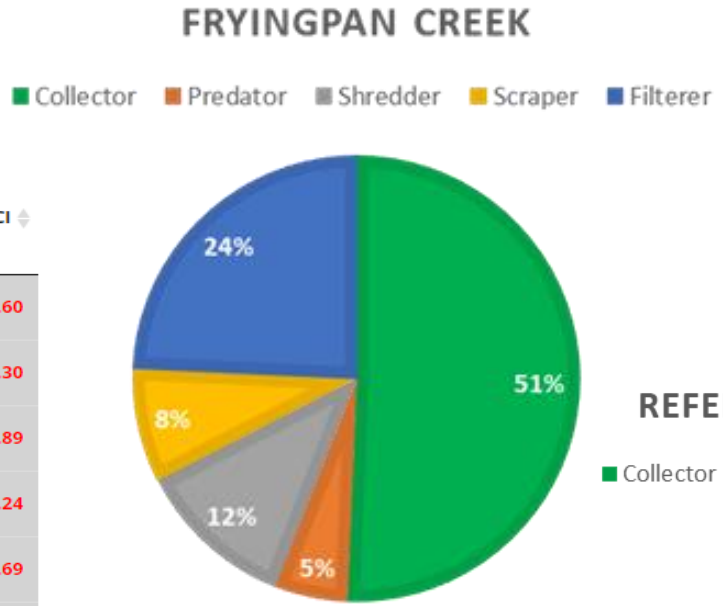
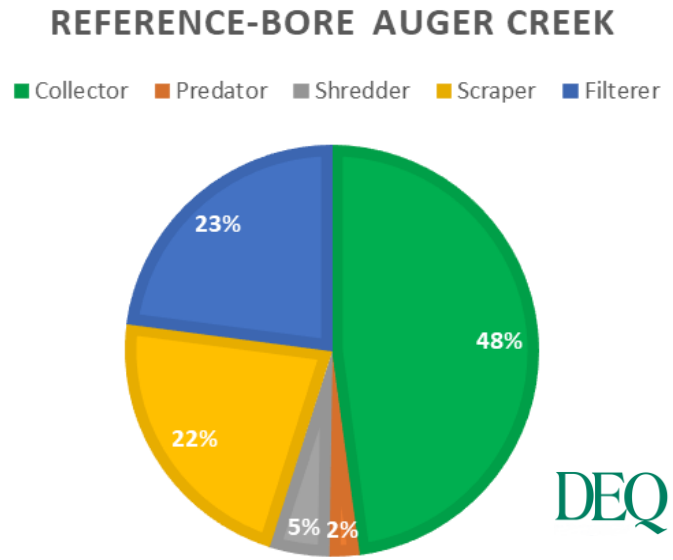
Fryingpan Creek Macroinvertebrate Data



	% Ephem Score	% PT-H Score	% Chironomidae Score	Fam Richness Score	Fam EPT Score	Family %Scraper Score	Family %2 Domniant Score	Family %MFBI Score	VSCI
Spring 2011	1.48	7.66	42.73	59.09	27.27	3.52	39.41	63.64	30.60
Fall 2011	10.38	100.00	54.55	50.00	63.64	8.81	21.02	93.98	50.30
Spring 2013	11.86	7.66	46.36	59.09	54.55	8.81	26.27	64.49	34.89
Fall 2013	29.87	19.78	74.65	77.27	54.55	46.40	81.41	73.96	57.24
Spring 2014	8.90	28.09	45.45	68.18	45.45	7.05	44.67	69.75	39.69
Fall 2014	45.97	5.11	71.82	68.18	63.64	38.76	65.69	71.52	53.84
Spring 2017	10.38	43.41	75.45	59.09	54.55	24.67	81.45	77.75	53.34
Fall 2017	28.18	20.43	86.36	77.27	100.00	31.71	69.63	71.66	60.65
Spring 2018	7.42	38.30	61.82	100.00	72.73	29.95	69.63	76.34	57.02
Fall 2018	35.59	12.77	90.00	68.18	63.64	52.85	55.18	73.26	56.43

- Fryingpan Creek had VSCI scores that were generally higher in the fall than the spring.
- The community had very few mayflies, stoneflies, and scrapers.
- Compared to the reference site, Fryingpan Creek had fewer scraping taxa and more collectors.





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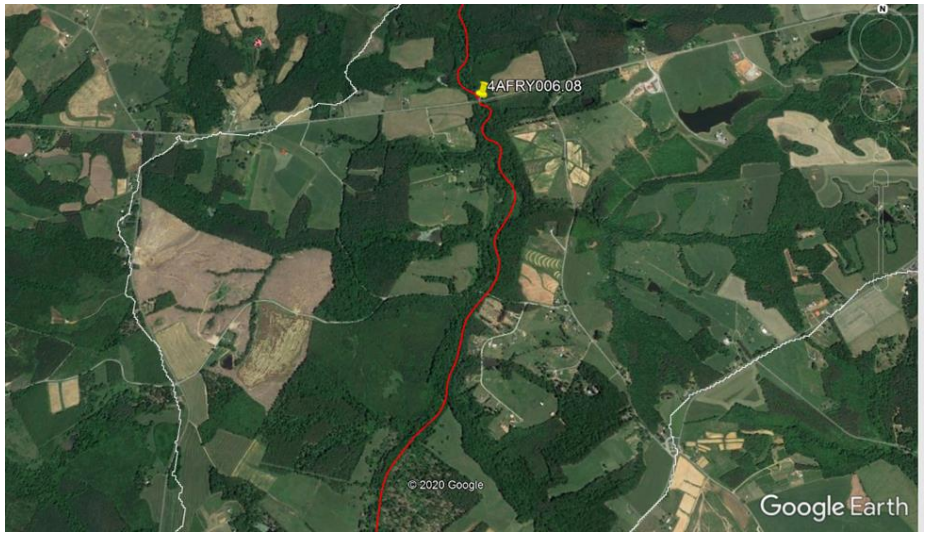
Fryingpan Creek-Non stressors

- pH, DO, nutrients (TP and TN), dissolved ions (sulfate, potassium, chloride, and sodium), specific conductivity, TDS, temperature are considered non-stressors based on the evidence described in Section 4 of the Draft Stressor Identification document.
- The CADDIS scores are shown in the table below.

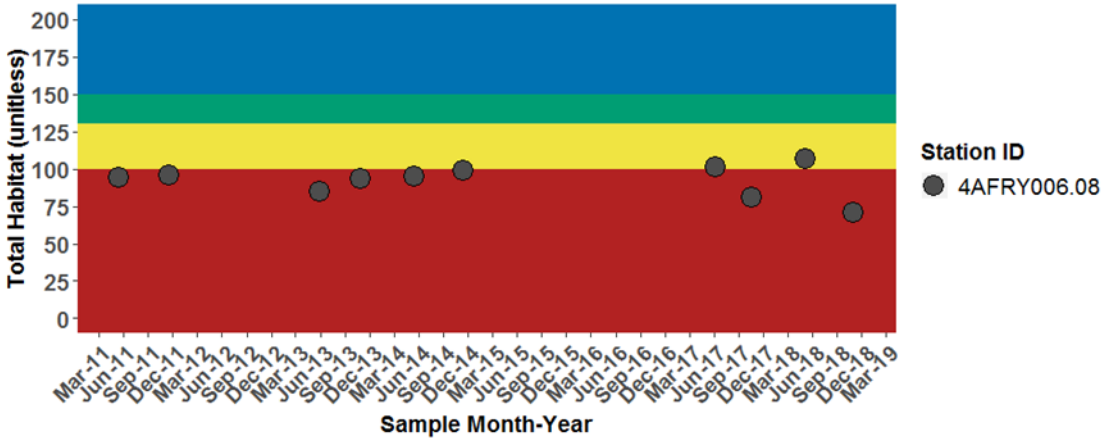
Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Fryingpan Creek	-24	-18	-22	-16	-16	-18	-16	-24	-16	-21	NA	-11		

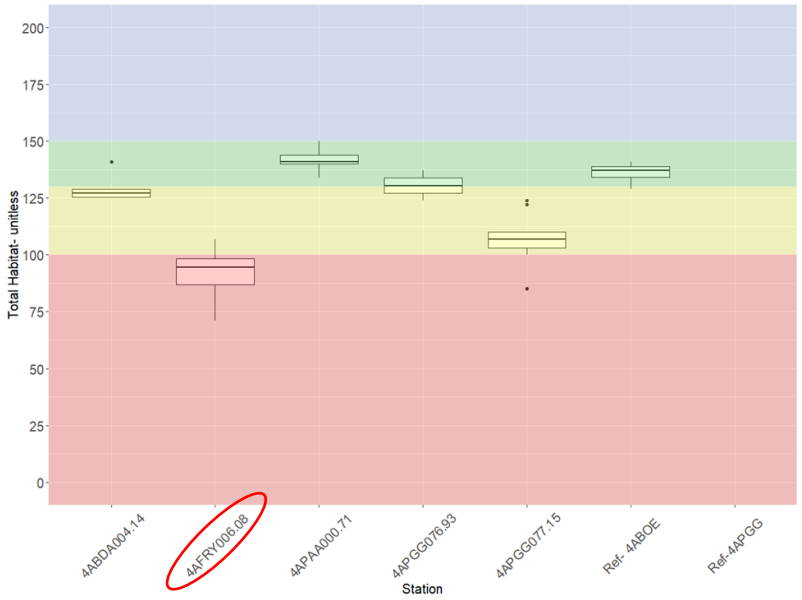
Fryingpan Creek-Possible stressors

- Several small farm ponds exist on tributaries to Fryingpan Creek that could be altering flow, contributing to influxes of sediment and nutrients or reducing the macroinvertebrate community downstream. Based on the evidence described in Section 4 of the Draft Stressor Identification document, we deemed Hydromodification as a possible stressor.
- Aerial pictures are shown below.



