Appendix 1e. Waters Proposed for Nesting into Approved TMDLs

AU	Water Name	Size	Unit	Parameter Name	Parameter Category	TMDL Project Name	Rationale Provided?
VAN-A04R_GOO02A04	Goose Creek	8.11	Miles	Escherichia coli (E. coli)	4A	Goose Creek Watershed	
VAN-A06R_XPC01A24	Unnamed tributary to North Fork Goose Creek	1.71	Miles	Escherichia coli (E. coli)	4A	Goose Creek Watershed	
VAN-A07R_DOG01A22	Dog Branch	1.22	Miles	Escherichia coli (E. coli)	4A	Goose Creek Watershed	
VAN-A08R_GOO04A08	Goose Creek	3.62	Miles	Escherichia coli (E. coli)	4A	Goose Creek Watershed	
VAN-A08R_LIV03A06	Little River	5.87	Miles	Escherichia coli (E. coli)	4A	Goose Creek Watershed	
VAN-A12R_DOC01A24	Doctors Run	1.23	Miles	Escherichia coli (E. coli)	4A	Four Mile Run Watershed	
VAN-A12R_LOF01A08	Long Branch	2.15	Miles	Escherichia coli (E. coli)	4A	Four Mile Run Watershed	
VAN-A12R_LUB01A24	Lubber Run	1.67	Miles	Escherichia coli (E. coli)	4A	Four Mile Run Watershed	
VAN-A13R_PIK01A22	Pike Branch	2.25	Miles	Escherichia coli (E. coli)	4A	Hunting Creek, Cameron Run, Holmes Run	
VAN-A13R_TAY01A24	Taylor Run	1.21	Miles	Escherichia coli (E. coli)	4A	Hunting Creek, Cameron Run, Holmes Run	
VAN-E05R_COV01A02	Covington River	7.38	Miles	Escherichia coli (E. coli)	4A	Upper Rappahannock River Watershed	
VAN-E05R_RUS01B08	Rush River	3.36	Miles	Escherichia coli (E. coli)	4A	Upper Rappahannock River Watershed	
VAP-A32E_CHB02A06	Cold Harbor Creek / Currioman Bay	0.0436	Square Miles	Fecal Coliform	4A	Nomini Creek watershed (growing area 4)	
VAP-A33E_SHA01A98	Shannon Branch	0.0863	Square Miles	Fecal Coliform	4A	Yeocomico River Watershed	
VAP-A34E_BBC01A08	Bridgemans Back Creek	0.0209	Square Miles	Fecal Coliform	4A	Little Wicomico River Watershed	
VAP-A34E_GLE04A04	Wrights Cove, UT	0.0464	Square Miles	Fecal Coliform	4A	Coan River Watershed	
VAP-A34E_KIN04A06	Kingscote Creek, UT	0.0094	Square Miles	Fecal Coliform	4A	Coan River Watershed	
VAP-C01E_BAI01A16	Bailey Prong	0.0517	Square Miles	Fecal Coliform	4A	Great Wicomico River Watershed	
VAP-C01E_GEO02B20	Georges Cove	0.0197	Square Miles	Fecal Coliform	4A	Indian, Tabbs, Dymer, Antipoison Creeks	
VAP-C01E_GWR01B08	Great Wicomico River	0.0695	Square Miles	Fecal Coliform	4A	Great Wicomico River Watershed	
VAP-C01E_GWR02E16	Great Wicomico River, UT	0.0329	Square Miles	Fecal Coliform	4A	Great Wicomico River Watershed	
VAP-C01E_HHB01A98	Horn Harbor	0.0713	Square Miles	Fecal Coliform	4A	Great Wicomico River Watershed	
VAP-C01E_JAR02B24	Jarvis Creek	0.0367	Square Miles	Fecal Coliform	4A	Dividing Creek and Prentice Cove	

AU	Water Name	Size	Unit	Parameter Name	Parameter Category	TMDL Project Name	Rationale Provided?
VAP-C01E_PEN01A12	Penny Creek	0.0085	Square Miles	Fecal Coliform	4A	Great Wicomico River Watershed	
VAP-C01E_TIP02A08	Tipers Creek	0.0385	Square Miles	Fecal Coliform	4A	Great Wicomico River Watershed	
VAP-C01E_XEV01A12	XEV - Mill Creek, UT	0.0059	Square Miles	Fecal Coliform	4A	Mill Creek, Ball Creek and Cloverdale Creek	
VAP-C02R_DRN01A98	Dragon Swamp	12.37	Miles	Escherichia coli (E. coli)	4A	Piankatank River and Harper Creek	
VAP-C03E_FER01B20	Ferry Creek	0.1148	Square Miles	Fecal Coliform	4A	Piankatank River and Harper Creek	
VAP-C03E_JCK03C10	Jackson Creek	0.0131	Square Miles	Fecal Coliform	4A	Broad Creek and Jackson Creek	
VAP-C03E_PNK01A02	Piankatank River	0.5579	Square Miles	Fecal Coliform	4A	Piankatank River and Harper Creek	
VAP-C03E_PNK02C20	Piankatank River	0.4074	Square Miles	Fecal Coliform	4A	Piankatank River and Harper Creek	
VAP-C04E_BEV01A08	Belleville Creek	0.0528	Square Miles	Fecal Coliform	4A	North River	
VAP-C04E_DAV01B24	Davis Creek	0.0369	Square Miles	Fecal Coliform	4A	North River	
VAP-C04E_DYE01A08	Dyer Creek	0.0523	Square Miles	Fecal Coliform	4A	Horn Harbor, Davis and Doctors Creek	
VAP-C04E_EST01D10	East River, UT	0.0225	Square Miles	Fecal Coliform	4A	East River and Put In Creek	
VAP-C04E_NOR02B24	North River	0.0642	Square Miles	Fecal Coliform	4A	North River	
VAP-C04E_NOR04A22	North River, UT	0.0102	Square Miles	Fecal Coliform	4A	North River	
VAP-C04E_QUE02A12	Queens Creek, UT	0.011	Square Miles	Fecal Coliform	4A	Milford Haven and Gwynn Island (Growing areas 36 and 37)	
VAP-C04E_STT02B20	Stutts Creek, UT	0.0055	Square Miles	Fecal Coliform	4A	Milford Haven and Gwynn Island (Growing areas 36 and 37)	
VAP-C05E_WAR02B18	Ware River, UT	0.0095	Square Miles	Fecal Coliform	4A	Ware River watershed	
VAP-E24E_RPP03D24	Rappahannock River	0.061	Square Miles	Fecal Coliform	4A	Upper Rappahannock River Watershed (growing areas 25 and 26)	
VAP-E25E_LAN03A06	Lancaster Creek	0.023	Square Miles	Fecal Coliform	4A	Lancaster, Mulberry and Deep Creeks	
VAP-E25E_MUB02A06	Mulberry Creek	0.0999	Square Miles	Fecal Coliform	4A	Lancaster, Mulberry and Deep Creeks	
VAP-E25E_ROS02C16	Robinson Creek, UT	0.0134	Square Miles	Fecal Coliform	4A	Lagrange and Robinson Creeks	
VAP-E25E_ROS02D24	Robinson Creek	0.0389	Square Miles	Fecal Coliform	4A	Lagrange and Robinson Creeks	
VAP-E25E_RPP03B16	Rappahannock River Run Bluffs	0.003	Square Miles	Fecal Coliform	4A	Upper Rappahannock River Watershed (growing areas 25 and 26)	

AU	Water Name	Size	Unit	Parameter Name	Parameter Category	TMDL Project Name	Rationale Provided?
VAP-E26E_MEA02C24	Meachim Creek, UT	0.0236	Square Miles	Fecal Coliform	4A	Whiting and Meachim Creeks	
VAP-E26E_WHR01B24	Whitehouse Creek	0.0449	Square Miles	Fecal Coliform	4A	Corrotoman River Watershed	
VAP-E26E_WHR01C24	Whitehouse Creek, UT	0.005	Square Miles	Fecal Coliform	4A	Corrotoman River Watershed	
VAP-G02E_TIC01A24	Turkey Island Creek	0.066	Square Miles	Escherichia coli (E. coli)	4A	Turkey Island Creek and James River and Tributaries, Westover to Claremont, VA	
VAS-O14R_BMC02A00	Big Moccasin Creek	0.67	Miles	Escherichia coli (E. coli)	4A	North Fork Holston River watershed	
VAS-P09R_LSR01A02	Little Stony Creek	2.74	Miles	Escherichia coli (E. coli)	4A	Lower Clinch River watershed	
VAS-P11R_CRC01A02	Clear Creek	3.77	Miles	Escherichia coli (E. coli)	4A	Lower Clinch River watershed	
VAS-P14R_COP01A02	Copper Creek	9.82	Miles	Escherichia coli (E. coli)	4A	Clinch River and Cove Creek	
VAS-P14R_COP01B04	Copper Creek	4.12	Miles	Escherichia coli (E. coli)	4A	Clinch River and Cove Creek	
VAS-Q05R_DIS01A00	Dismal Creek	5.39	Miles	Escherichia coli (E. coli)	4A	Levisa Fork Watershed including Garden Creek and Slate Creek	
VAS-Q08R_PLR01A14	Poplar Creek	0.2	Miles	Benthic Macroinvertebrates Bioassessments	4A	Levisa Fork Watershed including Garden Creek and Slate Creek	Y
VAT-AO23_ATL03A24	Atlantic Ocean Beaches - 15th Street	0.3158	Square Miles	Enterococcus	4A	Lynnhaven River, Broad Bay and Linkhorn Bay Watersheds	
VAT-C07E_BCK02A06	Back Creek - Middle (DSS-marina area)	0.1119	Square Miles	Fecal Coliform	4A	Poquoson River and Back Creek	
VAT-C07E_BCK02A06	Back Creek - Middle (DSS-marina area)	0.1119	Square Miles	Fecal Coliform	4A	Poquoson River and Back Creek	
VAT-C07E_BCK02A06	Back Creek - Middle (DSS-marina area)	0.1119	Square Miles	Fecal Coliform	4A	Poquoson River and Back Creek in York County	
VAT-C07E_GLD01A10	Grunland Creek - Mouth	0.0528	Square Miles	Fecal Coliform	4A	Back River Watershed (freshwater and shellfish)	
VAT-C08E_LKN02B24	Linkhorn Bay - Linkhorn Shores	0.0351	Square Miles	Fecal Coliform	4A	Lynnhaven River, Broad Bay and Linkhorn Bay Watersheds	
VAT-F27E_CRT02A00	Carter Cr. (Gloucester Co.) - Mouth	0.2531	Square Miles	Fecal Coliform	4A	York River shellfish waters (growing area 47)	
VAV-H23R_XJV01A10	X-trib to Parrott Branch	1.15	Miles	Escherichia coli (E. coli)	4A	Rivanna River Watershed	
VAV-H28R_BSC02A10	Biscuit Run	2.28	Miles	Escherichia coli (E. coli)	4A	Moores Creek Watershed	
VAV-H28R_PLK01A24	Pollocks Branch	0.51	Miles	Escherichia coli (E. coli)	4A	Moores Creek Watershed	

AU	Water Name	Size	Unit	Parameter Name	Parameter Category	TMDL Project Name	Rationale Provided?
VAV-H28R_TWN01A10	Town Branch	1.2	Miles	Escherichia coli (E. coli)	4A	Rivanna River Watershed	
VAV-I33R_MRY02A04	Maury River	6.23	Miles	Escherichia coli (E. coli)	4A	Maury River, Cedar Creek, and tributaries	
VAV-H27R_RRN02A00	Rivanna River North Fork	3.82	Miles	Benthic Macroinvertebrates Bioassessments	4A	North Fork Rivanna	Y
VAV-H27R_RRN03A10	Rivanna River North Fork	3.51	Miles	Benthic Macroinvertebrates Bioassessments	4A	North Fork Rivanna	Y
VAS-P17R_LOC01A12	Looney Creek	6.05	Miles	Benthic Macroinvertebrates Bioassessments	4A	Powell River and North Fork Powell River Watersheds	Y
VAS-P17R_POT01A14	Potcamp Fork	2.86	Miles	Benthic Macroinvertebrates Bioassessments	4A	Powell River and North Fork Powell River Watersheds	Y
VAS-P17R_RIN01A00	Roaring Fork	5.05	Miles	Benthic Macroinvertebrates Bioassessments	4A	Powell River and North Fork Powell River Watersheds	Y
VAS-Q08R_CNW01A08	Conaway Creek	2.63	Miles	Benthic Macroinvertebrates Bioassessments	4A	Levisa Fork Watershed including Garden Creek and Slate Creek	Y
VAS-Q08R_CNW02A14	Conaway Creek and tributaries	2.85	Miles	Benthic Macroinvertebrates Bioassessments	4A	Levisa Fork Watershed including Garden Creek and Slate Creek	Y
VAS-Q08R_PLR01A08	Poplar Creek	3.04	Miles	Benthic Macroinvertebrates Bioassessments	4A	Levisa Fork Watershed including Garden Creek and Slate Creek	Y

MEMORANDUM

To: Amanda Shaver

From: Sara Jordan

Date: July 29, 2025

Re: 4A Nesting Rationale: North Fork Rivanna River Segments

Benthic TMDL Development for the North Fork Rivanna River Watershed and Tributaries
Located in Albemarle, Greene, and Orange Counties
TMDL ID #11523
Completed April 2019

Table 1. Impaired segments included in the TMDL

Water Name	305(b) Segment ID	Segment Length	Segment Description
Blue Run	VAV-H27R_BLU01A04	8.72 mi	Blue Run from the headwaters downstream to its confluence with Swift Run.
Marsh Run	VAV-H27R_MSH01A10	3.65 mi	Marsh Run from the headwaters downstream to its confluence with the North Fork Rivanna River.
Preddy Creek	VAV-H27R_PRD01A00	7.48 mi	Preddy Creek from the headwaters downstream to its confluence with the North Fork Rivanna River.
Preddy Creek North Branch	VAV-H27R_PRD02A06	6.24 mi	North Branch of Preddy Creek from the headwaters downstream to its confluence with Preddy Creek
Quarter Creek	VAV-H27R_QTR01A16	1.58 mi	Quarter Creek from the dam outfall at Jonquil Road to its confluence with Swift Run.
North Fork Rivanna River	VAV-H27R_RRN03A10	3.51 mi	North Fork Rivanna River from its confluence with the Lynch River downstream to its confluence with Swift Run.
North Fork Rivanna River	VAV-H27R_RRN02A00	3.82 mi	North Fork Rivanna River from its confluence with Swift Run downstream to the RWSA-NF Rivanna River Public Water Intake.
Stanardsville Run	VAV-H27R_SDV01A14	5.71 mi	Stanardsville Run and tributaries from the headwaters downstream to its confluence with Blue Run.

Water Name	305(b) Segment ID	Segment Length	Segment Description
Swift Run	VAV-H27R_SFR01A00	1.91 mi	Swift Run from its confluence with Welsh Run downstream to its confluence with the North Fork Rivanna River.
X-Trib to Flat Branch	VAV-H27R_XKL01A08	2.03 mi	X-trib to Flat Branch from the headwaters (including tributaries) downstream to its confluence with Flat Branch.

Table 2. Segments proposed for nesting in the 2024 Integrated Report

Water Name	305(b) Segment ID	Segment Length	Segment Description
North Fork Rivanna River	VAV-H27R_RRN03A10	3.51 mi	North Fork Rivanna River from its confluence with the Lynch River downstream to its confluence with Swift Run.
North Fork Rivanna River	VAV-H27R_RRN02A00	3.82 mi	North Fork Rivanna River from its confluence with Swift Run downstream to the RWSA-NF Rivanna River Public Water Intake.

During the 2016 water quality assessment cycle, two segments of the North Fork Rivanna River (VAV-H27R_RRN02A00, VAV-H27R_RRN03A10) were listed as impaired for aquatic life use based on benthic macroinvertebrate data collected at DEQ station 2-RRN012.89 and Rivanna Conservation Alliance (RCA) level III station 2-RRN-RRN06-RCA. This impairment extends 7.33 miles from the North Fork Rivanna's confluence with the Lynch River downstream to the Rivanna Water and Sewer Authority's public water supply intake on the North Fork Rivanna. DEQ station 2-RRN012.89 and 2-RRN-RRN06-RCA are collocated, approximately 50m downstream from the Advance Mill Dam (Figure 1). VSCI/ASCI scores at 2-RRN012.89 and 2-RRN-RRN06-RCA show a borderline impairment, with values bouncing above and below the impairment threshold of 60 (Figure 2).

Figure 1. North Fork Rivanna River impaired assessment units and DEQ/RCA benthic monitoring stations.

