
DEQ
VIRGINIA DEPARTMENT OF
ENVIRONMENTAL QUALITY

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

A water quality study for watersheds in Pittsylvania, Franklin and Bedford Counties

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Virginia Department of Environmental Quality
November 18, 2021

Our goals for today…

- Share with you DEQ's water quality improvement process.
  - Information on the streams of interest
  - Discuss the stressor identification process and data used.
  - Solicit interest in becoming part of the TAC
- You share your thoughts on these conclusions

While we will be presentation during this meeting, it is not intended to be a monologue (i.e. WE NEED TO HEAR FROM YOU)

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What does the 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

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Agenda

- What is DEQ's process for addressing impaired streams?
  - Describe DEQ's water quality data
  - Describe the TMDL process
  - Describe the Implementation planning
- What's the problem with Fryingpan Creek, Pigg River, Poplar Branch and Beaverdam Creek?
- Next Steps and what you can do to help!

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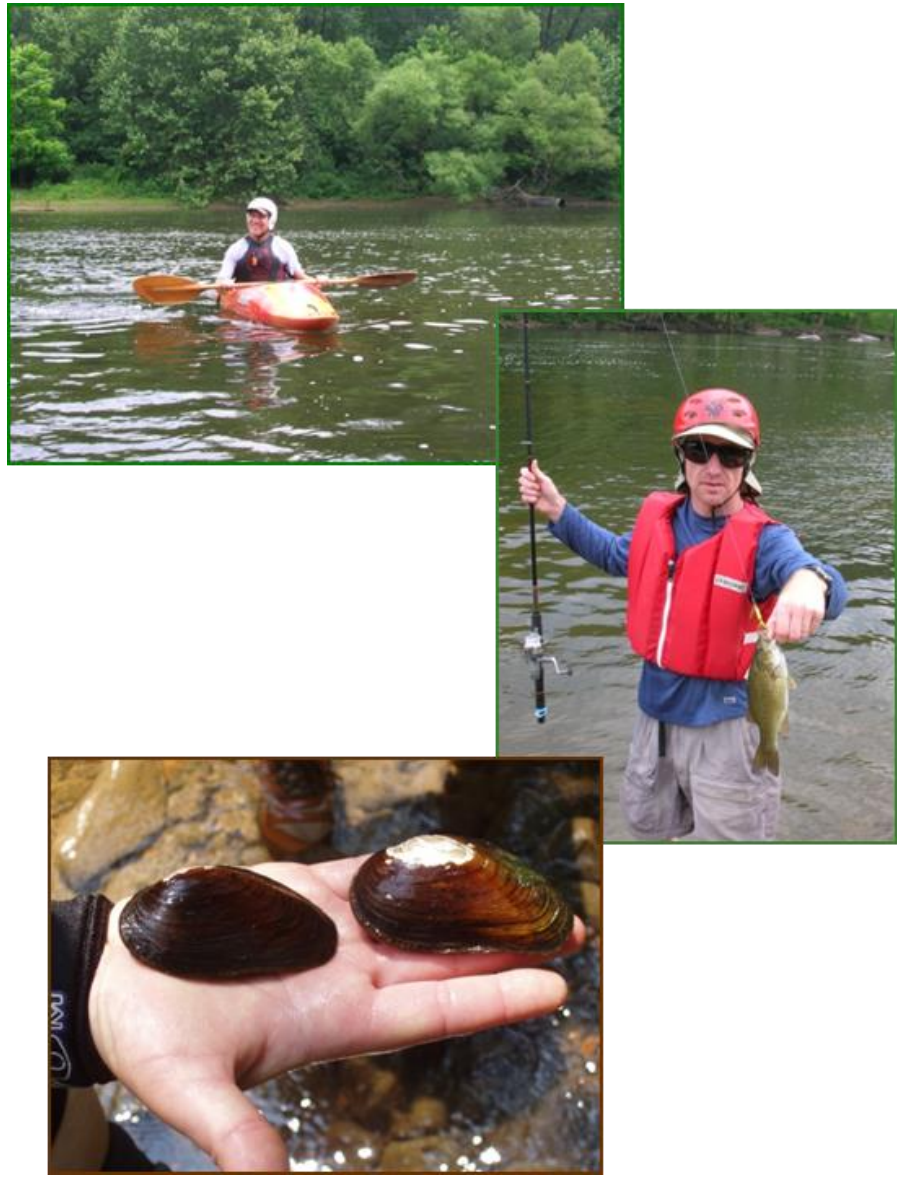
Background: Clean Water Act

- The 1972 Clean Water Act (CWA) requires that all waters meet water quality standards that promote healthy water use.

- In order to meet the goals of the CWA, Virginia established water quality standards (WQS)



Virginia's Water Quality Standards

- WQS protects the 6 designated uses:
  - **aquatic life**
  - wildlife
  - fishing
  - shellfish
  - swimming
  - drinking water

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DEQ's Water Wheel

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DEQ's Water Wheel

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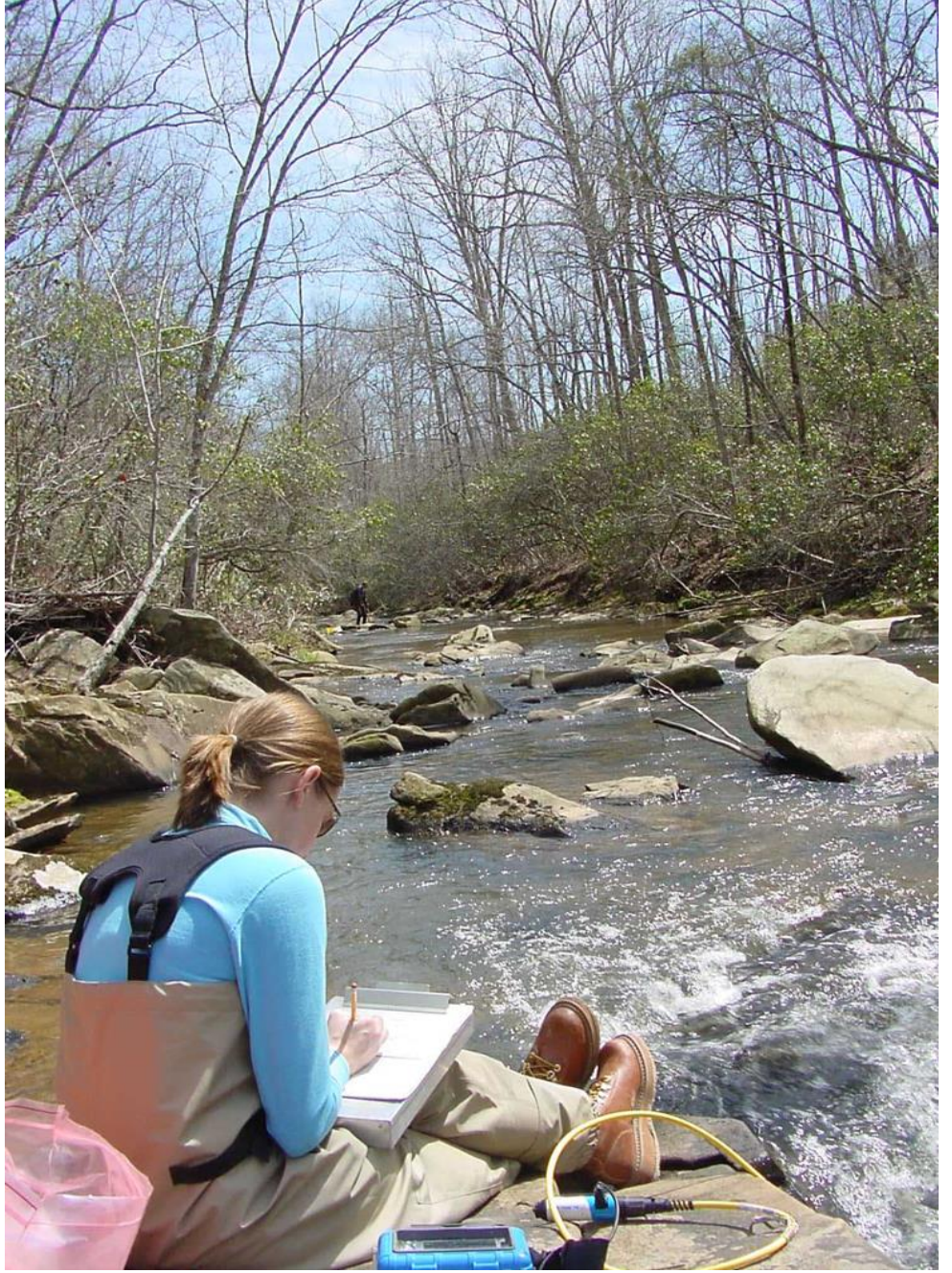
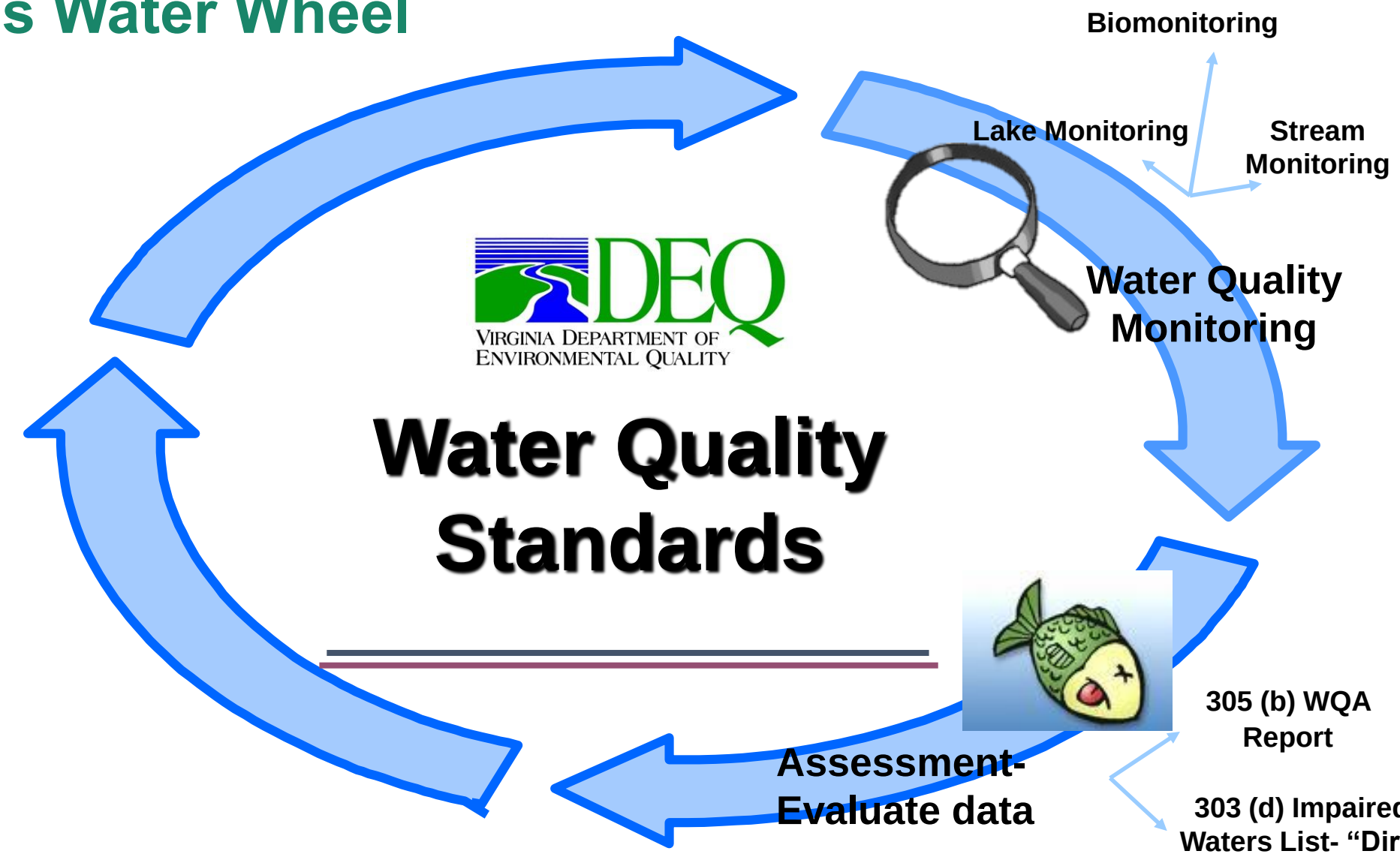
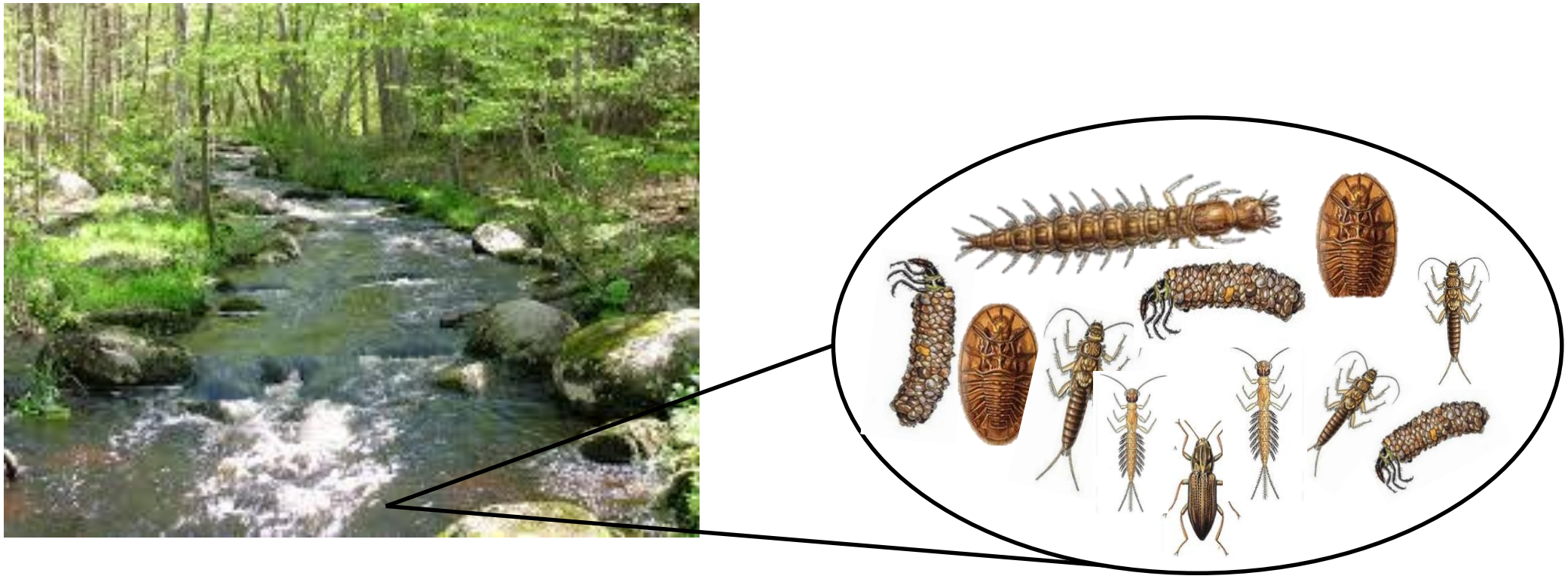