Fryingpan Creek- Most probable stressor





Station ID	Date	Channel Alteration	Banks	Bank Vegetation	Embeddedness	Flow	Riffles	Riparian Vegetation	Sediment	Substrate	Velocity	Total Habitat
4AFRY006.08	2013-05-28	12	2	6	11	14	12	11	2	4	11	85
4AFRY006.08	2013-10-28	12	2	10	9	18	10	7	5	11	9	93
4AFRY006.08	2014-11-12	11	4	13	11	19	6	10	3	6	16	99

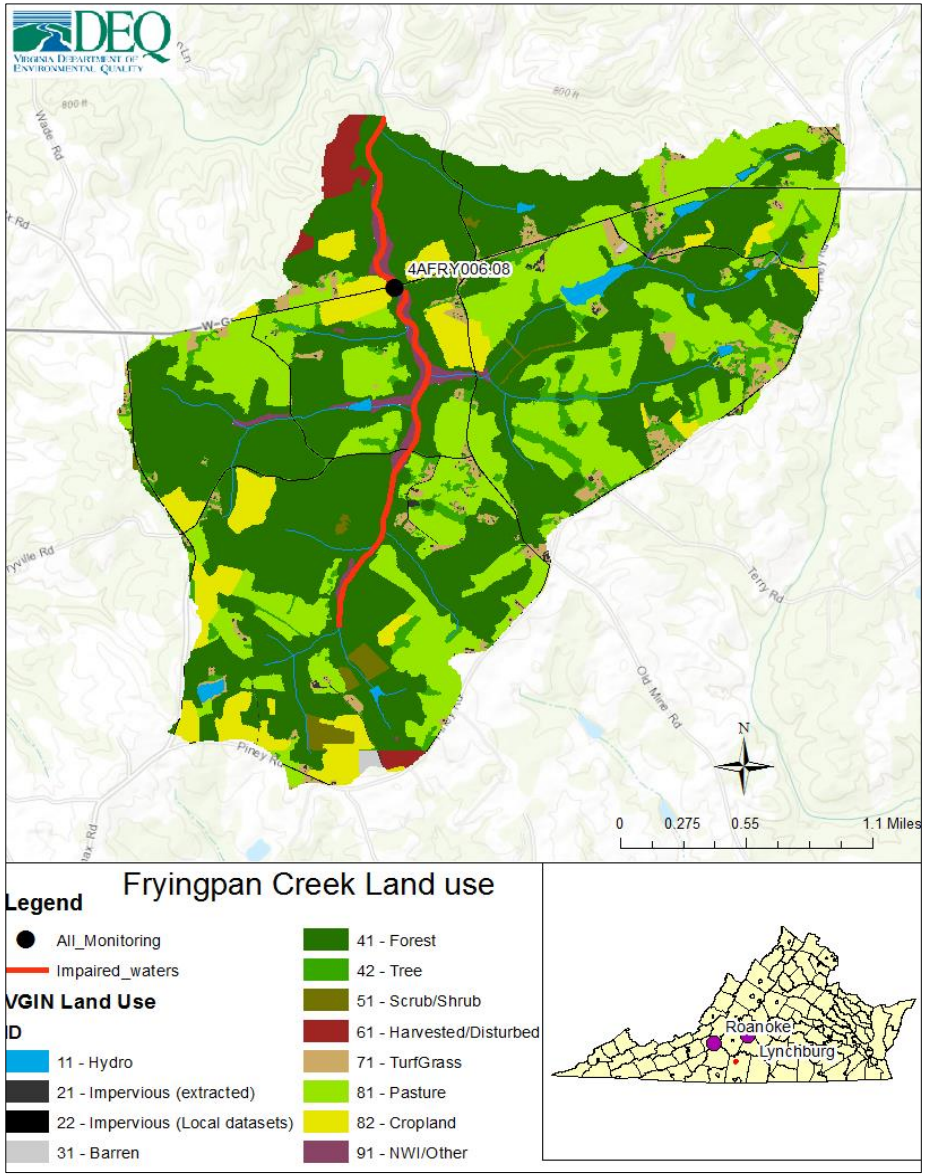
Station ID	Date	Channel Alteration	Bank Stability	Bank Vegetation	Flow	Pool Substrate	Pool Variability	Riparian Vegetation	Sediment	Sinuosity	Substrate	Total Habitat
4AFRY006.08	2011-05-16	18	6	10	16	6	5	10	7	9	7	94
4AFRY006.08	2011-11-16	18	4	6	19	5	6	14	8	11	5	96
4AFRY006.08	2014-05-14	12	4	10	15	11	5	16	5	8	9	95
4AFRY006.08	2017-06-07	15	4	18	15	7	4	16	6	9	7	101
4AFRY006.08	2017-10-18	12	4	10	10	11	5	12	5	7	5	81
4AFRY006.08	2018-05-07	15	2	15	19	10	9	13	8	8	8	107
4AFRY006.08	2018-11-01	15	3	3	15	7	3	13	4	5	3	71

- The median total habitat scores were within the high probability category for aquatic stress and individual habitat parameters were categorized as poor or suboptimal, especially sediment and bank stability.
- The percent embeddedness was 65% at Fryingpan Creek and 66% of the substrate was classified as sand or fine sediments.

Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Fryingpan Creek	-24	-18	-22	-16	-16	-18	-16	-24	-16	-21	NA	-11	8	-2

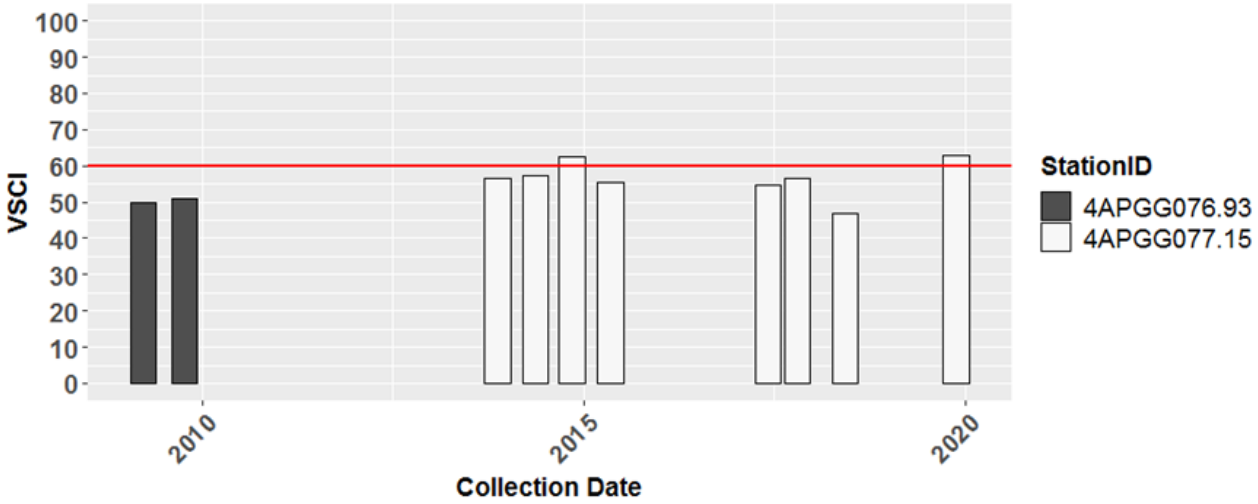
DEQ

Fryingpan Creek Summary



- **Questions for you:**
  - Does the pollutant identified make sense to you?
  - Are there large sources of this pollutant in the Fryingpan Creek watershed? Are there large sources of other pollutants?
  - Does anyone have experience with the ponds identified or know of others in the watershed?
  - What BMPs have been installed in this watershed or water quality initiatives we should be aware of?
  - Is there interest in additional BMPs in this watershed? If so, which ones?
  - Are there stakeholders who we need to reach out to in this watershed?