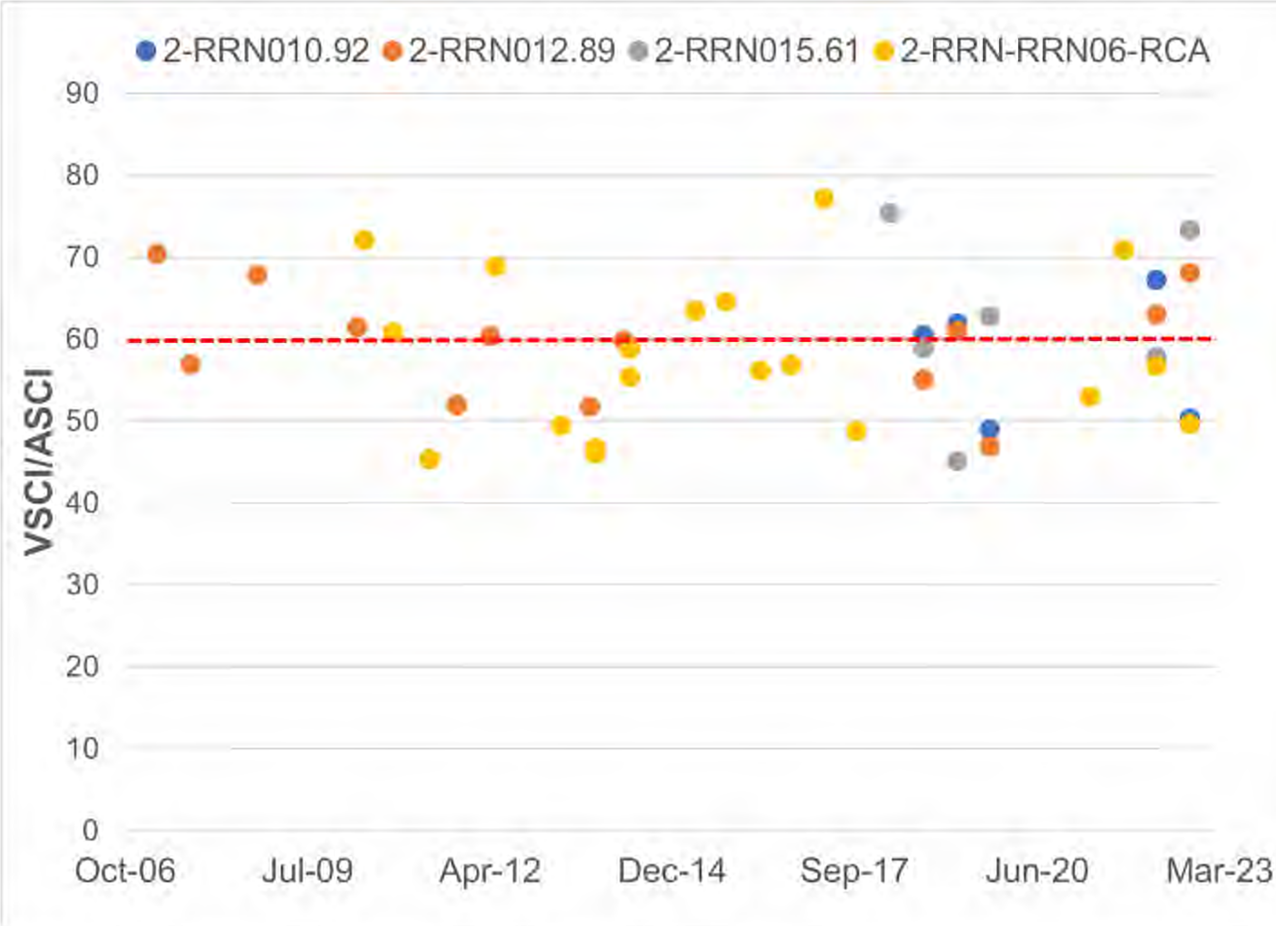

Figure 2. DEQ and RCA benthic monitoring scores at NF Rivanna River stations. *Note: RCA scores are based on the ASCI and DEQ scores are calculated using the VSCI.*

A benthic TMDL was completed for the North Fork Rivanna River and several of its tributaries in 2020 (Figure 3). Table 1 lists the impaired segments included in the TMDL. A benthic stressor analysis was conducted in support of the TMDL, which identified sediment as the pollutant of concern in all the impaired streams, and phosphorus as an additional stressor in two small tributaries. The Causal Analysis/Diagnosis Decision Information System (CADDIS) (USEPA, 2018) was used to evaluate potential stressors for the impaired segments. The results of this analysis for the North Fork Rivanna River segments (VAV-H27R_RRN02A00 and VAV- H27R_RRN03A10) and tributaries are shown in Table 3. Table 4 provides a summary of the scheme used to classify candidate causes. As shown in Table 3, there was considerable evidence that sediment was the most probable stressor to aquatic life in the NF Rivanna River segments with a score of +13. The stressor analysis also identified the presence of the dam upstream of the listing station (2-RRN0012.89) as a possible stressor.

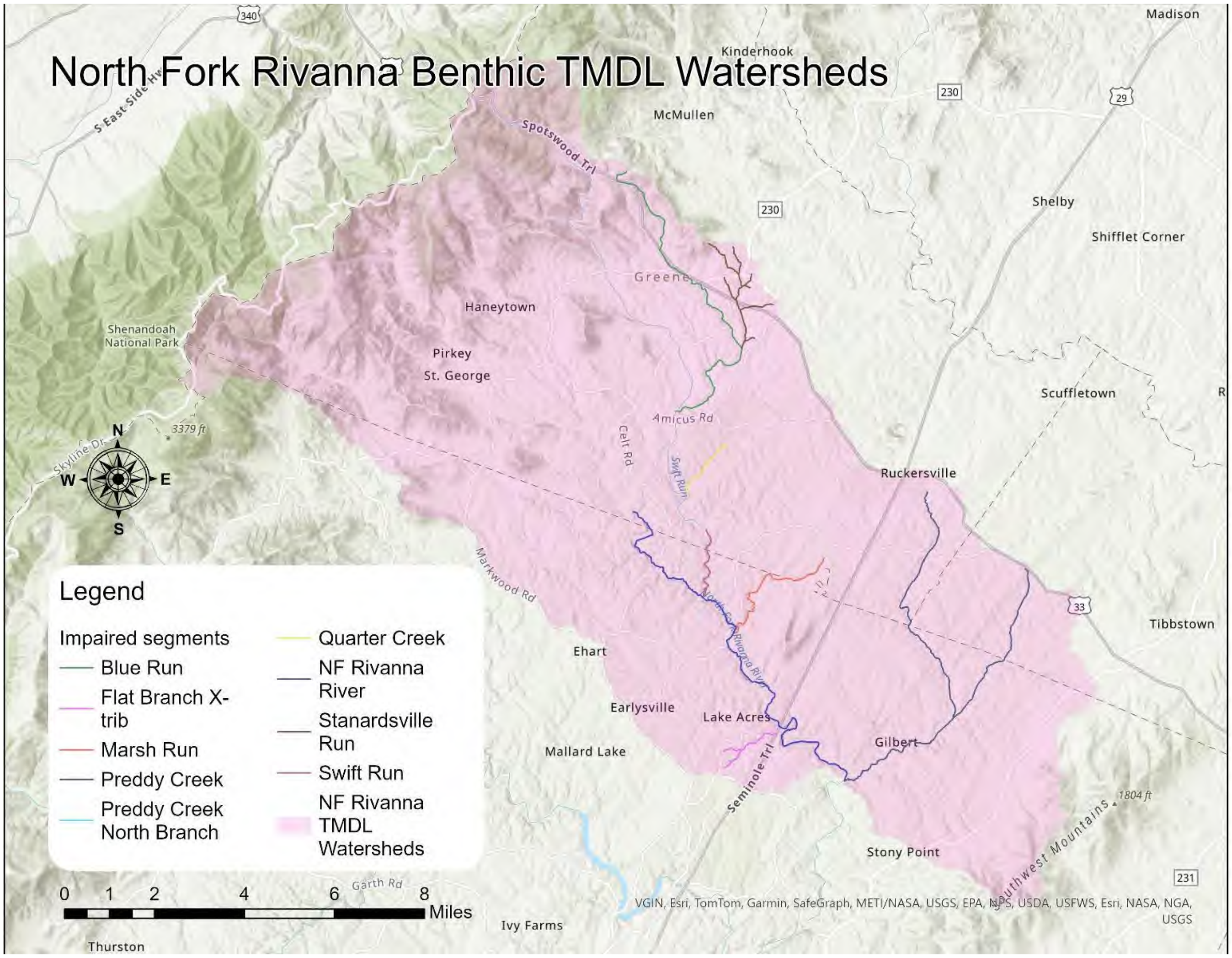

Figure 3. North Fork Rivanna Benthic TMDL watersheds with impaired segments (North Fork Rivanna segments proposed for nesting are shown in blue).

Table 3. Causal analysis results for sediment as a stressor in the NF Rivanna River watershed.

Evidence	Blue Run	Stanardsville Run	Quarter Creek	Swift Run	Marsh Run	Preddy Creek	X-Trib Flat Branch	NF Rivanna	Explanation
Spatial Co-occurrence	2	3	2	3	2	3	3	3	In the habitat assessment, the sediment metric was dramatically reduced at all impaired sites. This reduction was statistically significant in all streams with more than 2 visits (Stanardsville Run, Swift Creek, Preddy Creek, X-Trib to Flat Branch, and NF Rivanna); the sediment metric was not significantly reduced at the unimpaired Roach River site
Temporal Co-occurrence	0	0	3	2	0	0	1	-1	Temporal trends in benthic data correlated with spring high sediment flows in Quarter Creek, Swift Run, and X-trib to Flat Branch; spring benthic scores were higher in NF Rivanna
Causal Pathway	3	3	1	2	1	3	1	1	Causal pathway from sediment sources to impaired benthic community intact for most streams
Stressor-Response Relationships from the Field	2	2	2	2	2	2	2	2	Strong statistically significant regression between total suspended solids and benthic scores

Evidence	Blue Run	Stanardsville Run	Quarter Creek	Swift Run	Marsh Run	Preddy Creek	X-Trib Flat Branch	NF Rivanna	Explanation
Temporal Sequence	0	0	3	2	0	0	1	-1	Decreased benthic scores in Quarter Creek and Swift Run followed dam maintenance activities. Temporal trends in benthic data correlated with spring high sediment flows in X-trib to Flat Branch; spring benthic scores were higher in NF Rivanna
Symptoms	3	3	3	1	3	3	3	2	In small streams, functional feeding group analysis revealed increases in filterers and collectors and decreases in scrapers; in NF Rivanna, filterers increased and scrapers decreased; in Swift Run, only filterers increased.
Stressor-Response Relationships from Other Field Studies	1	1	0	-1	-2	3	-1	-1	Relative bed stability measurements were in the high probability for stressor effects range for Preddy Creek, medium range for Stanardsville Run and Blue Run, low range for Swift Run, X-Trib to Flat Branch, and NF Rivanna, and no probability range for Marsh Run

Evidence	Blue Run	Stanardsville Run	Quarter Creek	Swift Run	Marsh Run	Preddy Creek	X-Trib Flat Branch	NF Rivanna	Explanation
Mechanistically Plausible Cause	3	3	3	2	2	3	2	2	Causal pathway from sediment sources to impaired benthic community intact for most streams; strong correlation between imperviousness and benthic score
Manipulation of Exposure at Other Sites	3	3	3	1	3	3	3	2	Benthic community composition and functional feeding group analysis indicated sediment impacts in most streams and were consistent with literature on sediment effects at other sites
Analogous Stressors	1	2	0	3	0	2	0	3	Streambed permeability significantly reduced in Swift Run and NF Rivanna; TSS levels in Blue Run, Stanardsville Run, and Preddy Creek exceeded reference site; load duration curves for NF Rivanna showed excess sediment loads
Consistency of Evidence	2	3	3	2	1	3	1	1	Weight of evidence strongly supported sediment as a stressor
Sum	**20**	**23**	**23**	**19**	**12**	**25**	**16**	**13**	

Table 4. Scheme for classifying candidate causes based on causal analysis.

Total Score	Classification
<-2	Non-Stressor
-1	
0	
+1	Possible Stressor
+2	
+3	
+4	Probable Stressor
+5	
>+6	

The AllForX regression model was used to establish sediment endpoints for impaired segments in the North Fork Rivanna River Benthic TMDL. While the model identified necessary reductions for the impaired tributaries, regression results indicated that reductions were not necessary for VAV-H27R_RRN02A00 and VAV- H27R_RRN03A10.

Excerpt from pages 58-59 of North Fork Rivanna Benthic TMDL Report:

> *The AllForX regression did not show a need for reduction to sediment loads for the North Fork Rivanna mainstem, indicating that excess sediment loads from upstream sources are not the sole cause of the impairment in the mainstem. This result coincides with several lines of evidence already noted in the stressor analysis document. First, the impairment on the North Fork Rivanna is borderline. Health scores of the benthic community have bounced around above and below the threshold value of 60 throughout time and seasons. Secondly, the impairment is highly localized to the monitoring station just downstream from the Advance Mills Dam. Monitoring stations 2-3 miles upstream and downstream of the dam show healthy benthic communities. The stressor identification analysis identified the presence of the dam as an additional probable stressor. Historic imagery shows significant scour and deposition over time just downstream of the dam, with the channel shifting from one side of the river to the other and small islands forming and being washed away. This continual shifting of bed sediments, as well as the ecological change in available food supply resulting from the upstream impoundment, are possible contributors to the marginal impairment noted at the site.*

Based on the combined factors of the highly localized nature of the marginal impairment, model results that show no need for mainstem sediment reductions, and additional sediment reductions that will come from implementation of upstream TMDLs, VDEQ has decided not to assign specific reductions to the mainstem North Fork Rivanna River at this time. Implementation of upstream reduction scenarios related to the other impairments in the watershed will only improve the water quality in the North Fork Rivanna River, providing an estimated 8% reduction in sediment loads to the mainstem.

Based on the results of the AllForX analysis, a decision was made to begin monitoring further downstream of the dam at 2-RRN0010.92. It was expected that after additional monitoring, the results would indicate that the benthic community below this zone of recovery is not impaired and the North Fork Rivanna mainstem segments could be delisted. Since the TMDL analysis showed that sediment reductions were not needed for these segments, and given the expected delisting of these two segments, it was determined that the two impaired segments did not need to be assigned reductions in the TMDL, thus leaving them classified as Category 5A waters.

DEQ continued biological monitoring at 2-RRN0010.92 following completion of the TMDL. In addition, DEQ began monitoring at station 2-RRN0015.61, located approximately 4.5 miles upstream of the original listing station. As shown in Figure 2, results for all stations have continued to bounce above and below the impairment threshold, showing evidence of a borderline impairment below the zone of recovery downstream of the dam. This indicates that while the presence of the Advance Mills Dam is altering the community structure directly below it, excess sediment is the primary stressor to aquatic life in the impaired segments.

An implementation plan is currently under development for the NF Rivanna River watershed. This plan will address the sediment reduction goals established in the benthic TMDL, in addition to bacteria reduction goals established in the Rivanna River Bacteria TMDL, which includes VAV-H27R_RRN02A00 and VAV-H27R_RRN03A10. There is considerable overlap in best management practices that address bacteria and those that address sediment, meaning that implementation of this plan will result in sediment reductions on the mainstem of the NF Rivanna River in addition to its tributaries.

Recommendations:

We recommend that VAV-H27R_RRN02A00 and VAV-H27R_RRN03A10 be nested into the NF Rivanna River benthic TMDL and re-categorized as Category 4A waters in the 2024 assessment cycle. These segments were included in the benthic stressor analysis conducted in support of the TMDL study. This analysis provided clear evidence for sediment as a primary stressor to aquatic life in the NF Rivanna segments. The benthic stressor analysis and the TMDL study were completed in 2019. There have been no significant changes in land use in the project area, nor have any new permits been issued within the project area since TMDL study completion. Relocation of the DEQ monitoring station downstream from the zone of recovery below the dam has demonstrated that sediment is the primary cause of benthic impairment in the NF Rivanna River segments. While the benthic community structure directly below the dam is likely impacted by its presence, impacts from sediment are the primary cause of the impairment. The borderline nature of the aquatic life impairment further below the dam suggests that restoration of this use could be accomplished with relatively minimal reductions in sediment loads in the watershed. This conclusion is supported by results of AllForX analysis in the TMDL study, which did not show that any reductions in sediment were needed for the NF Rivanna River segments. Once sediment reductions in upstream tributaries called for in the TMDL are accomplished, sediment loads to the NF Rivanna River segments will be reduced by an estimated 8%. Given that the TMDL includes a 10% margin of safety and that the AllForX regression does not show that reductions are needed for the NF Rivanna River segments, we are confident that the NF Rivanna River Benthic TMDL sufficiently addresses benthic impairment of VAV-H27R_RRN02A00 and VAV-H27R_RRN03A10.

An implementation plan is currently under development for the North Fork Rivanna watershed, which will include best management practices that will reduce sediment coming into the North Fork Rivanna River segments. The NF Rivanna River Benthic TMDL includes wasteload allocations of all permitted sources of sediment upstream of the impaired segments below the dam. There are no permitted sources of sediment discharging directly to the mainstem impairments that would not be addressed by the benthic TMDL. Therefore, the two impaired segments can be nested into the North Fork Rivanna River Benthic TMDL.

Benthic TMDL Nesting Rationale

Powell River, Lee and Wise Counties, Virginia

Completed TMDL Name: **E. coli and Phased Benthic Total Maximum Daily Load for Powell River and Tributaries (North Fork Powell River, South Fork Powell River, Butcher Fork, and Wallen Creek)**

Stream Name: **Powell River**

TMDL Completion Date: **03/10/2011**

Benthic Impaired Segments Included in the TMDL:

ID305B	Cause Group Code	Water Name	Size (Miles)	Location
VAS-P18R_PLL01A02	P18R-01-BEN	South Fork Powell River	1.97	Mainstem from the confluence of Beaverdam Creek downstream to the Butcher Fork confluence at East Stone Gap
VAS-P18R_PLL01A98*	P18R-01-BEN	South Fork Powell River	3.83	Mainstem from the Butcher Fork confluence north of East Stone Gap downstream to the confluence with the Powell River at Three Forks in Big Stone Gap
VAS-P20R_PWL01A00	P20R-01-BEN	North Fork Powell River	6.05	From the Straight Creek confluence at river mile 6.25, through Pennington Gap, downstream to the Powell River confluence
VAS-P17R_POW01A94	P17R-02-BEN	Powell River	2.71	Powell River from the Roaring Branch confluence at river mile 180.83, downstream to Dakota Street in Big Stone Gap at river mile 177.53, this segment includes Callahan Creek
VAS-P19R_POW03A00	P19R-01-BEN	Powell River	6.62	Near Dryden from the confluence of Poor Valley Creek downstream to Public Water Supply segment in WQS Section 1
VAS-P23R_POW02A00*	P23R-01-BEN	Powell River	8.47	From Hardy Creek near White Shoals downstream to the Yellow Creek confluence

***** VAS-P18R_PLL01A98 and VAS-P23R_POW02A00: PARTIAL DELIST -Aquatic Life.

Segments Approved for Nesting in the 2014 and 2016 Integrated Assessment:

ID305B	Cause Group Code	Water Name	Size (Miles)	Location
VAS-P17R_POW03C14	P17R-02-BEN	Powell River	1.57	Headwaters of the mainstem Powell River
VAS-P17R_PIG01B12	P17R-07-BEN	Pigeon Creek	3.42	Headwaters from Little Black Mountain, the Kentucky line, through the Exeter community downstream to the Laurel Fork confluence

Segments Proposed for Nesting in the 2024 Integrated Report:

ID305B	Cause Group Code	Water Name	Size (Miles)	Location
VAS-P17R_LOC01A12	P17R-07-BEN	Looney Creek	6.04	A Powell River tributary west of Appalachia
VAS-P17R_POT01A14	P17R-09-BEN	Potcamp Fork	2.86	A Roaring Fork tributary, segment is from headwaters downstream to Dunbar.
VAS-P17R_RIN01A00	P17R-09-BEN	Roaring Fork	5.04	The lower mainstem from the Roaring Fork community to the Powell River confluence at Kent Junction

Justification for Nesting:

The *E. coli and Phased Benthic Total Maximum Daily Load for Powell River and Tributaries (North Fork Powell River, South Fork Powell River, Butcher Fork, and Wallen Creek)* was completed in 2010 and approved by EPA on 03/10/2011. A comprehensive revision of this TMDL which includes both Phase I and Phase II was submitted to EPA on 07/02/2014. Figure 1 presents the Powell River and Tributaries TMDL watershed boundary, which includes Looney Creek, Potcamp Fork and Roaring Fork. The revised TMDL considered and modeled all point and non-point sources of potential benthic stressors in the watershed. The process outlined in USEPA's Stressor Identification Guidance Document (USEPA, 2000) was used to identify the critical probable stressor(s) for the Powell River. Analysis of physical, chemical, biological, and observational data indicated that sediment (TSS) was the most probable cause of the benthic impairment.