DEQ's Water Wheel



Aquatic Life Use Impairments

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



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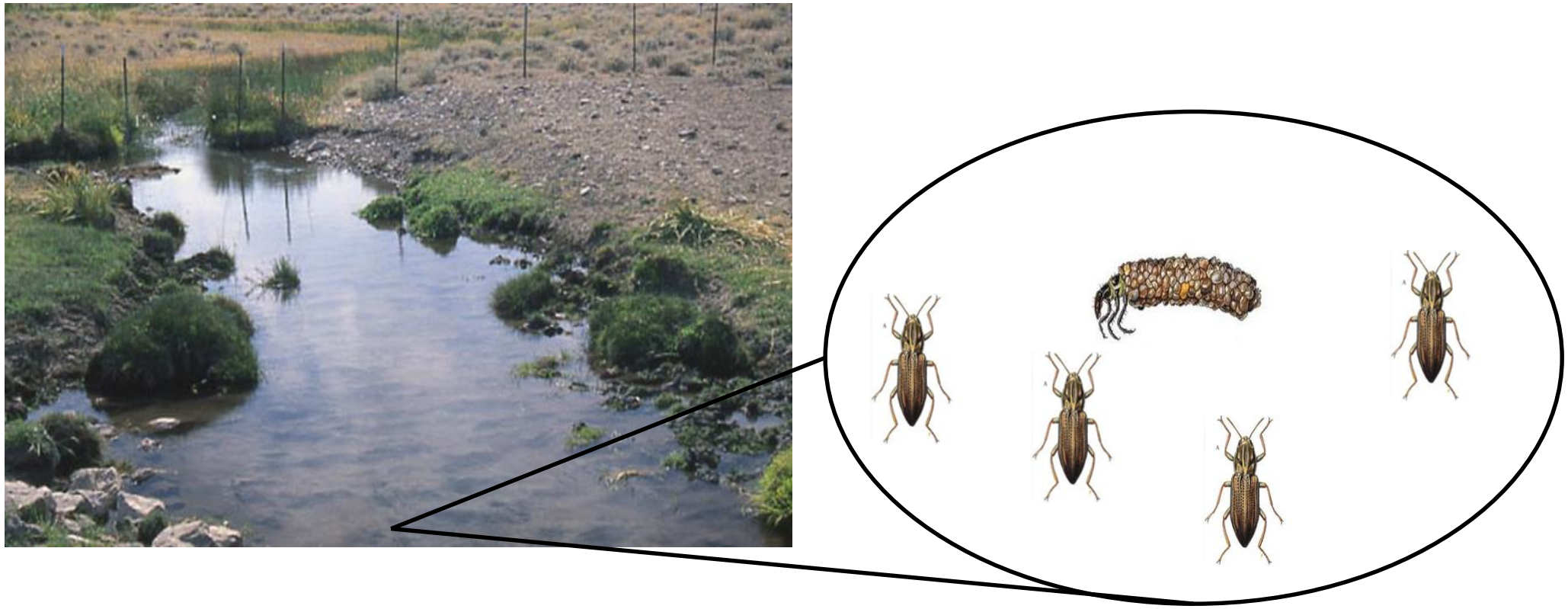
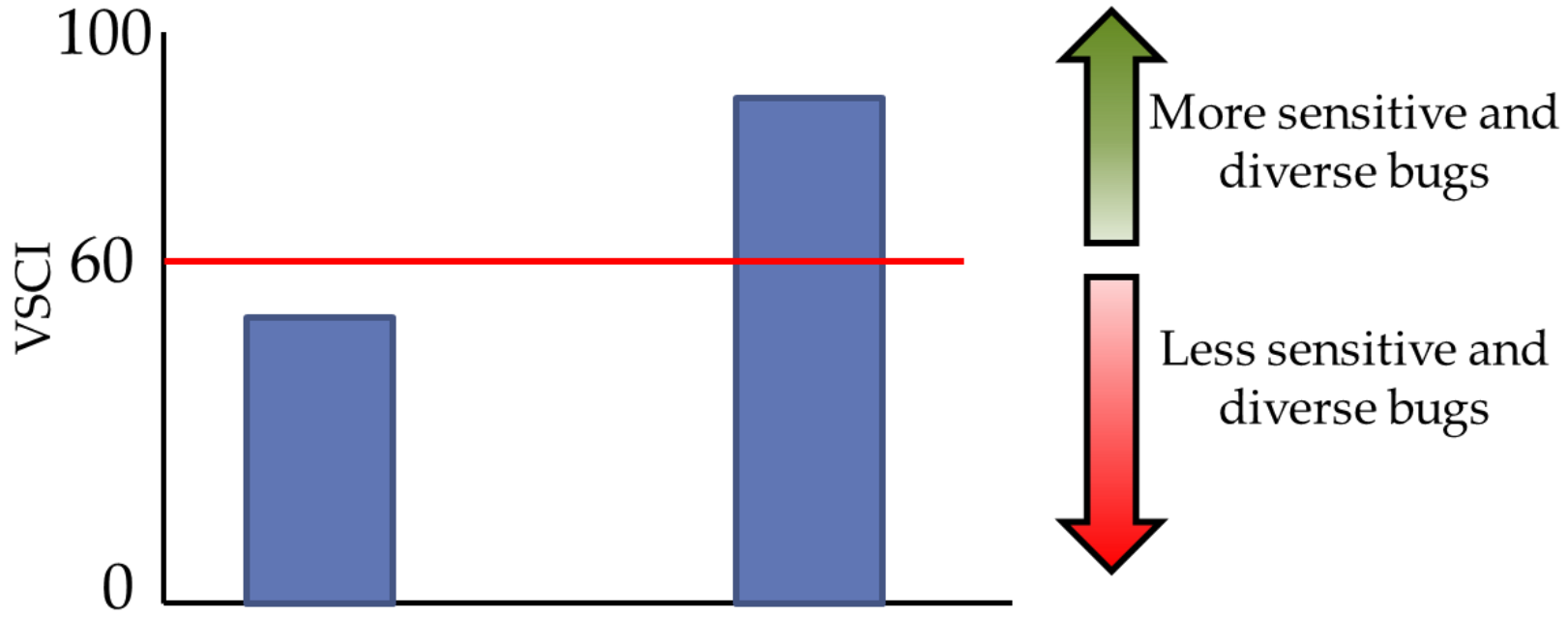
Aquatic Life Use Impairments

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



Virginia Stream Condition Index

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



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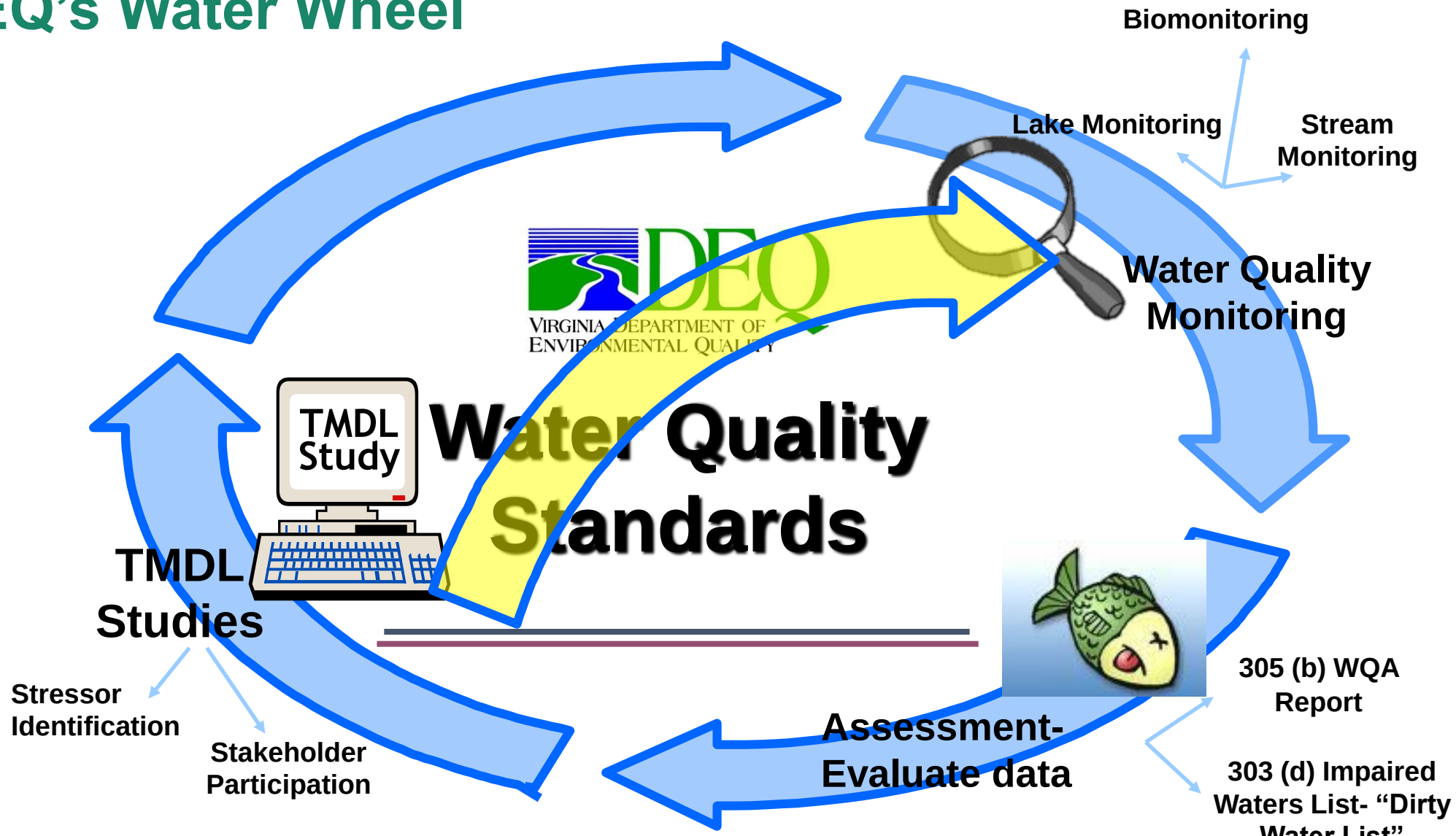
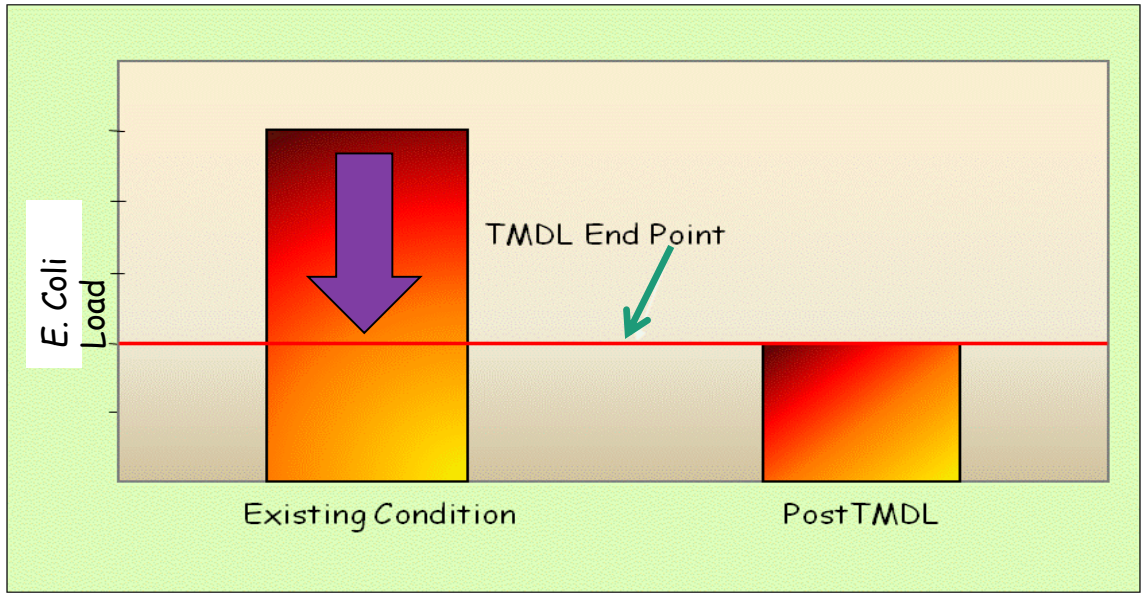
DEQ's Water Wheel



TMDL Study

- 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"