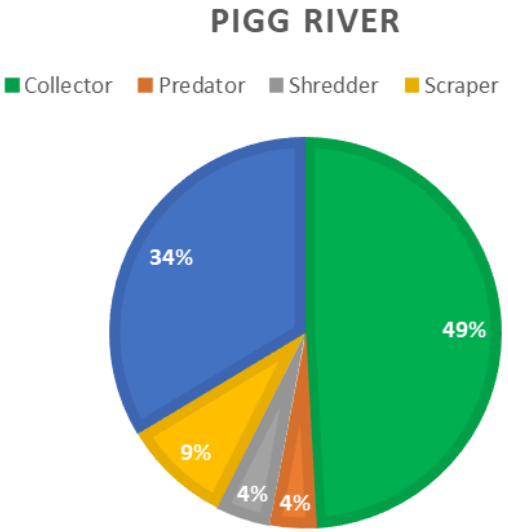
Pigg River Macroinvertebrate Data

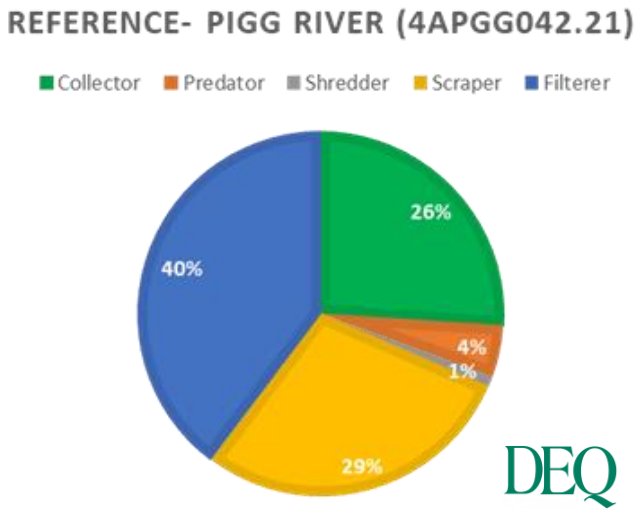


- Pigg River had VSCI scores that were generally higher in the fall than the spring. Two sampling events were over the impairment threshold.
- The community had very few stoneflies or scrapers.
- Compared to the reference site, the impaired site on the Pigg River had fewer scraping taxa and more collectors.

	% Ephem Score	% PT- H Score	% Chironomidae Score	Fam Richness Score	Fam EPT Score	Family %Scraper Score	Family %2 Domniant Score	Family %MFBI Score	VSCI
Fall 2013	19.28	45.97	76.36	72.73	100.00	14.09	49.92	74.20	56.57
Spring 2014	78.60	15.32	80.91	72.73	63.64	10.57	57.80	78.07	57.21
Fall 2014	45.97	33.20	90.91	63.64	72.73	38.76	78.82	76.50	62.57
Spring 2015	81.57	12.77	68.18	54.55	72.73	17.62	57.80	78.25	55.43
Spring 2017	56.35	28.09	78.18	54.55	63.64	8.81	69.63	78.98	54.78
Fall 2017	56.35	5.11	80.91	59.09	72.73	38.76	65.69	73.53	56.52
Spring 2018	31.14	10.21	69.09	63.64	63.64	7.05	63.06	67.59	46.93
Fall 2019	34.11	35.75	94.55	77.27	90.91	33.47	60.43	77.27	62.97

	% Ephem Score	% PT- H Score	% Chironomidae Score	Fam Richness Score	Fam EPT Score	Family %Scraper Score	Family %2 Domniant Score	Family %MFBI Score	VSCI
Spring 2009	88.98	5.11	70.91	59.09	54.55	10.57	32.84	78.07	50.02
Fall 2009	19.28	25.54	79.09	63.64	72.73	22.90	55.18	69.68	51.00





Pigg River-Non stressors

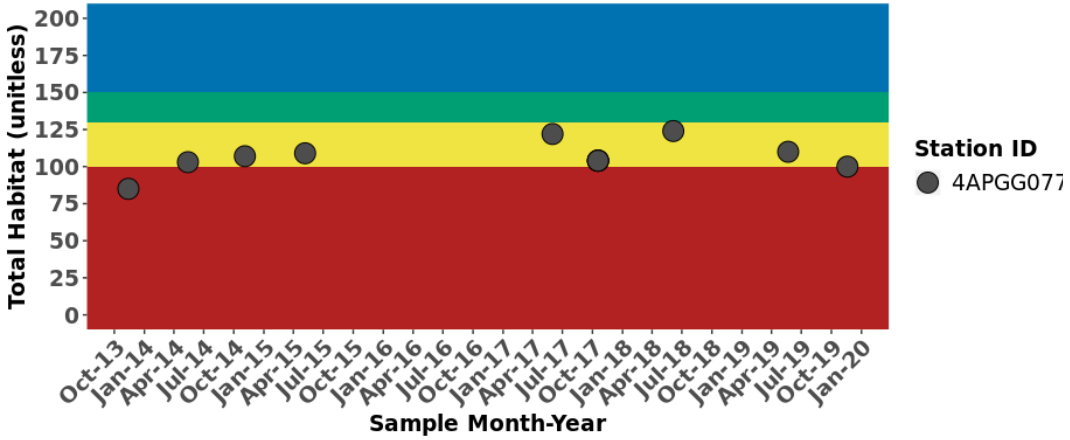
- pH, DO, nutrients (TP and TN), dissolved ions (sulfate, potassium, chloride, and sodium), specific conductivity, TDS, temperature, and hydrologic modifications are considered non-stressors based on the evidence described in Section 4 of the Draft Stressor Identification document.
- The CADDIS scores are shown in the table below.

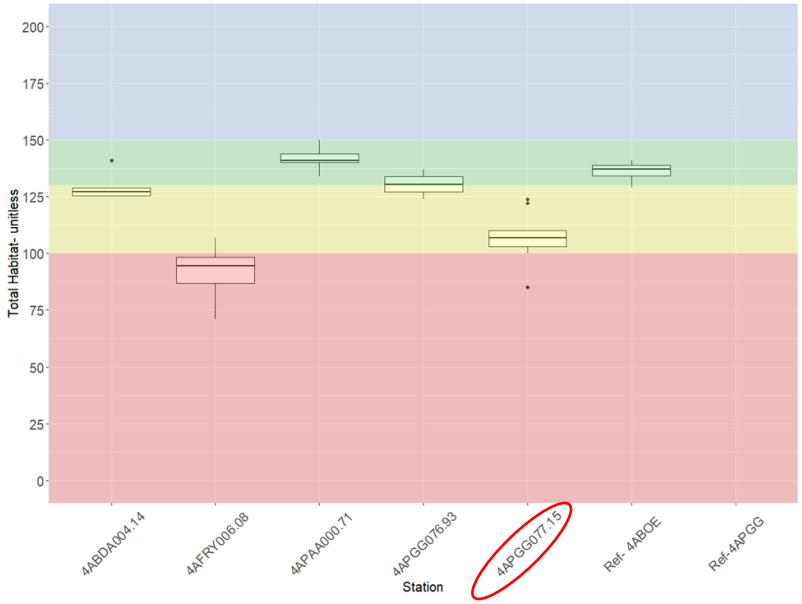
Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Pigg River	-20	-20	-8	-12	-19	-23	-16	-24	-14	-21	-15	-13		-12

Pigg River-Possible stressors

- There were no possible stressors identified for the Pigg River.

