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Via Electronic Filing

December 27, 2021

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: Niagara Hydroelectric Project (FERC No. 2466-034)
Filing of Updated Study Report Meeting Summary

Dear Secretary Bose:

Appalachian Power Company (Appalachian or Licensee), a unit of American Electric Power (AEP), is the Licensee, owner, and operator of the run-of-river, 2.4-megawatt Niagara Hydroelectric Project (Project) (Project No. 2466), located on the Roanoke River in Roanoke County, Virginia.

The Project is currently licensed by the Federal Energy Regulatory Commission (FERC or Commission). The Project underwent relicensing in the early 1990s, and the current operating license for the Project expires on February 29, 2024. Accordingly, Appalachian is pursuing a subsequent license for the Project pursuant to the Commission's Integrated Licensing Process (ILP), as described at 18 Code of Federal Regulations (CFR) Part 5.

Pursuant to 18 CFR § 5.15(c), Appalachian filed the Updated Study Report (USR) with the Commission on December 6, 2021. The USR filing also included notification of the USR Meeting date, time, and proposed agenda. As required by the ILP schedule, within 15 days of the USR filing, Appalachian held a virtual USR Meeting via WebEx from 9:00 am to 4:00 pm on Wednesday, December 14, 2021.

Pursuant to 18 CFR § 5.15(c)(3), Appalachian hereby files the USR Meeting summary for Commission and stakeholder review. The USR Meeting presentation is included as an attachment to the USR Meeting summary.

If there are any questions regarding this filing, please do not hesitate to contact me at (614) 716-2240 or jmmagalski@aep.com.

Sincerely,

Jonathan M. Magalski
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Meeting Summary

Project:	Niagara Hydroelectric Project (P-2466)
Subject:	Updated Study Report Meeting Summary
Date:	Tuesday, December 14, 2021
Location:	WebEx Virtual Meeting
Attendees:	Jonathan Magalski (AEP) Elizabeth Parcell (AEP) Fred Colburn (AEP) Sarah Kulpa (HDR) Maggie Salazar (HDR) Kerry McCarney-Castle (HDR) Misty Huddleston (HDR) Ty Ziegler (HDR) Eric Mularski (HDR) Joe Dvorak (HDR) Jon Studio (EDGE) Frank Simms (YES) Jeremy Feinberg (FERC) Laurie Bauer (FERC) Woohee Choi (FERC) Samantha Pollak (FERC) John McCloskey (USFWS) Scott Smith (VDWR) Lindsay Webb (Roanoke County – Parks Planning and Development Manager) Amanda McGee (Roanoke Valley – Alleghany Regional Commission) Paul Angermeier (VA Tech) Brian McGurk (VDEQ) Laura Galli (VDEQ) Harold Peterson (Bureau of Indian Affairs) Frank Maguire (Roanoke Valley Greenway Commission)

Overview

This document provides the meeting summary for Appalachian Power Company's (Appalachian) Niagara Hydroelectric Project (Project) Updated Study Report (USR) Meeting. The meeting was held via WebEx to review with stakeholders the progress and results of the USR, which was filed with the Federal Energy Regulatory Commission (FERC) on December 6, 2021. The USR can be accessed from either FERC's website or from the website: http://www.aephydro.com/HydroPlant/Niagara. A copy of the meeting presentation is included with this meeting summary as Attachment 1.

Safety Moment

Maggie Salazar presented a safety moment on Seasonal Affective Disorder (SAD) and the importance of staying active, eating healthy, and getting fresh air during the winter months, and especially around the holidays.

Welcome and Introductions (Slides 1-6)

Jon Magalski introduced the Niagara Project and the USR meeting goals and objectives and encouraged participation and feedback. He provided an overview of the agenda and the completed and upcoming Integrated Licensing Process (ILP) schedule milestones. The studies presented in the USR were completed in the first (2020) and/or second (2021) ILP study seasons:

- Shoreline Stability Assessment
- Wetlands, Littoral, and Riparian Habitat Characterization
- Cultural Resources Study
- Recreation Study
- Fish Community Study
- Benthic Aquatic Resources Study
- Water Quality Study
- Bypass Reach Flow and Aquatic Habitat Study

If revisions are made to any of the study reports based on today's discussion or comments on the USR, revised study plans will be filed with the final license application (FLA) (due to FERC February 28, 2022). The focus of today's presentation and discussion is studies or study progress completed in 2021 and not previously covered by the Initial Study Reports (ISR)/ISR meeting held on January 21, 2021.

Shoreline Stability Assessment (Slides 7-22)

Eric Mularski (HDR study lead) introduced the study, methodology, and results of the Shoreline Stability Assessment. (Note: this study was initiated and completed in 2021 and thus was not included in the ISR.)

Study Results

Results of the study did not identify any areas of active erosion upstream of Niagara Dam, the tailrace, or in the bypass reach. Erosion Areas 10-13 and 16-19 categorized as "high" are in the upstream reach of Tinker Creek and downstream of the confluence of Tinker Creek and the Roanoke River. These areas are most susceptible to high flows during storm events (i.e., flash floods) and subsequent potential accelerated erosion rates. Appalachian proposes to continue operating the Project as currently operated, including run-of-river operations. Appalachian does not propose remediation of any shoreline areas in the Project boundary at this time.

Stakeholder Questions/Comments

No comments or questions were raised on this study.

Wetlands, Riparian, and Littoral Habitat Study (Slides 23-44)

E. Mularski (HDR study lead) introduced the study, methodology, and results of the Wetlands, Riparian, and Littoral Habitat Study. (Note: this study was initiated and completed in 2021 and thus was not included in the ISR.)

Study Results

Wetland, riparian, and littoral habitats at the Project are reflective of current Project operations. Approximately 61.4 acres of wetlands identified during the desktop study using the National Wetlands Inventory (NWI) database were confirmed, and an additional 12.4 acres of features (not included in the NWI) were verified in the field (2.4 acres of emergent and 10 acres of forested wetlands). Forested wetlands were located in higher floodplains and point bars of the Roanoke River while emergent wetlands occurred as fringe wetlands along the shoreline floodplains of the Roanoke River, notably upstream of Niagara Dam. Forested wetland vegetation included American sycamore (*Platanus occidentalis),* box elder (*Acer negundo)*, black walnut (*Juglans nigra*), silver maple (*Acer saccharinum*), and tulip poplar (*Liriodendron tulipifera*) and the understory was comprised of spice bush (*Lindera benzoin*), green ash (*Fraxinus pennsylvanica*) Japanese stilt grass (*Microstegium vimineum*), jewelweed (*Impatiens capensis*), false nettle (*Boehmeria cylindrica*), and wood nettle (*Laportea canadensis*). The dominant herbaceous species for emergent wetlands included Japanese stilt grass, falsenettle (*Boehmeria cylindrica*), and maypop (*Passiflora incarnata*). Palustrine unconsolidated bottom waterbodies were also identified in the impounded section upstream of the Niagara Dam. The riparian area consisted of approximately 65 acres and occurs mainly along the shoreline, on islands, and within the bypass reach; riparian areas are characteristic of the Virginia Department of Conservation and Recreation (VDCR) Piedmont/Mountain Floodplain Forest and Swamp community type. For littoral zones, no submerged aquatic vegetation was collected in the four transects located in the reservoir. Water willow beds were mapped in the bypass reach in low-flow pools close to the banks and between the rocky outcropping.

Operations and maintenance of the Project are not anticipated to have any long-term adverse impacts on wetland, riparian, and littoral resources, and there are no plans that would require disturbance of wetlands or tree clearing activities.

Stakeholder Questions/Comments

Brian McGurk asked for clarification regarding the slide on temporary impacts to wetlands due to drawdowns. Sarah Kulpa explained that the slide B. McGurk was referring to was inadvertently a carry-over from the Byllesby-Buck presentation for AEP as there are no significant or regular drawdowns at Niagara. J. Magalski agreed with S. Kulpa and stated that Niagara operations remain within the licensed operating band.

Cultural Resources Study (Slides 45-51)

Study Results

Terracon Consultants, Inc. (Terracon) conducted an archaeological assessment of the Project's Area of Potential Effects (APE) in October 2020 and a geomorphological investigation in April 2021.

There are three aboveground historic properties within the APE: the Blue Ridge Parkway Historic District, the Blue Ridge Parkway Bridge, and the Virginian Railway.

No historic properties are currently being adversely affected by the Project; therefore a Historic Management Plan is not necessary. The Cultural Resources Study Report was distributed with the Initial Study Report and was therefore not provided with the USR.

Stakeholder Questions/Comments

Samantha Pollak asked if it was Terracon's conclusion that there are no historic properties being affected and also asked for confirmation that the study report was distributed to the State Historic Preservation Officer (SHPO) and the tribes. S. Kulpa confirmed it was Terracon's conclusion and that the study report was sent to SHPO and tribes; and no comments have been received to date.

Recreation Study (Slides 53-76)

M. Salazar (HDR study lead) introduced the study, methodology, and results of the Recreation Study. This study was initiated in 2020 and completed in 2021. Frank Simms (YES study lead) presented the recreation use documentation methods and results.

Study Results

The Roanoke River is a significant recreation and amenity resource for the Roanoke Valley providing numerous and varied opportunities for those residing in the area as well as those visiting from outside including canoeing, kayaking, fishing, tubing, wading, wildlife viewing, and watershed education. Recreation facilities in the vicinity of the Niagara Project are utilized each month of the year with most activities taking place from April through October.

Users are satisfied with the facilities provided with the exception of the canoe portage. However, users are recreating at the Project facility more than anticipated. Efforts to improve the canoe portage could include: (1) improvements to the existing take-out and put-in locations; (2) improved signage directing canoeists and kayakers to the take-out and put-in locations and along the portage trail itself; (3) a mechanism to assist those utilizing the portage with transporting canoes and kayaks; and (4) an education program informing the public of the availability of the portage and that the reservoir is open to use by all for recreation.

Appalachian plans to develop a draft Recreation Management Plan (RMP) for the Project, in consultation with agencies and other recreation stakeholders, to guide development and maintenance of recreation facilities and opportunities at the Project over the new license term.

Stakeholder Questions/Comments

Amanda McGee stated that Roanoke County put up notices for recreationists and visitors to stay away from the areas around the Blue Ridge Parkway bridge construction, and that may have deterred users from trying to access these facilities over the course of this year. She added that the fact that people still use the facilities for recreation despite the signs and construction is a testament that recreation near the Project is an important component of the Project relicensing and thanked Appalachian/HDR/YES for performing this study.

Lindsay Webb noted the Draft License Application (DLA) mentioned that the Project portage put-in below Niagara Dam (river left) is outside the Project boundary and asked for clarification. S. Kulpa stated that Appalachian and HDR were initially under the assumption that it was in the Project boundary based on initial drawings. However, during the development of the updated Exhibit G to current FERC Project boundary map standards for the DLA, it became apparent the put-in below the dam is actually outside the Project boundary on National Park Service-owned land. S. Kulpa asked if S. Pollak would be willing to offer general FERC guidance on the relationship between licensed project recreation facilities to the

FERC Project boundary in a generic sense. S. Pollak stated it would be difficult to say at this point until the location is mapped out with certainty and deferred review and resolution of the issue to the FLA. S. Kulpa added that if the land in question was owned by AEP it would be less of an issue; however, it is owned by National Park Service. National Park Service has not provided comments on this issue and did not join the call last year with recreation stakeholders.

L. Webb asked about the timeline for the draft RMP. S. Kulpa stated that Appalachian anticipates filing the draft RMP with the FLA. FERC would include a license article requiring the implementation of the RMP in the new license term (typically shortly after license issuance).

L. Webb asked whether the trail camera was also installed at the take-out location above the dam. F. Simms stated that there was only one camera and it was installed at the put-in. S. Pollak asked if the only way to access the portage is via the river. S. Kulpa confirmed and asked if F. Simms or Appalachian could weigh in regarding how one might access the portage if not accessing via the water. F. Simms stated there are informal trails and there is also a road that could be used to hike in and access the portage, although it is not likely. Elizabeth Parcell agreed and added that accessing via the road would be unlikely, but there are subdivisions in the area that one could hike in from.

S. Pollak asked where the closest put-in downstream of the Project is. F. Simms stated the next downstream put-in is Rutrough Point, followed by an additional put-in five river miles downstream at Smith Mountain Lake.

S. Pollak asked if Appalachian looked at adding access to the river on river right downstream of the dam. F. Simms stated that yes, access on river right was looked at several different ways and it was determined building a trail was infeasible due to trail length, topography, and property issues. L. Webb mentioned that negotiations for property access to construct the greenway continue and they will keep Appalachian updated on any new developments. S. Pollak requested that Appalachian state clearly in the FLA that river right has been evaluated and ruled out for a potential recreation access point.

L. Webb asked for confirmation that Appalachian is not proposing recreation releases at this time. J. Magalski confirmed this was correct.

Fish Community Study (Slides 78-101)

Misty Huddleston (HDR study lead) introduced the study, methodology, and results of the Fish Community Study. The Fish Community Study includes three separate studies: 1) 2020 Fish Community Study; 2) 2021 Roanoke Logperch Survey and 3) Impingement and Entrainment Study. The 2020 Fish Community Survey was covered in the ISR. M. Huddleston noted that the Roanoke Logperch larval drift study has not yet been completed due to a combination of weather and permitting delays and the field work will be carried out in spring 2022. Jon Studio of EDGE Engineering and Science (EDGE) provided high level methods and results of the Roanoke Logperch Survey.

Study Results

Roanoke Logperch Survey

The Roanoke Logperch Survey results indicated Roanoke logperch were documented in poor to excellent quality habitats at all of the survey sites with the greatest density in the bypass reach. There were 61 Roanoke logperch observations (7 juvenile and 54 adult) distributed amongst excellent (9), good (28), fair

(22), and poor (2) quality habitats. Site densities ranged from 4.6 to 72.4 logperch/hectare, while the mean density within the overall Project boundary was 32 fish/hectare. Mean density above Niagara Dam (23 logperch/hectare) compared to below Niagara Dam (24 logperch/hectare) was similar. Mean density in Tinker Creek at 32 fish/hectare. The average density of Roanoke Logperch between the spring and summer sample events in the bypass reach was 58 fish/hectare. Results suggest that the Roanoke River in the Project boundary is supporting a robust population of Roanoke logperch.

Impingement and Entrainment Study

The turbine blade strike analysis was initiated in 2020 and completed in 2021. Cumulative passage survival for 4-inch Roanoke logperch was between 81.4 and 96.0 percent. The highest cumulative survival would occur at the 0.01% flow exceedance when approximately 18,109 cfs of river flows would be spilled into the bypass channel. Survival increases with increasing spill volume due to low spill mortality and reduced blade strike probability. Risk of spillway mortality was low at 0.1 percent or less across all fish length classes. Fish length classes most at risk of entrainment (<6 inches) are estimated to have cumulative downstream passage survival between 73.7 and 91.3 percent.

Stakeholder Questions/Comments

Roanoke Logperch Survey

Paul Angermeier stated that he was impressed by the findings of study and was surprised by the high densities in the bypass reach and asked J. Studio if he could weigh in on the results. J. Studio replied that along the stretch of main-stem river (between Niagara and Smith Mountain) there are only a few habitat patches that would provide decent habitat for Roanoke logperch, so as fish are moving and looking for new habitat, they may move into the bypass reach, where there is abundant suitable habitat available.

John McCloskey asked about the flows in the bypass reach during the Roanoke logperch survey windows and how close flows were to minimum required flows. J. Studio replied that during the early and late summer efforts, flows in the bypass reach were around 20 cubic feet per second (cfs). Ty Ziegler stated that the minimum required is 8 cfs and that the Roanoke logperch study was coordinated with the hydraulic modeling study; the days that EDGE was in the bypass reach had flows measured at 24 cfs.

J. McCloskey reiterated that the main concern is determining if Roanoke logperch could be supported during minimum flows and the conclusions do not support that finding since there were no surveys carried out under minimum flows. S. Kulpa added that we will spend time in the afternoon talking about flows in the bypass reach and perhaps the conversation could be tabled until the Bypass Reach Flow presentation.

Laurie Bauer asked how densities were estimated and what is the difference between catch per unit effort (CPUE) and density. J. Studio replied that the density estimate takes into account visibility underwater so CPUE is typically lower than density values.

Impingement and Entrainment Study

J. McCloskey stated that he has concerns regarding HDR’s conclusion that early life stages are not susceptible to entrainment because that conclusion does not account for potential larval drift into the Project. M. Huddleston clarified that based on where spawning habitat is found, there is a lower risk of drift; however, the Roanoke logperch larval drift study will shed some light on these estimates. J.

McCloskey agreed that the Roanoke logperch larval drift study should help determine the risk for drift into the Project and subsequent entrainment.

Benthic Aquatic Resources Study (Slides 102-110)

M. Huddleston (HDR study lead) introduced the study, methodology, and results of the Benthic Aquatic Resources Study. J. Studio (EDGE study lead) covered macroinvertebrate and crayfish study methods and results. The mussels survey portion of this study was presented in the ISR.

Study Results

There were 38 macroinvertebrate taxa collected from 2 quantitative sites and 3 qualitative sites upstream of Niagara Dam and 45 macroinvertebrate taxa from 3 quantitative and 2 qualitative sites downstream of the dam. VSCI scores indicate impaired conditions above and below Niagara Dam in both fall and spring samples. Crayfish community diversity and abundance was low compared to the number of known crayfish species in Virginia. Five species of crayfish collected and identified in the field during survey efforts at 8 of the 10 sites. More invasive crayfish species were documented in the Project boundary than native species. Native Species were two native species upstream and one downstream of dam and included Appalachian Brook Crayfish (*Cambarus bartoni bartoni*) and Atlantic Slope Crayfish (*Cambarus longulus*). *Invasive Species* were two species upstream and three species downstream of dam including Ozark Crayfish (*Faxonius ozarkae*), Virile Crayfish (*Faxonius virilis*), and Red Swamp Crayfish (*Procambarus clarkii*).