Nine land uses were identified in the watershed, for modeling the 2014 TMDL. The distribution has been updated using the 2016 Land Cover Database produced by Virginia Geographic Information Network (VGIN) and its partners including GIS data from the Department of Mines, Minerals, and Energy (DMME). Figure 2 presents land uses in Powell River benthic TMDL boundary. A review of the current land uses indicated no significant changes after 2016.

Point sources discharging sediment were identified and given wasteload allocations (WLA) based on their issued Virginia Pollution Discharge Elimination System (VPDES) permits. Table 12-4 and Table 12-5 from the revised TMDL lists the DMME and DEQ VPDES permits and associated WLAs for the TSS TMDL. Any permits located on nested segments were captured in the original TMDL. In addition, there have been no new permits added in the watershed since the completion of the TMDL.

Looney Creek and Potcamp Fork were first listed as impaired for aquatic life in 2014. Roaring Fork was first listed as impaired in 2010. All the proposed nested segments fall within both the watershed and TMDL boundary for the Powell River. All the impairments are based on DEQ biological monitoring data summarized in Table 3. The locations for the monitoring stations are provided in Figure 3. Table 4 summarizes the benthic metrics and Table 5 summarizes the habitat data for the monitoring stations. Table 6 includes water column metals data.

Available water quality monitoring data including temperature, dissolved oxygen (DO), pH, specific conductance, Total Dissolved Solids (TDS), Nitrogen, Phosphorus, Sodium, Potassium, and Sulfate are shown in figures 4-13. Where applicable, minimum and/or maximum water quality standards are indicated. Monitoring results indicate sediment is the most probable stressor due to poor habitat scores for bank stability, embeddedness, and sediment deposition. Other parameters fall within the expected ranges.

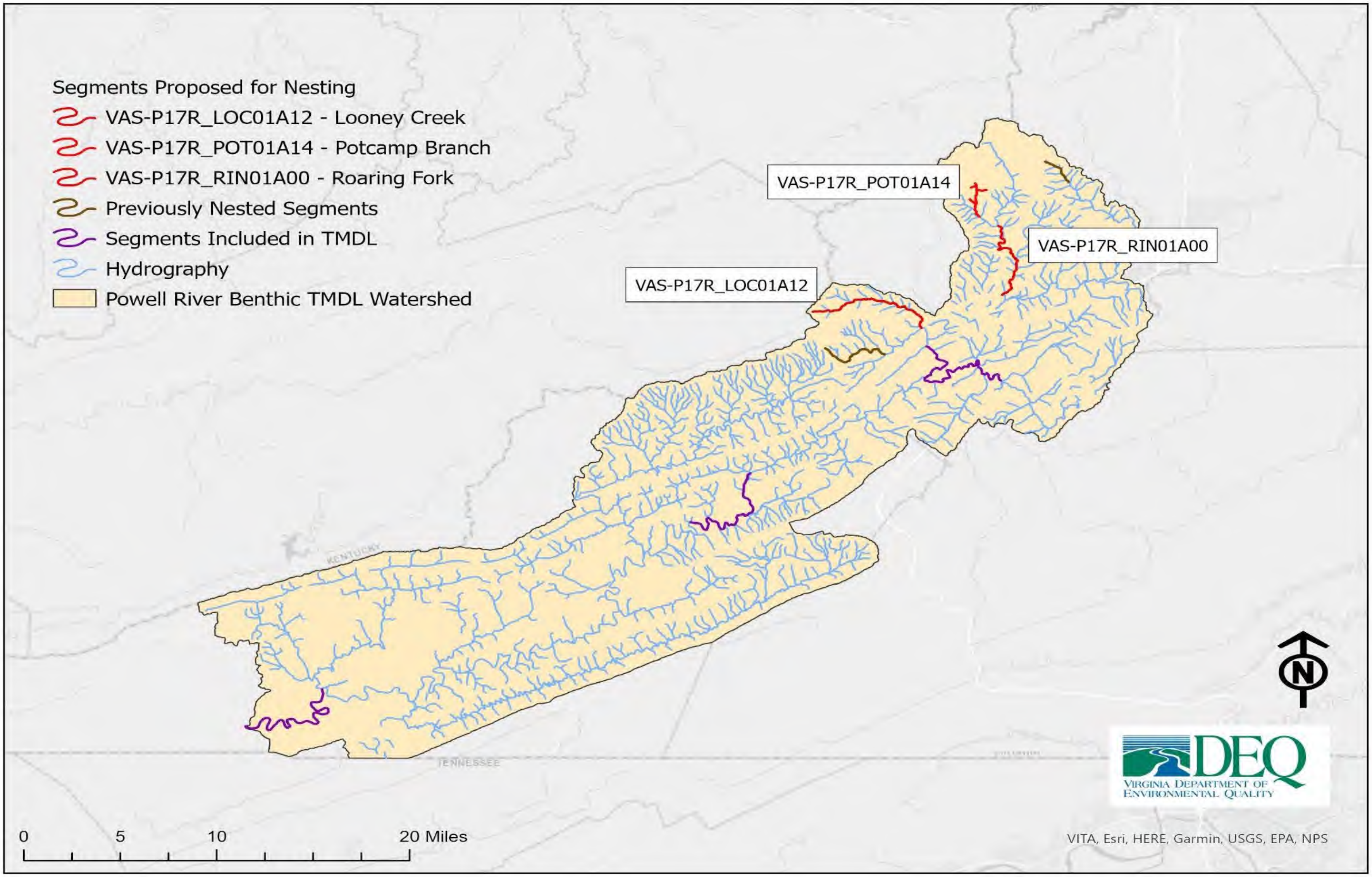

Figure 1. Proposed Segments for Nesting

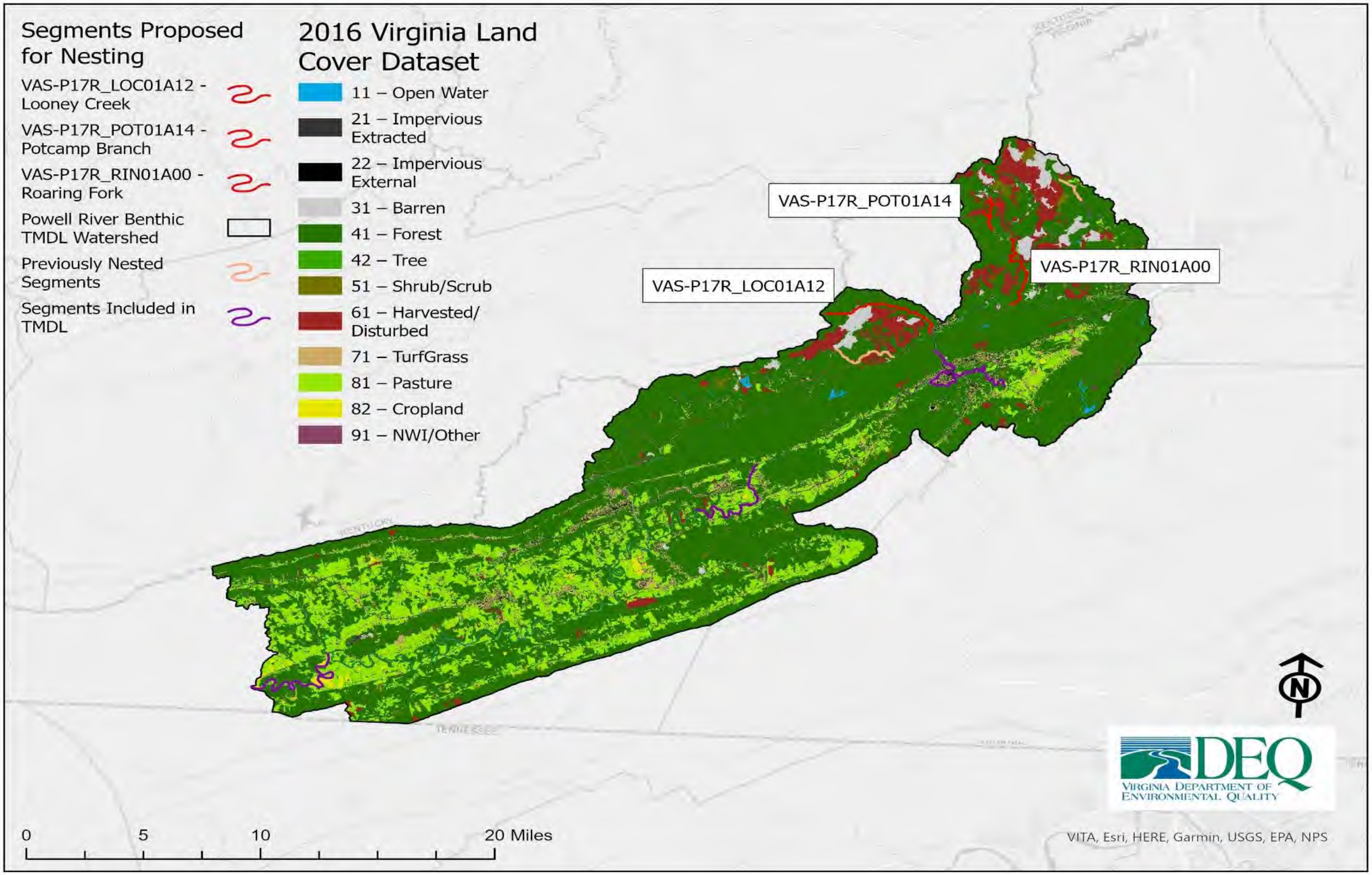

Figure 2 – Land use in the Powell River TMDL Watershed (VGIN 2016).

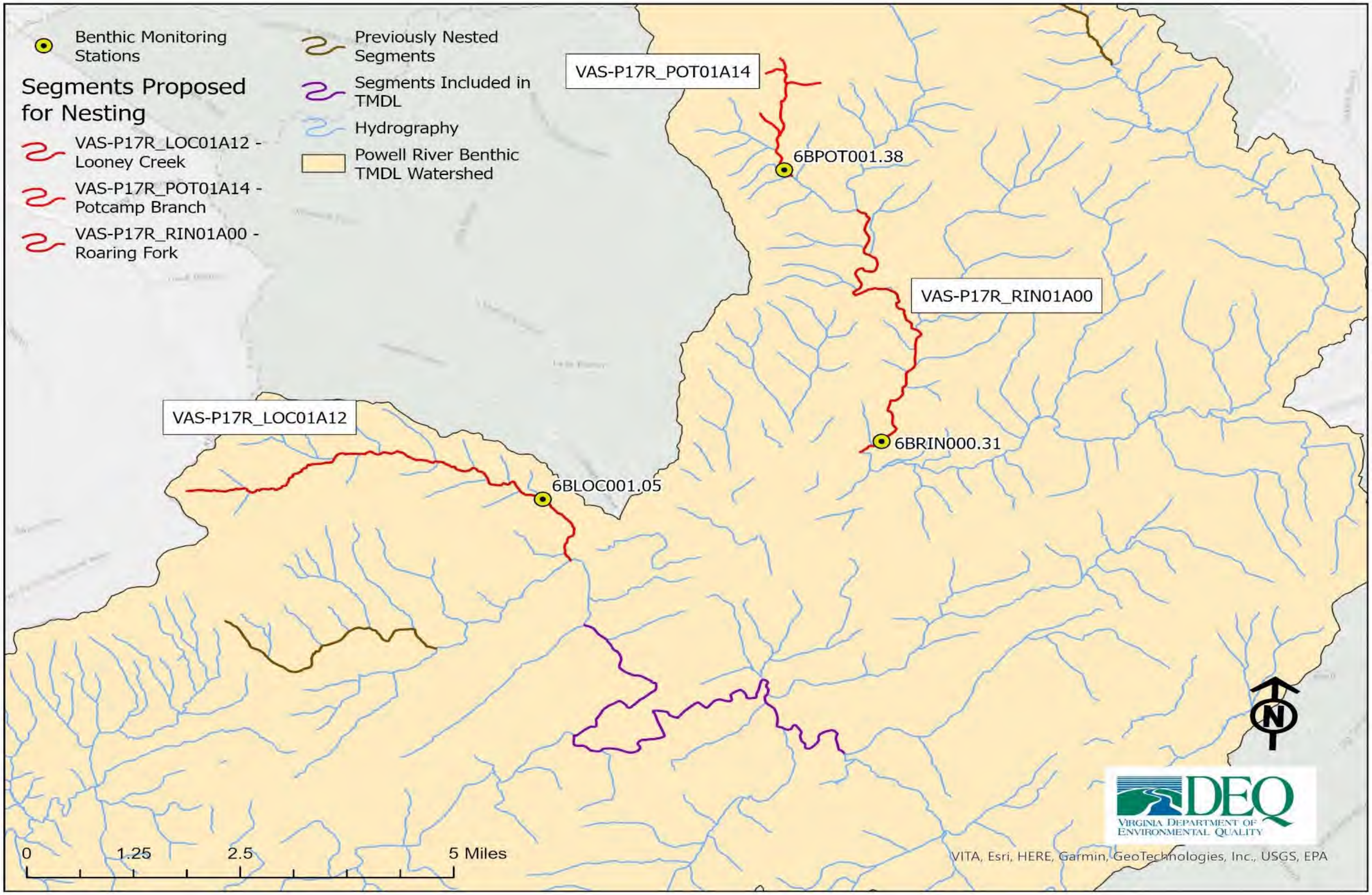

Figure 3 – Monitoring Stations for Proposed Nested Segments

Table 12-4 Average Annual Sediment TMDL

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
Powell River	**7,416.93**	**50,117.77**	**6,392.74**	**63,927.44**
DEQ VPDES permits:				
VAG750004	*0.41*			
VAG750024	*0.41*			
VA0020940	*82.95*			
VA0029599	*24.88*			
VA0052311	*2.03*			
VA0052337	*2.03*			
VA0053023	*5.60*			
VA0060798	*0.50*			
VA0063941	*0.20*			
VA0070751	*14.10*			
VA0075515	*1.24*			
VA0089397	*33.18*			
VAG110005	*0.14*			
VAG110210	*0.14*			
VAR050060	*0.14*			
VAR050065	*0.14*			
VAR050067	*0.14*			
VAR050131	*0.14*			
VAR050157	*0.14*			
VAR051276	*0.14*			
VAR051779	*0.14*			
VAG840005	*0.14*			
VAG840005	*0.14*			
VAG840005	*0.14*			
VAG840015	*0.14*			
VAR103405	*1.58*			
VAR101845	*0.81*			
VAR101845	*0.81*			
VAR101845	*0.81*			
VAR101845	*0.81*			
VAR104287	*0.80*			
VAR104305	*0.80*			
VAR104475	*0.81*			
VAR102769	*0.81*			
VAR104500	*0.80*			
VAR104502	*0.80*			
subtotal	*178.99*			
DMME Mining Permits:				

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
1100033	*41.25*			
1100439	*10.03*			
1100583	*6.75*			
1100584	*0.83*			
1100735	*3.81*			
1100877	*7.74*			
1101350	*14.97*			
1101554	*3.07*			
1101565	*3.52*			
1101661	*18.12*			
1101760	*76.05*			
1101800	*9.04*			
1101804	*42.12*			
1101813	*14.74*			
1101824	*4.37*			
1101905	*40.88*			
1101918	*24.64*			
1101954	*58.85*			
1101975	*15.04*			
1101991	*15.87*			
1102011	*16.49*			
1102028	*18.05*			
1102031	*2.95*			
1201589	*0.69*			
1201680	*0.17*			
1201803	*0.62*			
1201875	*0.97*			
1201921	*0.69*			
1201949	*1.23*			
1202015	*0.32*			
1301430	*0.49*			
1301533	*2.77*			
1301561	*2.38*			
1301590	*0.92*			
1301687	*12.10*			
1301742	*0.38*			
1301942	*0.36*			
1301992	*0.94*			
1402032	*1.69*			
1500090	*1.24*			
1501065	*24.16*			
1501778	*72.92*			

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
1501947	*3.01*			
1600876	*18.70*			
1601423	*10.18*			
1601466	*50.30*			
1601486	*54.13*			
1601519	*7.40*			
1601576	*64.57*			
1601656	*3.88*			
1601744	*54.03*			
1700624	*1.77*			
1701152	*0.53*			
1701869	*2.46*			
subtotal	*845.18*			
Future Growth	*6,392.74*			

Table 12-5 Maximum Daily Sediment TMDL

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
Powell River	**8.000**	**55877.260**	**52.045**	**520.452**
DEQ VPDES permits:				
VAG750004	*0.001*			
VAG750024	*0.001*			
VA0020940	*0.227*			
VA0029599	*0.068*			
VA0052311	*0.006*			
VA0052337	*0.006*			
VA0053023	*0.015*			
VA0060798	*0.001*			
VA0063941	*0.001*			
VA0070751	*0.039*			
VA0075515	*0.003*			
VA0089397	*0.091*			
VAG110005	*0.000*			
VAG110210	*0.000*			
VAR050060	*0.000*			
VAR050065	*0.000*			
VAR050067	*0.000*			
VAR050131	*0.000*			
VAR050157	*0.000*			
VAR051276	*0.000*			
VAR051779	*0.000*			
VAG840005	*0.000*			
VAG840005	*0.000*			
VAG840005	*0.000*			
VAG840015	*0.000*			
VAR103405	*0.004*			
VAR101845	*0.002*			
VAR101845	*0.002*			
VAR101845	*0.002*			
VAR101845	*0.002*			
VAR104287	*0.002*			
VAR104305	*0.002*			
VAR104475	*0.002*			
VAR102769	*0.002*			
VAR104500	*0.002*			
VAR104502	*0.002*			