Pigg River- Most probable stressor



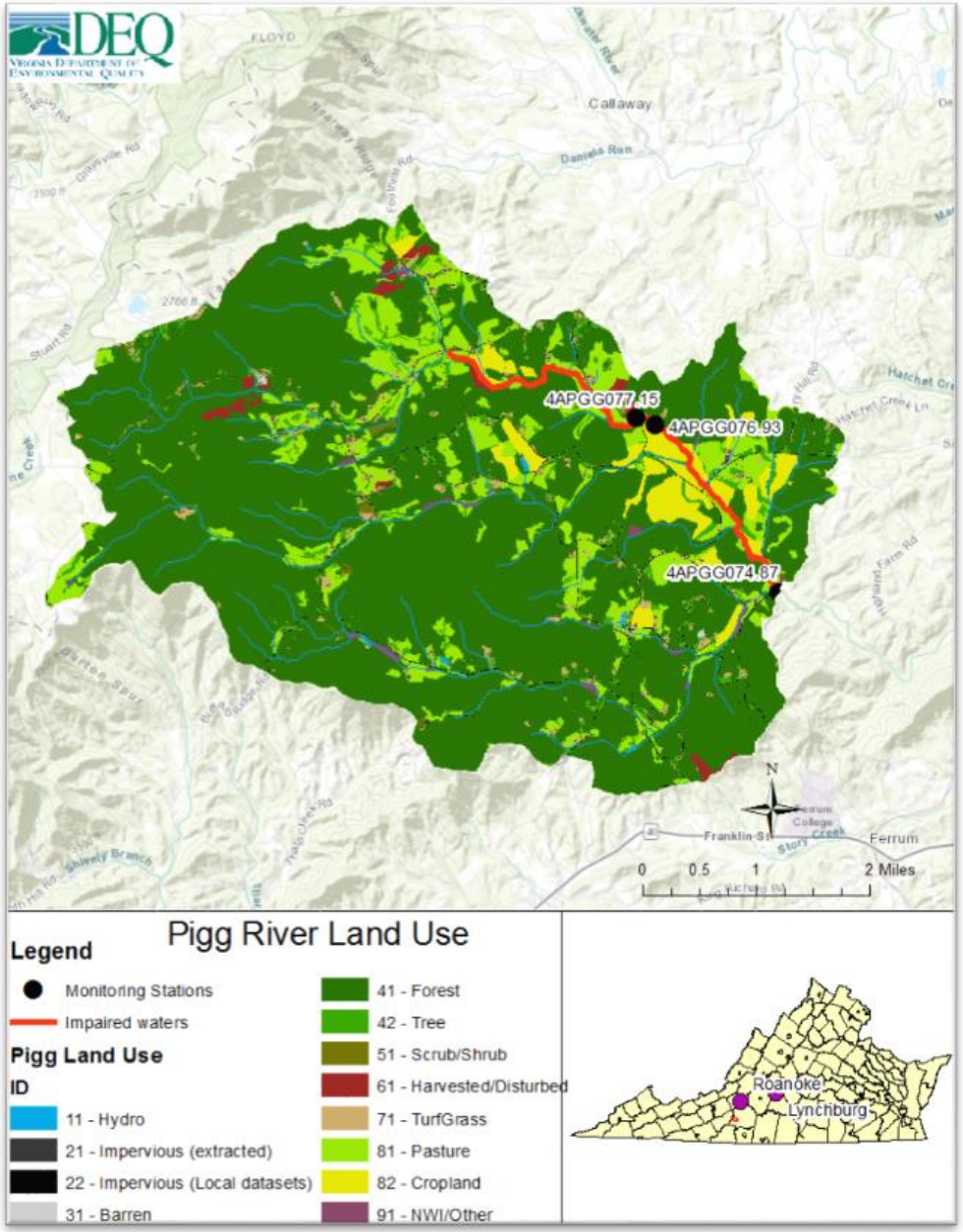


Station ID	Date	Channel Alteration	Banks	Bank Vegetation	Embeddedness	Flow	Riffles	Riparian Vegetation	Sediment	Substrate	Velocity	Total Habitat
4APGG077.15	2013-11-13	3	0	6	11	11	18	2	6	12	16	85
4APGG077.15	2014-05-14	7	4	8	12	15	18	4	7	11	17	103
4APGG077.15	2014-11-04	11	4	10	12	12	18	2	7	13	18	107
4APGG077.15	2015-05-07	11	6	10	11	15	19	4	8	10	15	109
4APGG077.15	2017-06-01	14	8	10	11	16	16	6	8	15	18	122
4APGG077.15	2017-10-18	14	4	8	14	11	17	4	7	12	13	104
4APGG077.15	2018-06-05	15	4	10	18	19	18	4	11	10	15	124
4APGG077.15	2019-05-22	13	7	12	8	17	18	4	8	8	15	110
4APGG077.15	2019-11-19	15	11	8	3	18	16	2	5	8	14	100

- The median total habitat scores was in the medium probability category for aquatic stress and banks were observed to be unstable with little riparian vegetation.
- The unimpaired station downstream had habitat that was in the low probability for aquatic stress and was observed to have more stable banks and better riparian vegetation. However, the sediment scores were generally low even at the reference site.

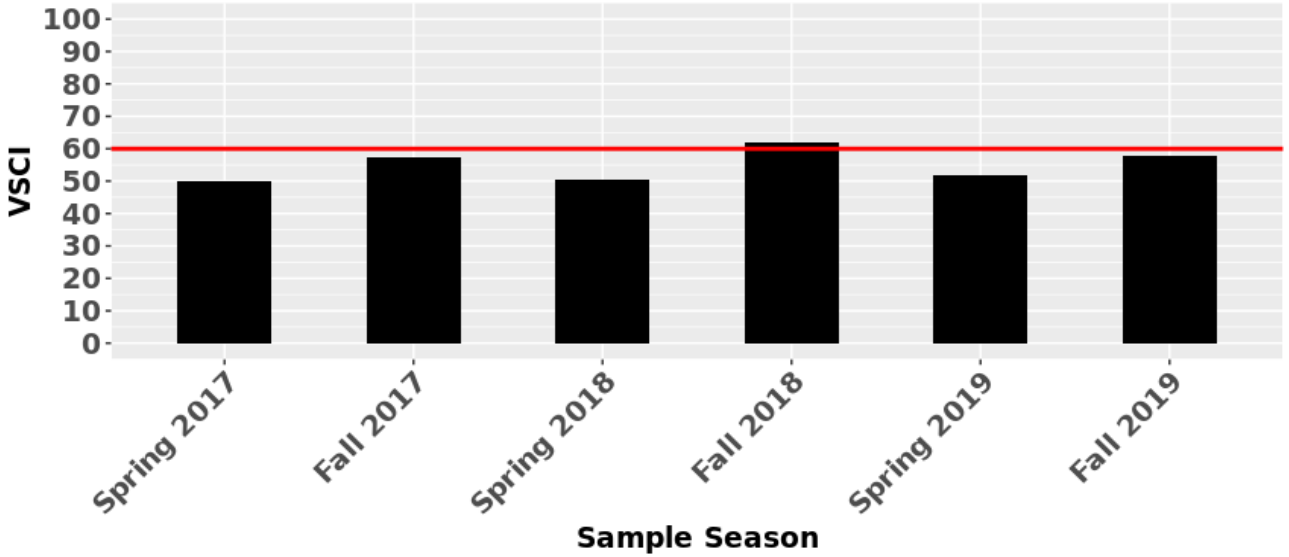
Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Pigg River	-20	-20	-8	-12	-19	-23	-16	-24	-14	-21	-15	-13	4	-12

Pigg River Summary



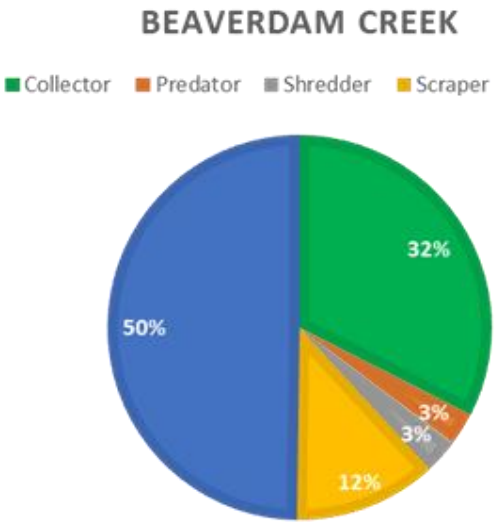
- **Questions for you:**
  - Does the pollutant identified make sense to you?
  - Are there large sources of this pollutant in the Pigg River watershed? Are there large sources of other pollutants?
  - What BMPs have been installed in this watershed or water quality initiatives we should be aware of?
  - Is there interest in additional BMPs in this watershed? If so, which ones?
  - Are there stakeholders who we need to reach out to in this watershed?

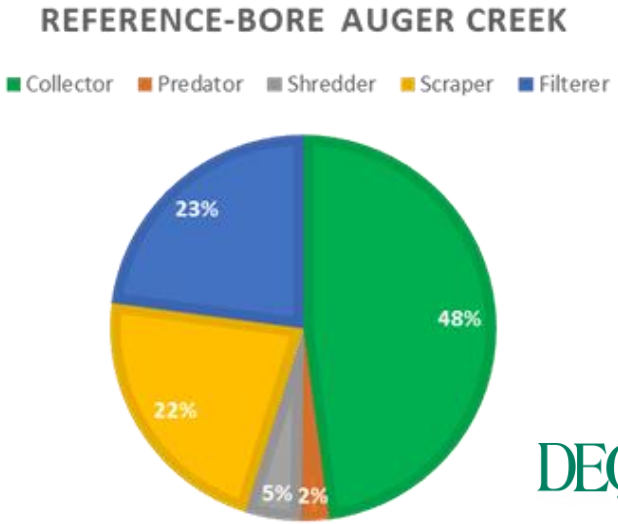
Beaverdam Creek Macroinvertebrate Data



	% Ephem Score	% PT-H Score	% Chironomidae Score	Fam Richness Score	Fam EPT Score	Family %Scraper Score	Family %2 Domniant Score	Family %MFBI Score	VSCI
Spring 2017	35.59	10.21	90.00	59.09	81.82	3.52	49.92	68.54	49.84
Fall 2017	40.04	17.88	87.27	68.18	72.73	49.33	53.86	70.70	57.50
Spring 2018	47.46	15.32	62.73	54.55	72.73	14.09	64.37	71.39	50.33
Fall 2018	25.21	53.63	81.82	68.18	100.00	22.90	68.31	77.21	62.16
Spring 2019	54.87	10.21	73.64	59.09	72.73	10.57	60.43	72.19	51.72
Fall 2019	26.69	17.88	95.45	72.73	100.00	38.76	43.35	68.45	57.91

- Beaverdam Creek had VSCI scores that were generally higher in the fall than the spring. One sampling events were over the impairment threshold.
- The community had very few mayflies, stoneflies, or scrapers.
- Compared to the reference site, the impaired site on the Beaverdam Creek had fewer scraping taxa and more filtering taxa that were mainly made up of *Simulium*, a tolerant fly larvae. These taxa are often an indicator of sewage or manure.