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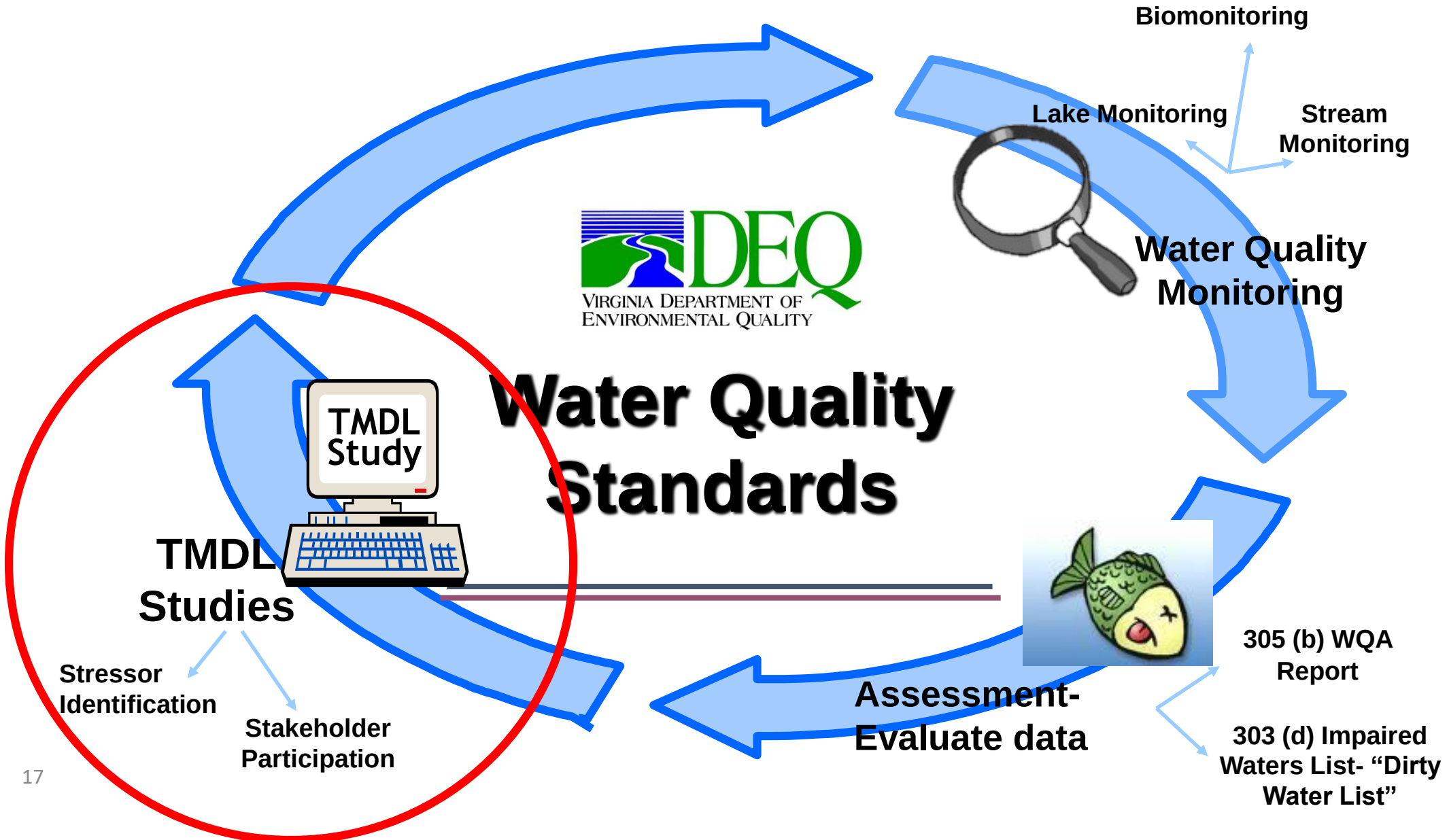
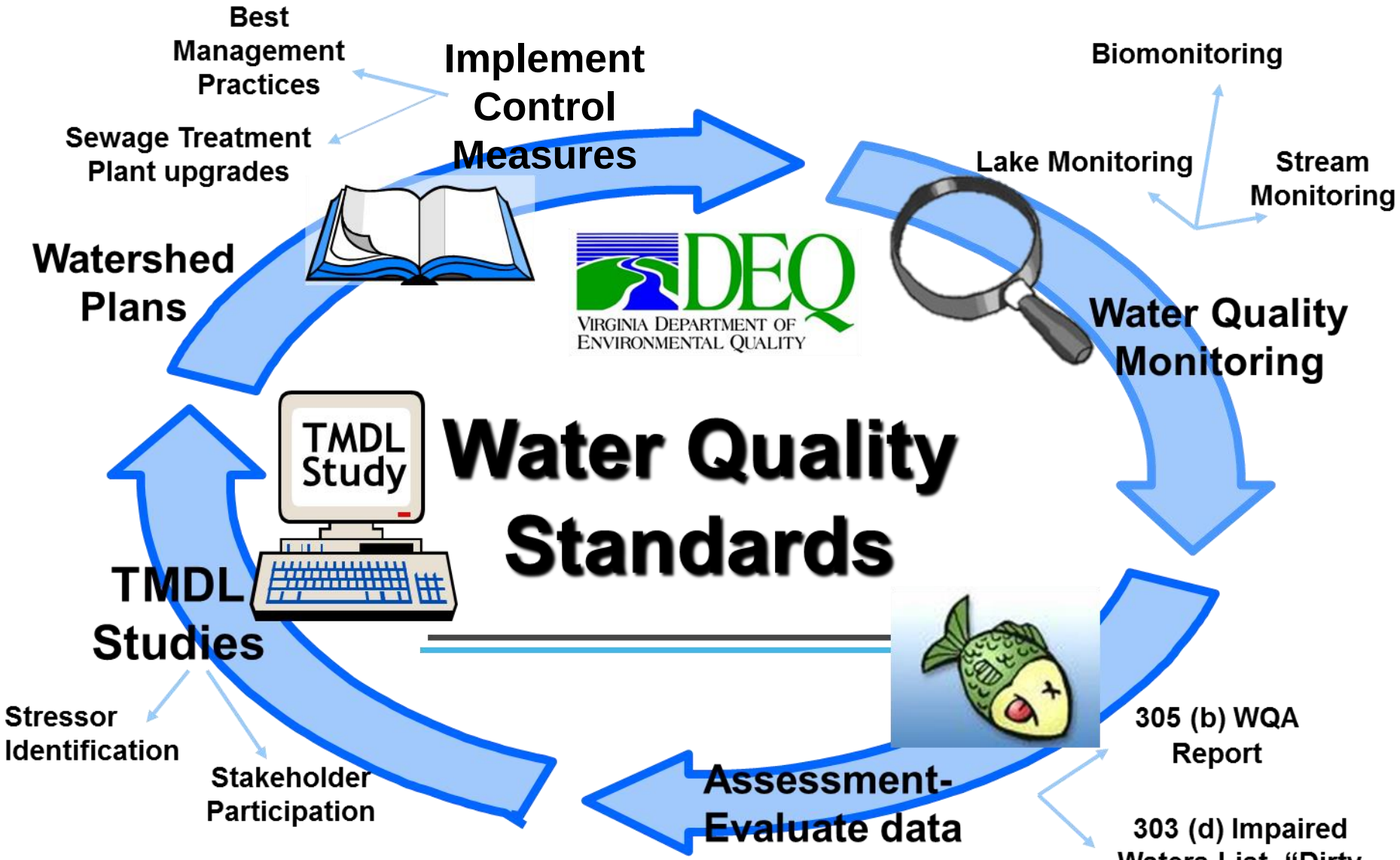
DEQ's Water Wheel



DEQ's Water Wheel



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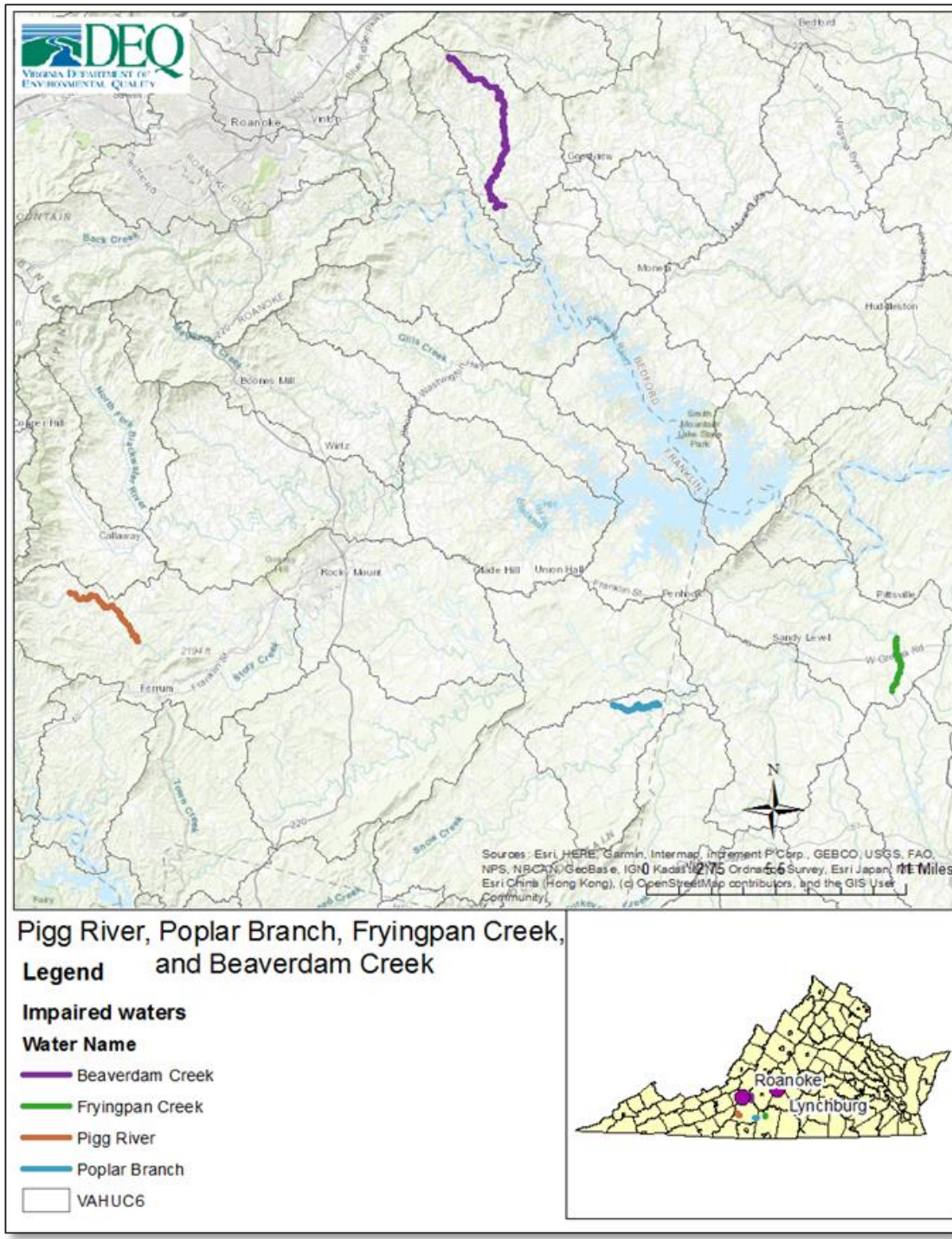
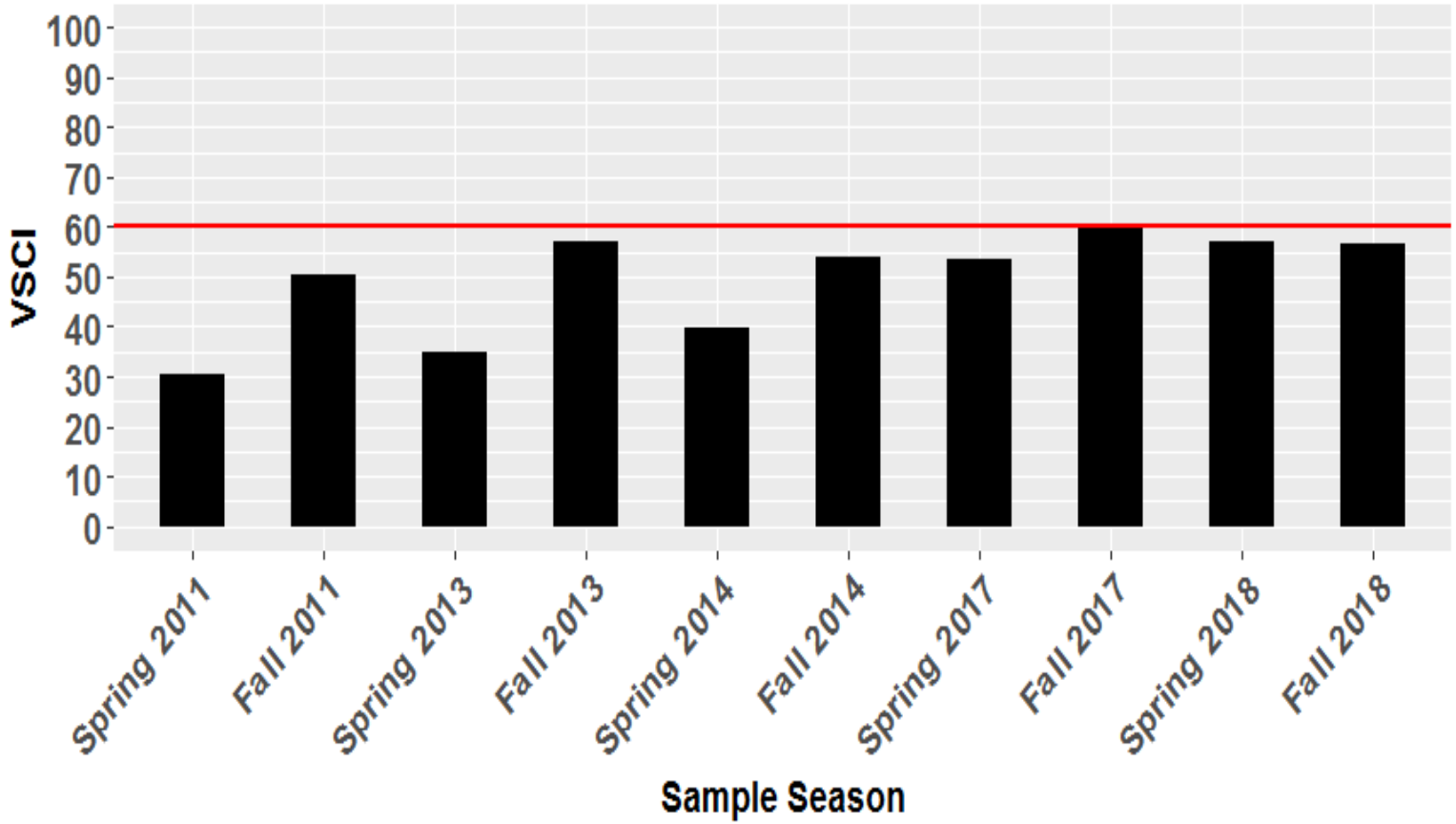
Fryingpan Creek, Pigg River, Poplar Branch and Beaverdam Creek

- Fryingpan Creek: Pittsylvania County
  - 2.56 miles from its headwaters downstream of the Rt. 40 crossing
- Pigg River: Franklin County
  - 4.43 miles from near Five Mile Mountain Road (Rt. 748) on downstream to the confluence of Turners Creek
- Poplar Branch: Franklin County
  - 2.56 miles from headwaters to confluence with Snow Creek
- Beaverdam Creek: Bedford County
  - 10.33 miles from mainstem waters from the 795 ft. pool elevation of Smith Mountain Lake upstream to its headwaters