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
subtotal	*0.483*			
DMME Mining Permits:				
1100033	*0.113*			
1100439	*0.027*			
1100583	*0.018*			
1100584	*0.002*			
1100735	*0.010*			
1100877	*0.021*			
1101350	*0.041*			
1101554	*0.008*			
1101565	*0.010*			
1101661	*0.050*			
1101760	*0.208*			
1101800	*0.025*			
1101804	*0.115*			
1101813	*0.040*			
1101824	*0.012*			
1101905	*0.112*			
1101918	*0.067*			
1101954	*0.161*			
1101975	*0.041*			
1101991	*0.043*			
1102011	*0.045*			
1102028	*0.049*			
1102031	*0.008*			
1201589	*0.002*			
1201680	*0.000*			
1201803	*0.002*			
1201875	*0.003*			
1201921	*0.002*			
1201949	*0.003*			
1202015	*0.001*			
1301430	*0.001*			
1301533	*0.008*			
1301561	*0.007*			
1301590	*0.003*			
1301687	*0.033*			
1301742	*0.001*			
1301942	*0.001*			
1301992	*0.003*			

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
1402032	*0.005*			
1500090	*0.003*			
1501065	*0.066*			
1501778	*0.200*			
1501947	*0.008*			
1600876	*0.051*			
1601423	*0.028*			
1601466	*0.138*			
1601486	*0.148*			
1601519	*0.020*			
1601576	*0.177*			
1601656	*0.011*			
1601744	*0.148*			
1700624	*0.005*			
1701152	*0.001*			
1701869	*0.007*			
subtotal	*2.312*			
Future Growth	*5.205*			

Table 3. Nested Segments Biological Monitoring Scores

Station ID	Stream Name	Assessment Unit ID	Date Sample Taken	Virginia Stream Condition Index Score (VSCI)
6BLOC001.05	Looney Creek	VAS-17R_LOC01A12	5-11-2020	45.82
6BLOC001.05	Looney Creek	VAS-17R_LOC01A12	11-17-2020	50.34
6BPOT001.38	Potcamp Fork	VAS-17R_POT01A14	5-11-2020	56.81
6BPOT001.38	Potcamp Fork	VAS-17R_POT01A14	11-17-2020	70.51
6BRIN000.31	Roaring Fork	VAS_P17R_RIN01A00	5-11-2020	45.02
6BRIN000.31	Roaring Fork	VAS_P17R_RIN01A00	11-17-2020	68.13

Table 4. Benthic Metrics

Station ID	**6BLOC001.05**	
Metric	05/11/2020	11/17/2020
Richness Score	36.36	54.55
EPT Score	45.45	63.64
% Ephem Score	65.25	45.97
% P+T-H Score	28.09	10.21
% Scraper Score	3.52	10.57
%Chironomidae Score	95.45	95.45
% 2 Dom. Score	26.27	60.43
% MFBI Score	66.18	61.9

Station ID	**6BPOT001.38**		**6BRIN000.31**	
Metric	05/11/2020	11/17/2020	5/11/2020	11/17/2020
Richness Score	54.55	72.73	45.45	59.09
EPT Score	54.55	72.73	36.36	72.73
% Ephem Score	20.76	23.73	74.15	44.49
% P+T-H Score	100	100	30.64	81.72
% Scraper Score	1.76	15.86	3.52	17.62
%Chironomidae Score	78.18	93.64	62.73	87.27
% 2 Dom. Score	44.67	85.39	24.96	86.71
% MFBI Score	100	100	82.35	95.45

Table 5. Habitat Evaluation for Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

Habitat Metrics	Station ID	6BLOC001.05	
	Collection Date	05/11/2020	11/17/2020
Channel Alteration	ALTER	14	14
Bank Stability	BANKS	15	13
Bank Vegetation	BANKVEG	15	15
Embeddedness	EMBED	16	14
Channel Flow Status	FLOW	19	17
Frequency of Riffles	RIFFLES	19	18
Riparian Vegetation	RIPVEG	11	12
Sediment Deposition	SEDIMENT	14	15
Substrate Availability	SUBSTRATE	17	17
Velocity/Depth Regime	VELOCITY	19	18
10-Metric Total		159	153

Habitat Metrics	Station ID	6BPOT001.38		6BRIN000.31	
	Collection Date	05/11/2020	11/17/2020	05/11/2020	11/17/2020
Channel Alteration	ALTER	14	14	14	14
Bank Stability	BANKS	10	5	17	13
Bank Vegetation	BANKVEG	16	16	16	16
Embeddedness	EMBED	14	10	10	8
Channel Flow Status	FLOW	18	12	19	13
Frequency of Riffles	RIFFLES	18	17	17	17
Riparian Vegetation	RIPVEG	15	14	17	15
Sediment Deposition	SEDIMENT	10	9	11	6
Substrate Availability	SUBSTRATE	16	16	17	18
Velocity/Depth Regime	VELOCITY	15	9	19	18
10-Metric Total		146	122	157	138

Habitat metric score assessed as “suboptimal” (grey shading)

Habitat metric score assessed as “marginal” or “poor” (peach shading)

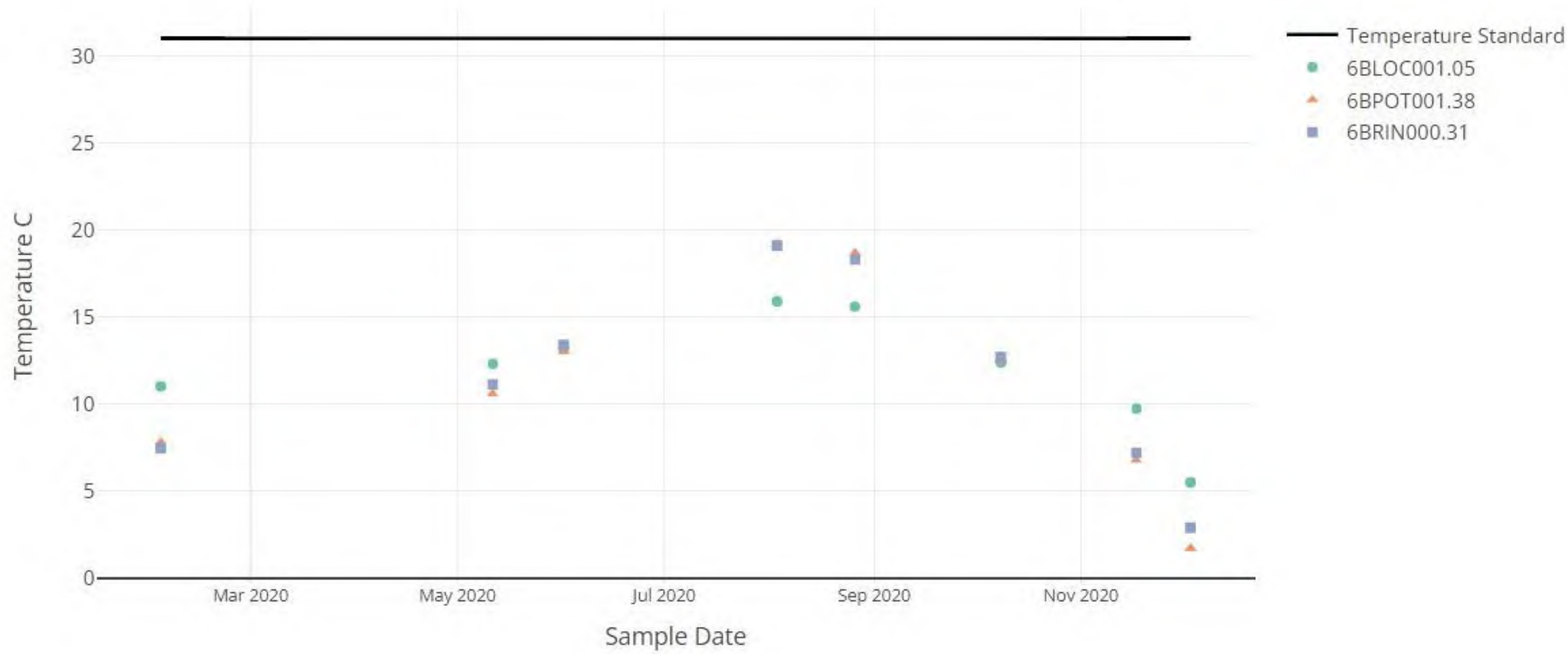

Figure 4. Field Temperature for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

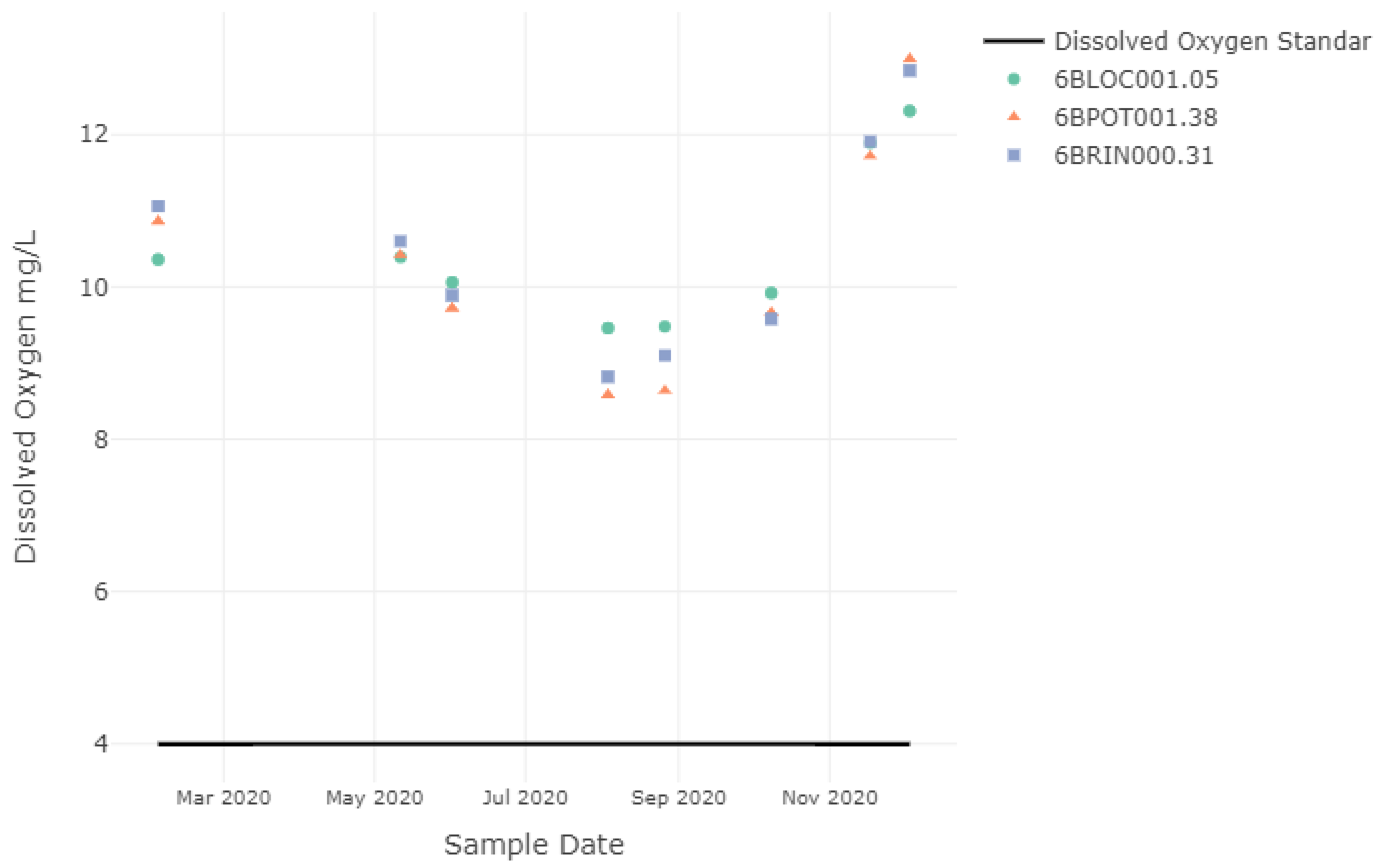

Figure 5. Dissolved Oxygen for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

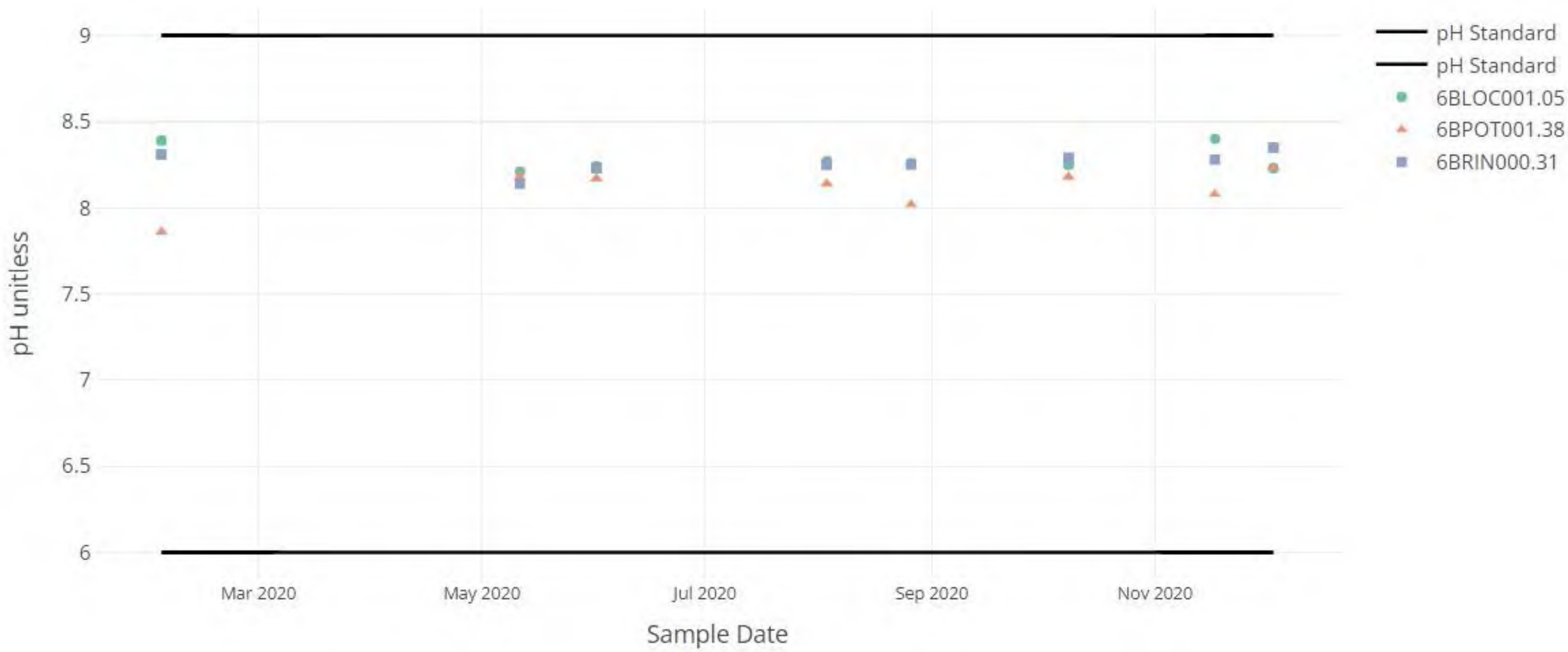

Figure 6. pH for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

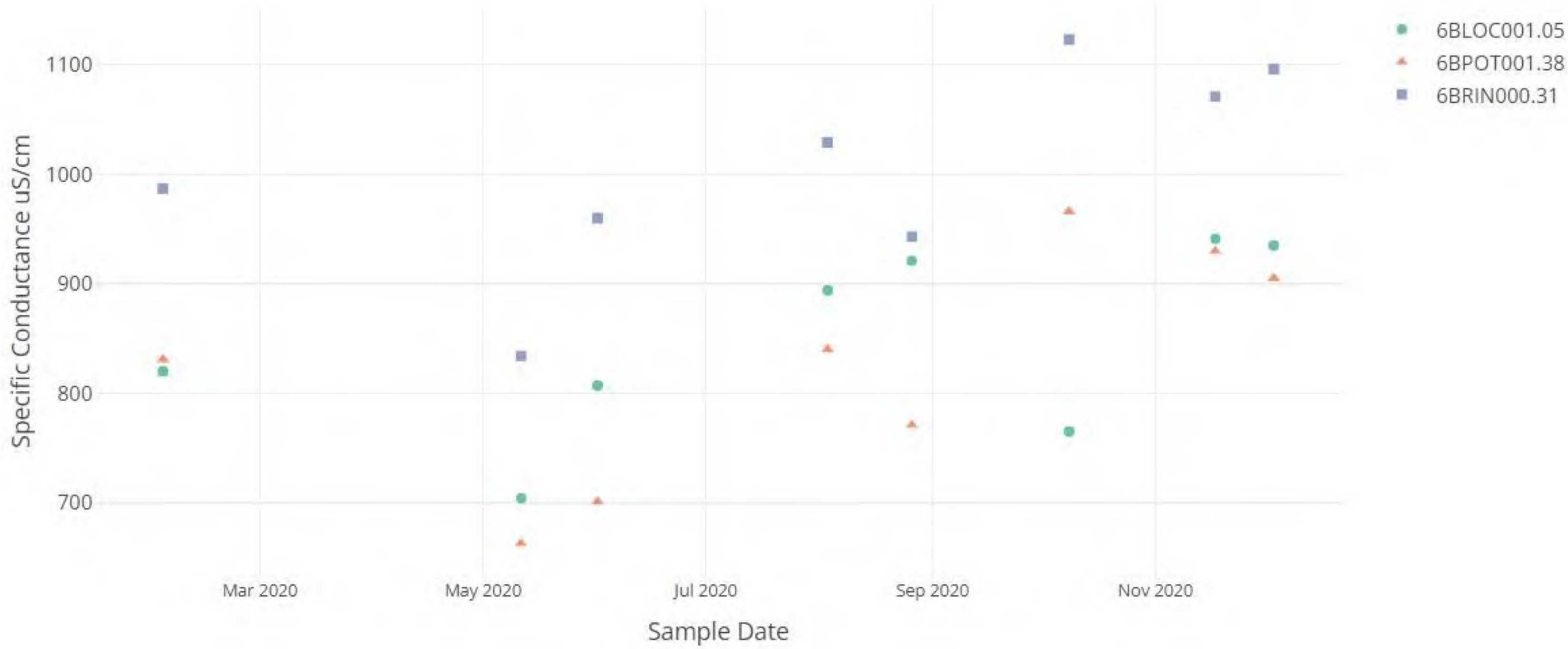

Figure 7. Specific Conductance for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