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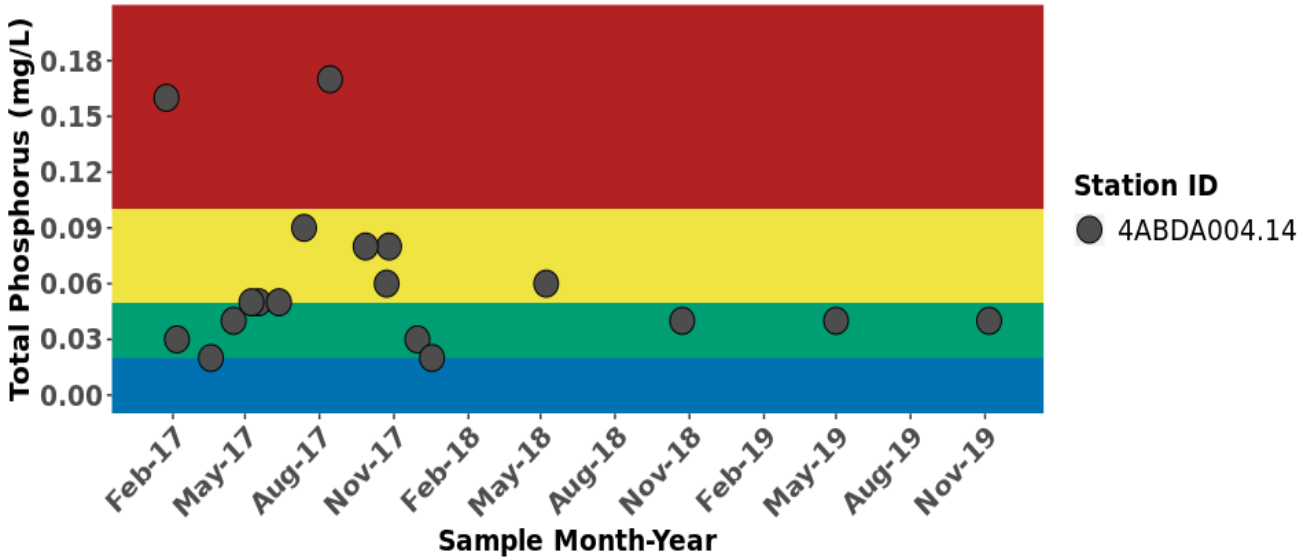
Beaverdam Creek-Non stressors

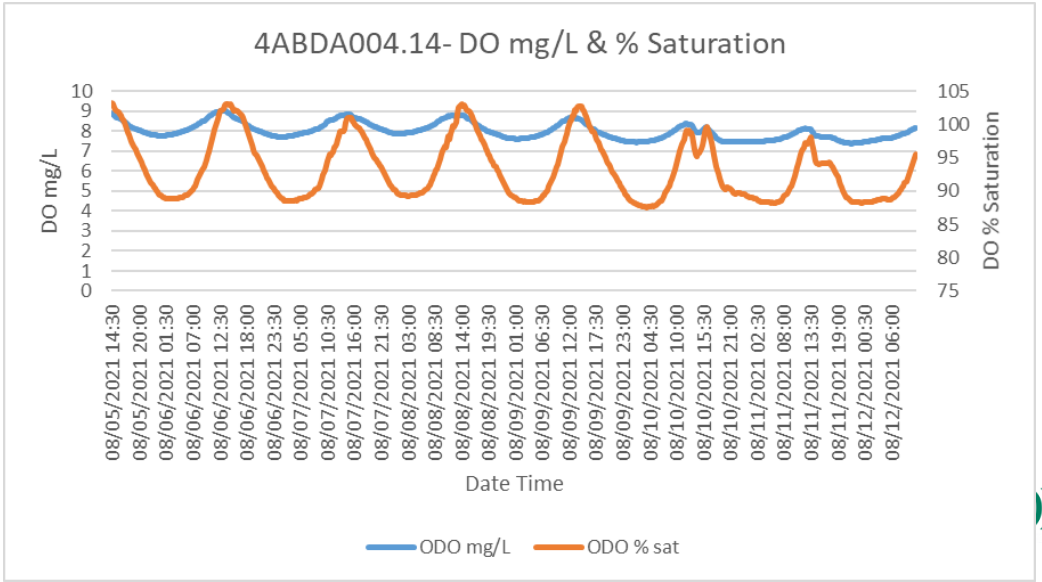
- pH, DO, TN, dissolved ions (sulfate, potassium, chloride, and sodium), specific conductivity, TDS, water temperature, metals, and hydrologic modifications are considered non-stressors based on the evidence described in Section 4 of the Draft Stressor Identification document.
- The CADDIS scores are shown in the table below.

Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Beaverdam Creek	-18	-13		-17	-15	-20	-16	-22	-6	-16	-15	-7		-15

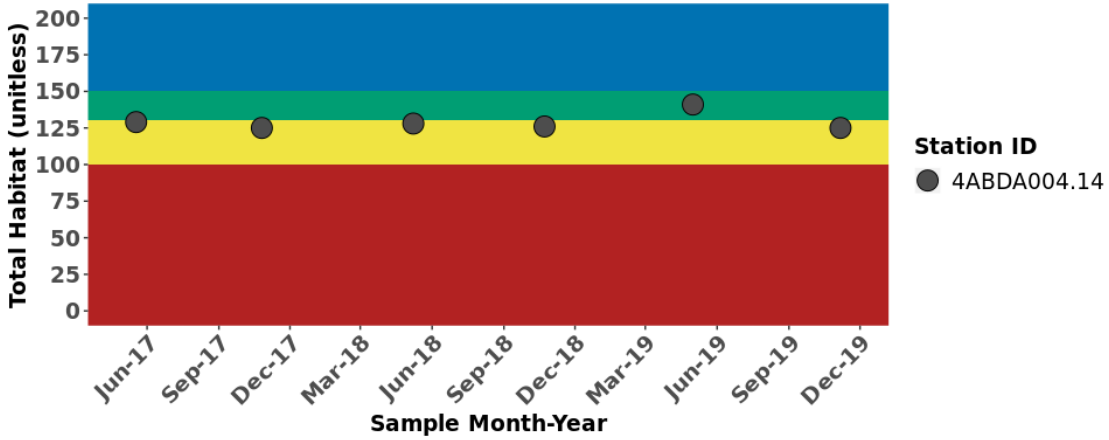
Beaverdam Creek-Possible stressors

- Total phosphorus was identified as a possible stressor to the Beaverdam Creek benthic community because the median concentration exceeded EPA's suggested criteria and observations were within the medium probability for stressor category. However, the diurnal DO data did not show extreme daily swings or exceed the water quality standard indicating that there is not a biological effect of the observed excess nutrients at this time.