Stakeholder Questions/Comments

No comments or questions were raised on this study.

Water Quality Study (Slides 112-127)

T. Ziegler (HDR study lead) introduced the study, methodology, and results of the Water Quality Study. This study was initiated in 2020 and completed in 2021; results from 2020 were covered in the ISR.

Study Results

Water temperatures, dissolved oxygen (DO) concentrations, and pH measurements largely met Virginia Class IV (Roanoke River) and Class VII (Tinker Creek) water quality standards during 2021. The exception was the instantaneous DO standard (4 mg/l) at the upstream bypass reach monitoring location during the hottest portion of the summer when bypass flows were at the 8.0 cfs minimum required flow release. Increasing the bypass reach flow to ~20 cfs resulted in increased DO concentrations at this location. Specific conductivity and pH ranges are suitable for aquatic species. Little to no thermal or DO stratification at the reservoir and forebay monitoring locations except during periods of low Project inflows or powerhouse outages.

Stakeholder Questions/Comments

J. McCloskey asked about the timing of the minimum flow increase from 8 cfs to 20 cfs and how long it persisted. T. Ziegler replied that after the first three data sonde download events (in which biofouling was observed to occur almost immediately after deployment), the minimum flow was raised to see if that might have a positive effect on reducing biofouling at the upper monitoring location. This appeared to be the

case during the 2 – 3 days immediately following the increase in bypass reach flow (i.e., little to no biofouling was evident after deployment). Several days after the minimum flow was raised, rainfall runoff from Tropical Storm Fred resulted in much higher flows in the bypass reach (i.e., up to approximately 4,400 cfs). By the time bypass flows returned to more normal levels, biofouling was less of an issue at this upper monitoring location during the remainder of the study period.

J. McCloskey asked if discrete DO values were measured in different portions of the upper bypass reach to see if the low values were real or if it was due to biofouling. T. Ziegler mentioned that discrete measurements were collected during the daytime so it would not capture any potential DO sag which would occur during nighttime hours. However, during the first three download events, discrete DO measurements were all much higher than the continuous deployed data sondes indicating biofouling had occurred. The continuous deployed data sondes also showed visible evidence of biofouling.

B. McGurk asked if there is standard information regarding how much biofouling would it take to reduce the DO below state standards. T. Ziegler stated that when discrete measurements were taken at the same time as the data sonde that had been deployed for two weeks, the discreet measurement were always much higher, such that the lower values measured with the in situ data sonde were assumed to be the result of biofouling.

J. McCloskey asked about the pools / stagnant areas in the bypass reach and wondered how much of that low flow area is present in the bypass reach. J. Dvorak pointed out the location of four pool areas in the bypass reach that could be stagnant at the minimum 8 cfs bypass reach flow requirement. Water quality data was collected in the upstream most of these pool areas, which represented the largest of the four pool areas.

B. McGurk asked for an example of a Protection, Mitigation, and Enhancement (PM&E) measure for water quality. S. Kulpa explained what a PM&E measure is and stated that examples might include flow releases or modified operations, continued monitoring, or DO mitigation. She reiterated that an impact that would require mitigation was not identified as a result of the study; however, Appalachian welcomes feedback from the stakeholders.

J. McCloskey asked how HDR/Appalachian could come to the conclusion that there are no PM&E measures required since it seems there is a documented problem with water quality in the bypass reach (i.e., low DO). S. Kulpa stated that it is not uncommon to have periods of low DO in a bypass reach in slow-moving pools and HDR has documented this at other facilities bound by similar water quality standards and licensing processes but noted that Appalachian is looking to this group for comment/feedback. J. Magalski weighed in that trying to maintain DO in every single pool may not be feasible due to flow requirements for different species in a stream reach.

J. McCloskey stated that the study is not comprehensive due to the low number of locations monitored and has concerns whether low DO is constrained to just that one pool that was measured or if it's a common occurrence in the bypass reach. J. Magalski indicated there were other DO measurements collected in the bypass reach and T. Ziegler agreed that there was one continuous monitor on the upstream end in the pool and one in the downstream reach; data sondes collected data through the 4-month study period and discreet measurements were also taken at those locations. J. Studio weighed in that they also took several DO measurements (discrete) in proximity to sampling sites, but not in the area of the bypass reach.

S. Kulpa stated that when the monitoring program was initiated, the data sondes were installed in what was considered the worst-case scenario locations (i.e., most conservative). It is therefore anticipated that adequate data to represent the bypass reach water quality conditions have been collected. T. Ziegler also added that pools where low DO values would be expected were chosen on purpose to derive conservative estimates. On the side-by-side comparisons with data rovers (i.e., discrete measurements), there were no values measured less than state standards, so it is assumed biofouling on the in situ sondes caused the low values.

L. Bauer asked what the percentage of low flow habitat in the bypass reach is. T. Ziegler referred to the aerial photograph of the bypass reach and Joe Dvorak shared his screen to show areas of low/stagnant flow conditions/pools and pointed out the main flow path(s) on the aerial image.

Bypass Reach Flow and Aquatic Habitat Study (Slides 129-157)

T. Ziegler (HDR study lead) introduced the study, methodology, and results of the Bypass Reach Flow and Aquatic Habitat Study. This study was initiated in 2020 and completed in 2021.

Study Results

A variety of habitat types are available in the bypass reach including shoals, shallow and deep pools, riffles, and runs. Substrate is dominated by larger particle sizes: cobble, boulders, and irregular bedrock. Over the calibration flow range, bypass reach average depths increased approximately 0.5 feet and average velocities increased approximately 0.8 feet per second. Travel times varied from approximately 35 minutes (low flow) to 16 minutes (high flow). Habitat model results indicate suitable habitat for the four guilds and Roanoke Logperch standalone target species under all four modeled flow scenarios. Model results for species/life stages that prefer larger substrate sizes with cover generally had larger amounts of potential habitat available. Potential available habitat generally increases as bypass flows increase with most of the incremental gain between the lowest modeled flow (7 cfs) and the two middle flows (24 – 33 cfs). Model results for Roanoke logperch indicate preferred habitat is primarily along the main flow path in the bypass reach, which is in agreement with the Roanoke logperch observation data collected during 2021.

Stakeholder Questions/Comments

Woohee Choi asked for confirmation on flows for calibration results. T. Ziegler confirmed the flows in question.

L. Bauer asked for confirmation regarding calibration flows and the difference between target flows and actual flows. T. Ziegler explained that HDR asked that the Obermeyer gate be set early in the morning and the forebay elevation held stable so that flows would be consistent during the field work. There is a difference between target flows and what was measured because it is difficult to hold the pond elevation steady, therefore some difference between target flows and measured flows is expected. Additionally, the flow measurement transect was not an ideal measurement transect due to irregular bathymetry so manual flow measurements may have some level of error, but within limits of uncertainty. In summary, a good dataset with enough separation between flows was achieved. J. Dvorak added that Obermeyer gates are not able to be set perfectly when the system is fluctuating, especially within fractions of an inch. Additionally, the target vs. generation flows isn't the biggest predictor of model accuracy, it's critical to

match elevations and travel times at the lower flows where there is uncertainty surrounding the streambed roughness/bathymetry.

B. McGurk asked about the heat maps and if there are significant differences in the heat maps between the four test flows. T. Ziegler showed the Water Surface Elevation plot and indicated there is a maximum elevation difference of about a foot. There's about a 25 percent increase in wetted between 8 cfs and 24 cfs. J. Dvorak showed his screen to compare the depths and velocities for all four modeled velocities showing the same pattern under all flow scenarios.

W. Choi asked about Manning's n values during low flow. J. Dvorak showed a National Landcover Database map and stated that a 0.025 Manning's n was used for the main channel for roughness since it is the standard. Since the same model is being used to determine different flow scenarios, the best fit roughness coefficient was chosen based on best professional judgement.

J. McCloskey asked if areas of habitat could be calculated. J. Dvorak answered that yes, areas of weighted habitat have been calculated and gave examples. J. McCloskey asked if that information is included in the report. J. Dvorak stated that no, it is not currently included in the study report but indicated that data for all species and life stages that were analyzed could be added. J. McCloskey stated it would be helpful to have that data. **Action Item** (HDR): Requested information to be provided in the final study report to be filed with the FLA.

B. McGurk asked if there was a time constraint to Habitat Suitability Index (HIS) values. T. Ziegler discussed periodicity but said habitat results for the guilds and standalone Roanoke Logperch assume all species and life stages could be present at any time of year. So, no time constraints related to HSI were factored into the analysis.

J. Studio added that the percentage of substrate types in the bypass reach area (bedrock / boulders) would not change between the four flow scenarios and that would be a good indicator for HSI because substrate carries a lot of weight in the model. So while there wouldn't be much of a change in habitat suitability due to the substrate in quickly changing flows, there may be a difference in the length of time which species would inhabit different areas (e.g., in contrast to the same flow over 2 months).

T. Ziegler explained HSI complexities and stated that since it is based on a multiplication factor, any individual zero value for depth, velocity, and/or substrate would result in a prediction of zero habitat available at a given flow scenario.

J. Studio added that when one is interpolating, an area might have adequate suitable habitat, but during interpolation, that single point looks less suitable because it is surrounded by non-suitable habitat. This method is standard and acceptable but wouldn't point out high resolution areas of suitable habitat (i.e. a square meter of habitat).

L. Bauer asked if it would be possible to set a background value of 0 to show relative suitable habitat. In other words to remove the zeros. **Action Item** (HDR): Show habitat suitability maps with zeros indicated (or removed) in the FLA.

J. McCloskey asked if habitat was assessed with flows strictly coming over the spillway. T. Ziegler said that was not assessed and J. Dvorak agreed, but HDR/Appalachian welcomes the feedback for consideration. J. McCloskey stated that the habitat may be affected on the side opposite the gate. J. Dvorak stated that in the Integrated Catchment Model (ICM) calibration, bathymetry data could not be collected in the pool area immediately below the toe of the spillway. As a result, modeled habitat

differences in this immediate pool area would be negligible between spilling over the spillway or via the Obermeyer gate. Also, regardless of how the flow is delivered to the bypass reach, all flow has to work its way through the same narrow gap at the base of the spillway pool, so downstream flow patterns (and thus available habitat results) would be similar regardless of how the flow is delivered to the bypass reach. J. McCloskey indicated that it would depend on the amount of water over the spillway but likely wouldn't have huge effect on habitat.

Scott Smith recommended plotting the location of the Roanoke logperch survey locations on the habitat suitability on the maps. J. Studio shared his screen to indicate where the transects were performed. **Action Item** (HDR): Show Roanoke logperch observation locations on model results maps and include in the FLA.

S. Smith asked if it was possible to modify the model to drop the substrate component to determine what results would look like with just depth and velocity components. **Action Item** (HDR): HDR will provide the depth and velocity maps at each model calibration flow in the revised study report to be filed with the FLA. These, in combination with mesohabitat maps, can be used to determine the effect that each of the three HSI parameters have on the habitat results.

S. Kulpa reiterated Appalachian would like to get comments on what stakeholders would like considered for the FLA other than the action items already highlighted. There were no further requests or comments.

Next Steps and Discussion

J. Magalski reviewed key milestones for the ILP including meeting summary, stakeholder requests, FERC determination.

Stakeholder Questions/Comments

Appalachian and Virginia Department of Environmental Quality (VDEQ) discussed timing of the filing of the Virginia Water Protection (VWP) Permit/401 Water Quality Certification (WQC) application relative to the deadline established by FERC's regulations (60 days from FERC's Ready for Environmental Analysis). L. Bauer stated that for the Niagara Project, FERC would not issue the Ready for Environmental Analysis until after staff have reviewed and processed the study report on the Roanoke Logperch larval study.

Action Item (Appalachian): Connect with the VDEQ to discuss the process and schedule for the 401 WQC.

Attachment 1

Attachment 1 – USR Meeting Presentation

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Niagara Hydroelectric Project

Updated Study Report Meeting
December 14, 2021

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Safety Moment

SAD- Seasonal Affective Disorder

- In most cases, seasonal affective disorder symptoms appear during late fall or early winter and go away during the sunnier days of spring and summer. Less commonly, people with the opposite pattern have symptoms that begin in spring or summer.
  - Feeling depressed most of the day, nearly every day
  - Losing interest in activities you once enjoyed
  - Having low energy
  - Having problems with sleeping
  - Experiencing changes in your appetite or weight
  - Feeling sluggish or agitated
  - Having difficulty concentrating
  - Feeling hopeless, worthless or guilty

Updated Study Report

- Appalachian is pursuing a new license for the Project pursuant to the Commission's Integrated Licensing Process (ILP), as described at 18 Code of Federal Regulations (CFR) Part 5.

- The Updated Study Report (USR) filed on December 6, 2021 describes the methods and results, the data collected, and any variances from the study plan and schedule.

- The Federal Energy Regulatory Commission's (FERC) regulations at 18 CFR § 5.15(f) requires Appalachian to hold a USR Meeting within 15 days of filing the ISR.

- The purpose of the USR Meeting is to discuss the study results.

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Meeting Agenda

Topic	Schedule
Welcome and Introduction	9:00 AM – 9:10 AM
Shoreline Stability Study	9:10 AM – 9:35 AM
Wetlands, Riparian, and Littoral Habitat Study	9:35 AM – 10:00 AM
Cultural Resources Study	10:00 AM – 10:15 AM
Morning Break	10:15 AM – 10:30 AM
Recreation Study	10:30 AM – 11:30 AM
Lunch Break	11:30 AM – 12:00 PM
Fish Community Study • Roanoke Logperch Survey • Impingement and Entrainment Benthic Aquatic Resources Study	12:00 PM – 1:15 PM
Water Quality Study	1:15 PM – 2:15 PM
Afternoon Break	2:15 PM – 2:30 PM
Bypass Reach Flow and Aquatic Habitat Study	2:30 PM – 3:30 PM

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Process Plan and Schedule

Date	Milestone
January 28, 2019	Appalachian Filed NOI and PAD (18 CFR §5.5, 5.6)
March 26, 2019	FERC Issued Notice of PAD/NOI and Scoping Document 1 (SD1) (18 CFR §5.8(a))
April 24-25, 2019	FERC Conducted Scoping Meetings and Site Visit (18 CFR §5.8(b) (viii))
July 9, 2019	FERC Issued Scoping Document 2 (SD2) (18 CFR §5.10)
July 9, 2019	Appalachian Filed Proposed Study Plan (PSP) (18 CFR §5.11(a))
August 1, 2019	Appalachian Held Study Plan Meeting (18 CFR §5.11(e))
November 6, 2019	Appalachian Filed RSP (18 CFR §5.13(a))
December 6, 2019	FERC Issued the SPD (18 CFR §5.13(c))
July 27, 2020	Appalachian Submitted First Quarterly Report, ILP Study Update, and Request for Extension of Time File ISR
August 10, 2020	FERC Issued Order Granting Appalachian Extension of Time for Filing of ISR
August – November 2020	Appalachian Conducted First Season of Field Studies (18 CFR §5.15(a))
October 27, 2020	Appalachian Submitted Second Quarterly Progress Report (18 CFR §5.15(b))
December 22, 2020	FERC Issued Scoping Document 3 (SD3)
January 11, 2021	Appalachian Submitted ISR (18 CFR §5.15(c)(1))
February 5, 2021	Appalachian Filed ISR Meeting Summary
April 30, 2021	Appalachian Submitted Third Quarterly Progress Report (18 CFR §5.15(b))
July 22, 2021	Appalachian Submitted Fourth Quarterly Progress Report (18 CFR §5.15(b))
October 1, 2021	Appalachian Filed Draft License Application (DLA) (18 CFR §5.16(a))
November 2, 2021	Appalachian Submitted Fifth Quarterly Progress Report
December 6, 2021	Appalachian filed USR (18 CFR §5.15(f))

Studies Approved in the SPD

FERC's December 6, 2019 Study Plan Determination (SPD) directed Appalachian to conduct eight studies:

1. Bypass Reach Flow and Aquatic Habitat Study
2. Water Quality Study
3. Fish Community Study
4. Benthic Aquatic Resources Study
5. Wetlands, Riparian, and Littoral Habitat Characterization Study
6. Shoreline Stability Assessment Study
7. Recreation Study
8. Cultural Resources Study

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Upcoming ILP Milestones

Date	Milestone
December 14, 2021	Appalachian Host USR Meeting (18 CFR §5.15(f))
December 29, 2021	Appalachian File USR Meeting Summary (18 CFR §5.15(f))
December 30, 2021	Stakeholders File Comments on DLA (18 CFR §5.16(e))
January 28, 2022	Stakeholders File Disagreements with USR Meeting Summary (18 CFR §5.15(f)(4)) (if necessary)
February 27, 2022	Appalachian File Response to USR Meeting Summary Disagreements (18 CFR §5.15(f)(5)) (if necessary)
February 28, 2022	Appalachian File Final License Application (18 CFR §5.17)

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Shoreline Stability Assessment Study

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Shoreline Stability Assessment Study

Study Goal and Objectives:

- Survey the Project's reservoir, bypass reach, and tailrace area to characterize the shoreline, with the focus on erosion or shoreline instability using the Bank Erosion Hazard Index (BEHI),
- Inventory, map, and document any areas of erosion or shoreline instability, and
- Prioritize any areas where remedial action or further assessment may be needed.