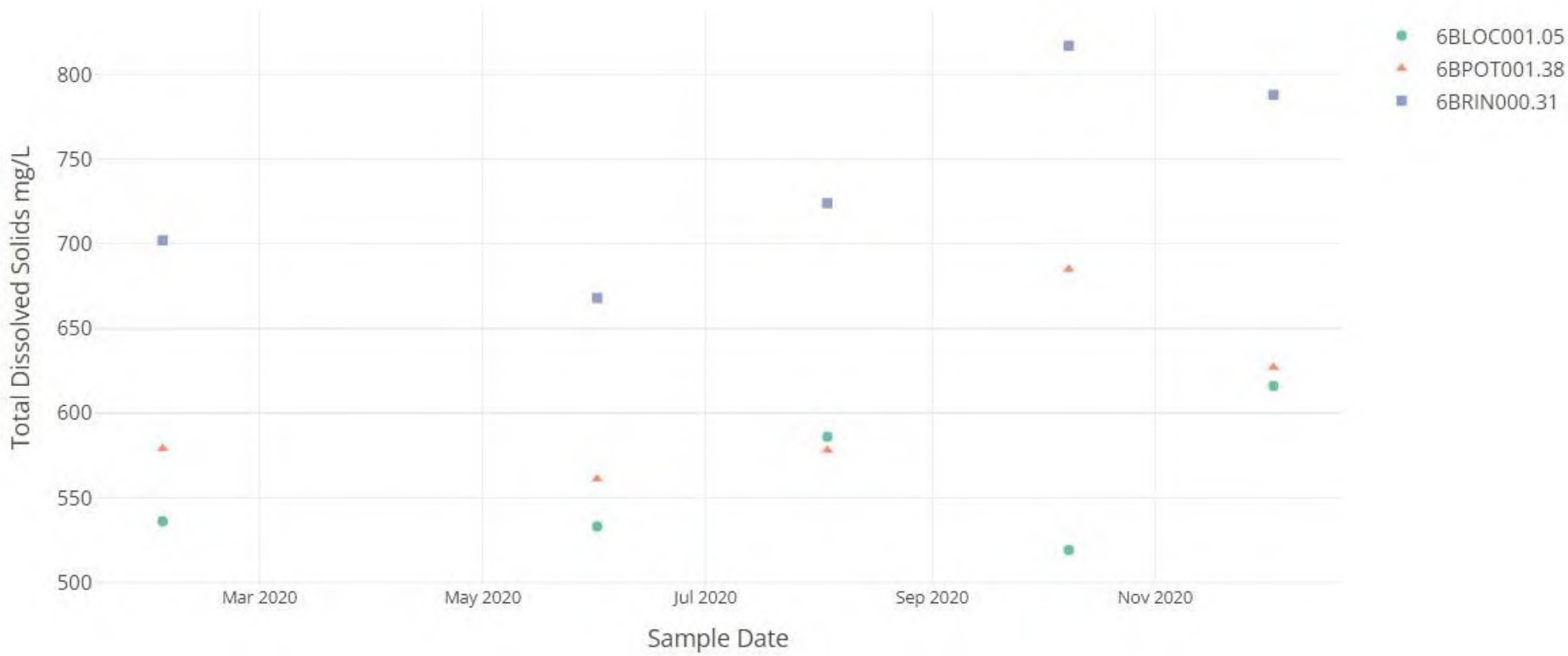

Figure 8. Total Dissolved Solids for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

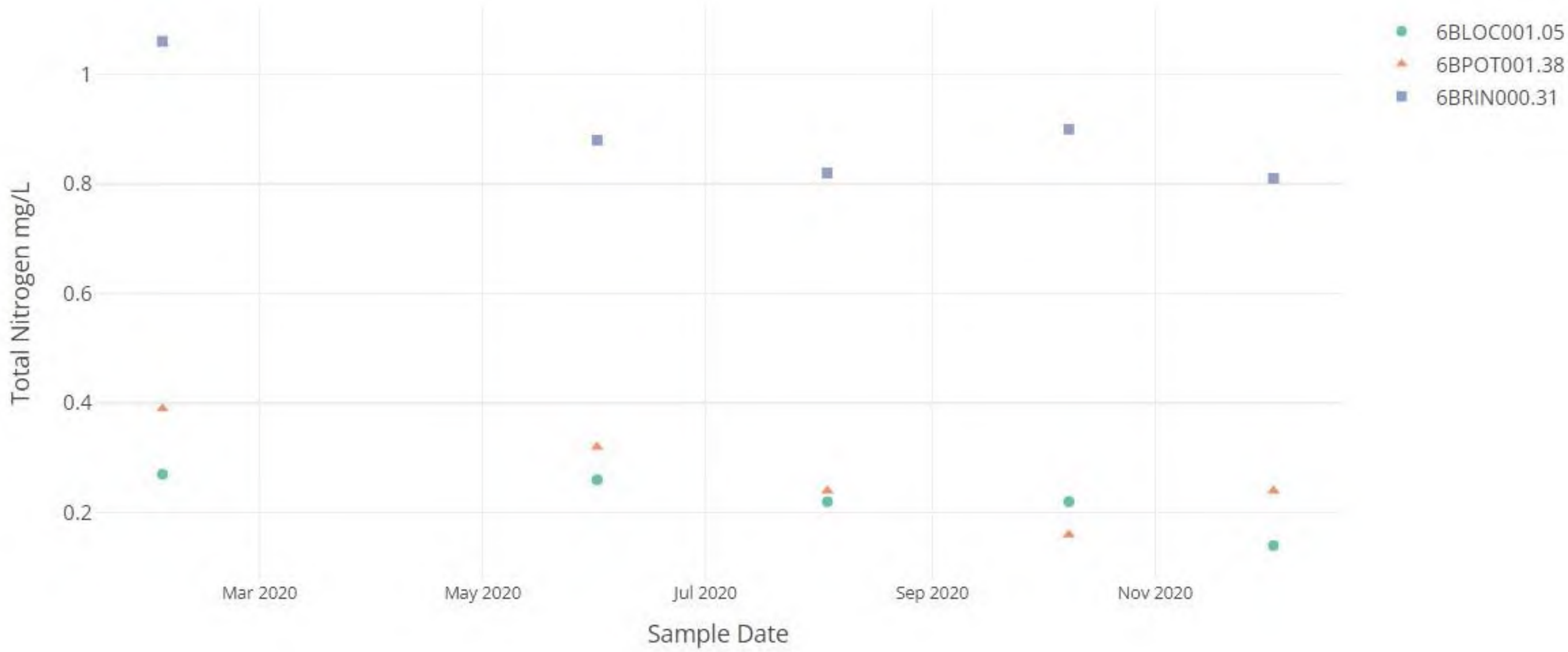

Figure 9. Total Nitrogen for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

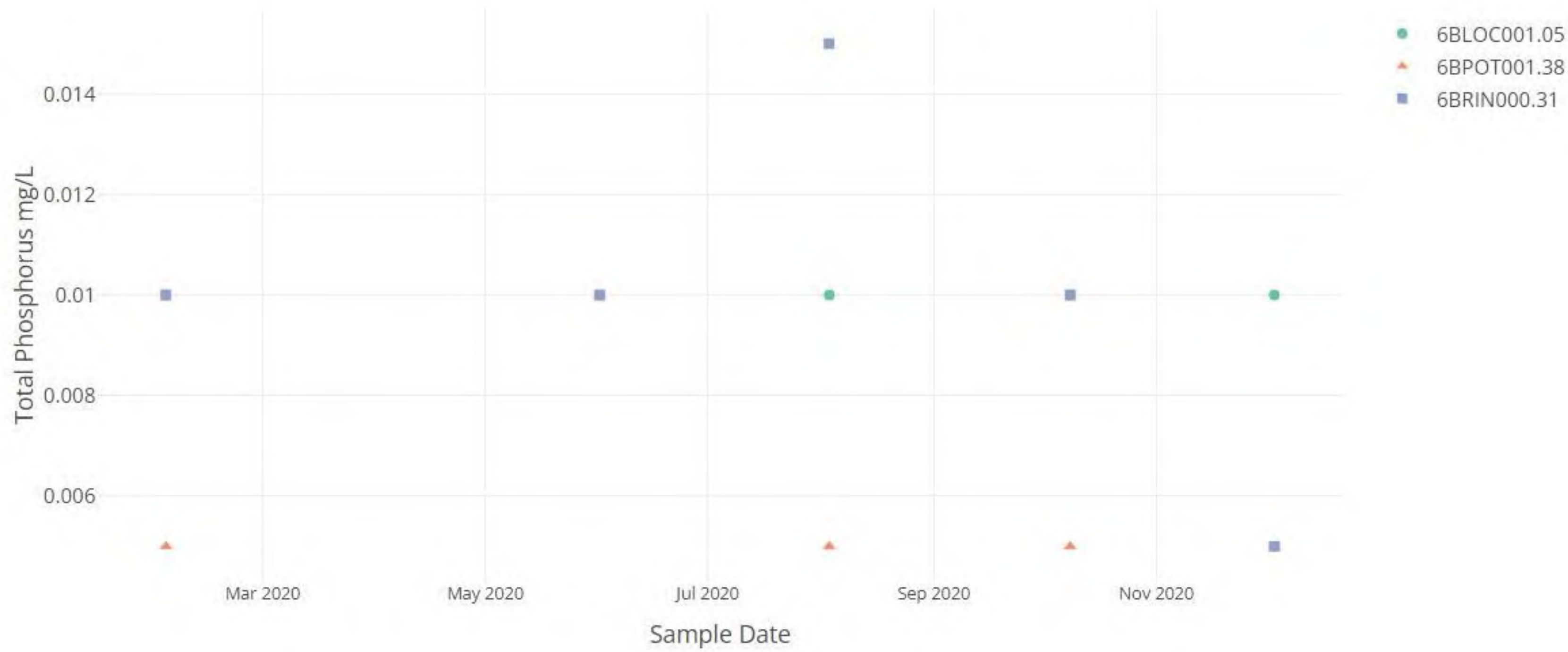

Figure 10. Total Phosphorus for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

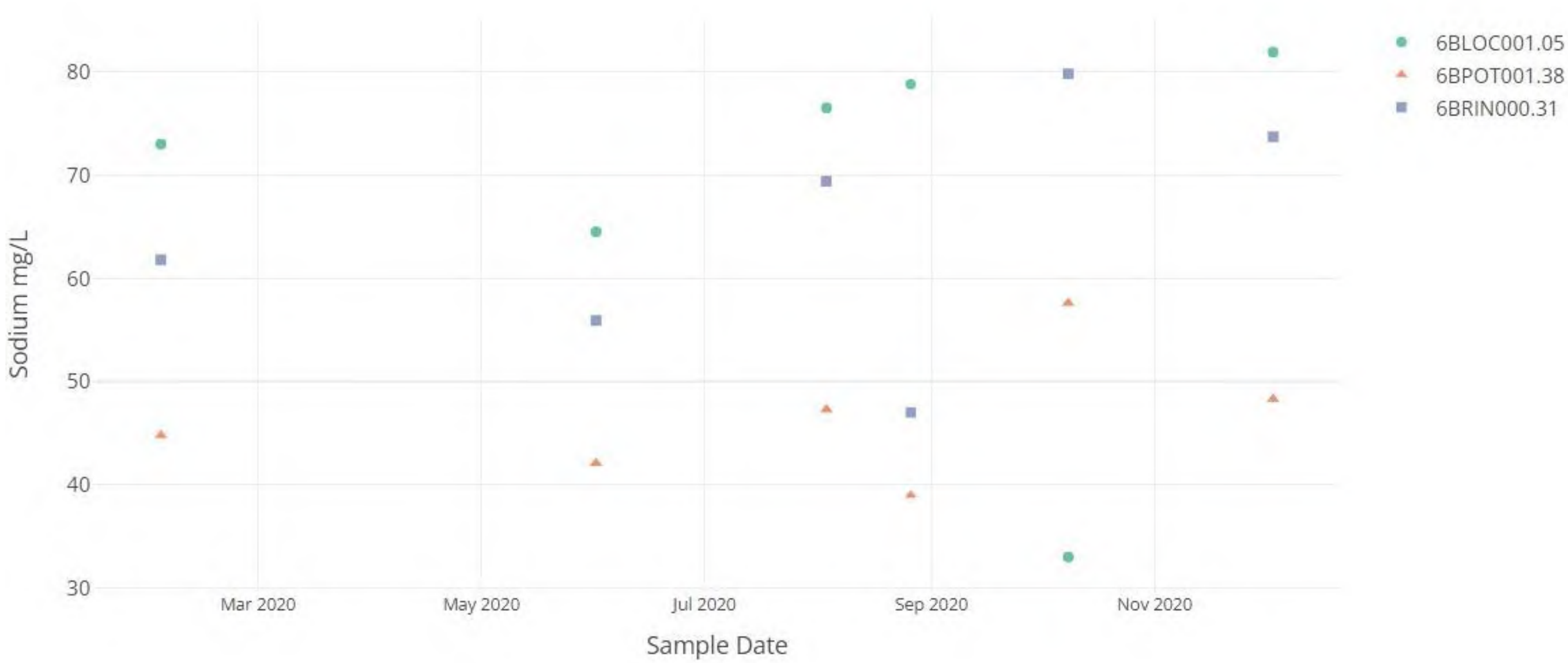

Figure 11. Sodium for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

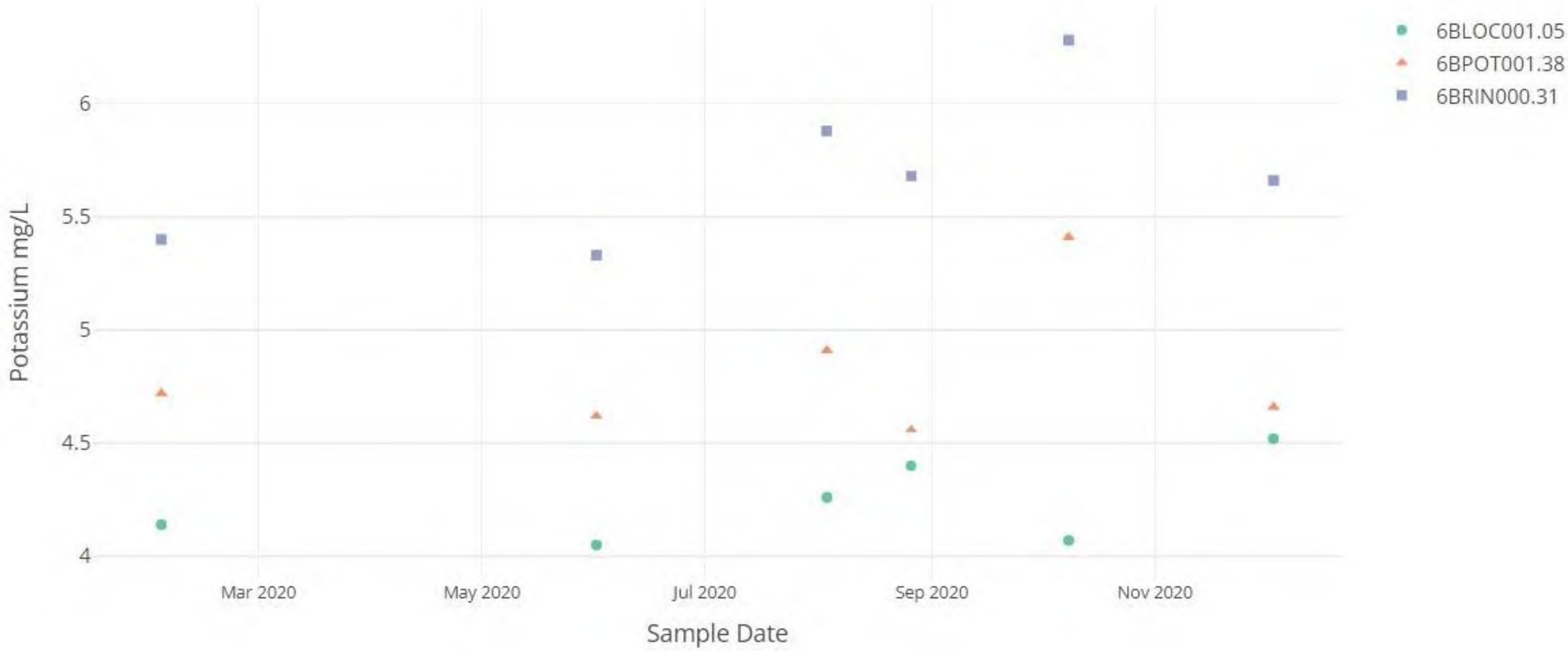

Figure 12. Potassium for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

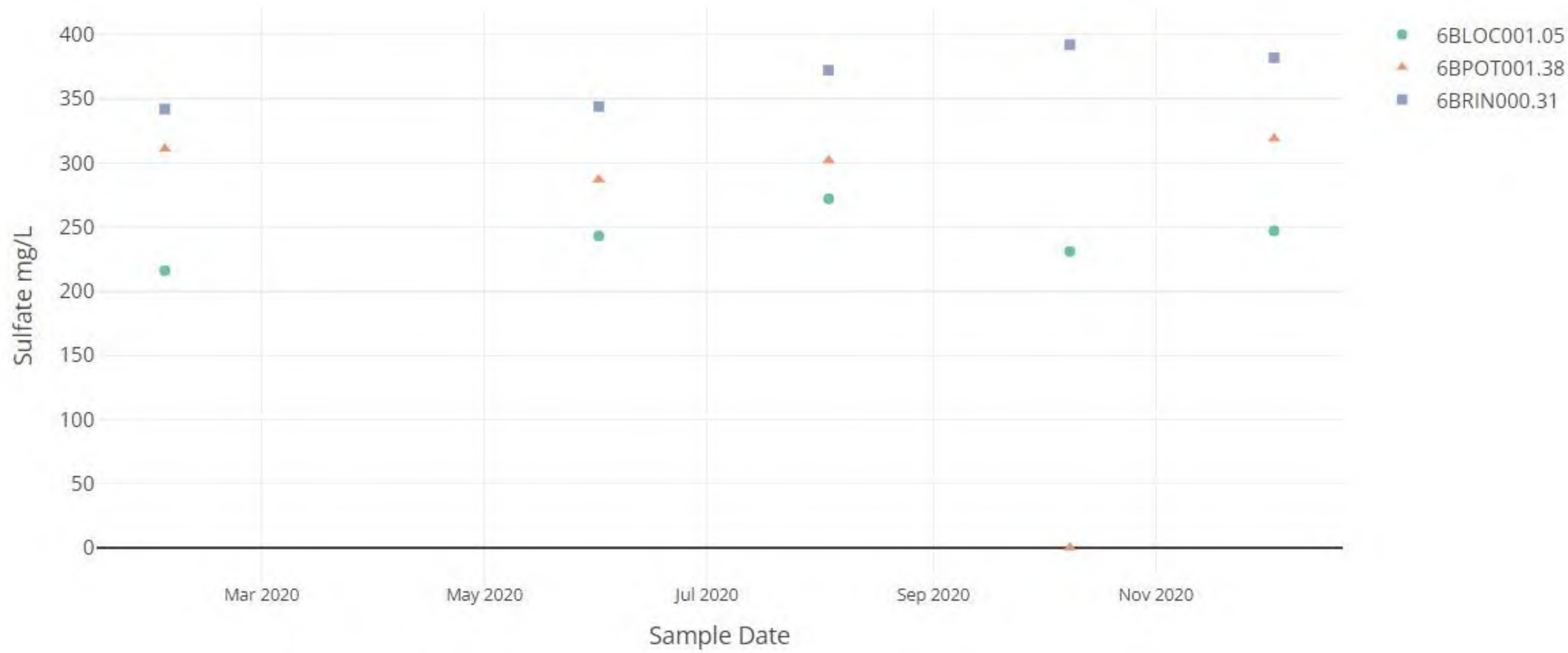

Figure 13. Sulfate for stations on Looney Creek (6BLOC001.05), Potcamp Fork (6BPOT001.38) and Roaring Fork (6BRIN000.31).