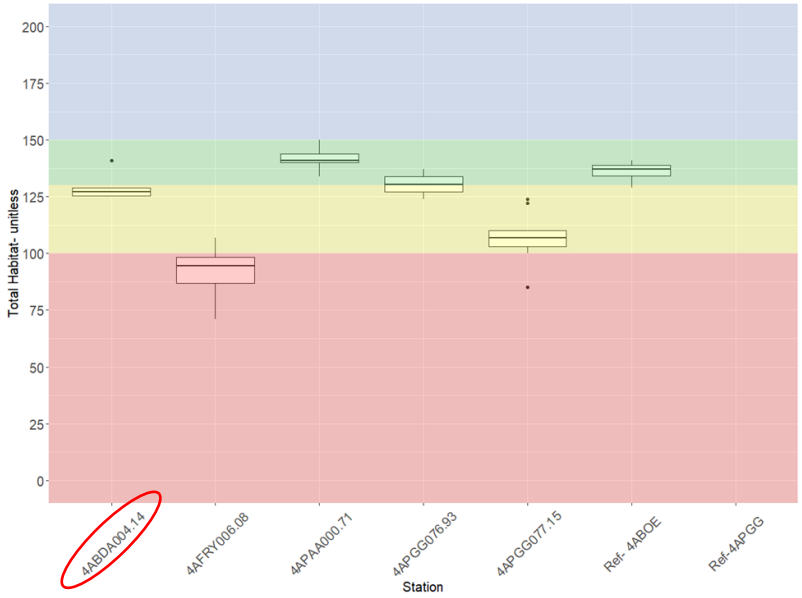


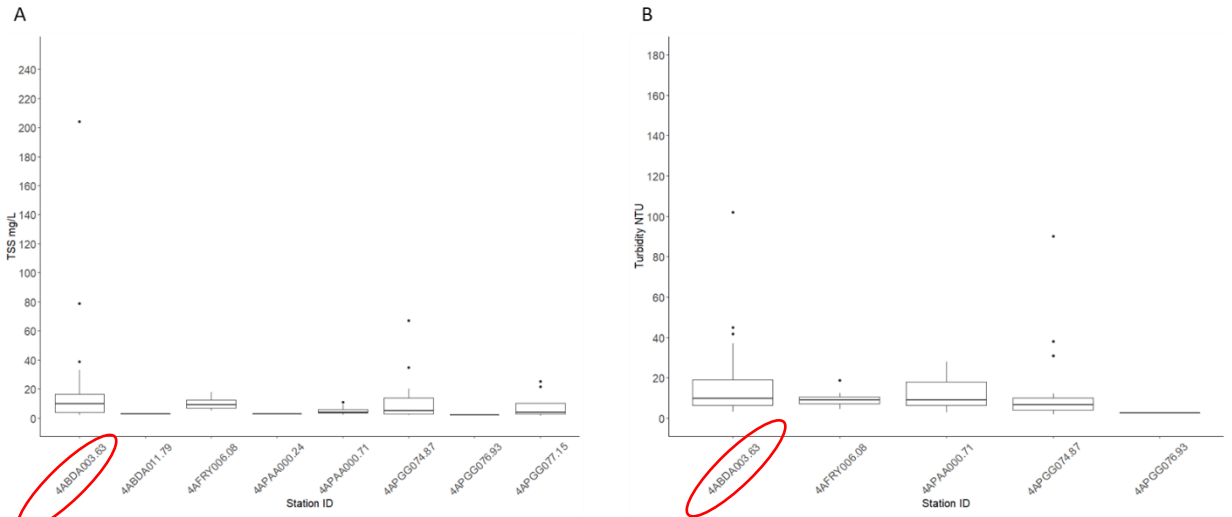


Beaverdam Creek- Most probable stressor



Station ID	Date	Channel Alteration	Banks	Bank Vegetation	Embeddedness	Flow	Riffles	Riparian Vegetation	Sediment	Substrate	Velocity	Total Habitat
4ABDA004.14	2017-05-18	15	8	14	11	18	16	12	7	11	17	129
4ABDA004.14	2017-10-26	14	8	12	16	15	16	12	6	11	15	125
4ABDA004.14	2018-05-08	15	9	13	18	16	14	8	8	12	15	128
4ABDA004.14	2018-10-23	15	5	12	14	17	17	10	8	11	17	126
4ABDA004.14	2019-05-01	15	7	12	18	19	17	13	6	16	18	141
4ABDA004.14	2019-11-06	15	10	10	10	16	14	8	11	15	16	125

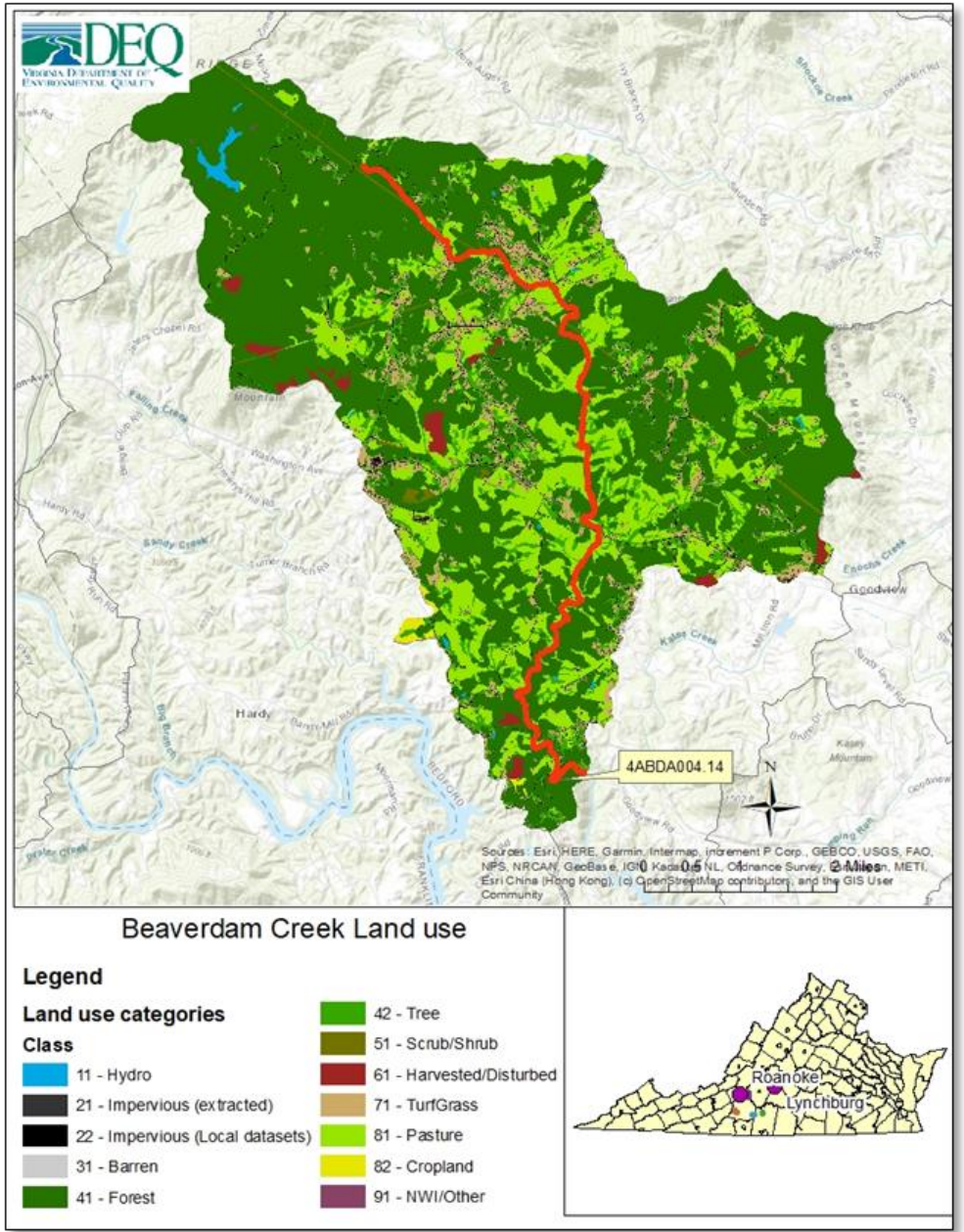




- The median total habitat scores was in the medium probability category for aquatic stress and banks were observed to be unstable with excess sediment observed.
- TSS and Turbidity at Beaverdam spiked during several sampling events.

Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Beaverdam Creek	-18	-13	-2	-17	-15	-20	-16	-22	-6	-16	-15	-7	4	-15

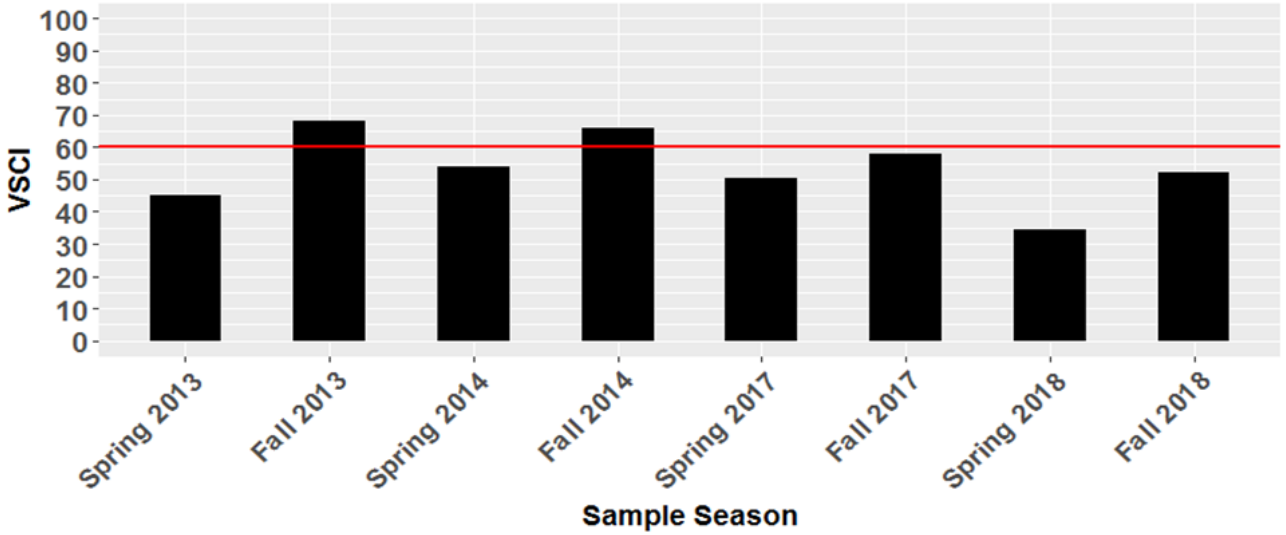
Beaverdam Creek Summary



- **Questions for you:**
  - Does the pollutant identified make sense to you?
  - Are there large sources of this pollutant in the Pigg River watershed? Are there large sources of other pollutants?
  - What BMPs have been installed in this watershed or water quality initiatives we should be aware of?
  - Is there interest in additional BMPs in this watershed that will specifically target sediment, bacteria, and TP?
  - Are there stakeholders who we need to reach out to in this watershed?