Shoreline Stability Assessment Study

Background and Existing Information:

- Existing riparian vegetation is mainly intact along the shorelines of Project reservoir.
- The upstream portion of the study area (Tinker Creek and upstream reach of the Roanoke River) is in an urban area associated with the City of Roanoke and town of Vinton. Riparian buffers are limited in the upstream portions of the study area and become wider downstream of the confluence of the Roanoke River and Tinker Creek.
- Urban areas have large areas of impervious surface; therefore, the upper Roanoke River and Tinker Creek watershed experience flashy stormwater flows during rainfall events.

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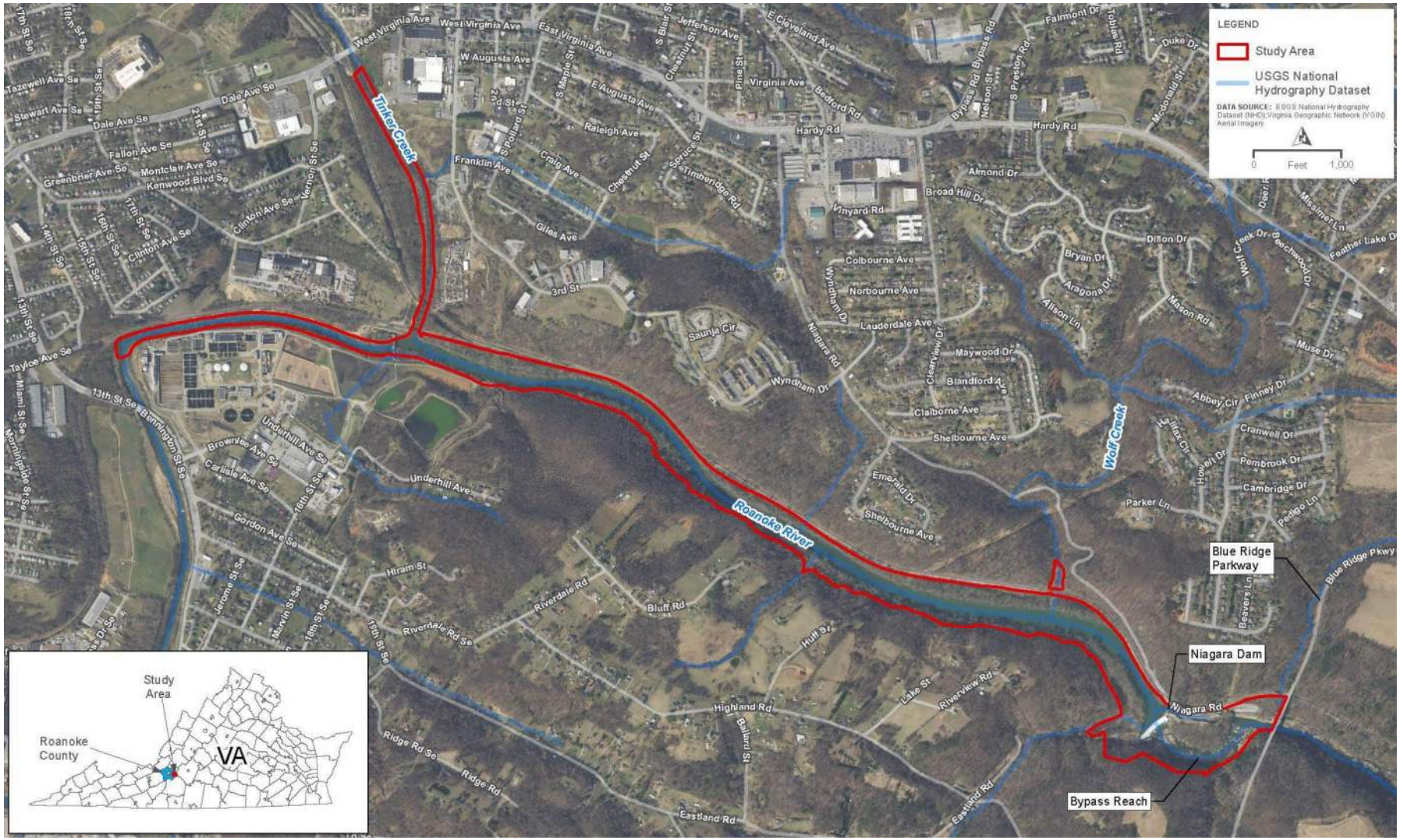

Shoreline Stability Assessment - Methods

Desktop Review

- ESRI Geographic Information System data, Virginia Geographic Information Network aerial photos, USGS topographic maps, and NRCS soil surveys to assess bank composition and erosion potential in the study area.

Field Survey (June 22, 2021)

- Bank stability and erosion potential for this study effort was analyzed using the modified Rosgen (2001) BEHI method and the West Virginia Department of Environmental Protection (WVDEP) complete BEHI procedure (WVDEP 2015).

Shoreline Stability Assessment - Methods

BEHI Methodology:

- Assesses physical and geomorphic properties of the streambank to validate the probable sources of bank instability using stream bank variables.
- The metrics used to estimate BEHI include ratio of bank height to bankfull height (BH), ratio of root depth to bank height (RDH), root density percentage (RD), surface protection percentage (SP), and bank angle in degrees (BA).
- These metrics are associated with scores and are totaled to categorize the overall condition of the stream reach assessed.
- *Near Bank Stress was not evaluated and sediment loading was not calculated as part of this study.*

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Shoreline Stability Assessment

Description of Rosgen Metrics for BEHI Evaluation

- Ratio of bank height to bankfull height (BH) – Ratio of bank height to bankfull height. Common bankfull indicators in stable streams include top of bank, top of point bars, and other changes in channel slope. (e.g. top of bank height is 2 feet and bankfull height is 1.5 foot = 1.3)
- Ratio of root depth to bank height (RDH) – Ratio of the average plant root depth to the bank height as percent (e.g. root extending 2 feet into a 4 foot tall bank = 50%).
- Root density percentage (RD) – is the proportion of the streambank surface covered (and protected) by plant roots. (e.g. a bank whose slope is half covered with roots = 50%)
- Surface protection percentage (SP) – is the percentage of the stream bank covered by plant roots, downed logs, branches, rocks, etc.
- Bank angle in degrees (BA) – is the angle of the “lower bank” – the bank from the waterline at base flow to the top of bank, as opposed to benches that are higher on the floodplain. Bank angles greater than 90% occur on undercut banks.

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Shoreline Stability Assessment

Stream Characteristics used to develop BEHI and Ratings

BEHI Category	Bank height	BH Score	Root Depth	RDH Score	Root Density	RD Score	Surface Protection	SP Score	Bank Angle	BA Score	Total Score
V. low	1.0-1.1	1.45	90-100	1.45	80-100	1.45	80-100	1.45	0-20	1.45	≤7.25
Low	1.1-1.2	2.95	50-89	2.95	55-79	2.95	55-79	2.95	21-60	2.95	7.26-14.75
Moderate	1.3-1.5	4.95	30-49	4.95	30-54	4.95	30-54	4.95	61-80	4.95	14.76-24.75
High	1.6-2.0	6.95	15-29	6.95	15-29	6.95	15-29	6.95	81-90	6.95	24.76-34.75
V. high	2.1-2.8	8.5	5-14	8.5	5-14	8.5	10-14	8.5	91-119	8.5	34.76-42.50
Extreme	>2.8	10	<5	10	<5	10	<14	10	>119	10	42.51-50

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Shoreline Stability Assessment - Results

- Approximately 7 miles of Roanoke River Shoreline was assessed.
- Approximately 90% of shoreline was stable and did not exhibit active erosion.
- Banks with some level of visible erosion had higher bank height ratios, lack of root depth, limited surface protection, and moderate to high bank angles scores.
- No areas were categorized as having very high or extreme erosion potential.

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Shoreline Stability Assessment

BEHI Scores for Niagara Erosion Areas

Erosion Area	Length (linear ft)	Average of BH Score	Average of RDH Score	Average of RD Score	Average of SP Score	Average of BA Score	Average of Total Score by Category	Category
Erosion Area 1	103	2.95	4.95	4.95	4.95	6.95	24.75	Moderate
Erosion Area 2	45	4.95	4.95	2.95	2.95	8.5	24.3	Moderate
Erosion Area 3	28	1.45	2.95	2.95	6.95	6.95	21.25	Moderate
Erosion Area 4	21	2.95	4.95	4.95	6.95	4.95	24.75	Moderate
Erosion Area 5	107	4.95	1.45	1.45	1.45	8.5	17.8	Moderate
Erosion Area 6	98	2.95	1.45	1.45	1.45	8.5	15.8	Moderate
Erosion Area 7	56	4.95	2.95	4.95	2.95	4.95	20.75	Moderate
Erosion Area 8	72	2.95	2.95	1.45	1.45	4.95	13.75	Low
Erosion Area 9	358	2.95	2.95	4.95	4.95	4.95	20.75	Moderate
Erosion Area 10	128	4.95	8.5	6.95	6.95	4.95	32.3	High
Erosion Area 11	225	2.95	6.95	6.95	6.95	6.95	30.75	High
Erosion Area 12	326	4.95	2.95	6.95	6.95	4.95	26.75	High
Erosion Area 13	261	4.95	4.95	6.95	4.95	4.95	26.75	High
Erosion Area 14	336	2.95	2.95	4.95	4.95	4.95	20.75	Moderate
Erosion Area 15	209	2.95	2.95	4.95	6.95	2.95	20.75	Moderate
Erosion Area 16	176	4.95	6.95	8.5	6.95	6.95	34.3	High
Erosion Area 17	99	4.95	6.95	8.5	8.5	4.95	33.85	High
Erosion Area 18	272	4.95	4.95	4.95	6.95	4.95	26.75	High
Erosion Area 19	289	4.95	6.95	8.5	8.5	4.95	33.85	High

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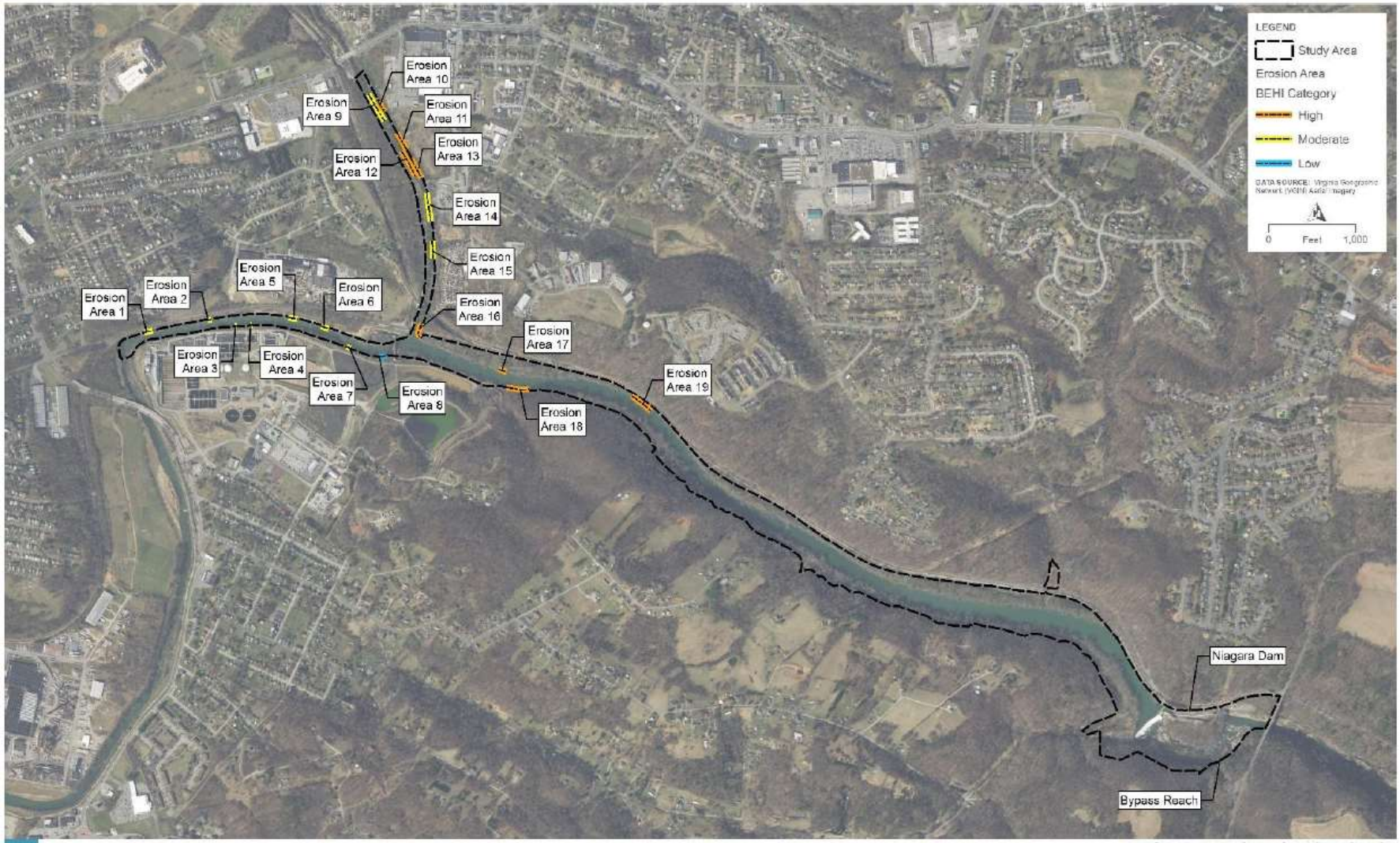
Shoreline Stability Results



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Shoreline Stability Assessment

Erosion Area 1: “Moderate”

Erosion Area 3: “Moderate”

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Shoreline Stability Assessment

Erosion Area 17: “High”

Erosion Area 19: “High”

Shoreline Stability Assessment

Summary and Discussion

- Overall, the visual inspection of the Project shoreline indicated stable banks and only localized streambank erosion. Approximately 90% of shoreline was stable and did not exhibit signs of active erosion.
- Existing bedrock and more established riparian buffers along the shorelines limit erosion potential.
- The main cause of bank/shoreline erosion in the Project include high concentration of impervious surface near Tinker Creek and the upstream portion of the project limits causing significant changes in water levels
- Areas of shoreline erosion are mainly concentrated in areas absent of vegetation or in areas susceptible to high flows during run-off events.

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Shoreline Stability Assessment

Summary and Discussion

- Did not identify any areas of active erosion upstream of Niagara dam, the trail race, or in the bypass reach.
- Erosion Areas 10-13, and 16-19 categorized as “high” are in the upstream reach of Tinker Creek and downstream of the confluence of Tinker Creek and the Roanoke River. These areas are most susceptible to high flows during storm events and subsequent potential accelerated erosion rates.
- Appalachian proposes to continue operating the Niagara development as currently operated, including run-of-river operations and maintenance of existing vegetation and buffer areas.
- Appalachian does not proposed remediation of any shoreline areas in the Project Boundary at this time.

Variances from FERC-approved Study Plan

The Shoreline Stability Assessment was conducted in conformance with the Commission's SPD.

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Wetlands, Riparian, and Littoral Habitat Study

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Wetlands, Riparian, and Littoral Habitat Study – Goals & Objectives

Study Goal: Conduct a study to identify and characterize the existing wetlands, waterbodies, and riparian and littoral vegetative habitats (including emergent and submergent aquatic vegetation beds).

Specific Objectives:

- Perform a desktop characterization using the USFWS National Wetlands Inventory (NWI), USGS National Hydrography Dataset (NHD), the VDEQ Wetland Conditional Assessment Tool (WetCAT), and other resources include GIS based topographic maps, hydrography, aerial imagery, and soil surveys to identify and describe, approximate, and classify wetlands and waterbodies within the study area.
- Perform a field verification to confirm the location of wetlands and waterbodies, dominant vegetative communities, and vegetation classifications identified in the desktop survey.
- Develop a GIS based map using the results of the desktop characterization and field verification to identify the locations of wetlands and waterbodies according to the Cowardin Classification System.
- The desktop and field verification was used to evaluate the potential for Project effects on wetlands, riparian, and littoral habitats within the study area.