Fryingpan Creek Biomonitoring Data



Low VSCI scores are driven by % Mayflies, % Stoneflies and Caddisflies, and % Scrapers

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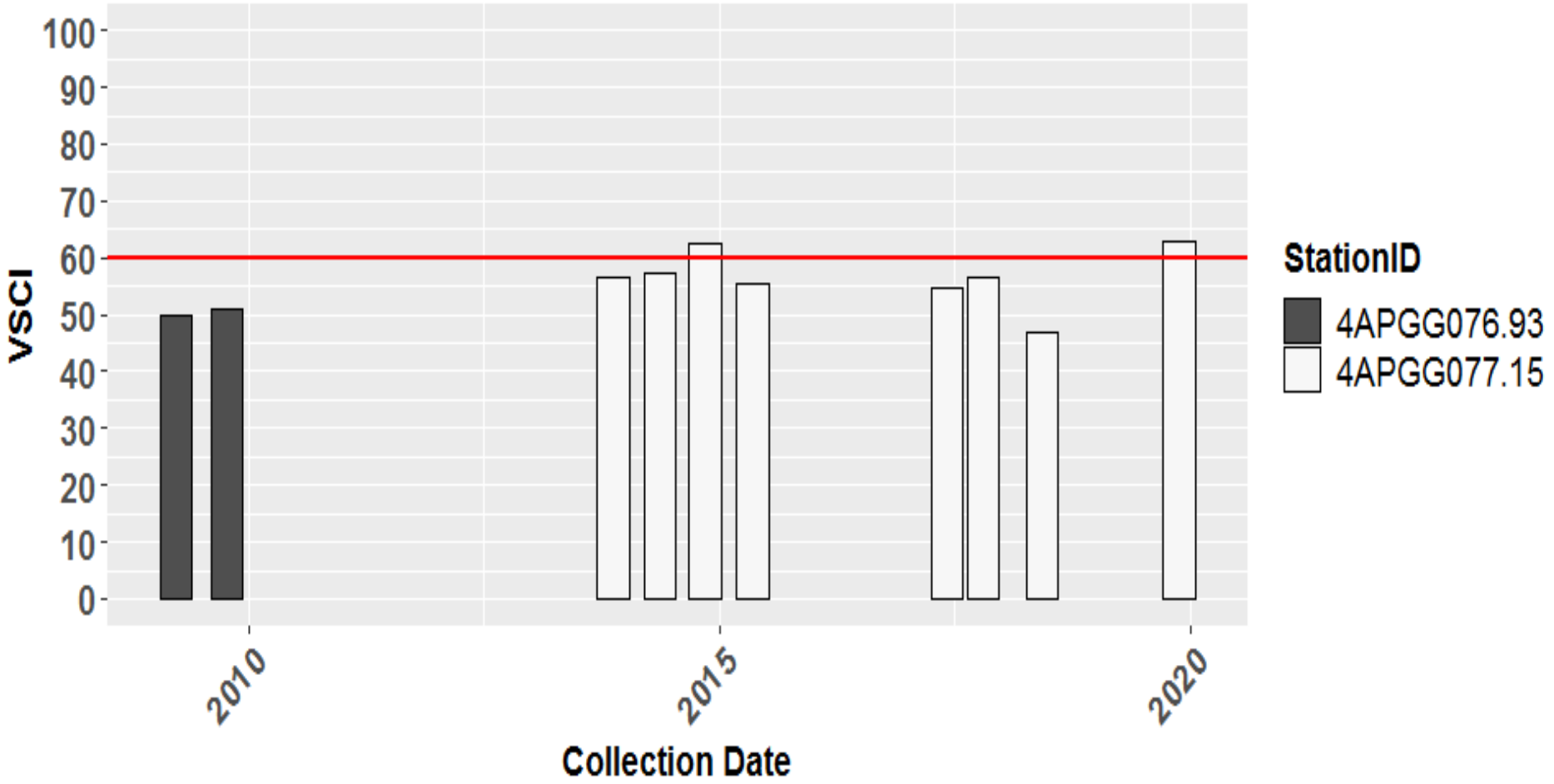
Pigg River Biomonitoring Data



Low VSCI scores are driven by % Mayflies, % Stoneflies and Caddisflies, and % Scrapers

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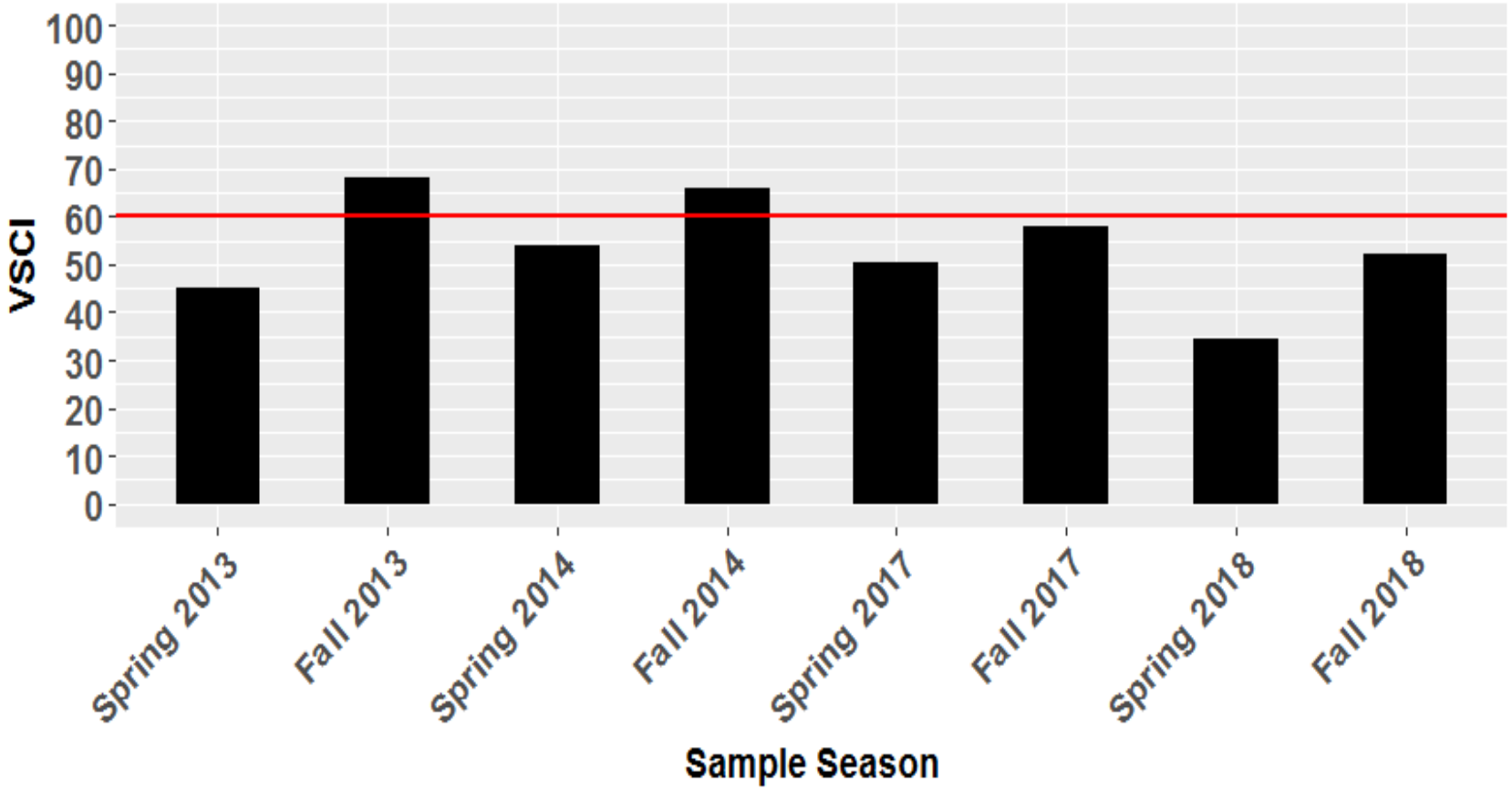
Poplar Branch Biomonitoring Data



Low % Mayflies, and low % stoneflies and caddisflies

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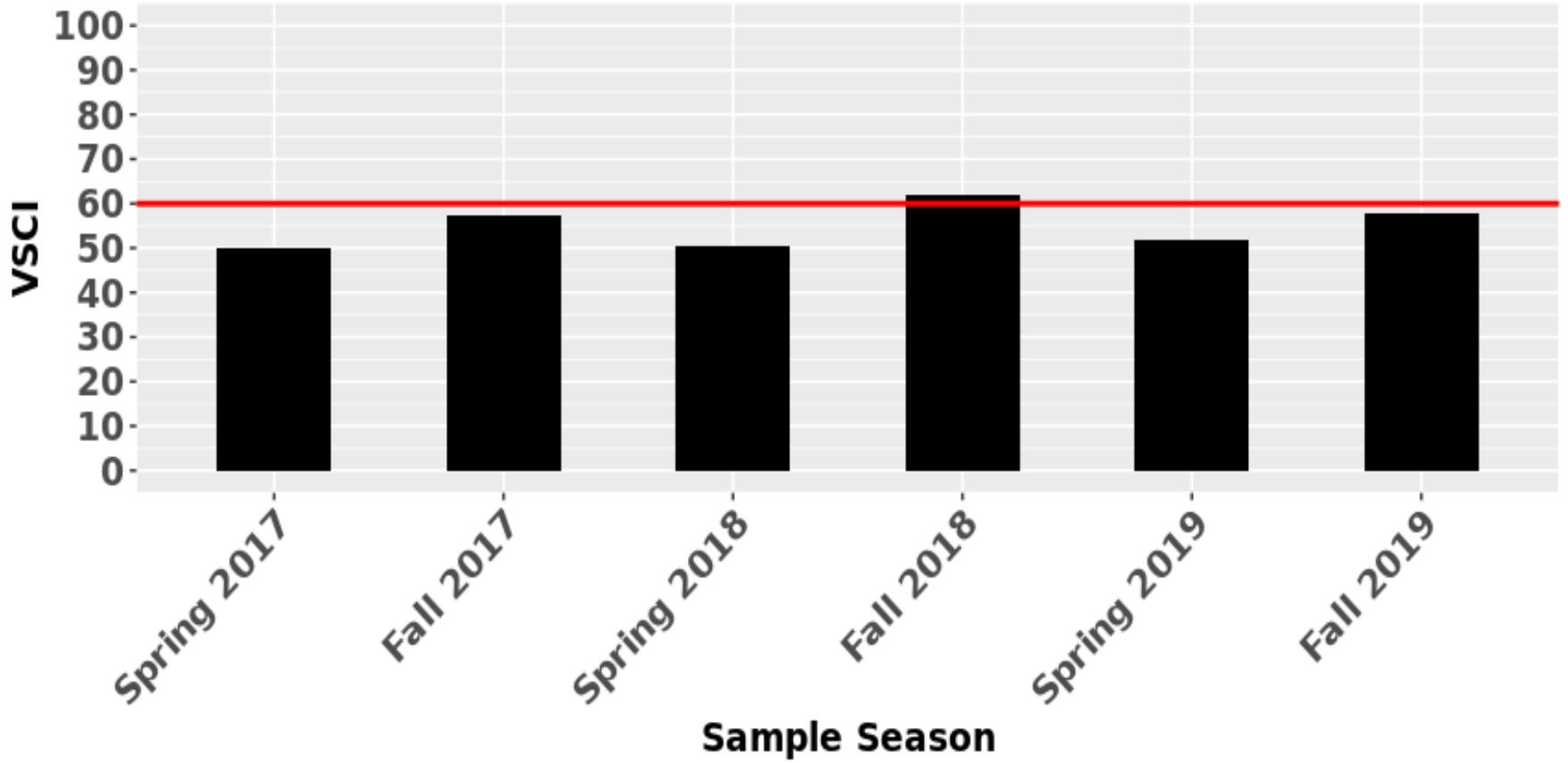
Beaverdam Creek Biomonitoring Data



Low % Mayflies, low % stoneflies and caddisflies, and low % scrapers

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Stressor Analysis Process

- DEQ and JMU 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.

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Candidate Stressors

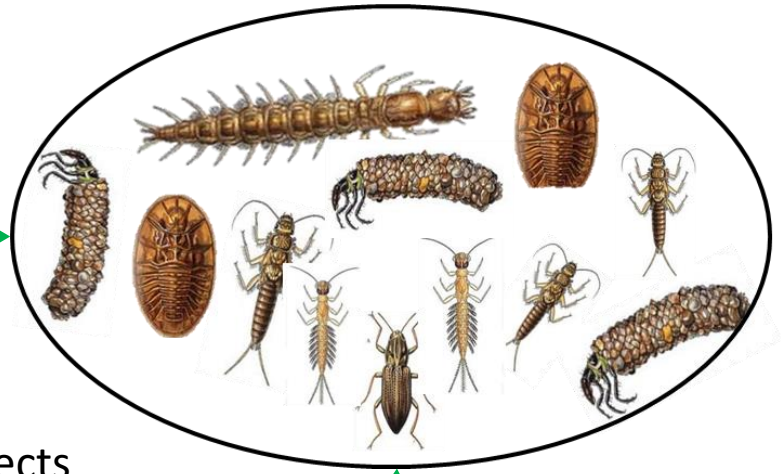
Sediment measured by:
TSS
Total Habitat scores
LRBS