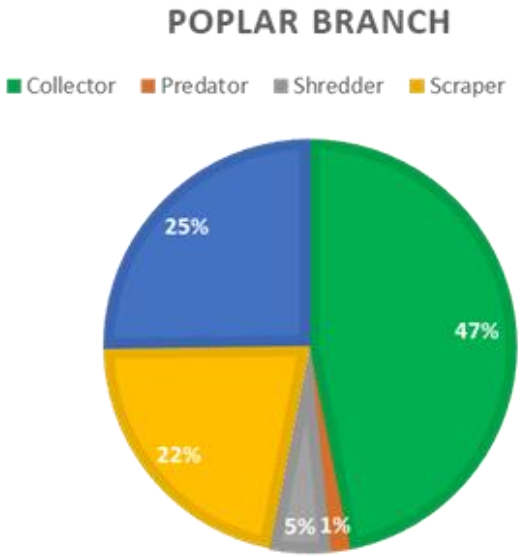
DEQ

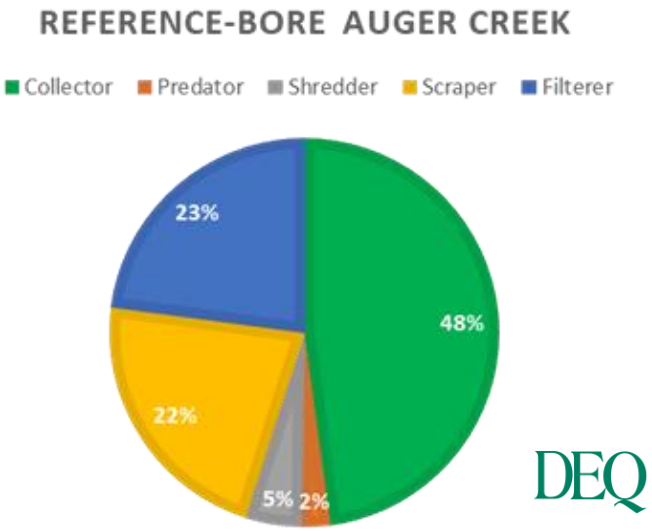
Poplar Branch Macroinvertebrate Data



	% Ephem Score	% PT-H Score	% Chironomidae Score	Fam Richness Score	Fam EPT Score	Family %Scraper Score	Family %2 Domniant Score	Family %MFBI Score	VSCI
Spring 2013	31.14	10.21	60.00	50.00	54.55	37.00	48.61	68.00	44.94
Fall 2013	84.53	45.97	92.73	40.91	54.55	95.14	47.29	84.22	68.17
Spring 2014	37.08	20.43	58.18	68.18	72.73	45.81	55.18	73.66	53.91
Fall 2014	59.32	40.86	74.55	72.73	72.73	68.71	61.74	76.36	65.87
Spring 2017	45.97	0.00	71.82	59.09	36.36	52.85	65.69	71.93	50.46
Fall 2017	38.56	43.41	60.91	63.64	72.73	38.76	67.00	77.58	57.82
Spring 2018	22.25	10.21	39.09	40.91	45.45	14.09	38.10	65.64	34.47
Fall 2018	38.56	10.21	76.36	50.00	45.45	61.66	61.74	71.93	51.99

- Poplar Branch had VSCI scores that were generally higher in the fall than the spring. Two sampling events were over the impairment threshold. The observed seasonal variation is greater than normal.
- The community had very few mayflies and stoneflies.
- The functional feeding group distribution is very similar between Poplar Branch and the reference site.





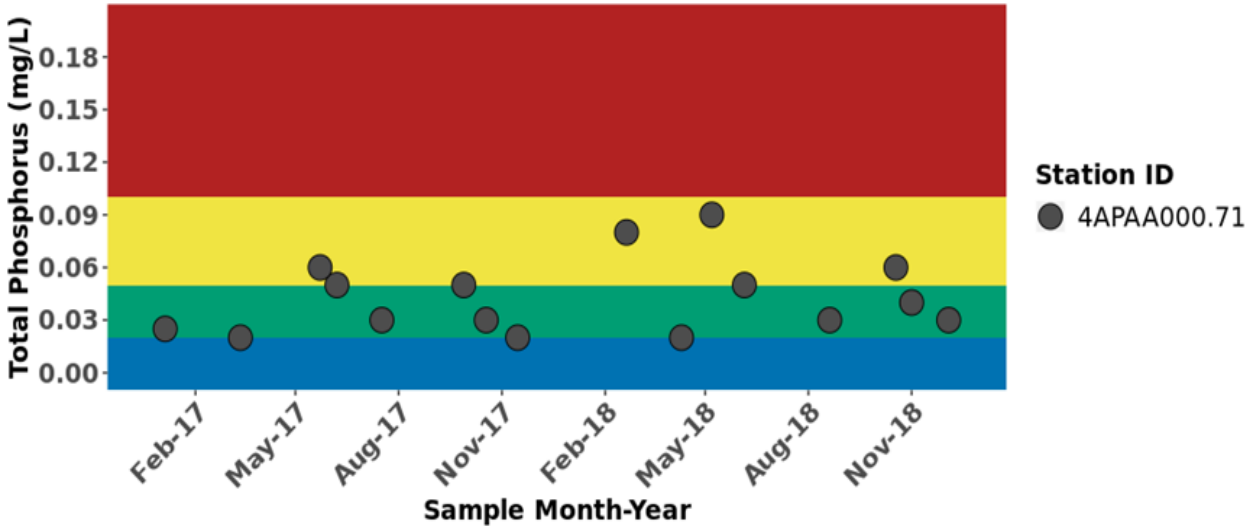
Poplar Branch -Non stressors

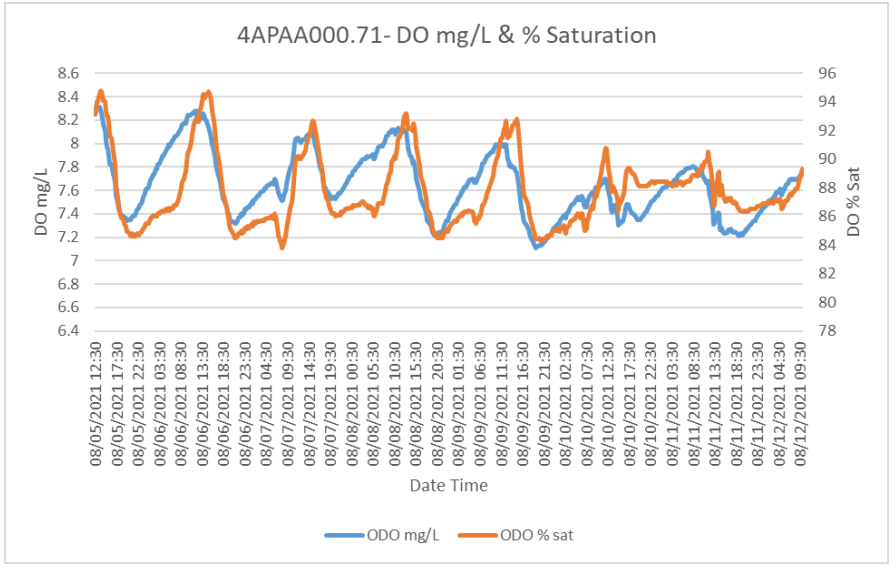
- pH, DO, TN, dissolved ions (sulfate, potassium, chloride, and sodium), specific conductivity, TDS, and water temperature were determined to be non-stressors based on the evidence described in Section 4 of the Draft Stressor Identification document.
- The CADDIS scores are shown in the table below.

Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Poplar Branch	-24	-15		-5	-17	-20	-21	-22	-6	-18	NA	-15		

Poplar Branch -Possible stressors

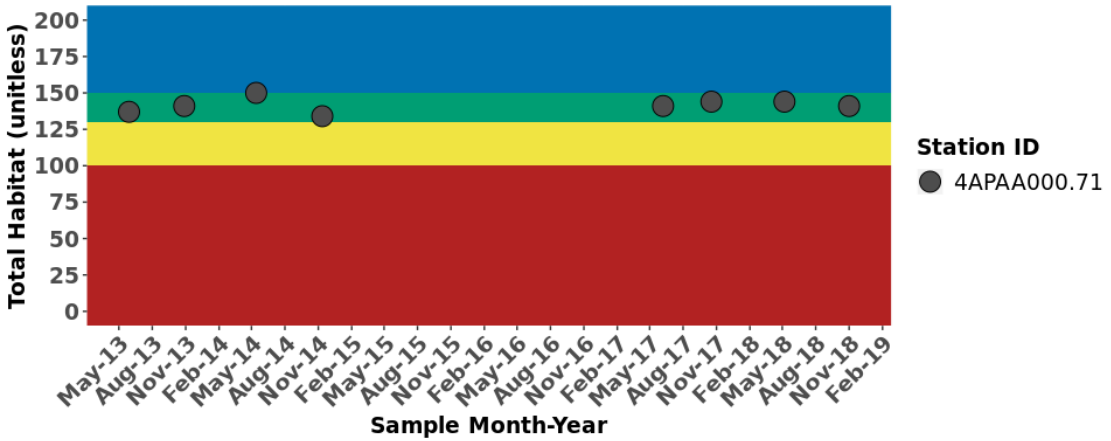
- Total phosphorus was identified as a possible stressor to the Poplar Creek benthic community because the median concentration exceeded EPA's suggested criteria; however, the median value was within the low probability for stressor category. The diurnal DO data did not show extreme daily swings or exceed the water quality standard indicating that there is not a biological effect of the observed excess nutrients at this time. There was a relationship between elevated TP concentration and low VSCI scores.