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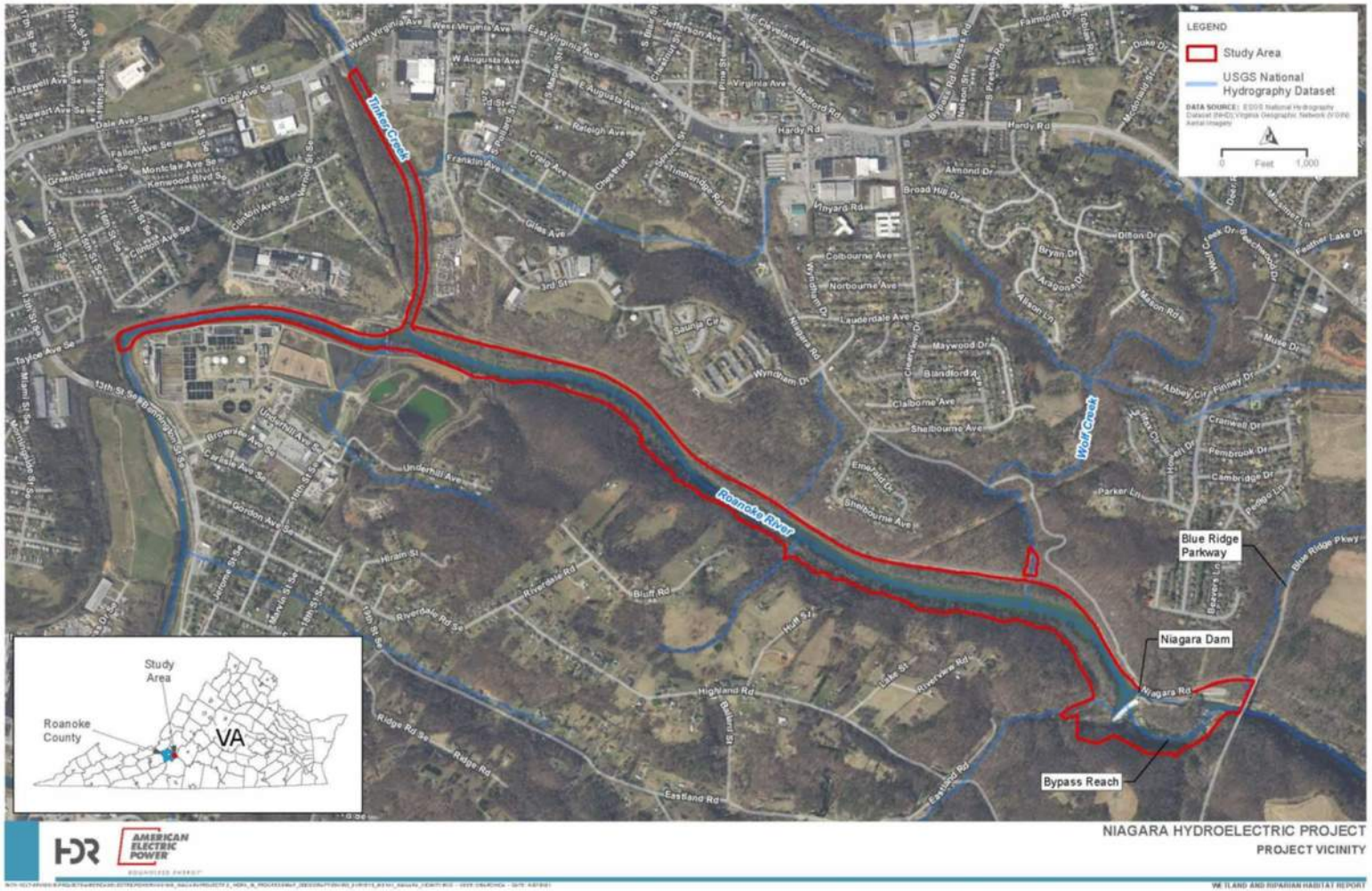

NIAGARA HYDROELECTRIC PROJECT
PROJECT VICINITY

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Study Methods

Desktop Study

- An initial desktop study was carried out to identify areas likely to contain wetlands, riparian, and littoral habitat and estimate the amount of each resource area.
  - USFWS NWI – estimated approximately 61.4 acres of wetlands and waterbodies (0.3 acres of palustrine forested; 0.9 acres of palustrine emergent, 25.9 acres of palustrine unconsolidated bottom; and 34.3 acres of riverine).
  - VDEQ WetCAT – identified two (2) somewhat severely stressed and one (1) severely stressed wetland based on habitat and water quality stressors associated with surrounding land use types.
- Data collected during the desktop survey including the USGS topographic maps and NHD, elevation data, high-resolution orthoimagery, and NRCS soils survey were used to create habitat characterization base maps that were used to facilitate the field verification efforts.

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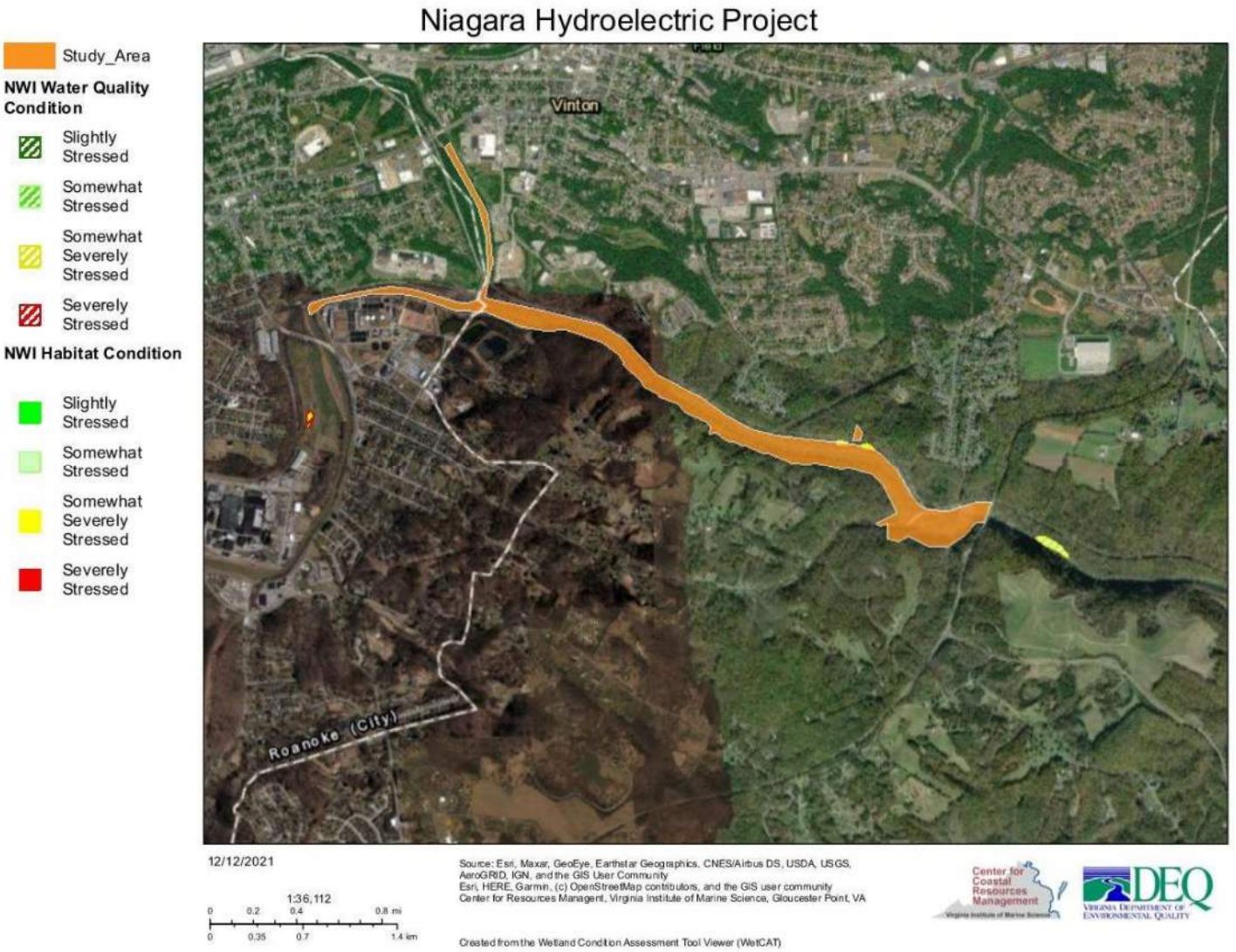
WetCAT Results

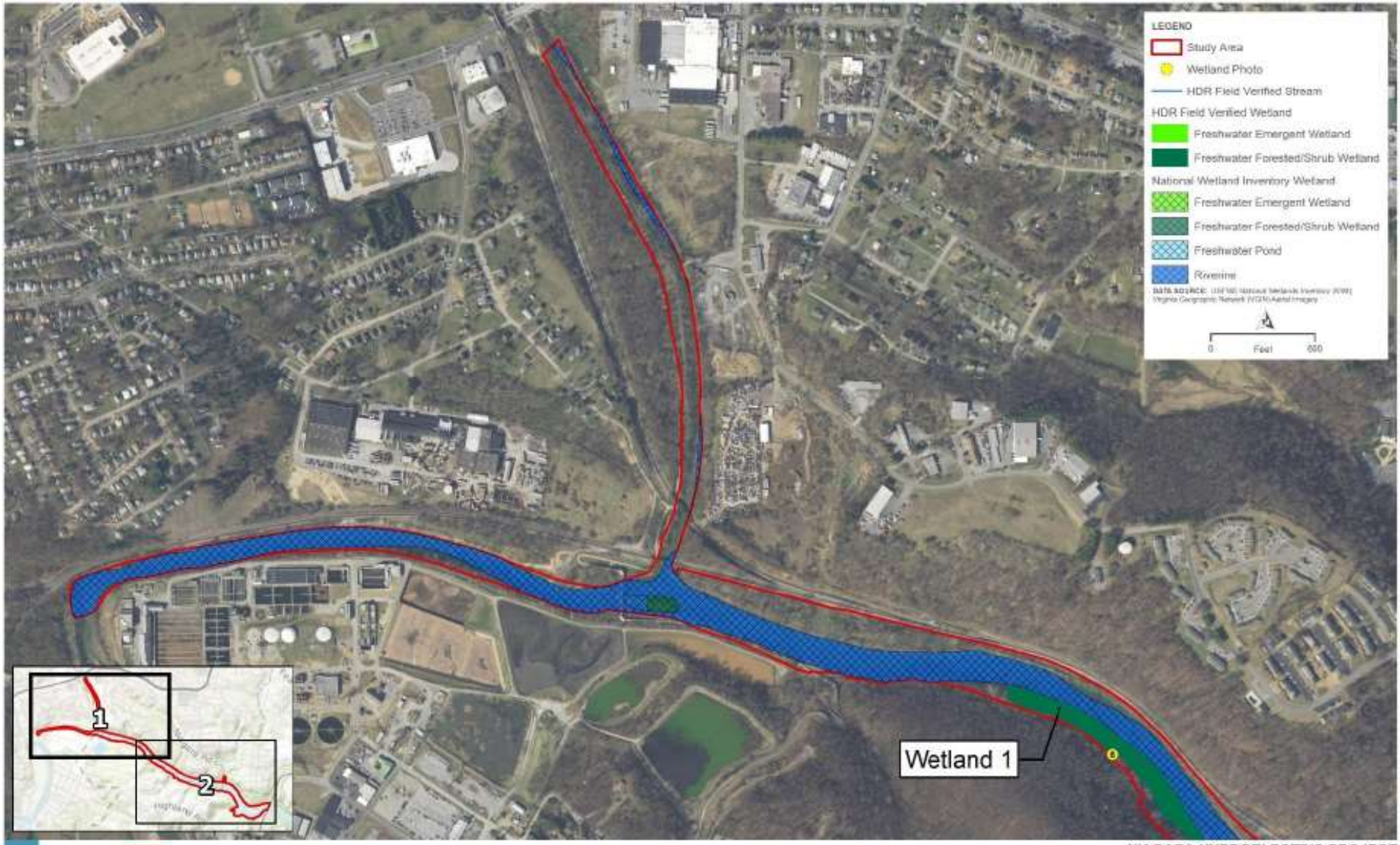


Study Methods

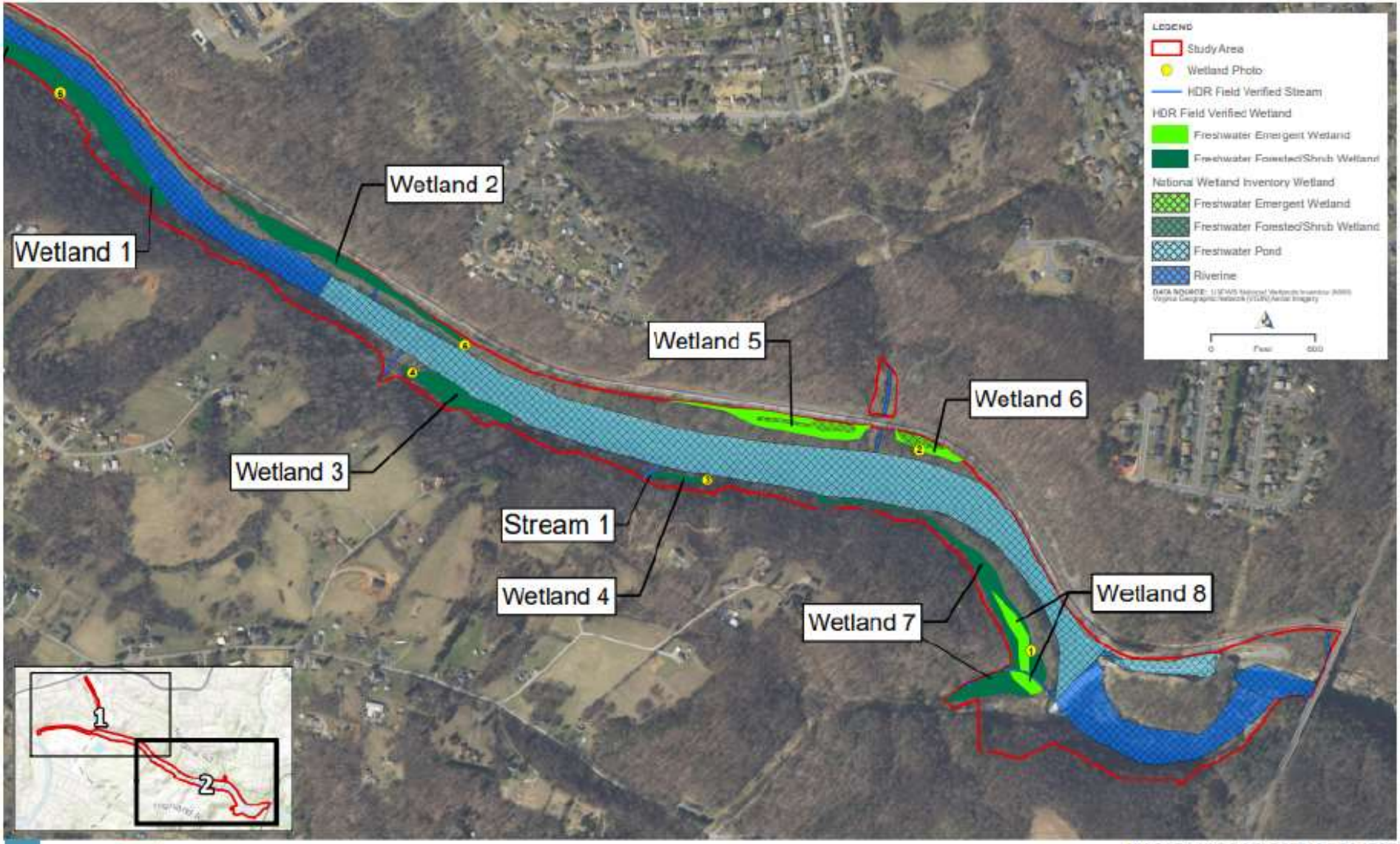
Field Verification

Wetlands and Waterbodies: June 22, 2021

- Wetland areas and streams identified in the desktop study were field-verified, but not formally delineated (i.e., no flagging or boundary marking), using the USACE Wetland Delineation Manual and Eastern Mountains and Piedmont Regional Supplement and USACE Regulatory Guidance OHWM Identification Guidance.
- Wetland scientists used handheld GPS units to estimate the boundaries of wetlands and waterbodies identified from the desktop survey as well as new surface waters not indicated on the desktop mapping.
- Identified waterbodies were photo-documented and USACE Wetland Determination Data Forms were completed.
- Data collected in the field was used to digitize the boundaries of existing wetland and waterbodies in GIS.



NIAGARA HYDROELECTRIC PROJECT
WETLAND AND RIPARIAN HABITAT
PAGE 1 OF 2



NIAGARA HYDROELECTRIC PROJECT
WETLAND AND RIPARIAN HABITAT

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Results – Wetlands and Waterbodies

- Approximately **12.4 acres of freshwater wetlands** were identified:
  - 2.4 acres of emergent wetlands
  - 10 acres of forested wetlands
- Approximately 125 linear feet of an intermittent tributary to the Roanoke River not illustrated on the on the USGS topographic quadrangles or National Hydrography Database and USFWS National Wetlands Inventory.

Results – Palustrine Forested Wetlands

- Located in higher floodplains and point bars of the Roanoke River.
- Dominant vegetation consisted of American sycamore, box elder, tulip poplar, black walnut, and silver maple.
- The majority of understory included Japanese stilt grass, jewel weed, false nettle, wood nettle and spice bush.
- Wetland hydrology indicators included soil saturation, high water tables, and areas of standing waters.
- Hydric soils indicators included depleted matrix and redox depressions.

Results - Palustrine Emergent Wetlands

- Fringe wetlands location along the shoreline floodplains of the Roanoke River notably upstream of Niagara dam.
- Herbaceous species are dominant and included Japanese stilt grass, reed canary grass, smart weed, and false nettle.
- Wetland hydrology indicators included soil saturation, high water tables, and areas of standing water.
- Soils were mostly silt and clay and exhibited hydric soils indicators such as depleted matrix and depleted below dark surface.

Results - Palustrine Unconsolidated Bottom Waterbodies

- Permanently flooded habitats with less than 30% vegetative cover.
- Impounded section of the Roanoke River upstream of Niagara dam.
- Dominant vegetation includes algae and water willow.
- Characterized by the lack of stable surfaces for plant and animal attachment.
- Typically associated with limited wave and current activity.

Results - Riverine Habitats

- Riverine habitats in the study area include the Roanoke River and associated tributaries. The Roanoke River is a lower perennial riverine feature on the upstream and downstream limits of the study area but is classified as PUB in the middle section of the study area upstream of Niagara dam.
- There are several perennial tributaries that flow into the Roanoke River including Tinker Creek, Wolf Creek, and three unnamed tributaries.
- The dominant substrate included cobble to boulder sized rock along with bedrock.