Indirect Effects

Habitat

pH
DO
Dissolved Metals
Temperature
Toxins
Conductivity

Direct Effects



Total Phosphorus
Total Nitrogen
Organic Matter

Indirect Effects

Food Resources

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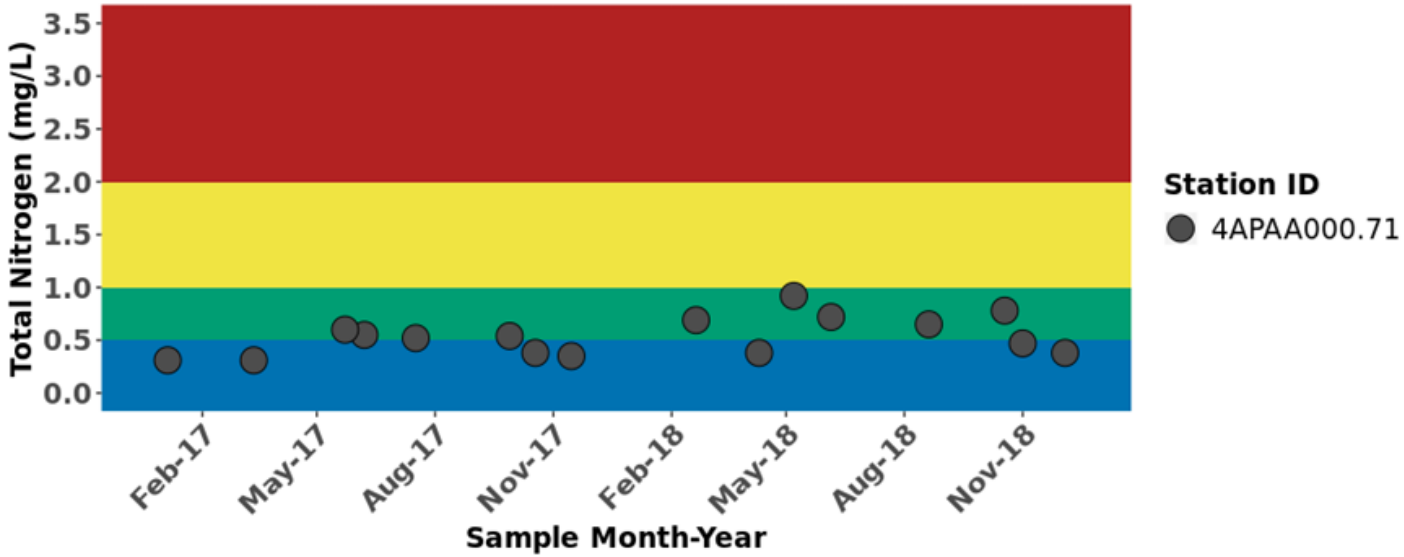
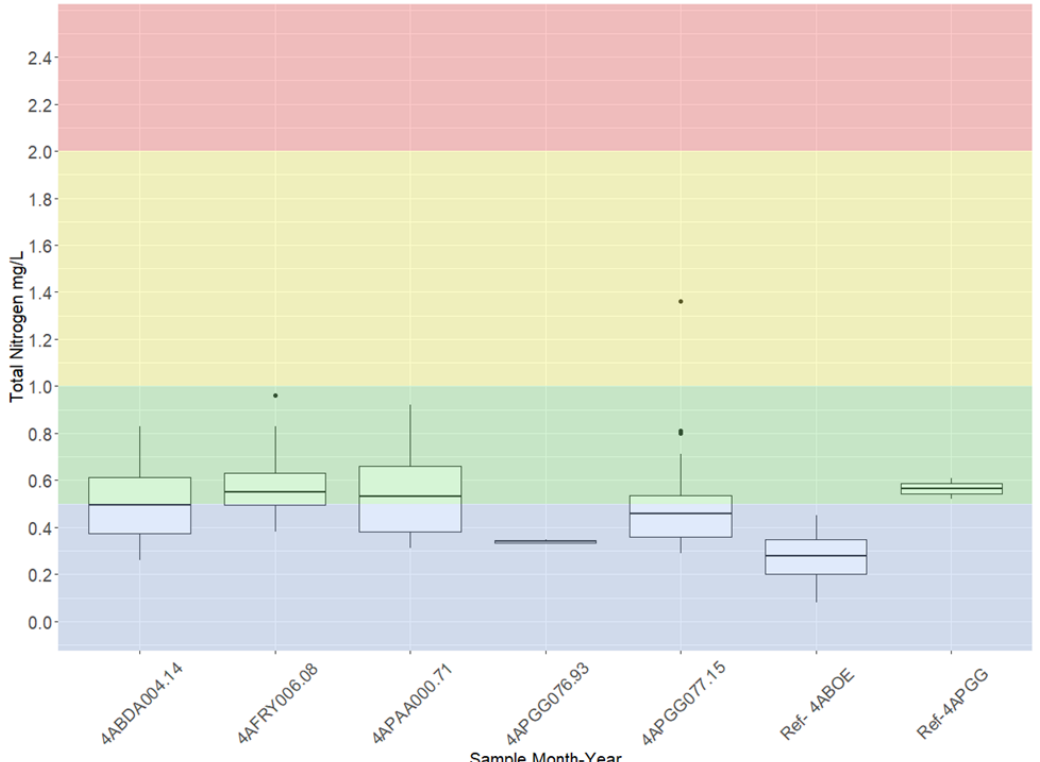
Evaluate Candidate Stressors

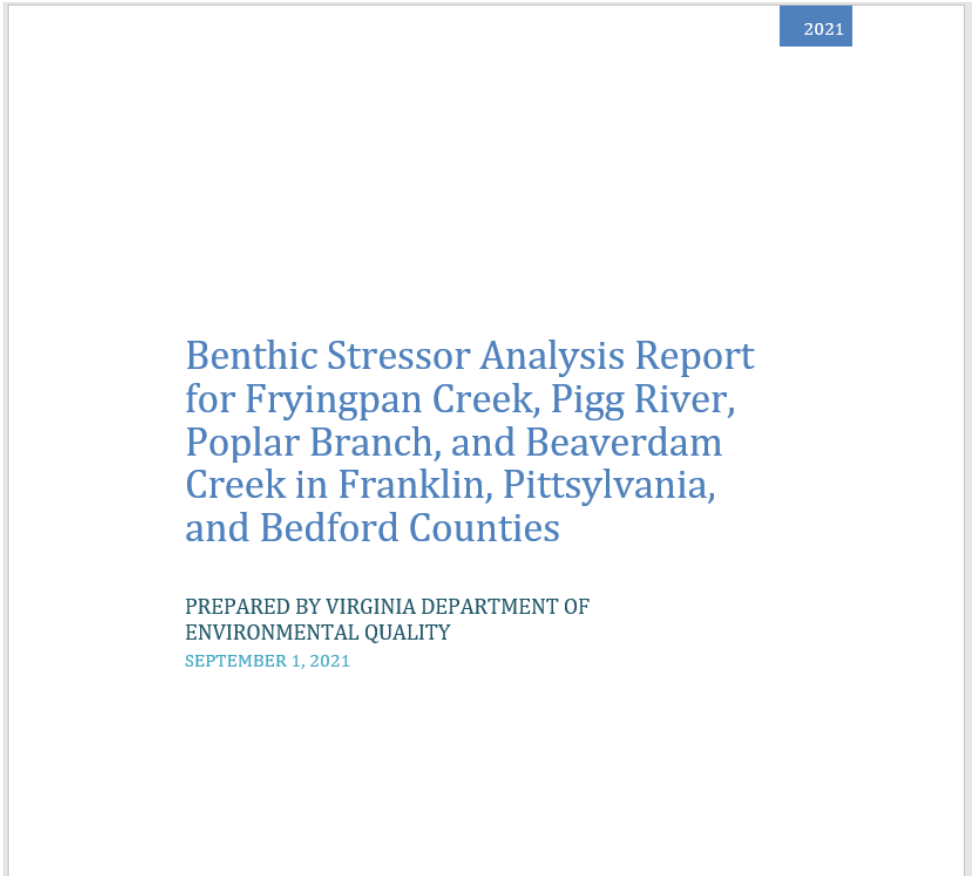
Evidence	Score	Explanation
Spatial Co-occurrence	-2	The TN observations were generally low at the upstream unimpaired site and the downstream impaired site
Temporal Co-occurrence	-2	TP concentrations were higher in the summer months; however, there is no pattern between TN and VSCI scores. In fact, fall samples had a higher VSCI score than spring samples at 4ARAB000.52
Stressor-Response Relationships from the Field	-3	TN levels were similar in the impaired and unimpaired stations
Symptoms	-2	The % scraper metric was one of the lowest parameters in the VSCI score for most of the samples, indicating that algae scraping animals did not dominate the community. DO levels were also relatively high, indicating no nutrient enrichment.
Stressor-Response Relationships from Other Field Studies	-3	All observations were within the low to no probability range for aquatic stress
Stressor-Response Relationships from Laboratory Studies	-3	Median TN levels were below EPA recommended criteria for Ecoregion IX
Consistency of Evidence	-2	Most evidence refutes TN as a stressor
Sum	**-17**	





DRAFT Stressor Analysis Report

- https://www.deq.virginia.gov/water/water-quality/tmdl-development/tmdls-under-development



30-day public comment period expires on January 3, 2022

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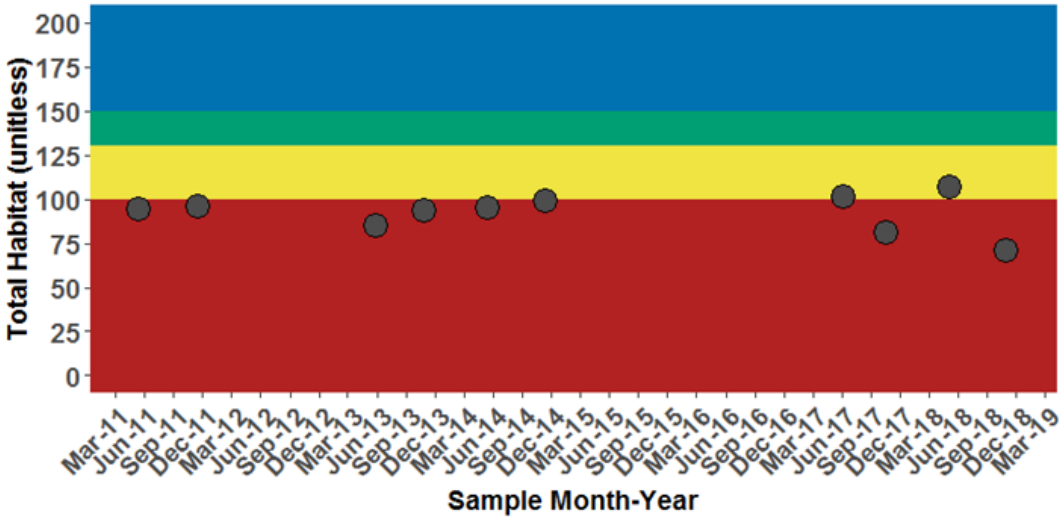
Fryingpan Creek Stressor Analysis Results

- Total Habitat Scores were consistently low and driven by excess sediment and unstable banks.

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



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

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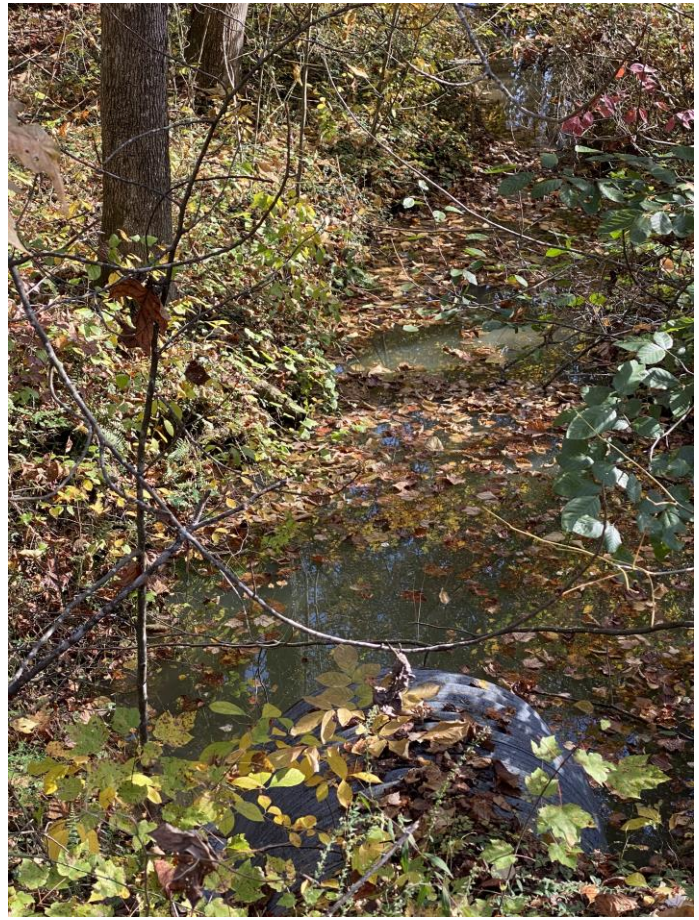
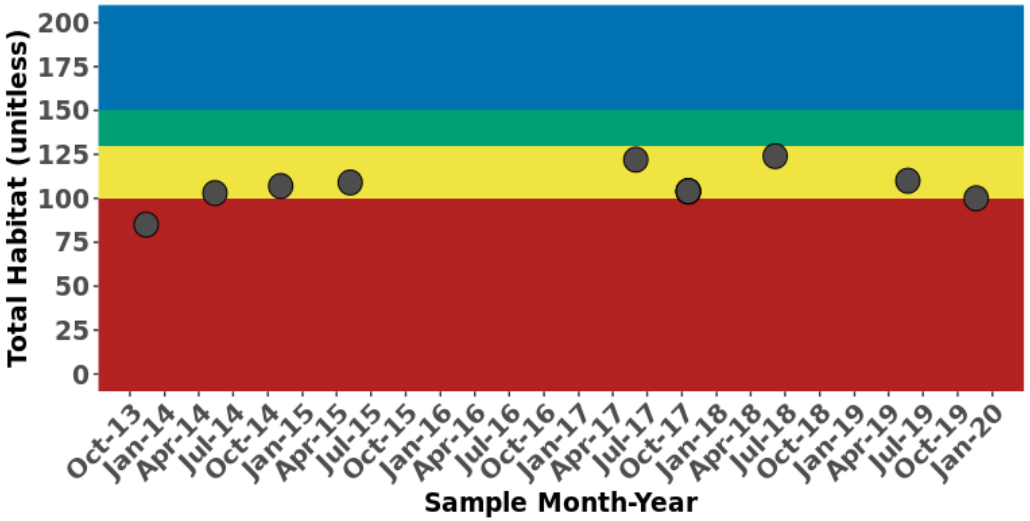
Fryingpan Creek



Pigg River Stressor Analysis

- 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.