Poplar Branch- Possible Stressors continued

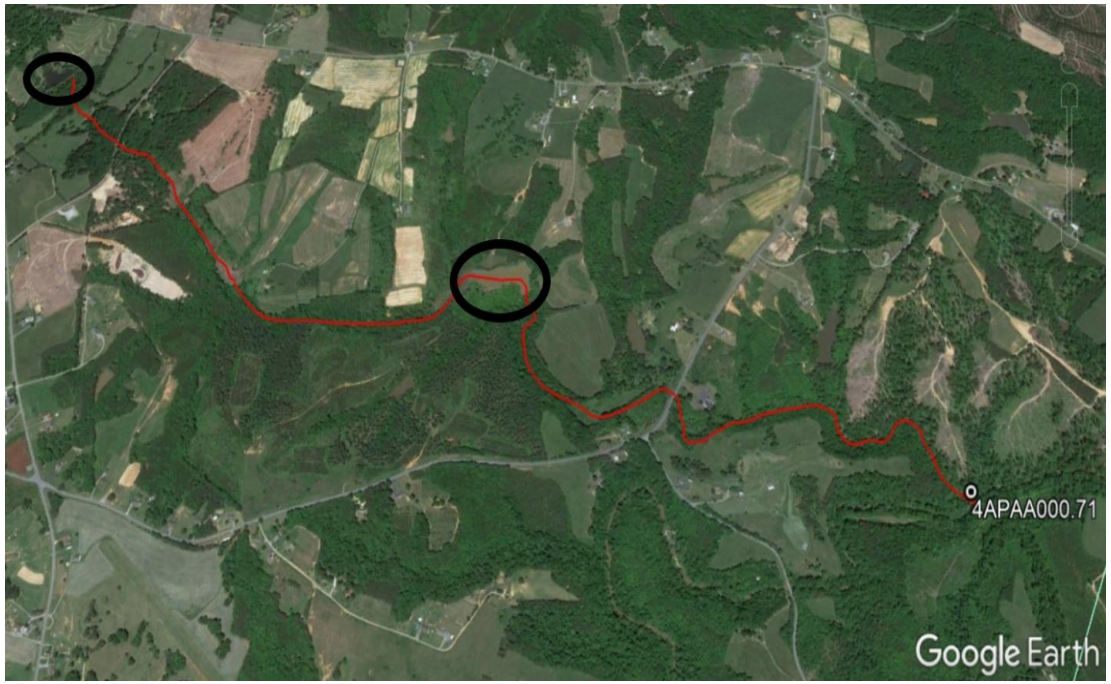
- The median total habitat scores was in the low probability category for aquatic stress yet individual habitat parameters showed that there was excessive sediment banks were observed to be unstable with excess sediment observed.
- TSS and Turbidity were consistently low at Poplar Branch



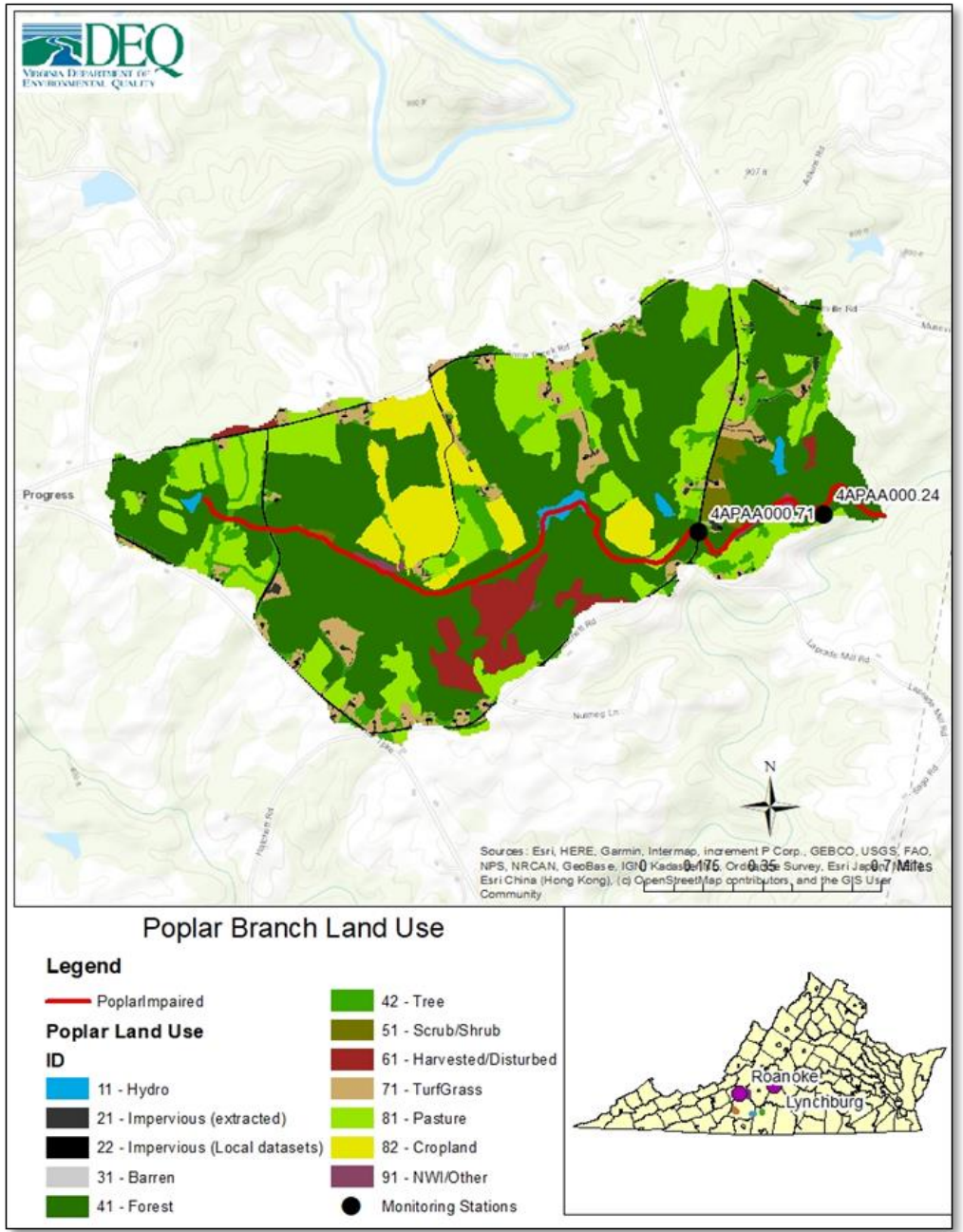
Station ID	Date	Channel Alteration	Banks	Bank Vegetation	Embeddedness	Flow	Riffles	Riparian Vegetation	Sediment	Substrate	Velocity	Total Habitat
4APAA000.71	2013-05-29	17	14	18	14	12	16	13	6	13	14	137
4APAA000.71	2013-10-28	15	18	14	17	7	18	7	12	17	16	141
4APAA000.71	2014-05-14	18	16	18	16	8	20	14	9	18	13	150
4APAA000.71	2014-11-12	19	13	14	13	11	19	8	8	16	13	134
4APAA000.71	2017-06-07	15	10	16	16	10	19	16	9	15	15	141
4APAA000.71	2017-10-18	19	9	15	17	8	19	17	11	19	10	144
4APAA000.71	2018-05-07	19	10	13	17	11	19	15	10	15	15	144
4APAA000.71	2018-11-01	19	10	15	15	13	19	14	10	15	11	141

Poplar Branch- Probable Stressor

- Hydromodification was identified to be a probable stressor (contributing factor) because several impoundments were observed just upstream of our sample site. Observations were made of very low flow conditions at the time of sampling.
- Impoundments can contribute to lower flows, greater nutrient cycling, and a more consistent source of sediment.
- Hydromodification due to impoundments/farm ponds is not considered a stressor by EPA and therefore a TMDL equation cannot be calculated.



Poplar Branch Summary



- **Questions for you:**
  - Does our assessment of the stressor for Poplar Branch make sense to you based on your knowledge of the watershed? What are we missing?
  - Are there large sources of this pollutant in the Poplar Branch watershed? Are there large sources of other pollutants?
  - Since we cannot calculate a TMDL equation for impoundments, we have several options to move forward….
    - Calculate TMDL equation for TP and/ or Sediment
    - Work on a watershed plan that would include BMPs for TP and sediment.
    - Focus implementation activities in the watershed using existing Pigg River IP funding opportunities.
      - Is there interest in this watershed?
      - Commit to occasional monitoring to evaluate improvements in the benthic community as BMPs are installed.
  - Are there stakeholders who we need to reach out to in this watershed?

DEQ