Study Methods

Field Verification

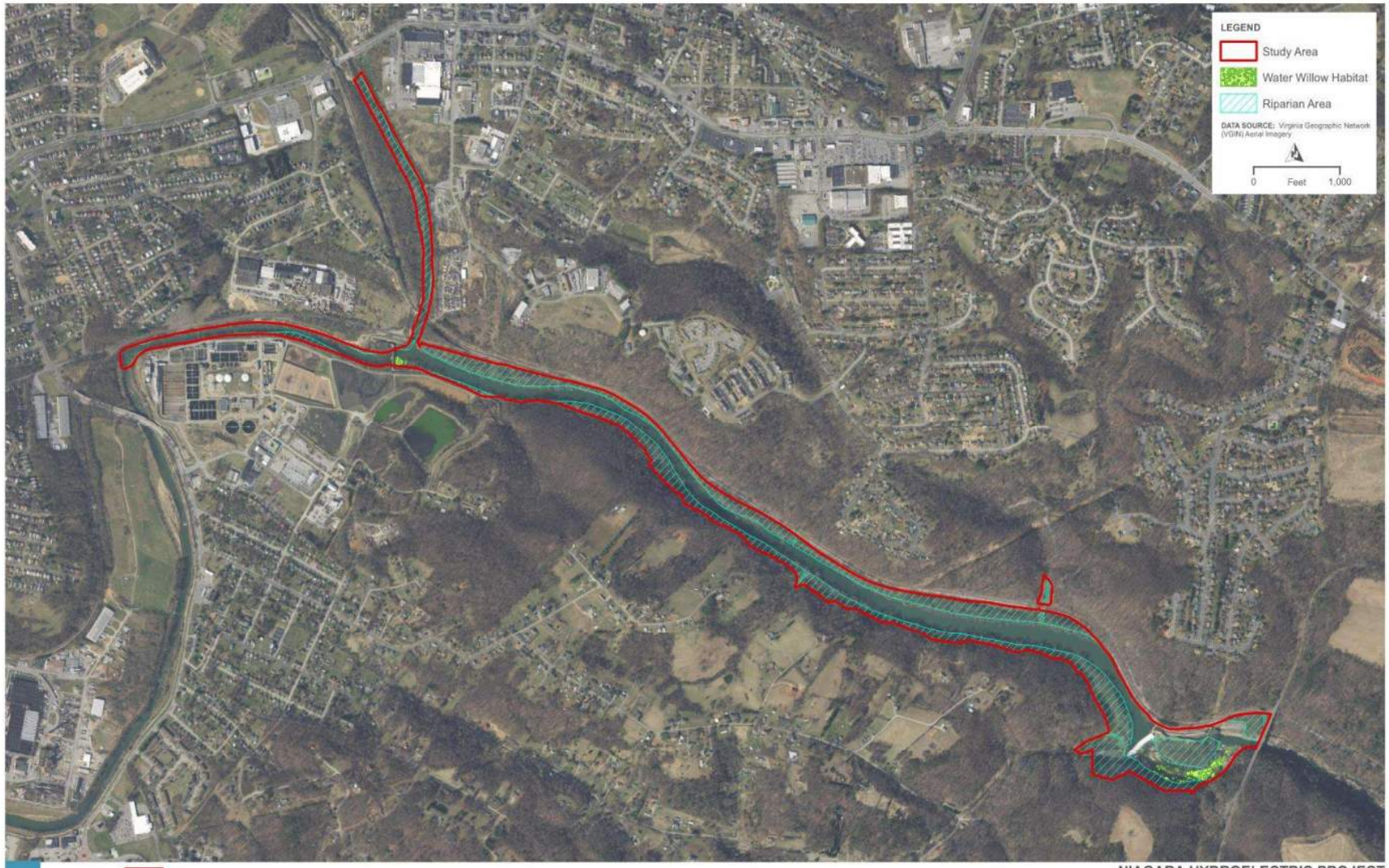
Riparian Zone: June 22, 2021

- Identification of vegetative community types by recording dominant species of vegetation at three strata (tree, sapling/shrub, and herb)
- HDR biologists used regional field guides and plant identification mobile apps to assist with identifying plans to genus and species level.
- Riparian zones identified within the study area best resembled Piedmont/Mountain Floodplain Forests and Swamps as described in the VDCR Natural Communities of Virginia Ecological Groups and Community Types.

Results – Riparian Habitats

The riparian area consists of approximately 65 acres and is mainly found along the shoreline, on islands, and within the bypass reach.

- Region is characteristic of the VDCR Piedmont/Mountain Floodplain Forest and Swamp community type.
- Dominant vegetation in the over story includes black walnut, black catalpa, elm, American sycamore, silver maple, box elder, green ash, and swamp white oak.
- The understory typically included white mulberry, pawpaw, and spice bush.
- The herbaceous vegetation consisted of jewelweed, Japanese stiltgrass, poison ivy, river oats, and wild geranium.
- Non-native invasive species were present and included Japanese knotweed, honeysuckle, Johnsongrass, and Tree of Heaven.



NIAGARA HYDROELECTRIC PROJECT

LITTORAL HABITAT AND RIPARIAN AREAS

FIGURE 3

Study Methods

Field Verification

Littoral Zone: June 23, 2021

- Defined as the shallow shoreline area of the Roanoke River along the stream bank and within shallow portions of the bypass reach. Includes instream and emergent and /or aquatic vegetation beds.
- A visual assessment was performed to characterize the availability of littoral zone aquatic habitats including emergent aquatic EAV and SAV beds within the bypass reach.
- Transect-based surveys were performed to characterize the availability of littoral zone aquatic habitats within the study area. Four transect lines oriented parallel to the shoreline were evaluated in the reservoir.

Results - Littoral Habitats

- No submerged aquatic vegetation were collected in the four transects located in the reservoir.
- The bypass reach consisted of angular bed rock and depositional bars of sand and organic material. Pools of surface water were present with patchy vegetation growth in areas that were above water level.
- Water willow beds were mapped in the bypass reach and located in low-flow pools close the to the banks and between the rocky outcropping.
- Littoral zone vegetation also included various terrestrial plants, and algae, with water willow being by far the most abundant EAV.
- Algae was sparse in the bypass reach and was primarily located in stagnant pools along the banks with low amounts of daily sunlight.

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Results - Littoral Habitats

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- Wildlife species observed during the Niagara field study effort

Common Name	Latin Name
Birds	
Turkey vulture	*Cathartes aura*
Canada goose	*Branta canadensis*
Red-tailed hawk	*Buteo jamaicensis*
Killdeer	*Charadrius vociferus*
Mourning dove	*Zenaida macroura*
Belted kingfisher	*Ceryle alcyon*
Blue jay	*Cyanocitta cristata*
American crow	*Corvus brachyrhynchos*
American robin	*Turdus migratorius*
Northern mockingbird	*Mimus polyglottos*
Northern cardinal	*Cardinalis cardinalis*
Great blue heron	*Ardea herodias*
Osprey	*Pandion haliaetus*
Wood duck	*Aix sponsa*
Mammals	
White-tailed deer	*Odocoileus virginianus*
Muskrat	*Ondatra zibethicus*
Gray squirrel	*Sciurus carolinensis*
River Otter	*Lontra canadensis*
Beaver	*Castor canadensis*
Amphibians	
Eastern newt	*Notophthalmus viridescens*
American toad	*Anaxyrus americanus*
Spring peeper	*Pseudacris crucifer*
American bullfrog	*Lithobates catesbeiana*
Green frog	*Lithobates clamitans*
Wood frog	*Lithobates sylvaticus*
Reptiles	
Snapping Turtle	*Chelydra serpentina*
Copperhead	*Agkistrodon contortrix*

Wetland, Riparian, and Littoral Habitat Study – Project Impacts

- Wetland, riparian, and littoral habitats at the Project are reflective of current Project operations.
- Seasonal drawdowns may result in temporary short-term impacts to wetlands identified immediately upstream of Niagara Dam but are not anticipated to result in long term adverse impacts or loss of wetlands.
- Sediment accumulation is slowly occurring at locations within and around the impoundment and in some cases this can lead to the creation of new wetlands.
- There are no plans for improvement projects that would require disturbance of wetlands or tree clearing activities.
- Operations and maintenance of the Project are not anticipated to have any long-term adverse impacts on wetland, riparian, and littoral resources.

Variances from FERC-approved Study Plan

The Wetlands, Riparian, and Littoral Habitat Study was conducted in conformance with the Commission's SPD.

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Cultural Resources Study

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Cultural Resources Study

Study Status

Tasks completed for the Cultural Resources Study:

1. Consultation for the Area of Potential Effects (APE) Determination
2. Background Research and Archival Review of the Study Area
3. Phase I Reconnaissance Survey of the APE
4. Inventory of Traditional Cultural Properties (TCPs)
   - No TCPs identified
5. Consulting with agencies to determine if a Historic Properties Management Plan (HPMP)
   - Not necessary for the Project

Cultural Resources Study

APE Consultation

On September 1, 2020, Terracon consulted with the SHPO and applicable tribes requesting concurrence on the Project's APE.

APE responses were received from:

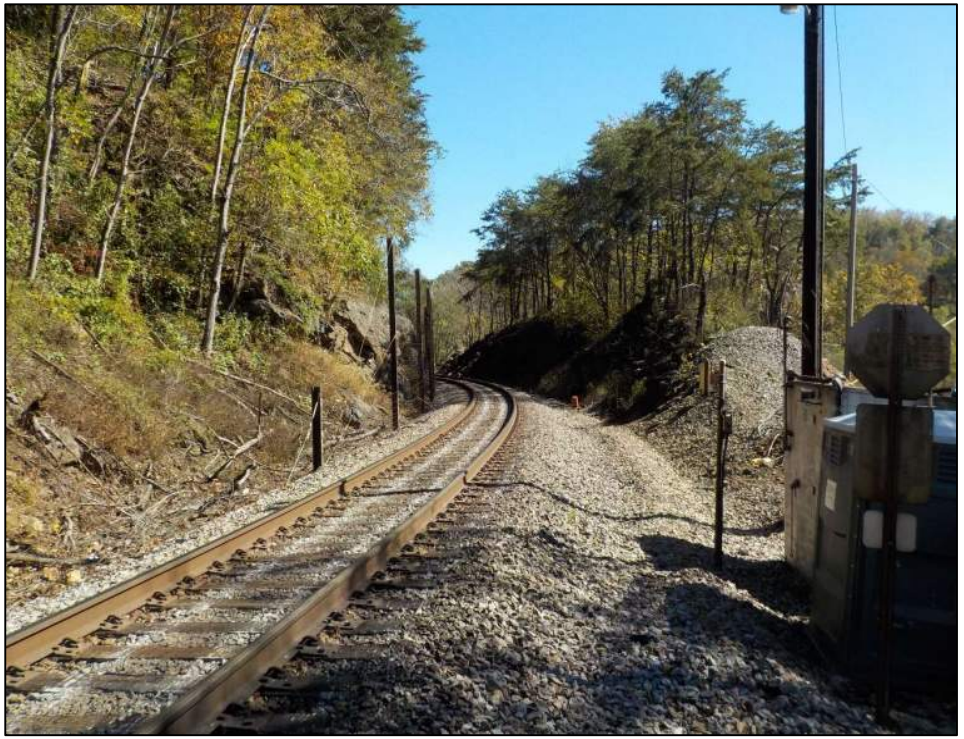
- The Catawba Indian Nation
- The Virginia DHR/SHPO
- The Pamunkey Indian Tribe
- The Monacan Indian Nation
- The Delaware Nation

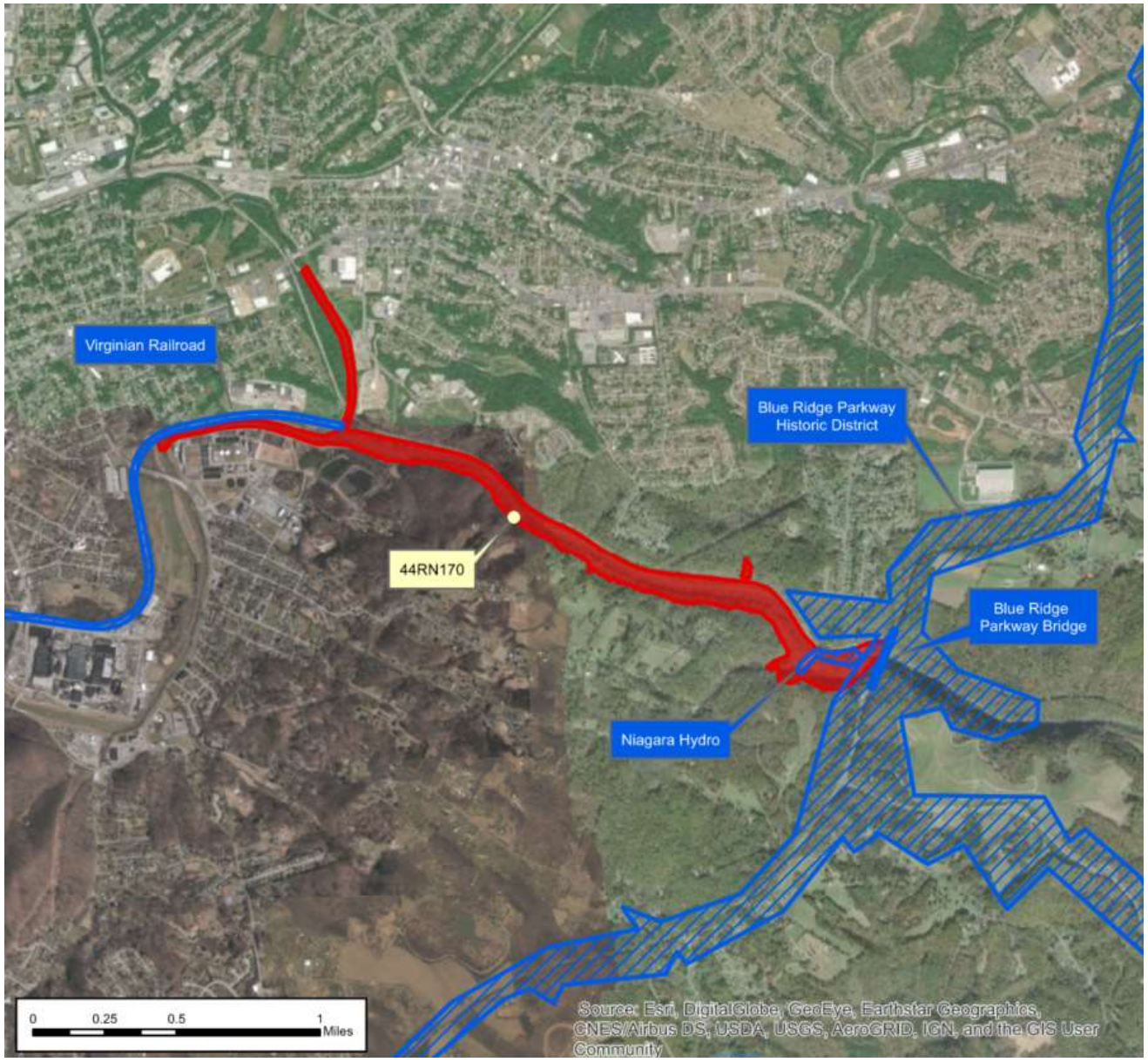
Cultural Resources Study Findings

- Terracon conducted an archaeological assessment of the Project APE in October 2020 and geomorphological investigations in April 2021.
- Based on the field studies, the APE was determined to have no potential for containing intact archaeological resources.
  - One previously recorded archaeological site that is within or immediately adjacent to the APE (44RN170) was thought to be a potential prehistoric rockshelter. However, the potential shelter was found to contain historic alluvial deposits down to bedrock with no chance of containing intact archaeological remains.

Cultural Resources Study Findings

- Three aboveground historic properties, the Blue Ridge Parkway Historic District, the Blue Ridge Parkway Bridge, and the Virginian Railway, are within the APE.
- No historic properties are currently being adversely affected by the Project.




Virginian Railroad
Blue Ridge Parkway Historic District
44RN170
Blue Ridge Parkway Bridge
Niagara Hydro
0
0.25
0.5
1
Miles
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Variances from FERC-approved Study Plan

- The Cultural Resources Study was conducted in conformance with the Commission's SPD.
- The final Study Report was filed with the Draft License Application on October 1, 2021 and is not included in the USR (PRIV).
- Since there are no historic properties in the APE being affected, a HPMP will not be necessary.

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Morning Break

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Recreation Study

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Recreation Study

Study Goal: to determine the need for enhancement to the existing recreation facility, or the need for additional recreational facilities, to support the current and future demand for public recreation in the Study Area.

Existing Project and Non-Project facilities:

- Project Canoe Portage Trail (Project Facility) includes a take-out and put-in below the Niagara dam.
- Tinker Creek Canoe Launch (Non-Project Facility) is upstream of the Niagara dam.
- The Roanoke River Trail (Non-Project Facility) includes a short-inclined trail and access to fishing in the bypass reach.
- Rutrough Point (Non-Project Facility) is 3 river miles downstream from the Niagara dam.