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



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

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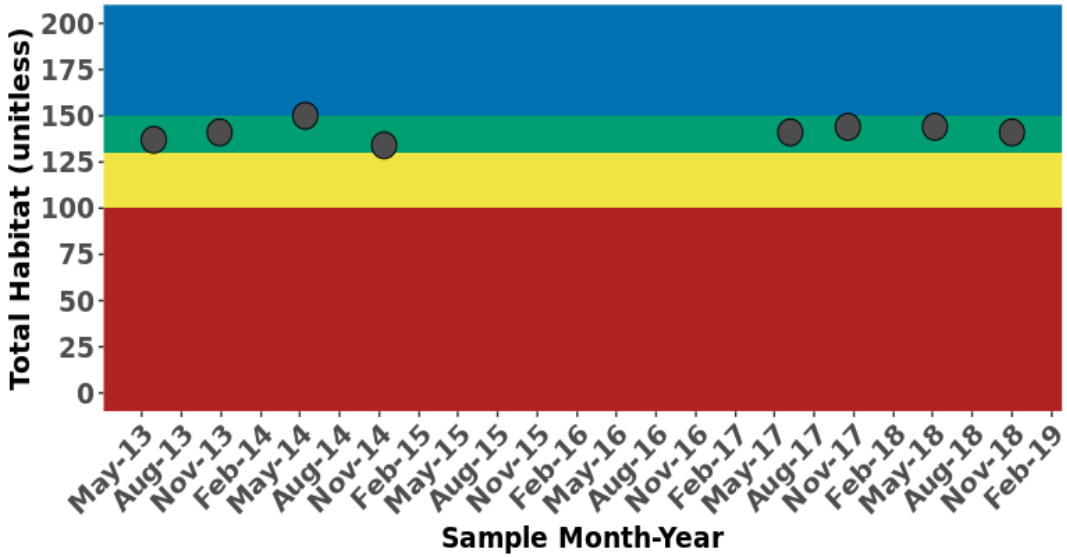
Poplar Branch Stressor Analysis

- 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.

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	8	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



Stream	pH	DO	TP	TN	Cond	TDS	Sulfate	Chloride	Potassium	Sodium	Metals CCU	Temperature	Habitat/ Sediment	Hydrologic Modification
Poplar Branch	-24	-15	0	-5	-17	-20	-21	-22	-6	-18	NA	-15	1	5

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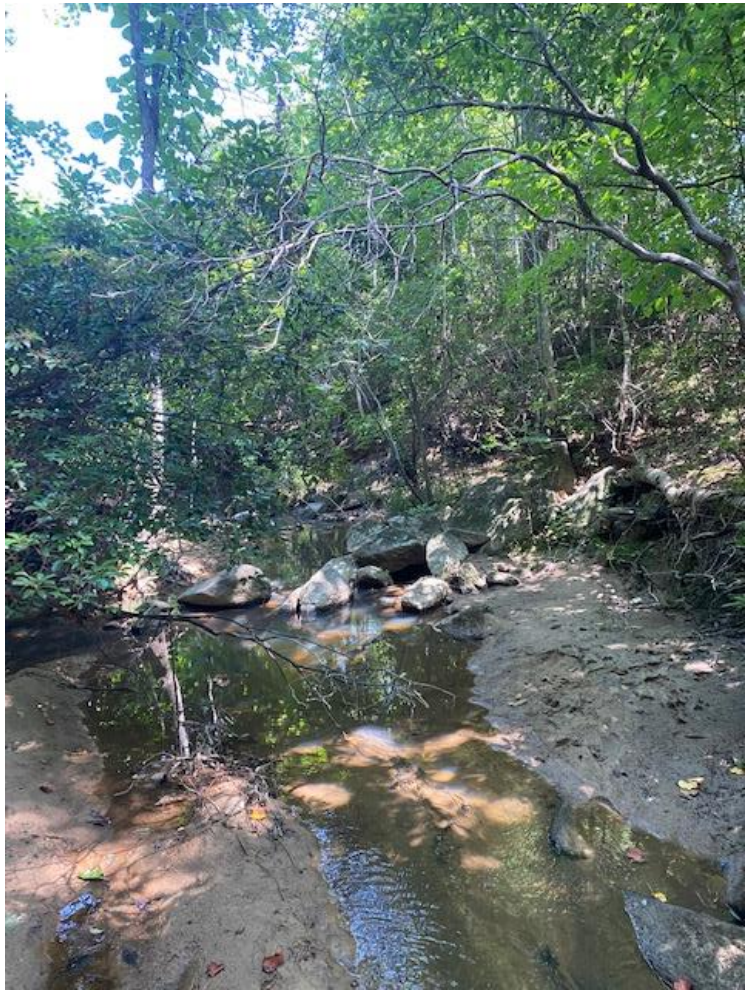
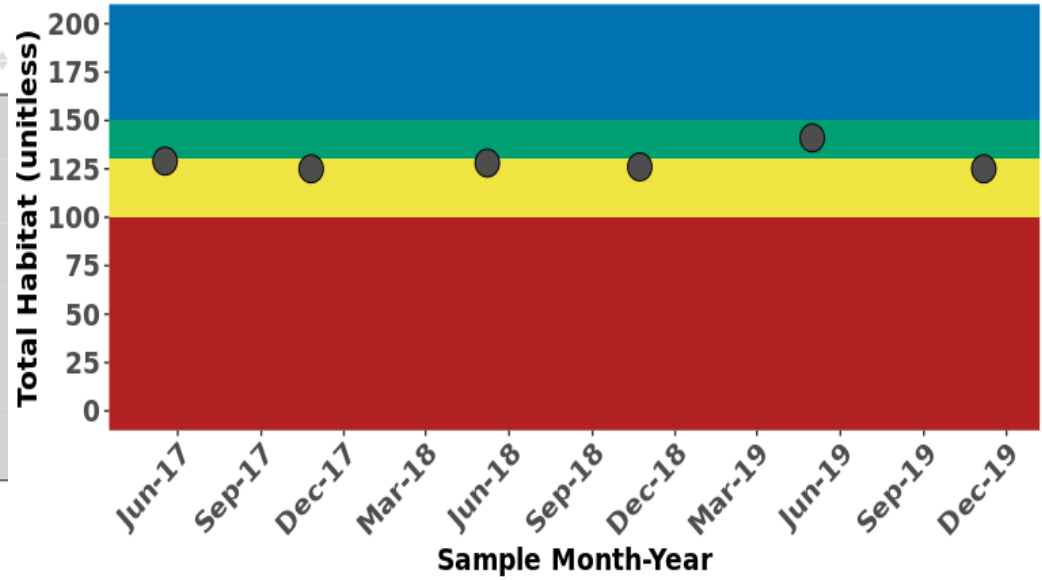
Poplar Branch



Beaverdam Creek Stressor Analysis

- 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.

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



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

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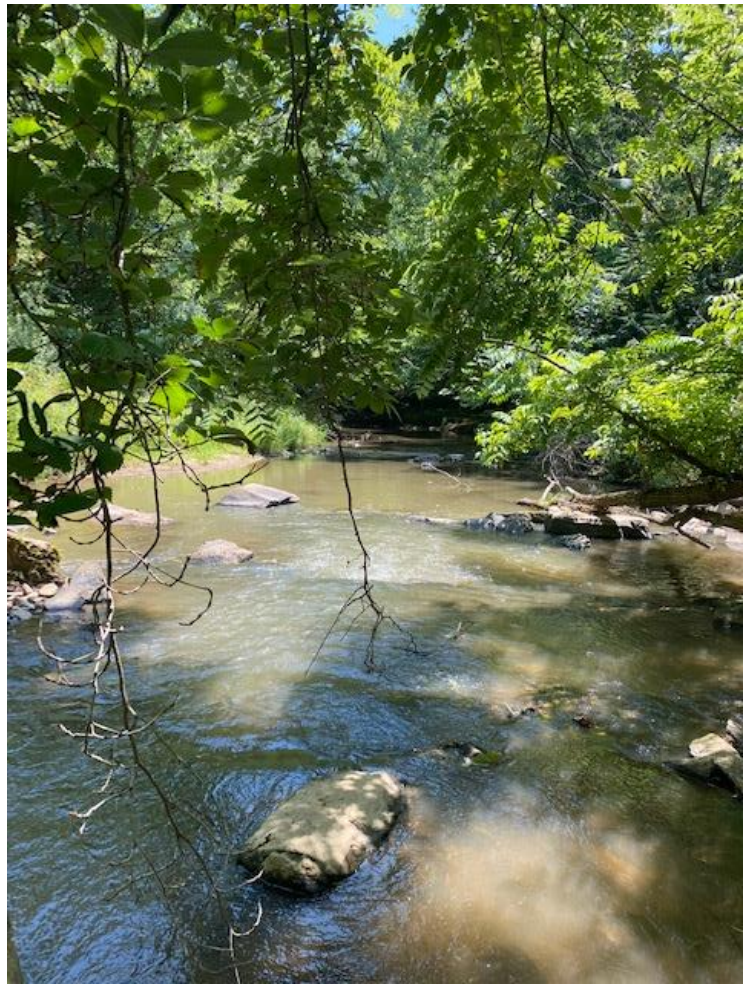
Beaverdam Creek



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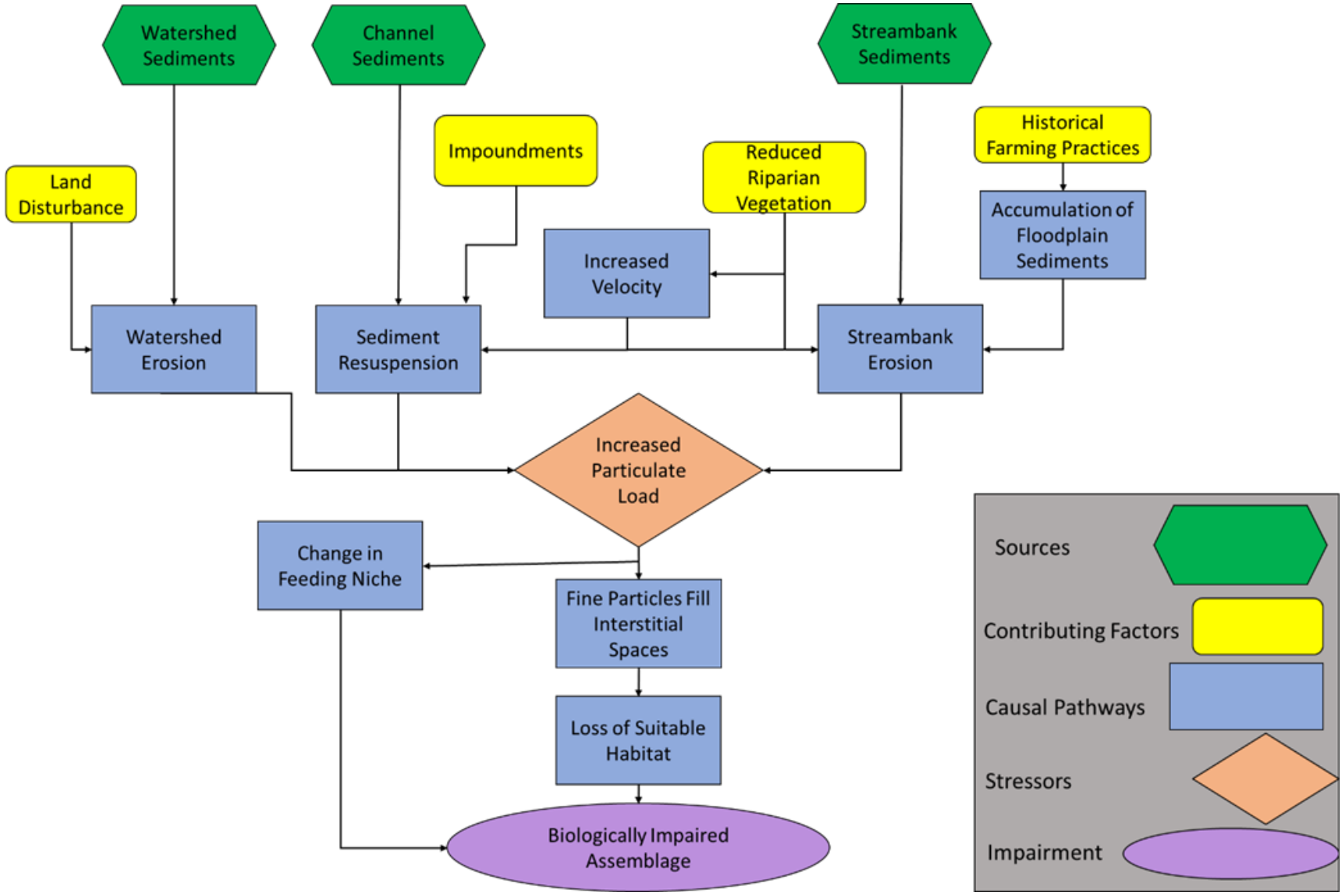
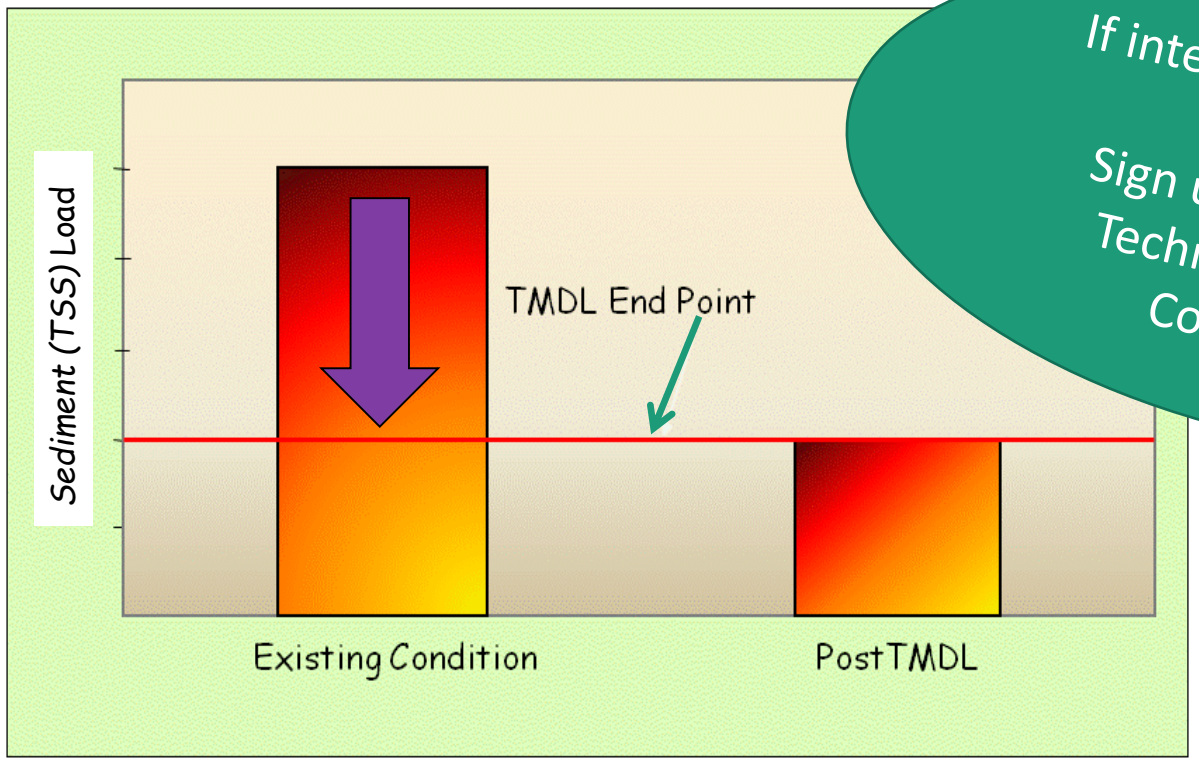
Causal Analysis- Sediment



Develop a TMDL equation for sediment

- Develop an TMDL equation that will help us meet the post TMDL scenario
  - First we need to identify the endpoint



If interested in learning more…
Sign up to be on the Technical Advisory Committee!