Table 6. Water Column Metals

Parameter Name	Pgc Spc Parm	**6BLOC001.05**	**6BPOT001.38**	**6BRIN000.31**	Freshwater Aquatic Life Criteria~		Human Health Criteria~	
					Chronic (ug/L)	Acute (ug/L)	PWS (ug/L)	Other (ug/L)
Arsenic, Dissolved (UG/L as AS)	01000	0.09	0.28	0.22	150	340	10	
Barium, Total (UG/L as BA)	01005	65.3	43.7	41.9			2,000	
Cadmium, Dissolved (UG/L as CD)	01025	0.06	0.01	0.01	0.72	1.8	5	
Chromium, Dissolved (UG/L as CR)	01030	0	0.02	0.02	74	570	100	
Copper, Dissolved (UG/L as CU_	01040	0.17	0.32	0.33	9.0	13	1,300	
Lead, Dissolved (UG/L as PB)	01049	0	0	0	11	94	15	
Thallium, Dissolved (UG/L as TL)	01057	0	0.01	0.02			0.22	0.43
Nickel, Dissolved (UG/L as NI)	01065	0.1	0.33	0.72	20	180	470	1,500
Silver, Dissolved (UG/L as AG)	01075	0	0	0		3.4		
Zinc, Dissolved (UG/L as ZN)	01090	-0.15	0.08	0.21	120	120	7,000	23,000
Antimony, Dissolved (UG/L as SB)	01095	0.02	0.06	0.06			5.3	580
Selenium, Dissolved (UG/L as SE)	01145	0.61	1.42	2.71	5.0	20	160	3,800

~9VAC25-260 Virginia Water Quality Standards, April 18, 2023.

Conclusion and Recommendation

The Stressor Analysis Report developed for the Powell River Phased TMDLs lists the most probable stressor for the Powell River as sediment. Candidate stressors considered in that stressor analysis include pesticides, sulfate, organic matter, conductivity/total dissolved solids, toxics, and sediment. A review of the available water quality data for the proposed nested segments indicate that field parameters are within expected ranges. Conductivity is elevated but is lower than levels at the time of TMDL development.

Sediment is supported as a probable stressor for these segments due to the suboptimal and marginal habitat metrics related to sediment. Marginal bank stability along with the presence of fine sediments indicates sediment deposition. The impairment is relatively minor, and sediment related habitat metrics are in the middle range. Therefore, sediment is indicated as the most probable cause of stress to the benthic community in these proposed segments.

The impairments on Looney Creek, Potcamp Fork, and Roaring Fork can be fully addressed through implementation of the Powell River and Tributaries TMDL.

Based on the rationale listed above, it is our recommendation that the above-mentioned assessment units in Powell River watershed be placed in Category 4A for the Aquatic Life Use.

Benthic TMDL Nesting Rationale

Levisa Fork, Buchanan County, Virginia

Completed TMDL Name: **E.coli, Phased Benthic, and Phased Total PCB TMDL Development for Levisa Fork, Slate Creek, and Garden Creek**
Stream Name: **Levisa Fork**
TMDL Completion Date: **03/18/2011**

Table 1. Benthic Impaired Segments Included in the TMDL:

ID305B	Cause Group Code	Water Name	Size (Miles)	Location
VAS-Q07R_SAT01A00	Q04R-01-BEN	Slate Creek	9.36	Mainstem from the Upper Rockhouse Branch confluence near Matney downstream to the confluence with Levisa Fork in Grundy
VAS-Q04R_LEV01A94	Q04R-01-BEN	Levisa Fork	3.95	Mainstem from the confluence of Garden Creek, river mile 155.94 at Oakwood, to the confluence of Dismal Creek at Route 460 crossing, river mile 151.84
VAS-Q06R_LEV01A98	Q04R-01-BEN	Levisa Fork	8.26	Mainstem from Dismal Creek confluence, river mile 151.84, downstream to Slate Creek confluence in Grundy, river mile 143.71
VAS- Q08R_LEV03A02	Q04R-01-BEN	Levisa Fork	6.31	From Slate Creek confluence in Grundy downstream parallel Route 460 to Bull Creek confluence
VAS-Q08R_LEV01A00	Q04R-01-BEN	Levisa Fork	2.68	From Rocklick Branch at Big Rock downstream to the Kentucky state line.

Table 2. Benthic Impaired Segments Previously Nested Under the TMDL:

ID305B	Cause Group Code	Water Name	Size (Miles)	Location
VAS-Q05R_DIS02A00	Q05R-00-BEN	Dismal Creek	9.14	Headwaters of Dismal Creek near Redoak Ridge downstream through Jewell Valley and Whitewood to the Laurel Fork confluence
VAS-Q08R_HME01A04	Q08R-02-BEN	Home Creek	4.79	Levisa Fork tributary south of Big Rock upstream to the Spencer Fork confluence
VAS-Q08R_HME01B14	Q08R-02-BEN	Home Creek	0.80	Headwaters of Home Creek

Table 3. Benthic Impaired Segments proposed for Nesting in the 2024 Integrated Report:

ID305B	Cause Group Code	Water Name	Size (Miles)	Location
VAS-Q08R_PLR01A08	Q04R-01-BEN	Poplar Creek	3.03	Mainstem from Poplar Fork confluence downstream to river mile 0.19 above confluence with Levisa Fork near Harman Junction
VAS-Q08R_PLR01A14	Q08R-09-BEN	Poplar Creek	0.19	Mainstem from Levisa Fork near Harman Junction upstream to first tributary at river mile 0.19
	Q08R-05-BEN	Conaway Creek	2.62	Levisa Fork tributary at Conaway near Kentucky state line upstream to Caney Fork confluence
	Q08R-08-BEN	Conaway Creek and Tributaries	2.85	From Lick Branch down to the confluence with Caney Fork

Justification for Nesting:

The *E.coli, Phased Benthic, and Phased Total PCB TMDL Development for Levisa Fork, Slate Creek, and Garden Creek* was completed in 2010 and approved by EPA on 03/18/2011. A comprehensive revision of this TMDL which includes both Phase I and Phase II was submitted to EPA on 07/02/2014. Figure 1 presents the Levisa Fork and Slate Creek TMDL watershed boundary, and includes Conaway Creek, Conaway Creek and tributaries, and Poplar Creek which are all within the Levisa Fork TMDL watershed. The process outlined in USEPA's Stressor Identification Guidance Document (USEPA, 2000) was used to identify the critical probable stressor(s) for the Levisa Fork. Analysis of physical, chemical, biological, and observational data indicated that sediment (TSS) was the most probable cause of the benthic impairment. The land uses for the approved Levisa Fork TMDL area are comparable and consistent with the proposed nested segments. Data from the Virginia Geographic Information Network (VGIN 2016) has been used to provide an updated and more accurate description of land uses in the watershed. Figure 2 illustrates land uses in the Levisa Fork watershed. The revised TMDL took into account and modeled all point and non-point sources of potential benthic stressors in the watershed. Point sources discharging sediment were identified and given wasteload allocations (WLA) based on their issued Virginia Pollution Discharge Elimination System (VPDES) permits. Tables 11.9 and 11.10 from the revised TMDL lists the DMME and DEQ VPDES permits and associated WLAs for the TSS TMDL on the Levisa Fork. No new permits have been added to the watershed since the completion of the TMDL. Permit tables from the TSS TMDL on Slate Creek are not shown since none of the proposed segments fall within the Slate Creek watershed.

The spring of 2021 benthic sampling effort on Poplar Creek (station 6APLR000.06) yielded a Virginia Stream Condition Index (VSCI) score of 40 indicating an impairment for aquatic life. This is expected to result in the Poplar Creek segment VAS-Q08R_PLR01A14 being listed in the 2024 Integrated Report. The Conaway Creek and the Conaway Creek and tributaries segments were both first listed in 2014. All the segments proposed for nesting fall within both the watershed and TMDL boundary for the Levisa. All the impairments are based on DEQ biological monitoring data. The locations for the monitoring stations are provided in Figure 3. Table 3 summarizes the DEQ data collected. The resulting low scores indicate impairment.

In figures 4-10 DEQ's Benthic Stressor Analysis Tool was used to review the information available for the proposed nested segments. The goal of the stressor analysis process is to apply a weight-of-evidence approach to define a/the most probable stressor(s) that explain(s) the shift in the benthic macroinvertebrate community. Candidate stressors were identified based on DEQ monitoring data and known effects of pollutants on macroinvertebrates. Results indicate sediment as the most probable stressor based on poor and suboptimal habitat scores for channel alteration, bank stability, embeddedness, and sediment deposition. Other parameters fall within expected ranges.