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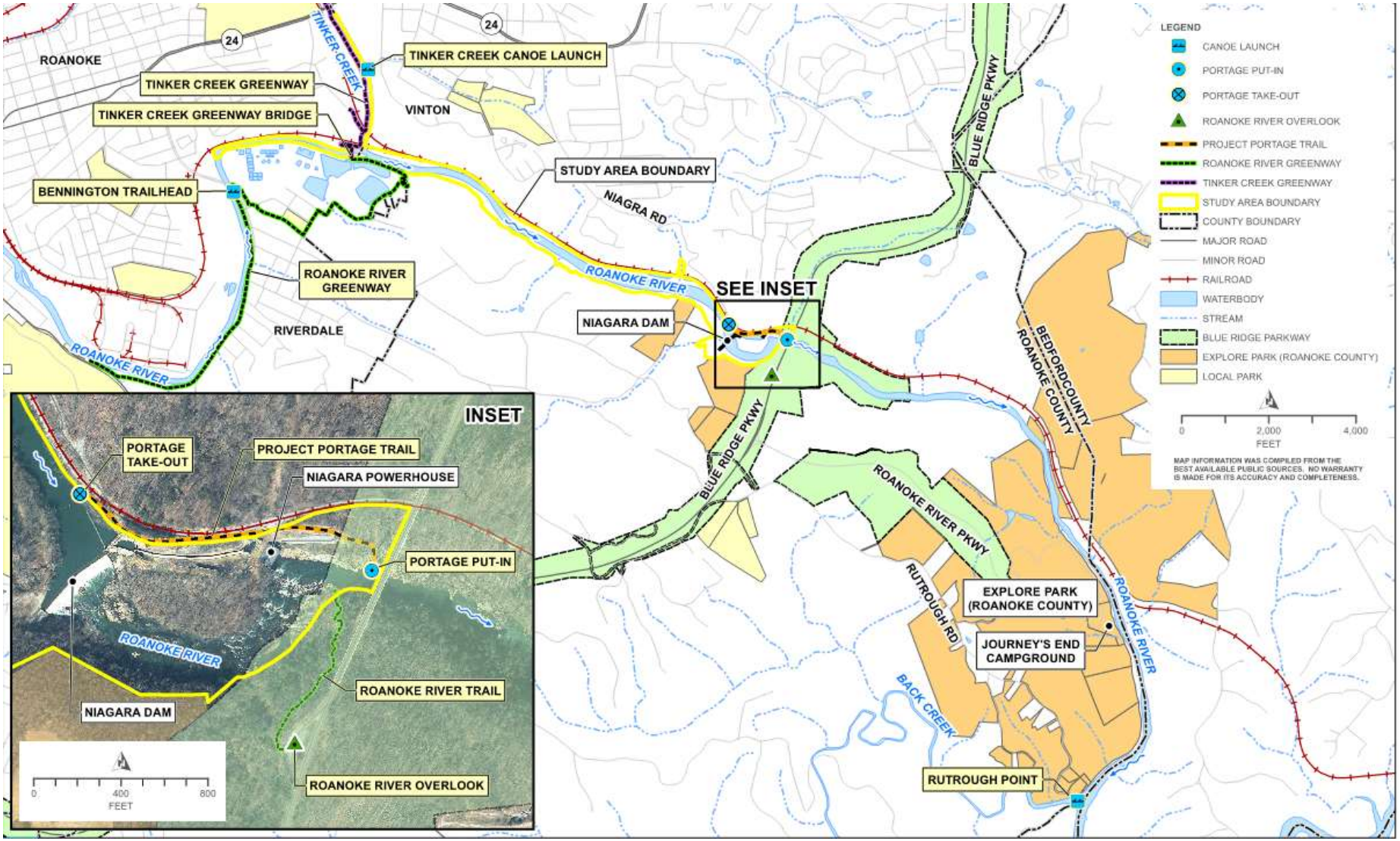

Recreation Study

Recreation Study tasks included:

- Recreation Facility Inventory and Condition Assessment
  - Completed in 2020
- Aesthetic Flow Documentation
  - Completed in 2020
- Recreational Flow Release Desktop Evaluation
  - Completed in 2020
- Existing and Future Recreational Opportunities
- Recreation Visitor Use Online Survey
- Recreational Use Documentation

Recreation Study: Existing and Future Recreational Opportunities

- Appalachian convened a virtual meeting on April 20, 2021 with interested relicensing participants. The goal was to have a focused discussion of existing and future recreational opportunities at or associated with the Project.
- Presentations were given on behalf of Appalachian, Roanoke County, Roanoke Valley Greenway Commission, and Roanoke River Blueway Committee.
- Discussions regarding potential conceptual level recreation enhancements and improvements to the canoe portage trail and other areas of the Project occurred.

Recreation Study: Online Survey

Summary of Study Methods

- Provides a method for existing and potential recreation visitors to the Study Area to respond and provide feedback on recreation opportunities on Project and Non-Project facilities.
- Outreach methods included: posted signs, coordinated with stakeholders, included in ILP Progress Report, and social media.
- From April 21, 2020 to October 27, 2021, Appalachian received 119 responses to the online survey.

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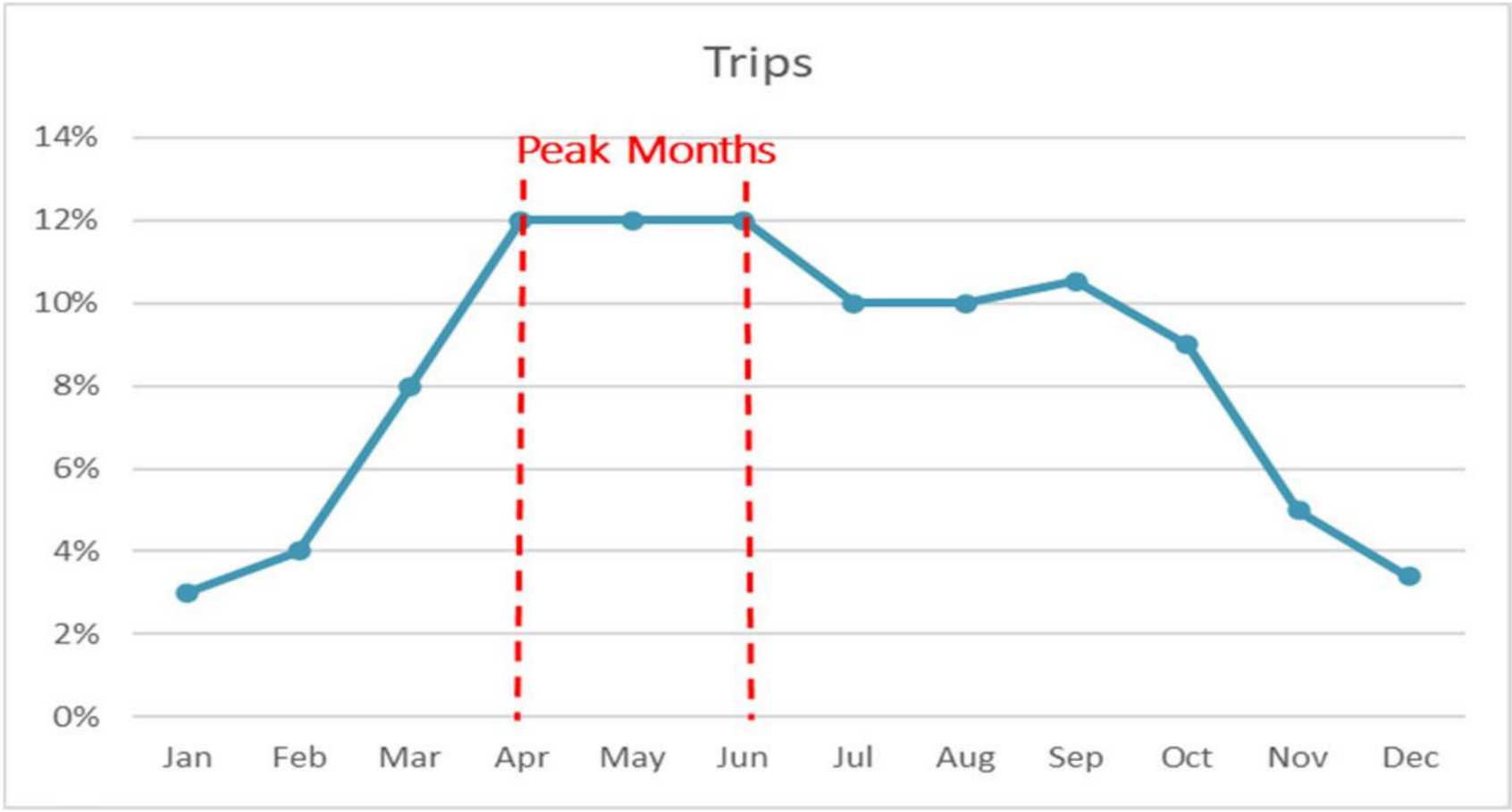
Monthly Recreation Activity for Project and Non-Project Facilities



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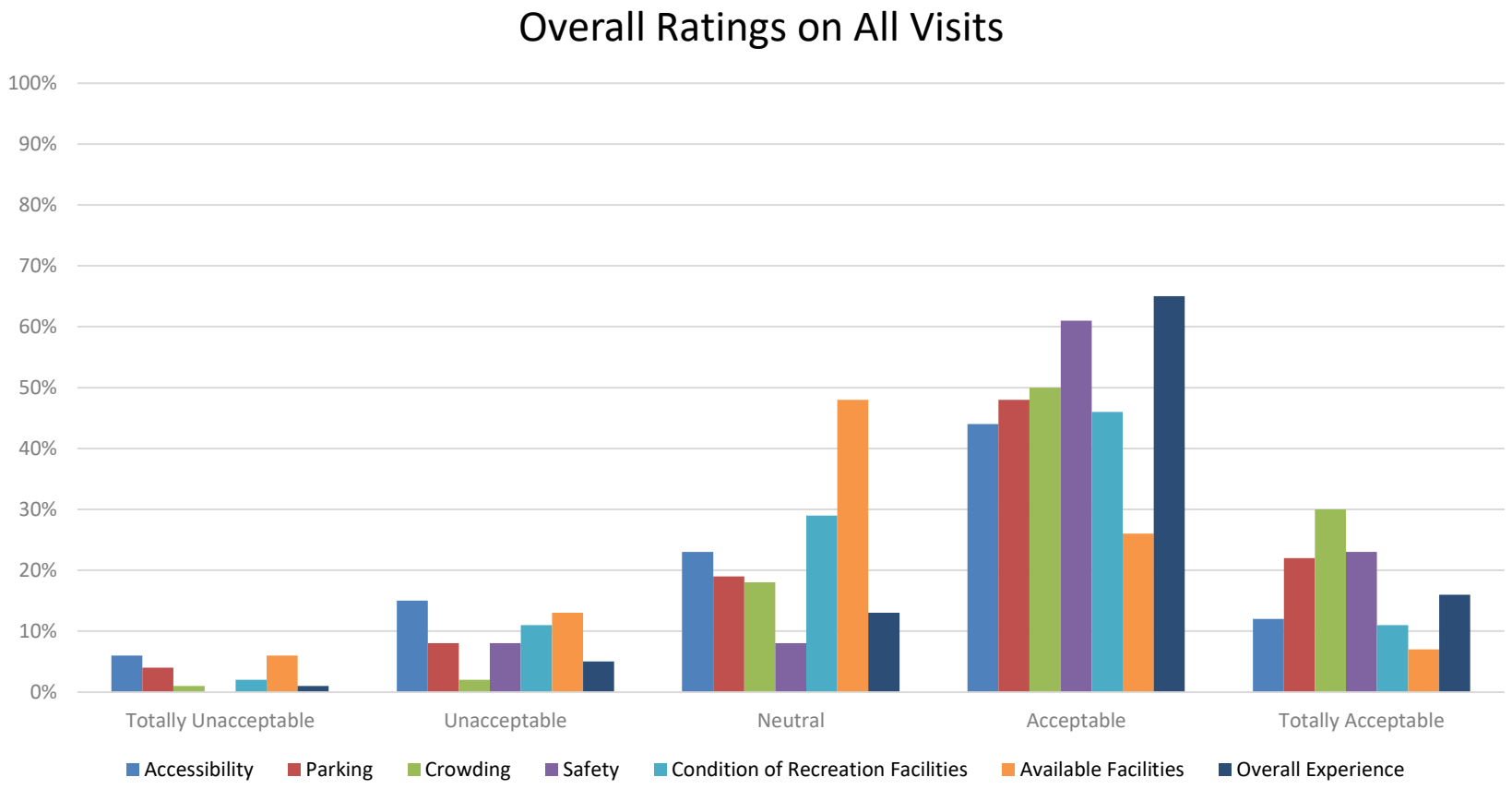
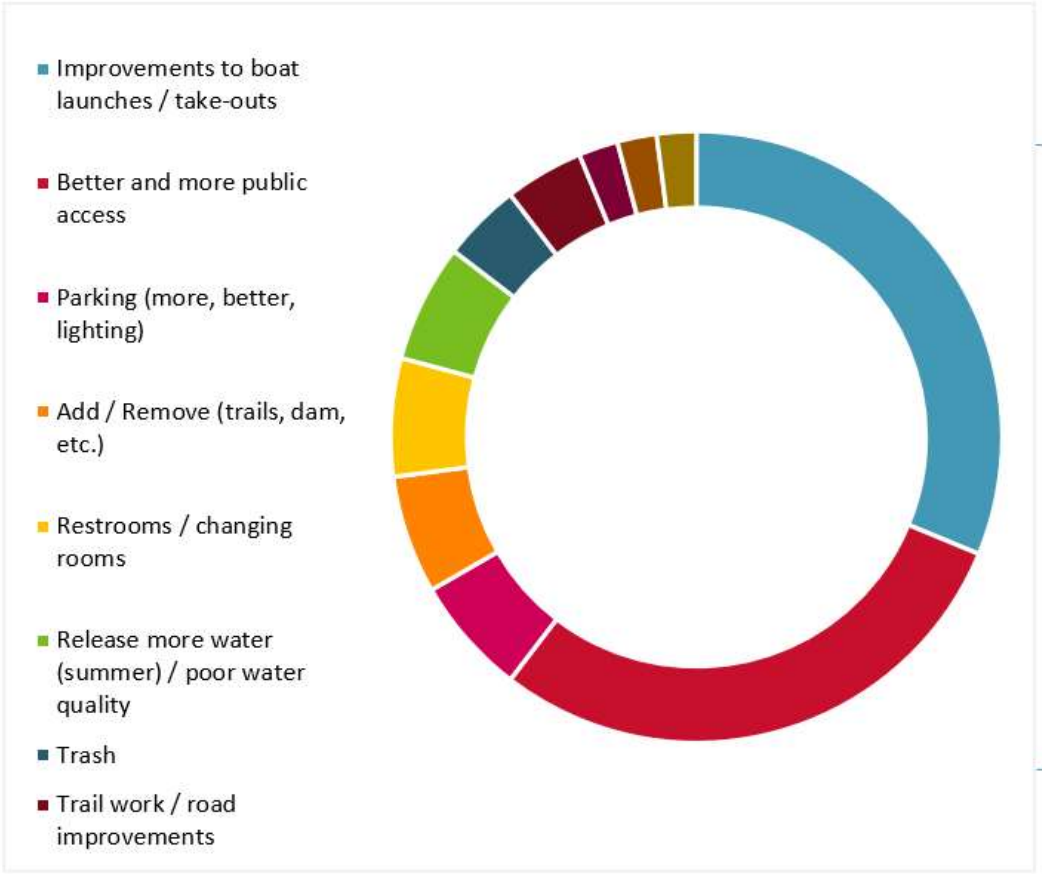
Summary for Primary Recreation Activities at all Project and Non-Project Facilities

Primary Activity	Percent (%)
Canoeing/kayaking/SUP	65
Fishing	17
Hiking	8
Pleasure boating/Tubing/Wake Surfing	3
Sight-seeing/Wildlife Viewing	3
Swimming	2
Picnicking	1
Running	1

Online Survey Summary for Overall Rating on All Visits at Project and Non-Project Facilities



Niagara Canoe Portage Trail: Suggested Improvement Online Responses



Improvement Suggestions	#
Improvements to boat launches / take-outs	15
Better and more public access	14
Parking (more, better, lighting)	3
Add / Remove (trails, dam, etc.)	3
Restrooms / changing rooms	2
Release more water (summer) / poor water quality	2
Trash	2
Trail work / road improvements	2
Signage & wayfinding	1
Access to water release schedule	1
More attractions	1