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Identify point sources

- Permitted dischargers
- Construction permits

WATERSHED	STREAM	PERMIT NUMBER	PERMIT TYPE	PARAMETERS SAMPLED
BEAVERDAM CREEK	Nat Branch, UT	VA0020842	VPDES IP- municipal	pH, BOD, TSS, Cl_2, Ammonia, E. Coli
	Beaverdam Creek	VAG402030	Domestic Sewage	pH, BOD, TSS, DO, Cl_2
	Nat Branch, UT	VAG402101	Domestic Sewage	pH, BOD, TSS, DO, Cl_2

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Identify nonpoint sources

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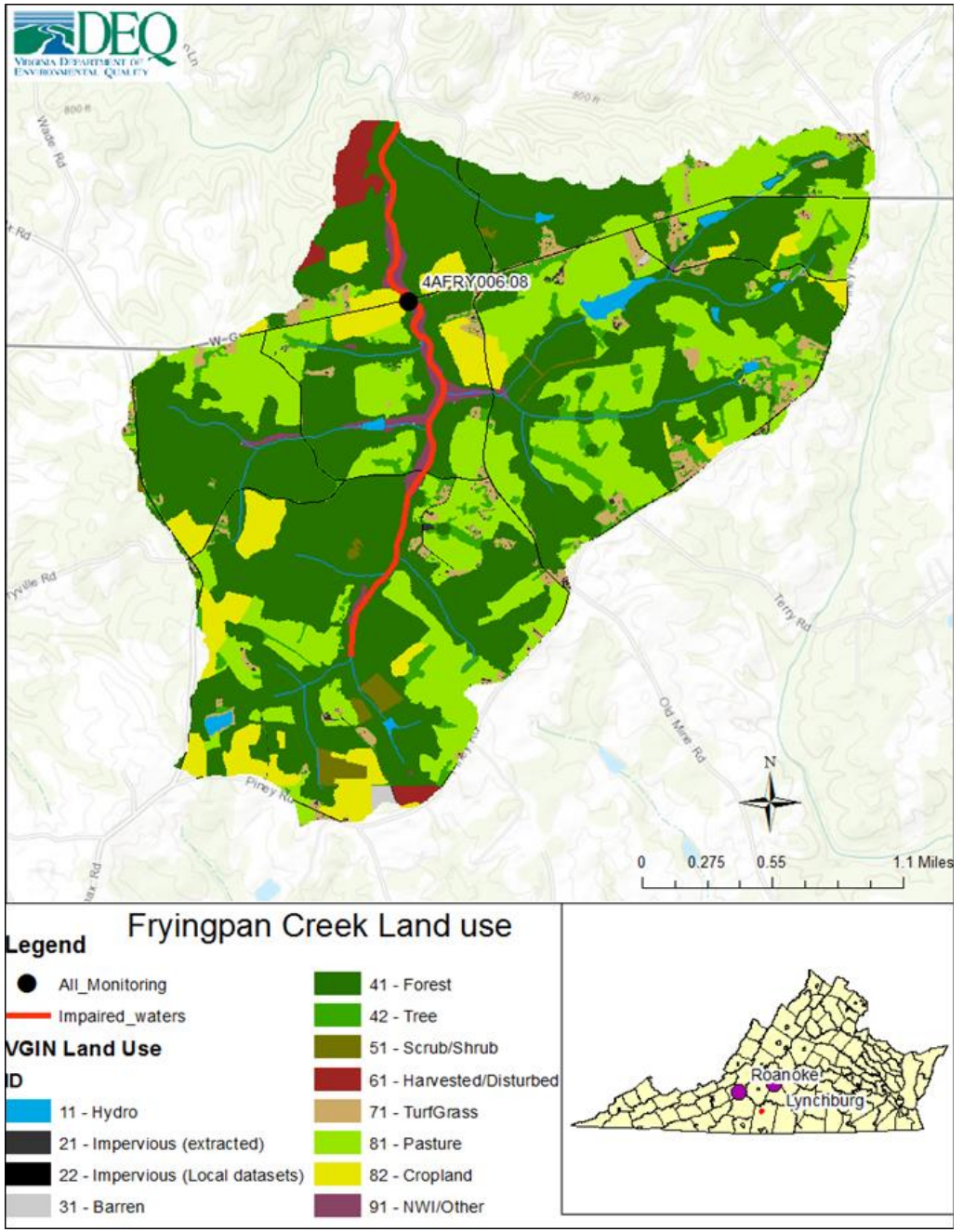
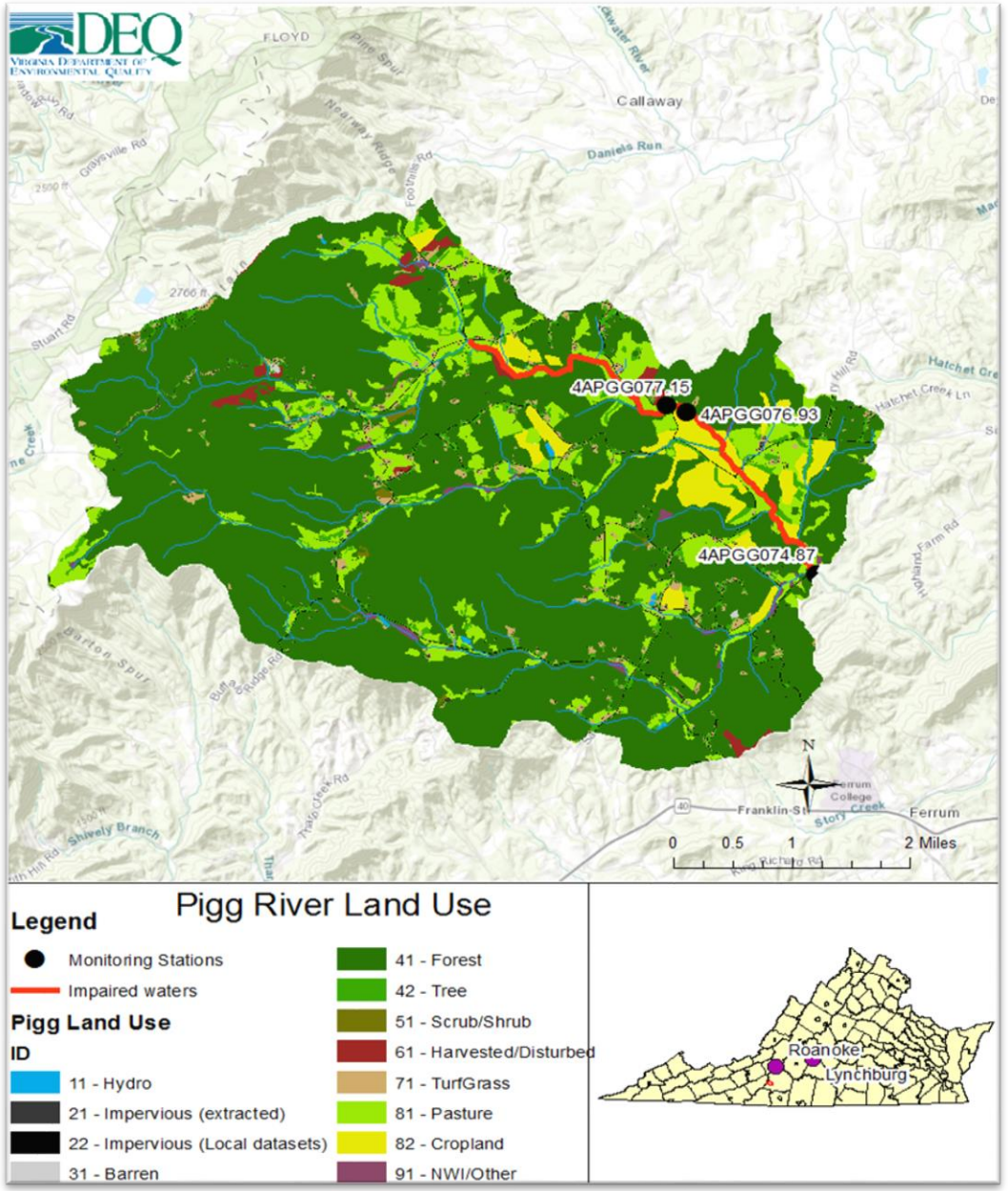
Fryingpan Creek Land use

		Fryingpan Creek	
Land use type	Land use description	**Area (acres)**	**Percent land use**
Water	Drainage networks and basins	**30.61**	0.89%
Impervious	Extracted and External- high percentage of constructed materials	**51**	1.48%
Barren	Areas with little or no vegetation	**5.43**	0.16%
Forest	Areas with tree cover of natural or semi-natural woody vegetation	**1780.69**	51.70%
Tree	Areas with tree cover of natural or semi-natural woody vegetation that does not encompass an acre	**170.60**	4.95%
Turf Grass	Primarily grasses	**121.01**	3.51%
Harvested/Disturbed	Areas of forest clear-cut, temporary clearing of vegetation, and other dynamically changing land cover due to land use activities as defined by the EPA	**42.43**	1.23%
Shrub	Areas of natural or semi-natural woody vegetation with aerial stems generally less than 6 meters	**32.78**	0.95%
Pasture	Areas of grasses, legumes, or grass-legumes planted for livestock grazing	**911.01**	26.45%
Cropland	Areas of herbaceous vegetation that has been planted for production of food	**6.87**	6.87%
NWI/Other	Soil or substrate periodically covered with water	**62.21**	1.81%



Pigg River Land use

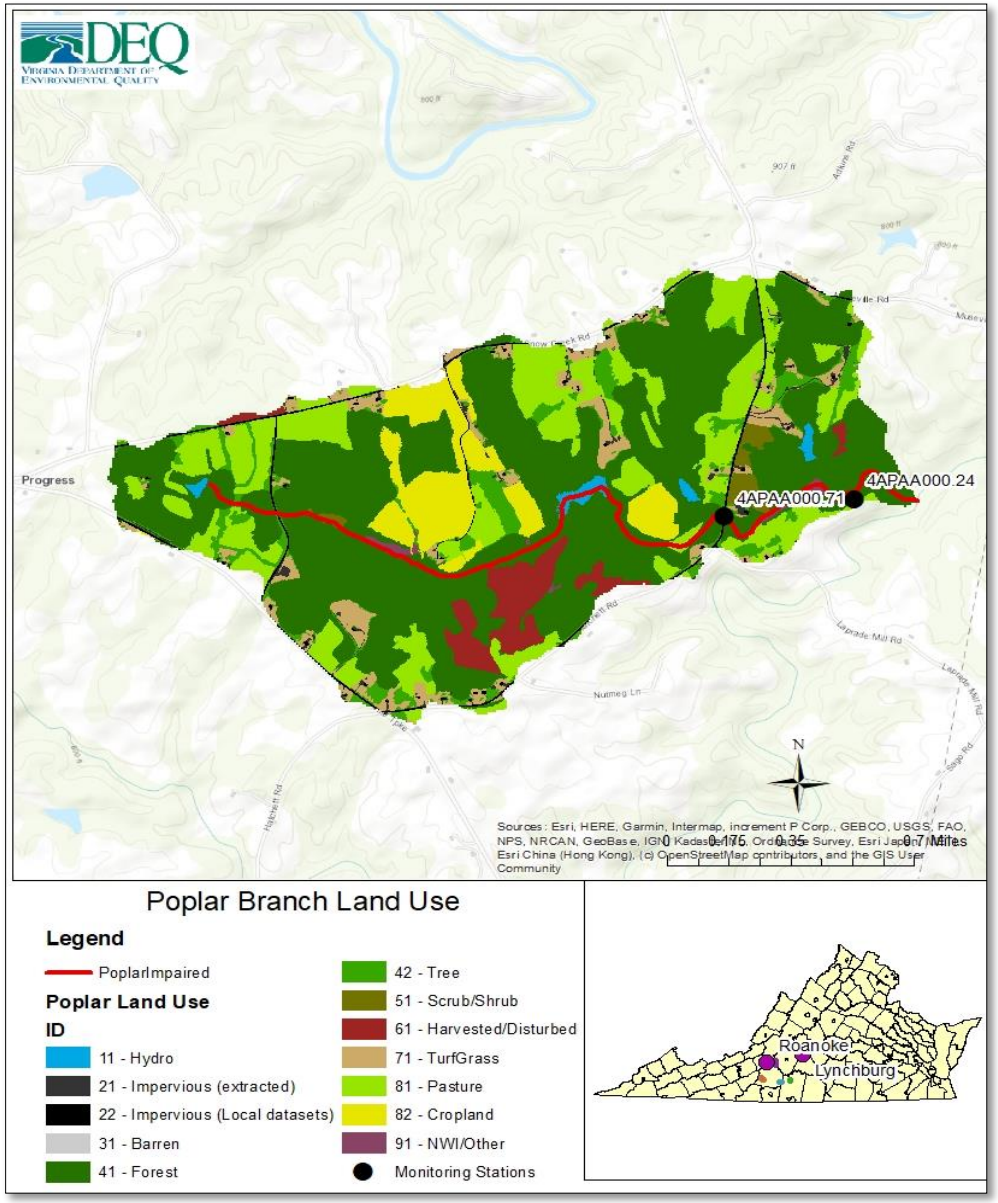
		Pigg River	
Land use type	Land use description	**Area (acres)**	**Percent land use**
Water	Drainage networks and basins	**14.61**	0.10%
Impervious	Extracted and External- high percentage of constructed materials	**193.46**	1.34%
Barren	Areas with little or no vegetation	**6.62**	0.05%
Forest	Areas with tree cover of natural or semi-natural woody vegetation	**10745.34**	74.55%
Tree	Areas with tree cover of natural or semi-natural woody vegetation that does not encompass an acre	**605.23**	4.20%
Turf Grass	Primarily grasses	**281.57**	1.95%
Harvested/Disturbed	Areas of forest clear-cut, temporary clearing of vegetation, and other dynamically changing land cover due to land use activities as defined by the EPA	**123.55**	0.86%
Shrub	Areas of natural or semi-natural woody vegetation with aerial stems generally less than 6 meters	**30.06**	0.21%
Pasture	Areas of grasses, legumes, or grass-legumes planted for livestock grazing	**1781.10**	12.36%
Cropland	Areas of herbaceous vegetation that has been planted for production of food	**554.59**	3.85%
NWI/Other	Soil or substrate periodically covered with water	**77.72**	0.54%