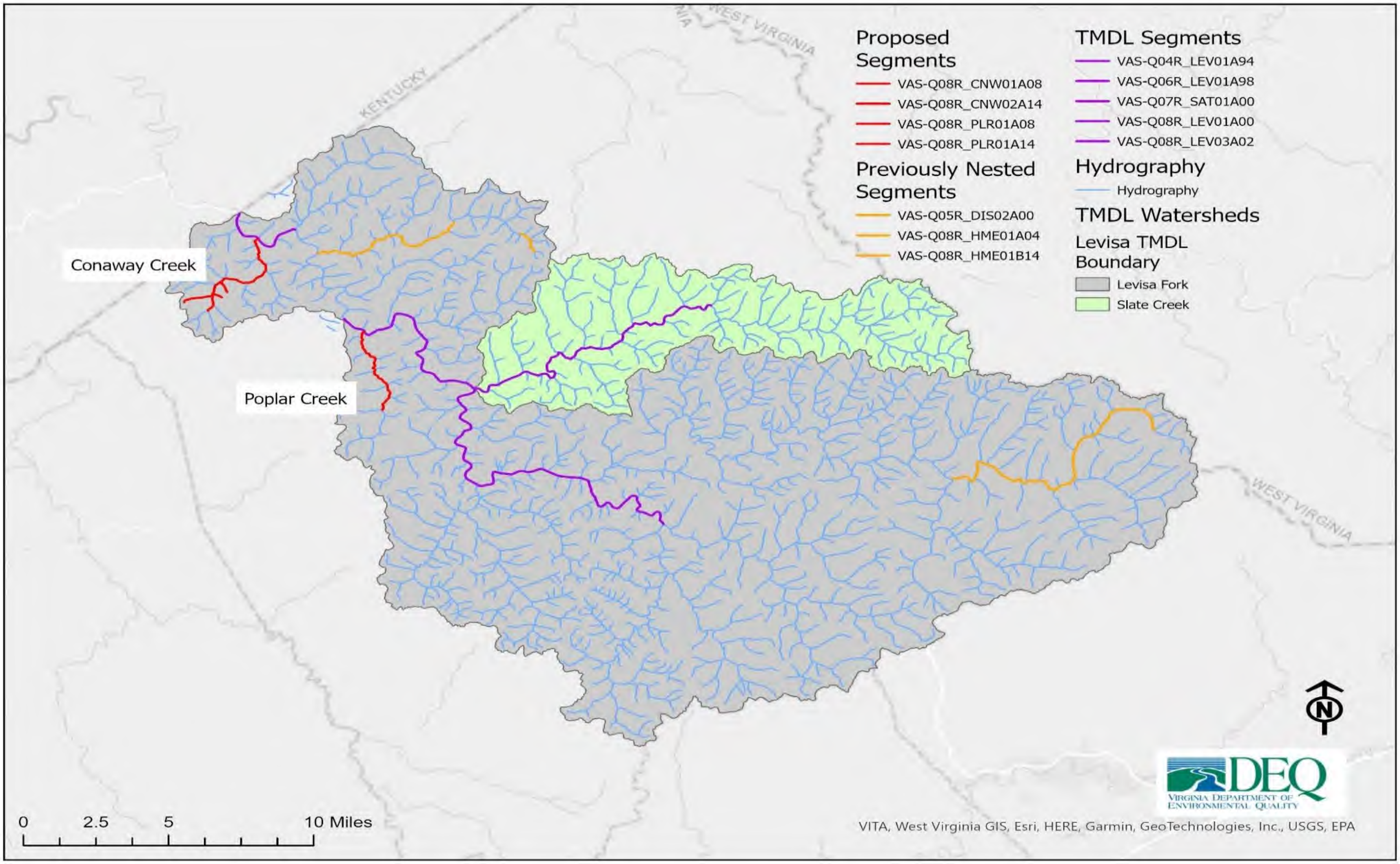

Figure 1. Proposed Segments for Nesting

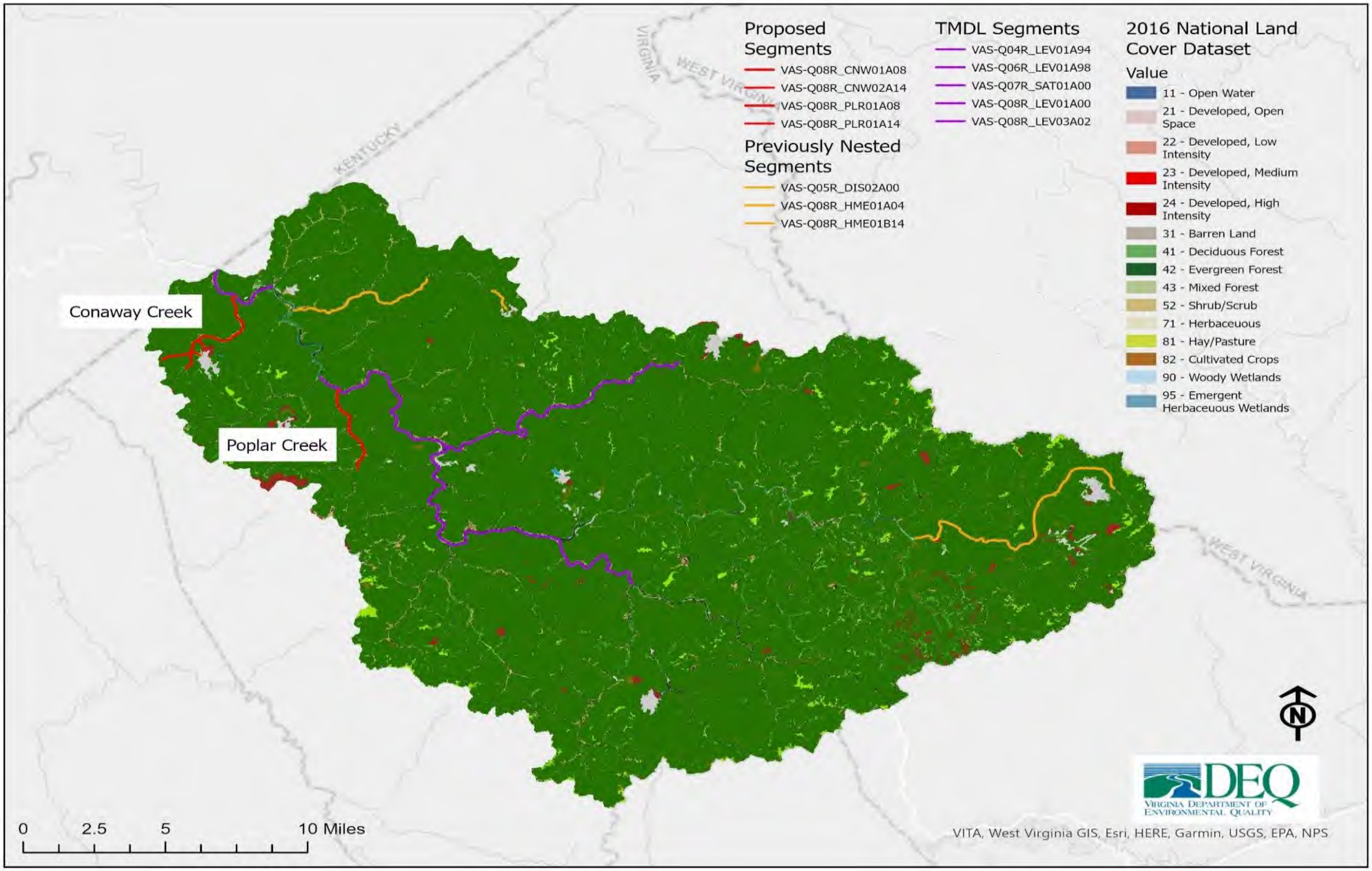

Figure 2. Land use in the Levisa Fork TMDL Watershed

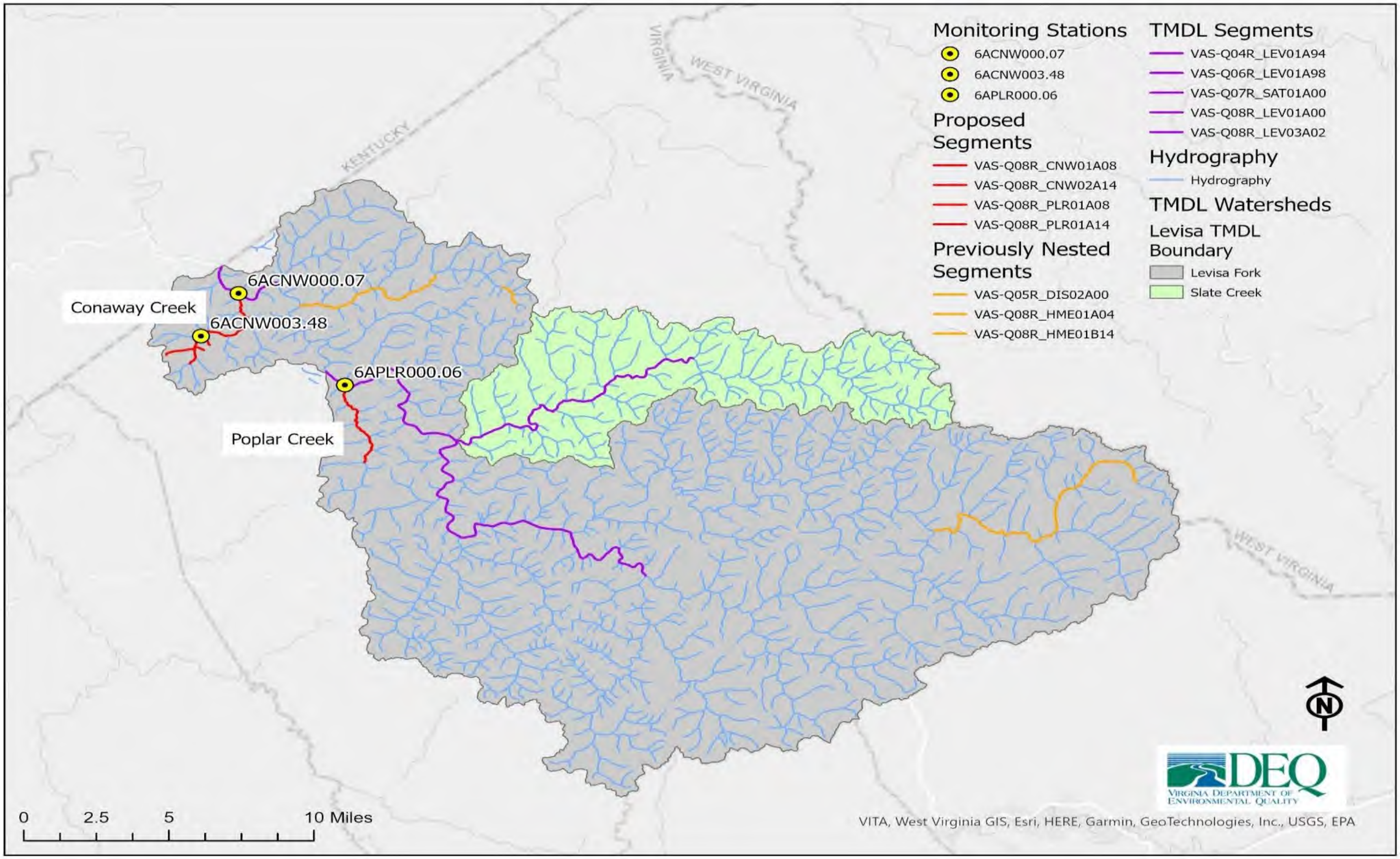

Figure 3. Monitoring Stations for Proposed Nested Segments

Table 11.9 Average Annual Sediment TMDL for Levisa Fork

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
Levisa Fork	**729.66**	**16,817.78**	**1,949.76**	**19,497.20**
VAR101038	4.70			
VAR104503	0.86			
VAR102495	0.16			
VAR104799	0.19			
VAR050018	4.50			
VAR050059	0.54			
VAR050102	0.62			
VAR051686	1.73			
VAG110243	0.49			
VAG750020	0.41			
VAG400200	0.04			
VAG400573	0.04			
VAG400405	0.04			
VAG400741	0.04			
VAG400809	0.04			
VAG400404	0.04			
VAG400697	0.04			
VAG400589	0.04			
VAG400192	0.04			
VAG400129	0.04			
VAG400681	0.04			
VAG400682	0.04			
VAG400698	0.04			
VAG400830	0.04			
VAG400190	0.04			
VAG400191	0.04			
VAG400515	0.04			
VAG400211	0.04			
VAG400445	0.04			
VAG400549	0.04			
VAG400613	0.04			
VAG400413	0.04			
VAG400686	0.04			
VAG400727	0.04			
VAG400730	0.04			
VAG400825	0.04			
VAG400342	0.04			
VAG400678	0.04			
VAG400087	0.04			
VAG400108	0.04			
VAG400663	0.04			
VAG400729	0.04			

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
VAG400710	0.04			
VAG400680	0.04			
VA0050351	13.83			
VA0052639	0.04			
VA0065536	0.83			
VA0065625	1.04			
VA0066907	0.83			
VA0068438	0.30			
VA0089907	0.31			
VA0090239	0.13			
VA0090531	82.96			
Future Growth	*194.97*			
Surface Mining Transient	418.86			
1100470	*2.36*			
1101381	*18.85*			
1101553	*11.10*			
1101752	*24.92*			
1101792	*9.64*			
1101846	*7.80*			
1101881	*0.35*			
1101903	*1.47*			
1101987	*5.74*			
1102001	*17.57*			
1102030	*3.76*			
1200194	*1.68*			
1200235	*1.03*			
1200282	*0.24*			
1200308	*2.59*			
1200335	*0.09*			
1200354	*2.32*			
1200881	*0.28*			
1201015	*0.75*			
1201050	*0.40*			
1201053	*0.17*			
1201091	*2.13*			
1201131	*0.10*			
1201182	*1.54*			
1201230	*0.36*			
1201273	*0.97*			
1201310	*0.19*			
1201345	*0.56*			
1201348	*3.20*			
1201373	*0.11*			
1201442	*0.21*			
1201484	*0.78*			
1201495	*0.45*			

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
1201508	*0.52*			
1201523	*0.31*			
1201532	*0.14*			
1201574	*0.98*			
1201698	*0.14*			
1201716	*0.96*			
1201749	*0.59*			
1201753	*5.59*			
1201902	*0.79*			
1201906	*0.09*			
1201907	*0.20*			
1202036	*0.43*			
1300120	*1.26*			
1300359	*5.88*			
1300378	*0.76*			
1300379	*3.44*			
1300398	*1.52*			
1300404	*1.14*			
1300417	*1.24*			
1300425	*11.26*			
1300426	*18.00*			
1300451	*1.79*			
1300453	*14.53*			
1300454	*2.52*			
1300945	*0.25*			
1301156	*1.20*			
1301226	*13.44*			
1400047	*79.20*			
1400345	*4.38*			
1400419	*0.95*			
1400492	*16.14*			
1400493	*8.26*			
1400496	*9.03*			
1400498	*5.46*			
1401039	*1.37*			
1401167	*2.61*			
1401181	*0.69*			
1401232	*5.10*			
1401489	*9.66*			
1401493	*1.44*			
1401531	*10.45*			
1401598	*4.65*			
1401635	*3.67*			
1500384	*5.82*			
1601787	*19.31*			
1601816	*6.08*			

Impairment	WLA t/yr	LA t/yr	MOS t/yr	TMDL t/yr
1700864	*5.87*			
1701300	*6.02*			
1801821	*0.02*			

Table 11.10 Maximum Daily Sediment TMDL for Levisa Fork

Impairment	WLA t/day	LA t/ day	MOS t/ day	TMDL t/ day
Levisa Fork	**1.999**	**125.40**	**14.16**	**141.56**
VAR101038	0.0129			
VAR104503	0.0024			
VAR102495	0.0004			
VAR104799	0.0005			
VAR050018	0.0123			
VAR050059	0.0015			
VAR050102	0.0017			
VAR051686	0.0047			
VAG110243	0.0013			
VAG750020	0.0011			
VAG400200	0.0001			
VAG400573	0.0001			
VAG400405	0.0001			
VAG400741	0.0001			
VAG400809	0.0001			
VAG400404	0.0001			
VAG400697	0.0001			
VAG400589	0.0001			
VAG400192	0.0001			
VAG400129	0.0001			
VAG400681	0.0001			
VAG400682	0.0001			
VAG400698	0.0001			
VAG400830	0.0001			
VAG400190	0.0001			
VAG400191	0.0001			
VAG400515	0.0001			
VAG400211	0.0001			
VAG400445	0.0001			
VAG400549	0.0001			
VAG400613	0.0001			
VAG400413	0.0001			
VAG400686	0.0001			
VAG400727	0.0001			
VAG400730	0.0001			
VAG400825	0.0001			
VAG400342	0.0001			
VAG400678	0.0001			
VAG400087	0.0001			
VAG400108	0.0001			
VAG400663	0.0001			
VAG400729	0.0001			

Impairment	WLA t/day	LA t/ day	MOS t/ day	TMDL t/ day
VAG400710	0.0001			
VAG400680	0.0001			
VA0050351	0.0379			
VA0052639	0.0001			
VA0065536	0.0023			
VA0065625	0.0028			
VA0066907	0.0023			
VA0068438	0.0008			
VA0089907	0.0008			
VA0090239	0.0004			
VA0090531	0.2273			
Future Growth	0.5342			
Surface Mining Transient	1.1476			
1100470	*0.0065*			
1101381	*0.0516*			
1101553	*0.0304*			
1101752	*0.0683*			
1101792	*0.0264*			
1101846	*0.0214*			
1101881	*0.0010*			
1101903	*0.0040*			
1101987	*0.0157*			
1102001	*0.0481*			
1102030	*0.0103*			
1200194	*0.0046*			
1200235	*0.0028*			
1200282	*0.0007*			
1200308	*0.0071*			
1200335	*0.0002*			
1200354	*0.0064*			
1200881	*0.0008*			
1201015	*0.0021*			
1201050	*0.0011*			
1201053	*0.0005*			
1201091	*0.0058*			
1201131	*0.0003*			
1201182	*0.0042*			
1201230	*0.0010*			
1201273	*0.0027*			
1201310	*0.0005*			
1201345	*0.0015*			
1201348	*0.0088*			
1201373	*0.0003*			
1201442	*0.0006*			
1201484	*0.0021*			
1201495	*0.0012*			

Impairment	WLA t/day	LA t/ day	MOS t/ day	TMDL t/ day
1201508	*0.0014*			
1201523	*0.0008*			
1201532	*0.0004*			
1201574	*0.0027*			
1201698	*0.0004*			
1201716	*0.0026*			
1201749	*0.0016*			
1201753	*0.0153*			
1201902	*0.0022*			
1201906	*0.0002*			
1201907	*0.0005*			
1202036	*0.0012*			
1300120	*0.0035*			
1300359	*0.0161*			
1300378	*0.0021*			
1300379	*0.0094*			
1300398	*0.0042*			
1300404	*0.0031*			
1300417	*0.0034*			
1300425	*0.0308*			
1300426	*0.0493*			
1300451	*0.0049*			
1300453	*0.0398*			
1300454	*0.0069*			
1300945	*0.0007*			
1301156	*0.0033*			
1301226	*0.0368*			
1400047	*0.2170*			
1400345	*0.0120*			
1400419	*0.0026*			
1400492	*0.0442*			
1400493	*0.0226*			
1400496	*0.0247*			
1400498	*0.0150*			
1401039	*0.0038*			
1401167	*0.0072*			
1401181	*0.0019*			
1401232	*0.0140*			
1401489	*0.0265*			
1401493	*0.0039*			
1401531	*0.0286*			
1401598	*0.0127*			
1401635	*0.0101*			
1500384	*0.0159*			
1601787	*0.0529*			
1601816	*0.0167*			

Impairment	WLA t/day	LA t/ day	MOS t/ day	TMDL t/ day
1700864	*0.0161*			
1701300	*0.0165*			
1801821	*0.0001*			

Table 3. Nested Segments Biological Monitoring Scores

Station ID	Stream Name	Assessment Unit ID	Date Sample Taken	Virginia Stream Condition Index Score (VSCI)
6APLR000.06	Poplar Creek	VAS-Q08R_PLR01A14 VAS-Q08R_PLR01A08	4/7/2021	39.97
6ACNW000.07	Conaway Creek	VAS-Q08R_CNW01A08	4/7/2021	56.29
6ACNW000.07	Conaway Creek	VAS-Q08R_CNW01A08	10/06/2014	51.64
6ACNW000.07	Conaway Creek	VAS-Q08R_CNW01A08	03/21/2014	36.24
6ACNW003.48	Conaway Creek and Tributaries	VAS-Q08R_CNW02A14	11/16/2020	38.84
6ACNW003.48	Conaway Creek and Tributaries	VAS-Q08R_CNW02A14	5/7/2020	51.65

Table 4. Benthic Metrics

Station ID	6APLR000.06	6ACNW000.07	6ACNW003.48	
Metric	**4/7/2021**	**4/7/2021**	**5/7/2020**	**11/16/2020**
Richness Score	54.55	45.45	50.00	36.36
EPT Score	36.36	36.36	36.36	36.36
% Ephem Score	65.25	56.35	68.22	31.14
% P+T-H Score	10.21	63.84	33.20	17.88
% Scraper Score	1.76	19.38	14.09	10.57
%Chironomidae Score	55.45	78.18	76.36	59.09
% 2 Dom. Score	22.33	63.06	49.92	48.61
% MFBI Score	73.80	87.70	85.03	70.67

Table 5. Habitat Evaluation for Poplar Creek, Conaway Creek and Conaway Creek and Tributaries

Habitat Metrics	Station ID:	**6APLR000.06**	**6ACNW000.07**	**6ACNW003.48**	
	Collection Date:	04/7/2021	4/7/2021	5/7/2020	11/16/2020
Channel Alteration	ALTER	12	14	14	13
Bank Stability	BANKS	7	13	13	10
Bank Vegetation	BANKVEG	6	14	16	14
Embeddedness	EMBED	14	15	15	12
Channel Flow Status	FLOW	19	19	19	12
Frequency of Riffles	RIFFLES	17	16	18	16
Riparian Vegetation	RIPVEG	7	13	14	13
Sediment Deposition	SEDIMENT	12	11	13	10
Substrate Availability	SUBSTRATE	17	13	14	13
Velocity/Depth Regime	VELOCITY	16	18	15	9
10-Metric Total		127	146	151	122

Habitat metric score assessed as "suboptimal"

Habitat metric score assessed as "marginal" or "poor"

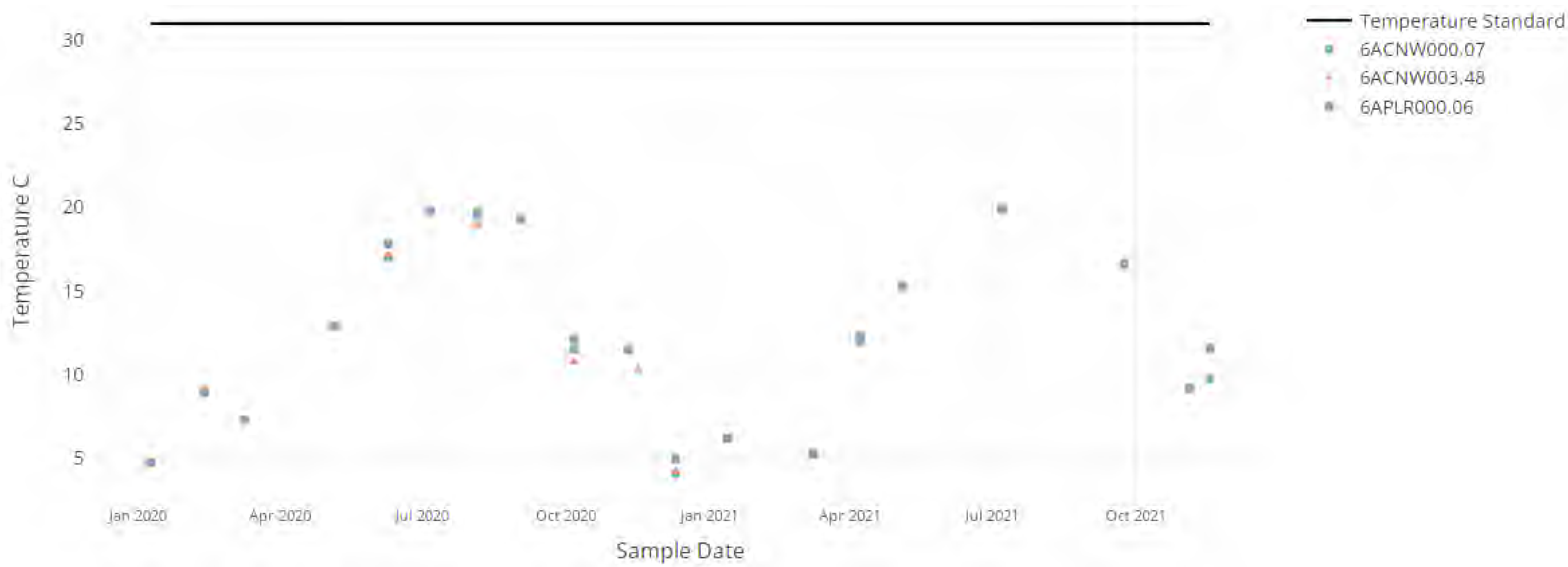

Figure 4. Field Temperature for stations on Conaway Creek (6ACNW000.07), Conaway Creek and Tributaries (6ACNW003.48), and Poplar Creek (6APLR000.0).