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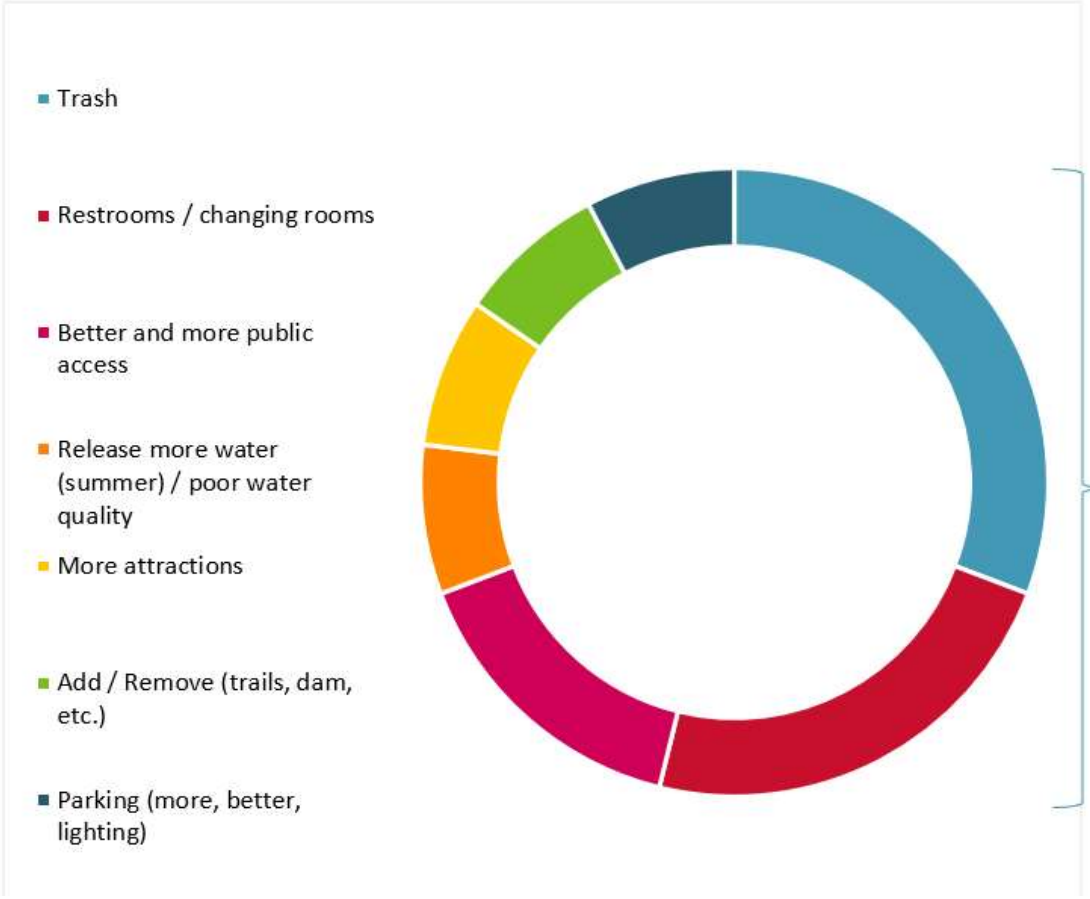
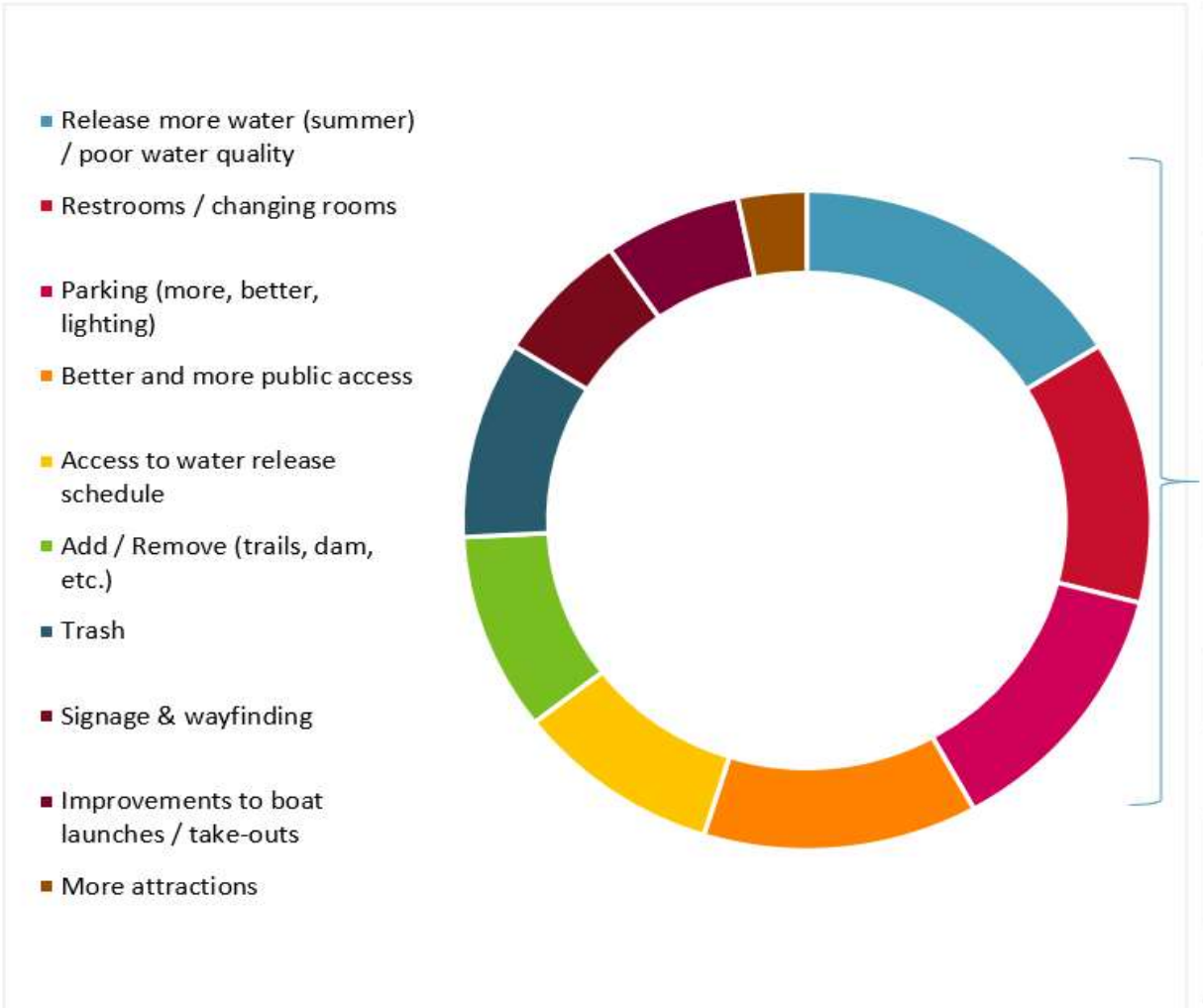
Tinker Creek Canoe Launch: Suggested Improvement Online Responses



Improvement Suggestions	#
Trash	4
Restrooms / changing rooms	3
Better and more public access	2
Release more water (summer) / poor water quality	1
More attractions	1
Add / Remove (trails, dam, etc.)	1
Parking (more, better, lighting)	1

Roanoke River Trail/Overlook: Suggested Improvement Online Responses



Improvement Suggestions	#
Release more water (summer) / poor water quality	5
Restrooms / changing rooms	4
Parking (more, better, lighting)	4
Better and more public access	4
Access to water release schedule	3
Add / Remove (trails, dam, etc.)	3
Trash	3
Signage & wayfinding	2
Improvements to boat launches / take-outs	2
More attractions	1

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Rutrough Point: Suggested Improvement Online Responses

Release more water (summer) / poor water quality	6
Improvements to boat launches / take-outs	5
More attractions	4
Better and more public access	4
Restrooms / changing rooms	4
Parking (more, better, lighting)	2
Trash	2
Add / Remove (trails, dam, etc.)	2
Access to water release schedule	1
Trail work / road improvements	1

Recreation Use Documentation Methods

- Visitor use data was obtained in 2021 at the Non-Project recreation facilities through a combination of in-person surveys and field reconnaissance during the prime recreational months (May-October).
- National Park Service planned work on the bridge over the Roanoke River which resulted in closure of the Blue Ridge Parkway from Route 24 to the entrance to Explore Park as well as the closure of the Roanoke River Trail and associated parking area.
  - In-person monitoring was performed at the Roanoke River Trail earlier in the year to obtain as much data as possible.
- After the closure of the bridge, the Roanoke River Trail could not be surveyed any longer. AEP installed a trail camera at the Niagara Portage put-in to document usage in lieu of in-person surveys.

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2020 Recreation Use Documentation

Recreation Site	Date	Time	Vehicles	Parking Spaces	Percentage	Activities
Rutrough Point						
	25-May	11:15 AM	5	12	42%	Two people fishing. High river flows.
	3-Jul	9:45 AM	6	12	50%	One kayak launching. Two people fishing.
	5-Sep	11:15 AM	4	12	33%	One canoe launching.
	26-Sep	3:40 PM	2	12	17%	Two pontoon boats on river. Three people bank fishing.
Tinker Creek						
	25-May	11:35 AM	0	5	0%	Ramp closed due to high water.
	3-Jul	10:15 AM	3	5	60%	No activity.
	5-Sep	12:30 PM	0	5	0%	No activity.
	26-Sep	4:40 PM	2	5	40%	One vehicle with trailer waiting for canoes/kayaks.
Roanoke River Trail						
	1-Jan	9:30 AM	2	35	6%	No activity.
	7-Feb	11:45 AM	0	35	0%	No activity.
	2-Mar	12:45 PM	1	35	3%	Two people hiking.
	25-Mar	12:00 PM	5	35	14%	Two people hiking; two people bank fishing.
	1-May	10:45 AM	3	35	9%	Four people hiking.
	25-May					Closed due to road conditions.
	3-Jul					Closed due to road conditions.
	5-Sep	11:45 AM	4	35	11%	One person bank fishing.
	26-Sep	3:50 PM	10	35	29%	Two people viewing spillway; five people hiking.

2021 In-Person Surveys

Roanoke River Trail/Overlook Dates:

- March 20
- March 29
- April 10
- April 12
- April 24
- May 1*
- May 11*

Tinker Creek Canoe Launch and Rutrough Point Dates:

- May 1*
- May 11*
- May 31 (holiday weekend)
- June 7
- June 19
- July 3 (holiday weekend)
- July 23
- August 14
- August 19
- September 5 (holiday weekend)
- September 24
- October 2
- October 4

Recreation Use Documentation: Niagara Portage Trail

- A motion-activated trail camera was installed from May 26, 2021 through October 27, 2021 at the Project Facility
- Recorded time, date, temperature and recreation activity

Recreation Use Documentation: Niagara Portage Trail

- June through August were the most popular months for recreational activity to occur.
- Activities observed included: Non-motorized boating activity (i.e. kayaks, canoes), bank fishing, and observation of the facility and river

Table 4.19: Trail Camera Primary Recreation and Usage Counts

Primary Recreation Activity(s) Observed	Highest Visitor Count (Month)	Total Visitor Count
Bank Fishing	7 (July)	28
Canoe/Kayak	9 (June)	21
Observation	8 (August)	21

Recreation Use Documentation: Tinker Creek Canoe Launch

- Primary activities included launching boats for fishing, and canoes and kayaks for paddling along Tinker Creek and the reservoir for the Niagara.
- Individuals utilize the facilities provided at the Tinker Creek Canoe Launch each month of the year with the higher percentage of visits occurring during the months of April through October.
- Those interviewed demonstrated their satisfaction with the facilities provided.
- Comments received included concerns with (1) crowding, (2) need for better signage and (3) a desire for improved connectivity between the portions of the Greenways along the Roanoke River and the river to increase in-water and shoreline fishing opportunities.
- None of the individuals interviewed stated that they continued downstream of the Project spillway by utilizing the Niagara Canoe Portage Trail or removed their boat from the water at another location.

Recreation Use Documentation: Roanoke River Trail/Overlook

- Primary activities included hiking, viewing, and bank fishing.
- Individuals visiting the Roanoke River Trail do so the entire year with most of the visits occurring during the months March through September.
- Most visits were of short duration during which a break could be taken from traveling along the Blue Ridge Parkway.
- Approximately 25 to 35 percent of users were from outside the Roanoke area.
- There were no observations of activities related to kayaking.

Recreation Use Documentation: Rutrough Point

- Primary activities bank fishing followed by kayaking and canoeing.
- Utilized extensively with the highest percentage of users visiting from April through September.
- Many of those visiting Rutrough Point either fish from the open area near the kayak/canoe launch or the riverbank upstream toward Explore Park.
- Users reported the facility as satisfactory. Items of concern include crowding and the condition of some of the amenities.

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Recreation Study Summary

- The Roanoke River is a significant recreation and amenity resource for the Roanoke Valley providing numerous and varied opportunities for those residing in the area as well as those visiting from outside including canoeing, kayaking, fishing, tubing, wading, wildlife viewing, and watershed education.
- Recreation facilities in the vicinity of the Niagara Project are utilized each month of the year with most activities taking place from April through October.
- Users appear to be quite satisfied with the facilities provided with the exception of the canoe portage. However, users are recreating at the Project facility more than anticipated.

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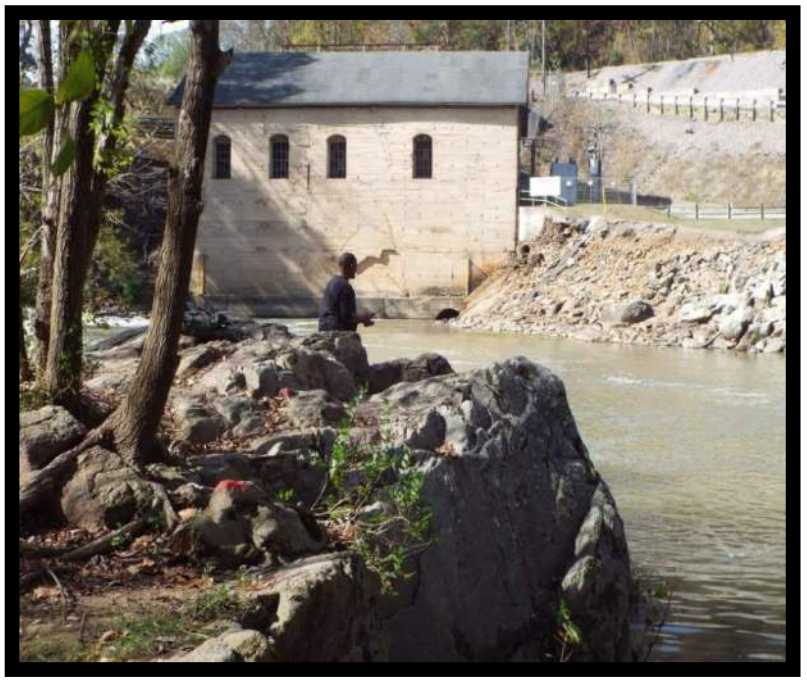
Recreation Study Summary

- Efforts to improve the canoe portage could include:
  - (1) improvements to the existing take-out and put-in locations;
  - (2) improved signage directing canoeists and kayakers to the take-out and put-in locations and along the portage trail itself;
  - (3) a mechanism to assist those utilizing the portage with transporting canoes and kayaks; and
  - (4) an education program informing the public of the availability of the portage and that the reservoir is open to use by all for recreation.

Variances from FERC-approved Study Plan

The Recreation Study was conducted in conformance with the Commission's SPD.

Appalachian plans to develop a draft **Recreation Management Plan** for the Project, in consultation with agencies and other recreation stakeholders, to guide development and maintenance of recreation facilities and opportunities at the Project over the new license term.



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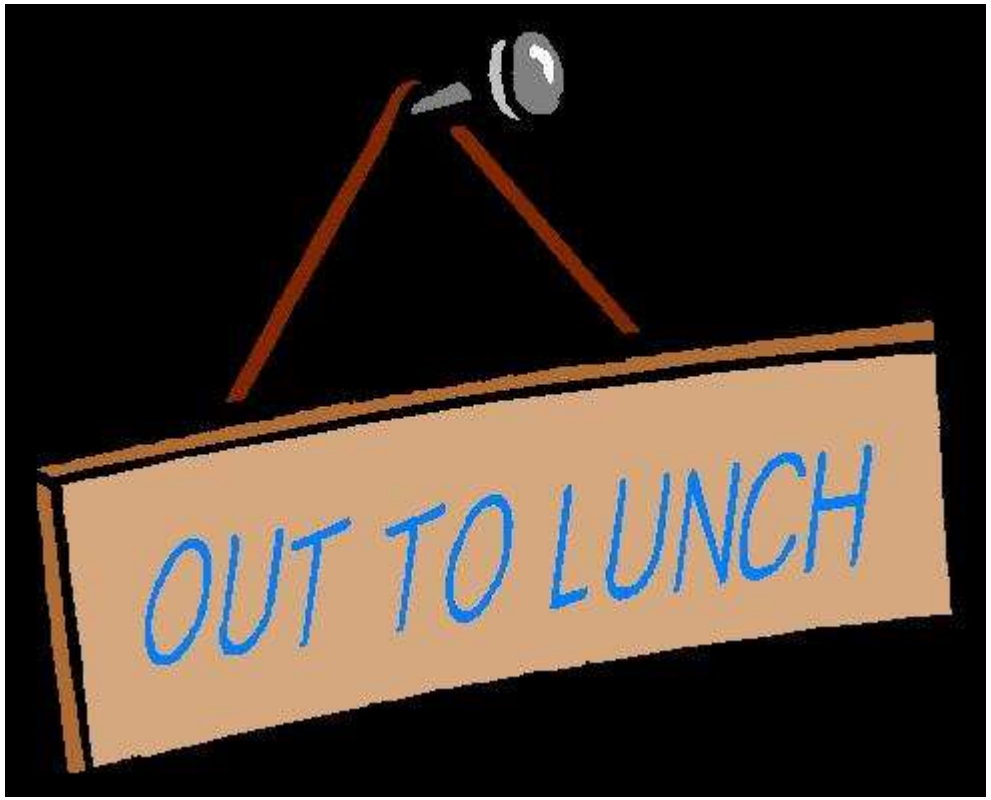
Lunch Break