DEQ

Poplar Branch Land use

		Poplar Branch	
Land use type	Land use description	**Area (acres)**	**Percent land use**
Water	Drainage networks and basins	**8.88**	0.83%
Impervious	Extracted and External- high percentage of constructed materials	**27.27**	2.56%
Barren	Areas with little or no vegetation	**0**	0
Forest	Areas with tree cover of natural or semi-natural woody vegetation	**565.57**	52.96%
Tree	Areas with tree cover of natural or semi-natural woody vegetation that does not encompass an acre	**65.96**	6.18%
Turf Grass	Primarily grasses	**53.88**	5.04%
Harvested/Disturbed	Areas of forest clear-cut, temporary clearing of vegetation, and other dynamically changing land cover due to land use activities as defined by the EPA	**43.51**	4.07%
Shrub	Areas of natural or semi-natural woody vegetation with aerial stems generally less than 6 meters	**11.80**	1.11%
Pasture	Areas of grasses, legumes, or grass-legumes planted for livestock grazing	**204.36**	19.14%
Cropland	Areas of herbaceous vegetation that has been planted for production of food	**80.43**	7.53%
NWI/Other	Soil or substrate periodically covered with water	**6.34**	0.59%



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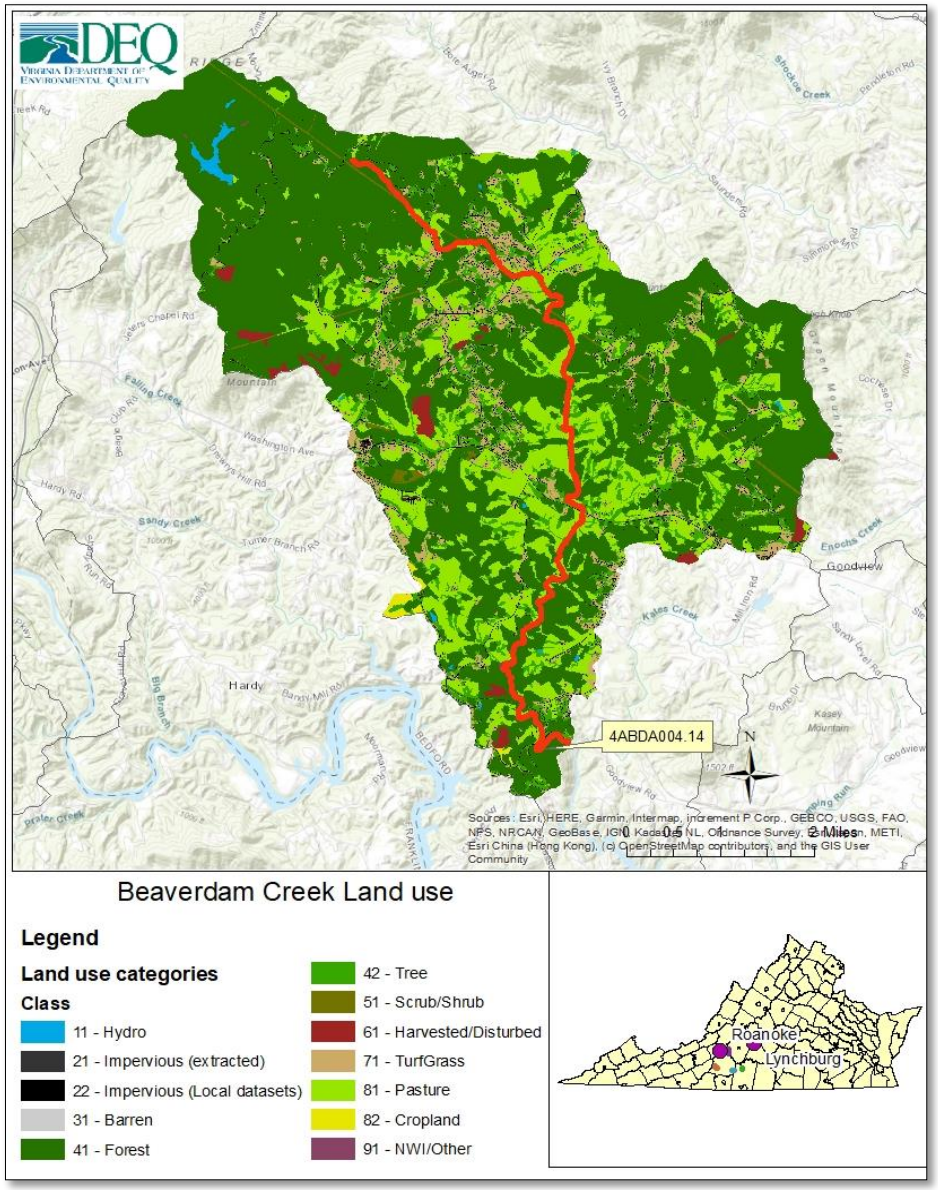
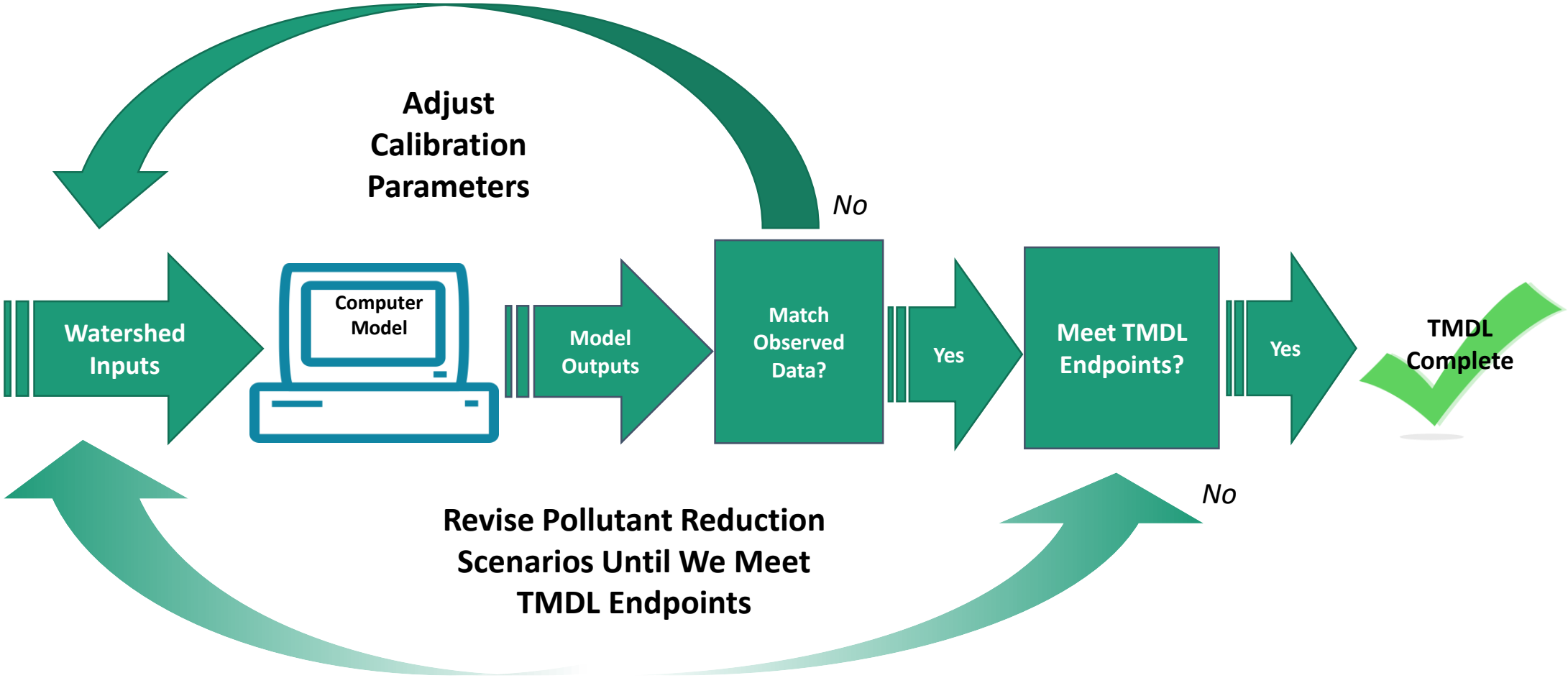
Beaverdam Creek Land use

		Beaverdam Creek	
Land use type	Land use description	**Area (acres)**	**Percent land use**
Water	Drainage networks and basins	**74.75**	0.43%
Impervious	Extracted and External- high percentage of constructed materials	**473.22**	2.74%
Barren	Areas with little or no vegetation	**0**	0
Forest	Areas with tree cover of natural or semi-natural woody vegetation	**10443.56**	60.39%
Tree	Areas with tree cover of natural or semi-natural woody vegetation that does not encompass an acre	**1738.75**	10.06%
Turf Grass	Primarily grasses	**1033.96**	5.98%
Harvested/Disturbed	Areas of forest clear-cut, temporary clearing of vegetation, and other dynamically changing land cover due to land use activities as defined by the EPA	**191.96**	1.11%
Shrub	Areas of natural or semi-natural woody vegetation with aerial stems generally less than 6 meters	**89.98**	0.52%
Pasture	Areas of grasses, legumes, or grass-legumes planted for livestock grazing	**3193.11**	18.47%
Cropland	Areas of herbaceous vegetation that has been planted for production of food	**48.18**	0.28%
NWI/Other	Soil or substrate periodically covered with water	**4.70**	0.03%



Model Watershed and assign reductions



Biological Systems Engineering

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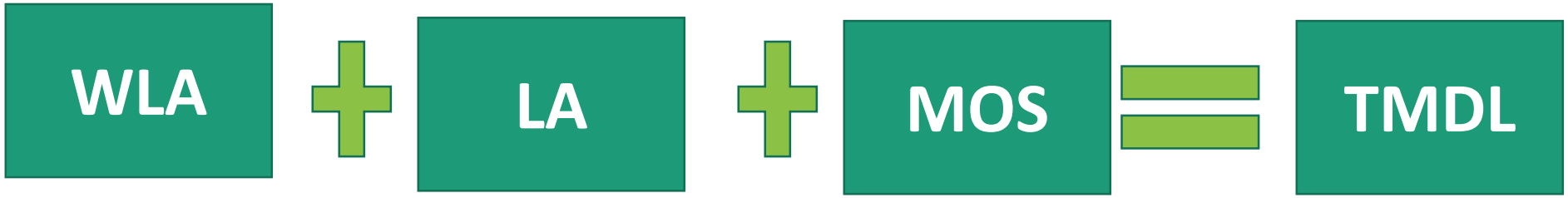
TMDL Equation



- WLA= Wasteload Allocation
  - Permitted/Point Source
- LA= Load Allocation
  - Nonpoint Source
- MOS= Margin of Safety
  - Extra load to account for uncertainty

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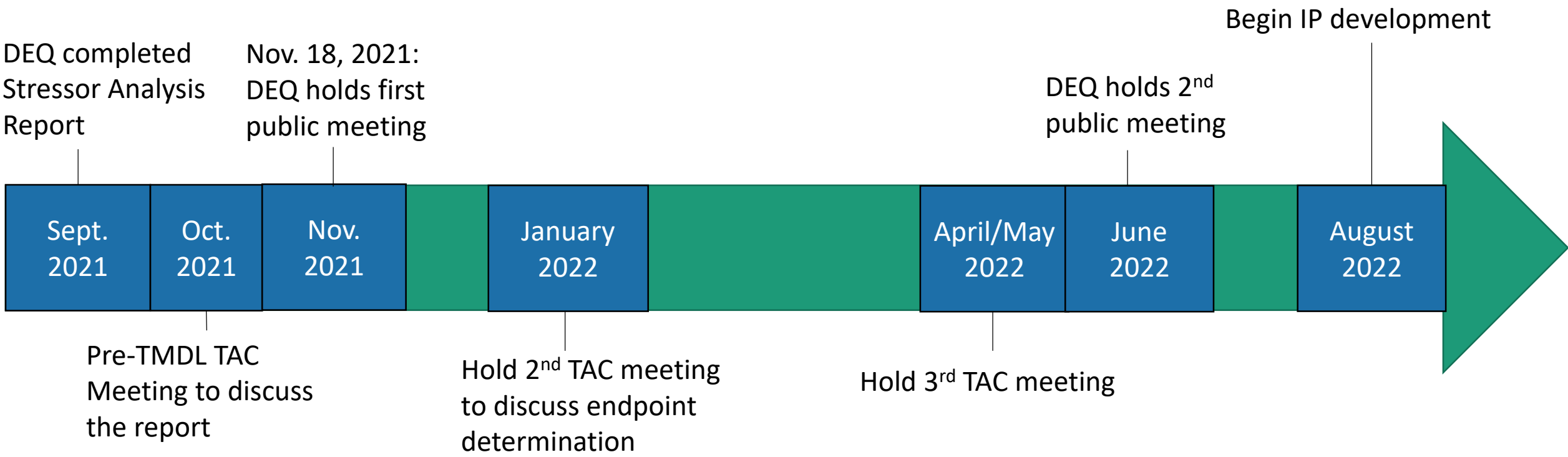
Where we are now…



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Please send all comments in writing to lucy.smith@deq.Virginia.gov or 901 Russell Drive Salem, VA 24153

The 30- day public comment period will end on 3 January, 2022.

To learn more about TMDLs, visit DEQ's website: https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL.aspx

Stressor Analysis Document: https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment/DocumentationforSelectTMDLs.aspx

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