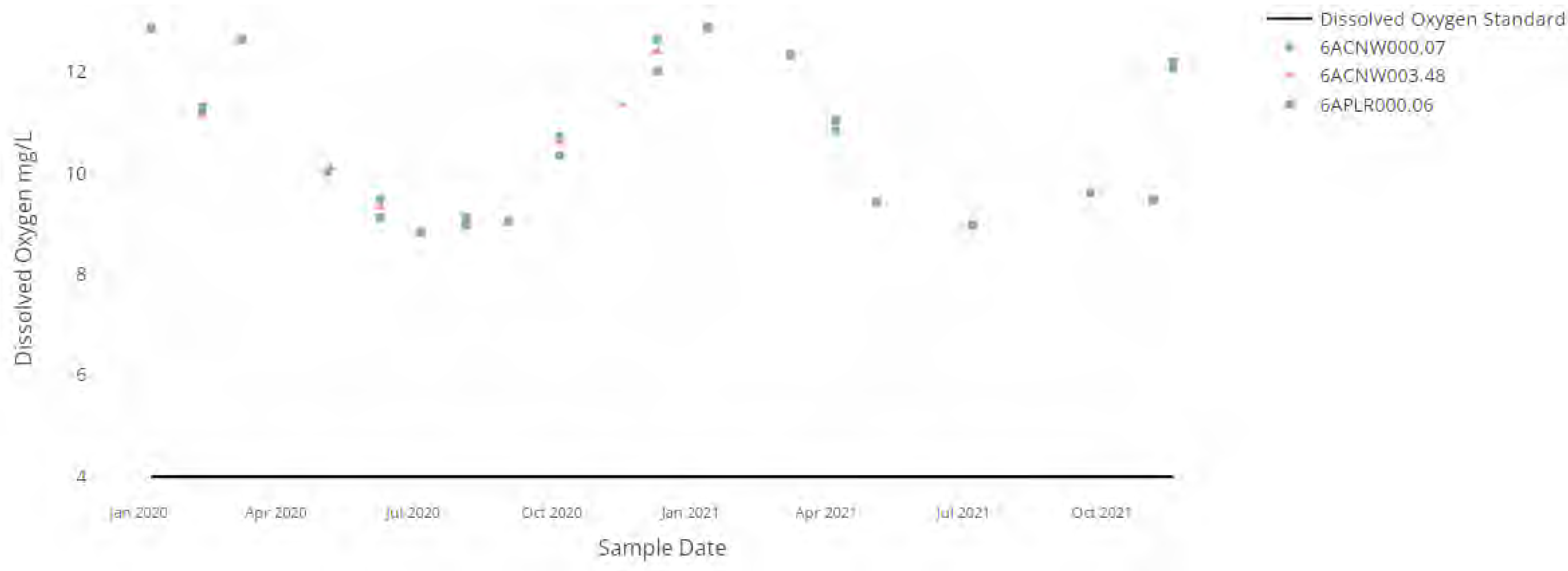

Figure 5. Dissolved Oxygen for stations on Conaway Creek (6ACNW000.07), Conaway Creek and Tributaries (6ACNW003.48), and Poplar Creek (6APLR000.0).

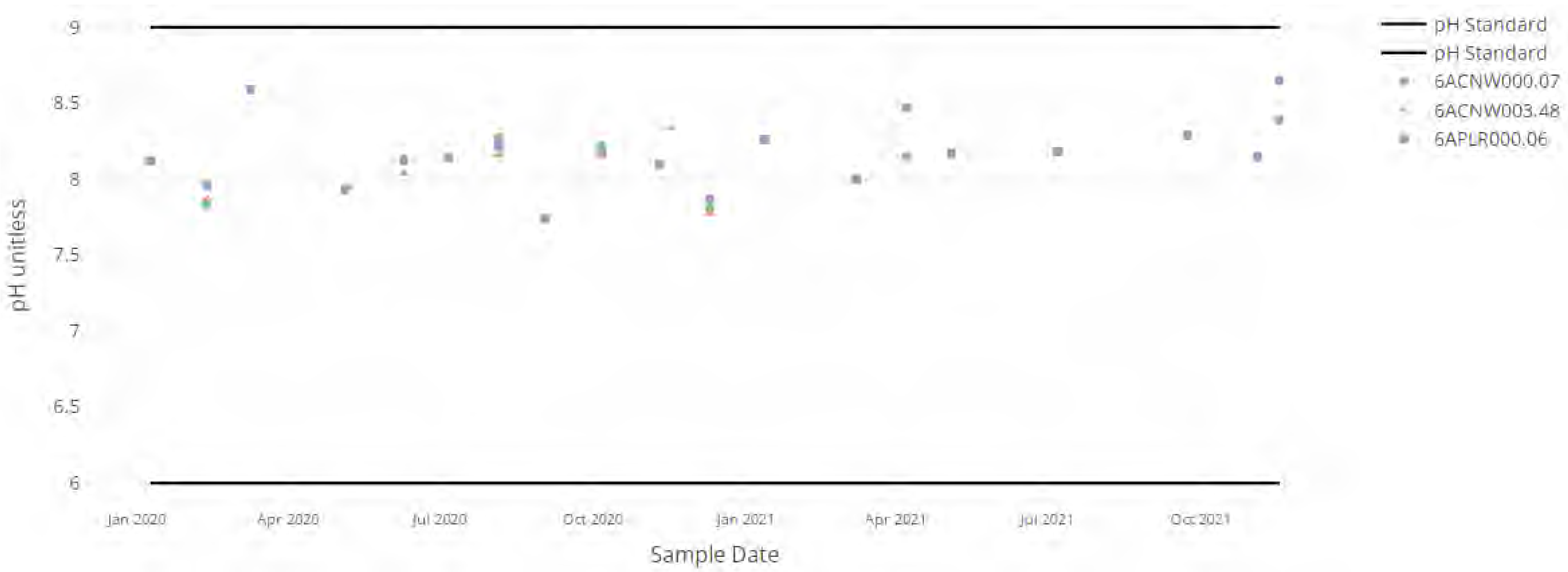

Figure 6. pH for stations on Conaway Creek (6ACNW000.07), Conaway Creek and Tributaries (6ACNW003.48), and Poplar Creek (6APLR000.0).

Figure 7. Specific Conductance for stations on Conaway Creek (6ACNW000.07), Conaway Creek and Tributaries (6ACNW003.48), and Poplar Creek (6APLR000.0).

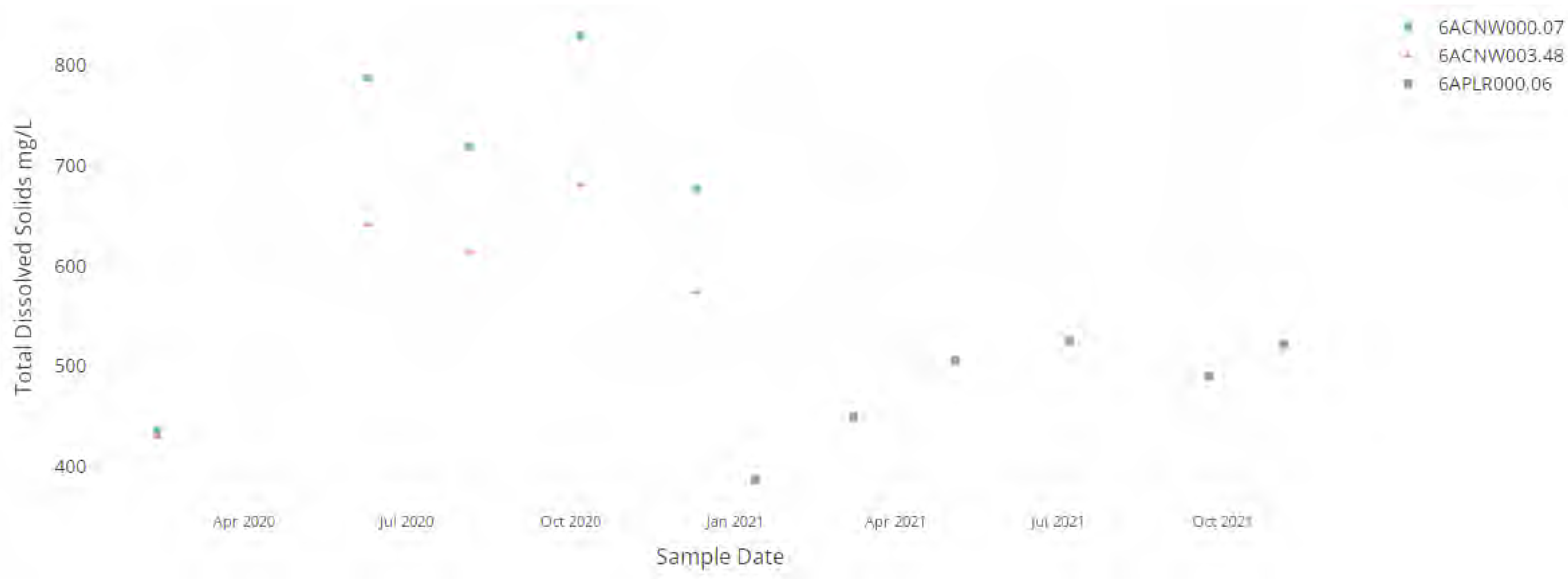

Figure 8. Total Dissolved Solids for stations on Conaway Creek (6ACNW000.07), Conaway Creek and Tributaries (6ACNW003.48), and Poplar Creek (6APLR000.0).

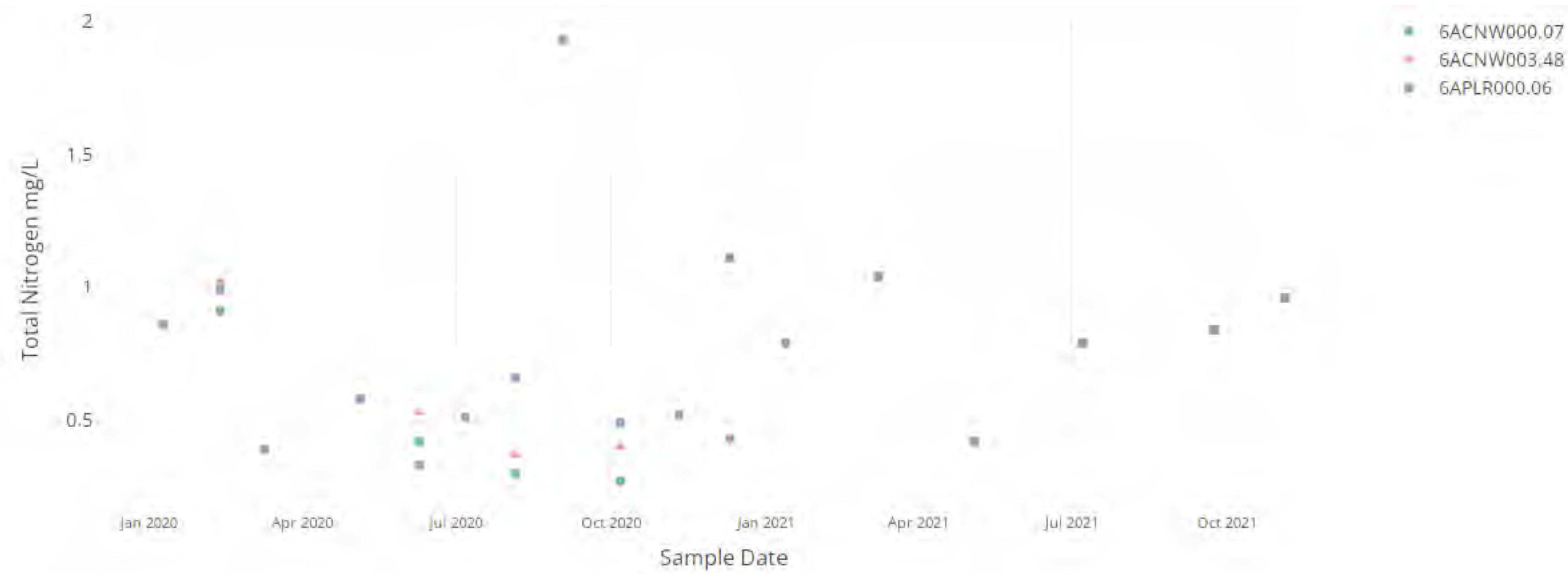

Figure 9. Total Nitrogen for stations on Conaway Creek (6ACNW000.07), Conaway Creek and Tributaries (6ACNW003.48), and Poplar Creek (6APLR000.0).

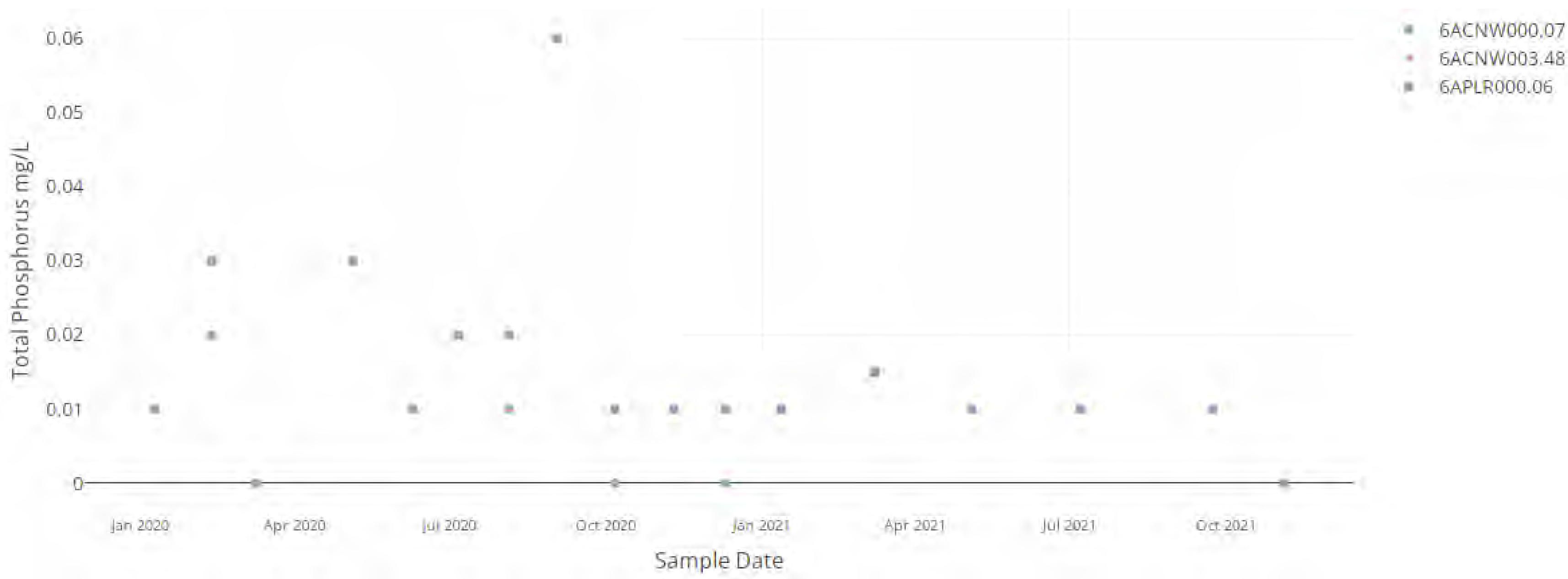

Figure 10. Total Phosphorus for stations on Conaway Creek (6ACNW000.07), Conaway Creek and Tributaries (6ACNW003.48), and Poplar Creek (6APLR000.0).

Table 6. Water Column Metals

Parameter Name	Pgc Spc Parm	6APLR000.06	6ACNW000.07	6ACNW003.48	Freshwater Aquatic Life Criteria~		Human Health Criteria~	
					Chronic (ug/L)	Acute (ug/L)	PWS (ug/L)	Other (ug/L)
Arsenic, Dissolved (UG/L as AS)	01000	0.27	0.2	0.18	150	340	10	
Barium, Total (UG/L as BA)	01005	90	26.7	40.6			2,000	
Cadmium, Dissolved (UG/L as CD)	01025	0.1	0.12	0.1	0.72	1.8	5	
Chromium, Dissolved (UG/L as CR)	01030	0.3	0.3	0.3	74	570	100	
Copper, Dissolved (UG/L as CU_	01040	0.53	0.59	0.22	9.0	13	1,300	
Lead, Dissolved (UG/L as PB)	01049	0.04	0.01	0.02	11	94	15	
Thallium, Dissolved (UG/L as TL)	01057	0.01	0.02	0.02			0.22	0.43
Nickel, Dissolved (UG/L as NI)	01065	0.54	11.61	2.43	20	180	470	1,500
Silver, Dissolved (UG/L as AG)	01075	0.006	0.003	0.004		3.4		
Zinc, Dissolved (UG/L as ZN)	01090	0.3	8.13	1.58	120	120	7,000	23,000
Antimony, Dissolved (UG/L as SB)	01095	0.44	0.06	0.07			5.3	580
Selenium, Dissolved (UG/L as SE)	01145	0.79	1.82	0.61	5.0	20	160	3,800
Hardness, CA MG (MG/L as CACO3) as Dissolved	DHARD	305	354	366				

~9VAC25-260 Virginia Water Quality Standards, April 18, 2023

Conclusion and Recommendation

The Stressor Analysis Report developed for the Levisa Fork Phased TMDLs lists the most probable stressor for the Levisa Fork as sediment. Candidate stressors considered in the stressor analysis included ammonia, hydrologic modifications, nutrients, organic matter, pH, sediment, TDS/conductivity/sulfates, temperature, and toxics. A review of the available water quality data for the proposed nested segment indicates that chemical parameters and field parameters are within expected ranges. Figures 4 – 10 illustrate the field parameters temperature, dissolved oxygen (DO), pH, specific conductivity, total dissolved solids (TDS), nitrogen and phosphorous respectively. Conductivity is elevated but remains at levels lower that those present when the TMDL was developed. Water column metals were collected at stations 6APLR000.06, 6ACNW000.07 and 6ACNW003.48 and displayed in Table 6.

Sediment is supported as a probable stressor for these segments due to the suboptimal and marginal habitat metric related to sediment (Table 5). Marginal bank stability along with the presence of fine sediments indicates sediment deposition. The impairment is relatively minor, and sediment related habitat metrics are in the middle range. Therefore, sediment is indicated as the most probable cause of stress to the benthic community in Poplar Creek, Conaway Creek, and Conaway Creek and tributaries. The impairments on these proposed segments can be fully addressed through implementation of the Levisa Fork TMDL.

Based on the rationale listed above, it is our recommendation that the above-mentioned assessment units in Levisa Fork watershed be placed in Category 4A for the Aquatic Life Use.