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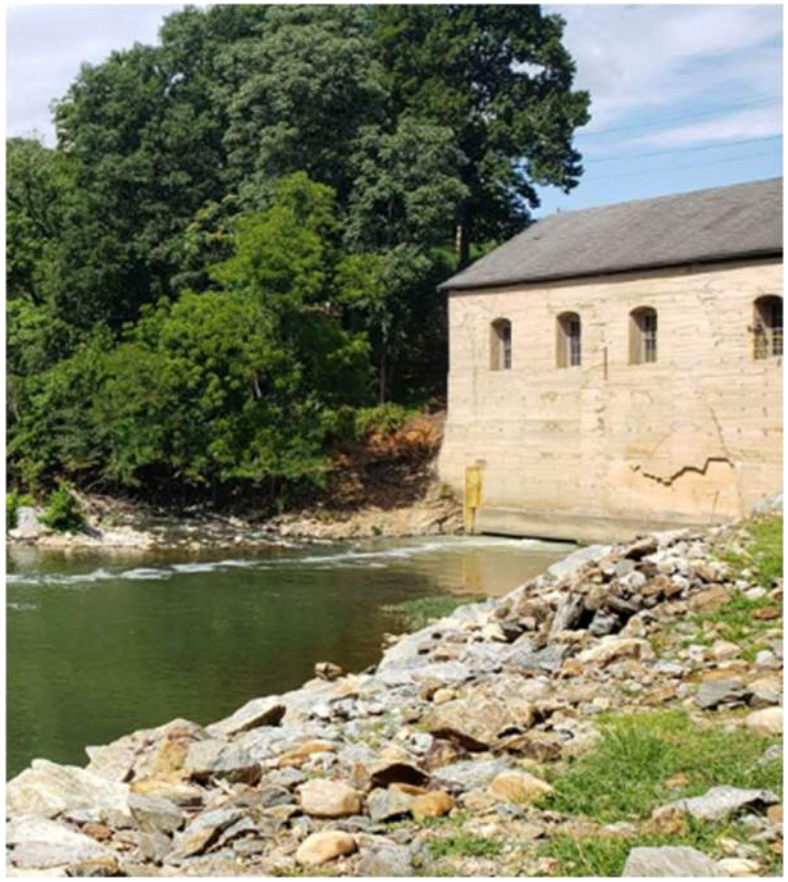
Fish Community Study



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Fish Community Study

- **Study Goal:** Obtain current information on the fish community in the Roanoke River in the vicinity of the Project to support an analysis of Project effects
- **Study Components:**
  - 2020 Fish Community Survey – Presented in ISR
  - 2021 Roanoke Logperch Survey
  - Impingement and Entrainment Study

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2021 Roanoke Logperch Survey

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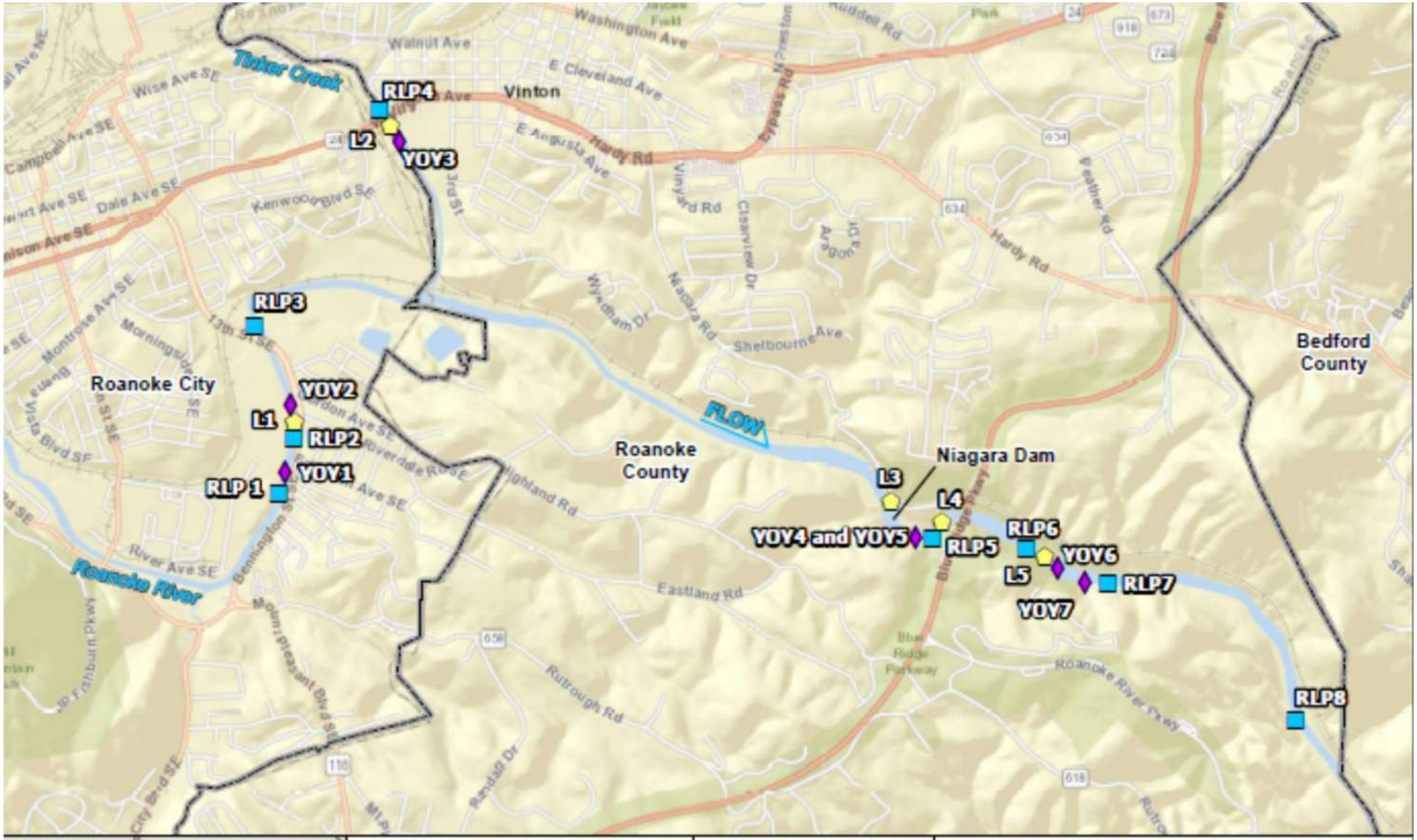
Roanoke Logperch Survey

Specific Objectives:

- Establish baseline abundance and distribution of Roanoke Logperch (including larvae, young-of-year [YOY], and adults) in the Roanoke River near the Project

Study Status:

- Roanoke Logperch YOY surveys were completed in 2021 in accordance with the RSP and SPD.
- Roanoke Logperch adult surveys were completed in 2021 using snorkel survey methods, a method change approved by VDWR and USFWS.
- Roanoke Logperch Larval Drift Survey rescheduled for spring 2022 due to delays in receiving the federal recovery permit from USFWS.
- Laboratory analyses to be performed under direction of Dr. Angermeier and Dr. Hallerman at Virginia Polytechnic Institute and State University.


Tinker Creek
RLP4
L2
YOY3
Vinton
RLP3
Roanoke City
YOY2
L1
RLP2
YOY1
RLP 1
Roanoke River
FLOW
Roanoke County
Niagara Dam
L3
L4
YOY4 and YOY5
RLP5
RLP6
YOY6
L5
RLP7
YOY7
RLP8
Bedford County
Legend
Drift Net Survey
Seine Survey
Snorkel Survey
County Boundary
N
0
400
800
Meters
Scale: 1:31,496
American Electric Power
Niagara Dam Roanoke Logperch Study
Map 1
Overall Niagara Project area including Adult (RLP), Young-of-Year (YOY), and Larval (L) survey sites on the Roanoke River in Roanoke County, Virginia.

Roanoke Logperch Survey

Survey Methods

- A quantitative assessment of suitable habitat was performed at each adult survey site following Ensign et al. (2000), Anderson and Angermeier (2015), and Anderson (2016):
  - 4 variables (water depth, velocity, silt coverage, and substrate) measured along grid formed by primary transects and secondary transects spaced at 12-meter intervals perpendicular to the primary transects
  - Variables were used to develop a Habitat Suitability Index (HSI) score based on HSI curves developed by Ensign and Angermeier 1994 and Ensign et al. 1998

Roanoke Logperch Survey

Survey Methods – Adults

- Snorkel surveys for adult Roanoke Logperch were performed at 8 riffle/run sites which included 4 to 9 transects varying from 30 to 235 meters in length.
- Snorkelers performed visual searches along transects/grids, moving from downstream to upstream and parallel to stream flow, while searching directly in front and from side-to-side.
- The distance from the snorkeler's centerline and the point where a Roanoke Logperch was initially observed was measured and recorded, followed by a GPS point, measurements for depth, velocity, silt cover, and five substrate measurements based on a modified Wentworth scale.

Roanoke Logperch Survey

Survey Methods – Young-of-Year

- Seining methods for young-of-year were derived from Argentina and Roberts (2014) and Roberts et al. (2016)
- 6 ft by 6 ft seine with 1/16-inch mesh
- Seine samples upstream of Niagara Dam:
  - 2 sites in the Roanoke River and one site in Tinker Creek; 20 seine hauls each site
- Seine samples downstream of Niagara Dam:
  - 2 sites in the bypass reach and 2 sites downstream of the tailrace; 20 seine hauls each site
- Seine samples were supplemented with visual searches along shoreline adjacent to low velocity habitats

Roanoke Logperch Survey

Statistical Analyses

- Adult Roanoke Logperch densities were calculated for each site per Ensign et al. (1995) and then compared to densities previously reported by Appalachian 1992 and other locally relevant studies

- No statistical analyses were necessary for young-of-year as none were collected during the survey

Roanoke Logperch Survey

Survey Results:

- Survey completed 5,460 meters of transections covering 21,688 square meters of habitat
- 61 Roanoke Logperch observations (7 juvenile and 54 adult) distributed amongst excellent (9), good (28), fair (22), and poor (2) quality habitats
- Mean density within Project boundary of 32 fish/hectare (SD=19.8)
- Mean density above Niagara Dam (23 logperch/hectare) compared to below Niagara Dam (24 logperch/hectare) was similar
- Mean density in Tinker Creek at 32 fish/hectare
- The average density of Roanoke Logperch between the spring and summer sample events in the bypass reach was 58 fish/hectare

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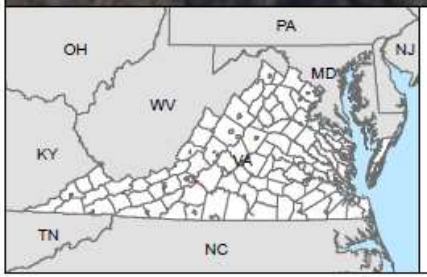
Roanoke Logperch Example



Roanoke Logperch Sighting
Snorkel Transect
Excellent Habitat
Good Habitat
Fair Habitat
Poor Habitat

N

0 10 20
Meters

Scale: 1:787

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EDGE ENGINEERING & SCIENCE

American Electric Power
Niagara Dam Roanoke Logperch Study

Map 10
Adult RLP snorkel survey extent including habitat suitability and RLP sighting locations in Roanoke, Virginia.

Roanoke Logperch Survey

Survey Summary:

- Appalachian 1992 documented 10 Roanoke Logperch approx. 1 mile downstream of Niagara Dam and concluded that the logperch were not expected to populate the Project boundary outside of the reach where the fish were located
- Regardless of Project influence, Roanoke Logperch were documented in poor to excellent quality habitats, at all of the survey sites, with the greatest density in the bypass reach
- Site densities ranged from 4.6 to 72.4 logperch per hectare; while the mean density within the overall Project boundary was 32 fish/hectare
- Results suggest that the Roanoke River in the Project boundary is supporting a robust population of Roanoke Logperch

Variances from FERC-approved Study Plan

Roanoke Logperch Survey

- Rescheduled from spring 2021 to spring 2022 due to delays in receiving the required USFWS federal recovery permit authorizing “take” of larval Roanoke Logperch
- Switch from 4 paired sites to 8 independent sites for the adult survey and added one YOY site in bypass reach and one downstream of tailrace per SPD
- Minor adjustments to survey site locations based on target habitat availability at the time of sampling
- Switch to snorkel methods for adult Roanoke Logperch instead of backpack electrofishing, with agency approval

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Impingement and Entrainment Study

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Impingement and Entrainment Study

Specific Objectives:

- Calculate approach velocities at the intake structure
- Assess entrainment potential at the Project during project hydropower generation
- Model turbine and spillway passage survival using the USFWS Turbine Blade Strike Analysis Model (2020)

Study Status:

- Appalachian completed the Impingement and Entrainment Study in accordance with the methods described in the RSP and SPD

Impingement and Entrainment Study

Assessment Methods

- **2020 Study Efforts – presented in ISR**
  - Compiled intake specifications, flow characteristics, and calculated approach velocity, identified target species/groups
  - Assessed potential of impingement or entrainment including intake avoidance, size exclusion, and early life stage entrainment
  - Estimated entrainment rates based on 33 facilities in the EPRI database

Impingement and Entrainment Study

2020 Study Results – Presented in ISR

- Intake avoidance and Impingement
  - Approach velocity - 1.1 fps
  - Swim burst speeds indicate that most juvenile and adult species can overcome approach velocities and avoid the intake
  - Bar rack spacing wide enough that most fish are easily entrained through the bars – if they cannot overcome velocities
- Early life stage entrainment susceptibility
  - Spawning primarily from May-June, subsequent egg and larval development from June-August
  - Spawning habitats required for most resident fish are not found in the vicinity of the intake structure; therefore, entrainment potential is considered low for most early life stages.

Impingement and Entrainment Study

Assessment Methods

- **2021 Study Efforts – presented in USR**
  - Estimated fish passage and blade strike survival using USFWS Turbine Blade Strike Analysis model (USFWS 2020)
  - Modeled under two operational scenarios
    - Typical/normal flow conditions – no spill beyond required min bypass flows
    - Spilling conditions* – flows distributed to turbines or spillway based on project-specific flow exceedance percentiles

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Fish Impingement and Entrainment Study

Methods - Operational Scenario 1:

- Estimated turbine blade strike probability and fish passage survival
- Based on typical/normal flow conditions where all flows pass through the Niagara turbines and powerhouse (no spill beyond the 8 cfs minimum bypass flow requirement)
- Estimated strike probability by fish length classes (2, 4, 6, 8, 10, 15, 20, 25, and 30 inches)
- Route selection probability based on percentage of flows passed at Niagara Unit 1 (54.8% of flows), Unit 2 (44.1% of flows), and required bypass flows (1.2% of flows)

Fish Impingement and Entrainment Study

Methods - Operational Scenario 2:

- Estimated turbine blade strike probability and fish passage survival during spilling conditions
- Route probabilities based on volume of spillage at the range of percentiles where river discharge exceeded turbine capacity
  - Unit 1 (379 cfs), Unit 2 (305 cfs), required bypass flows (8 cfs), and spillage flows at 20, 17, 15, 12, 10, 7, 5, 2, and 0.01 percent exceedances.
  - Modeled for 4-inch Roanoke Logperch with standard deviation of 0 inches based on site-specific data and the typical size of Roanoke Logperch expected to be entrained at hydroelectric projects (Froese and Pauly 2021).

*The probability of a fish passing through a turbine or via spill was assumed to be in direct proportion to the volume of flow passing through each route. A spillway and bypass passage survival rate of 97 percent was assumed based on the average of 136 survival tests conducted with juvenile salmonids on the Columbia river (Amaral et al. 2013).

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Impingement and Entrainment Study Results

Scenario 1 Results – Strike and Survival Probabilities by Fish Size Class (all species) under Typical Operations

Size Class (inches)	Blade Strike Probability	Bypass Failure Probability	Survival Probability
0-2	8.7	0.1	91.2
2.1-4	18.2	0.1	81.8
4.1-6	26.3	0.0	73.7
6.1-8	34.3	0.0	65.7
8.1-10	46.4	0.0	53.6
10.1-15	66.0	0.0	34.0
15.1-20	89.8	0.0	10.2
20.1-25	98.9	0.1	1.0
25.1-30	98.8	0.1	1.0

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Impingement and Entrainment Study Results

Scenario 2 Results – Roanoke Logperch Passage

Flow Data Period	Flow Exceedance (%)	Volume Spill (cfs)	Spill Route Selection Probability	Turbine Strikes (%)	Spillway Mortalities (%)	Cumulative Downstream Passage Survival (%)
Annual	20	13	0.018	18.4	0.2	81.4
Annual	17	88	0.113	16.4	0.3	83.3
Annual	15	153	0.181	13.7	0.7	85.7
Annual	12	288	0.294	11.9	1	87.1
Annual	10	398	0.365	13.6	1.1	85.2
Annual	7	678	0.495	9.4	1.5	89.1
Annual	5	1,008	0.593	6.7	1.3	92
Annual	2	2,218	0.762	4.1	2.4	93.5
Annual	0.01	18,109	0.963	0.8	3.2	96

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Fish Impingement and Entrainment Study

Turbine Blade Strike Results Summary

- Cumulative passage survival for 4-inch Roanoke Logperch was:
  - Between 81.4 and 96.0 percent
  - Highest cumulative survival would occur at the 0.01 % flow exceedance when approx. 18,109 cfs of river flows would be spilled into the bypass channel
  - Survival increases with increasing spill volume due to low spill mortality and reduced blade strike probability
- Risk of spillway mortality was low at 0.1 percent or less across all fish length classes
- Fish length classes most at risk of entrainment (<6 inches) are estimated to have cumulative downstream passage survival between 73.7 and 91.3 percent

Variances from FERC-approved Study Plan

Variances from FERC-approved Study Plan:

- Intake velocity
  - Unable to evaluate with ADCP due to high low events and station operation
  - Determined using desktop calculation

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Benthic Aquatic Resources Study

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Benthic Aquatic Resources Study

- **Study Goal:** Obtain current information on the benthic aquatic community in the Roanoke River in the vicinity of the Project to support an analysis of Project effects
- **Specific Objectives:**
  - Quantify the amount of benthic habitat available for macroinvertebrates, crayfish, and mussels within the bypass reach;
  - Collect a baseline of existing macroinvertebrate and crayfish communities in the vicinity of the Project using two temporally independent sampling efforts (fall 2020 index period and spring 2021 index period); and
  - Identify potential habitat and characterize mussel communities within the Study Area.

Benthic Aquatic Resources Study

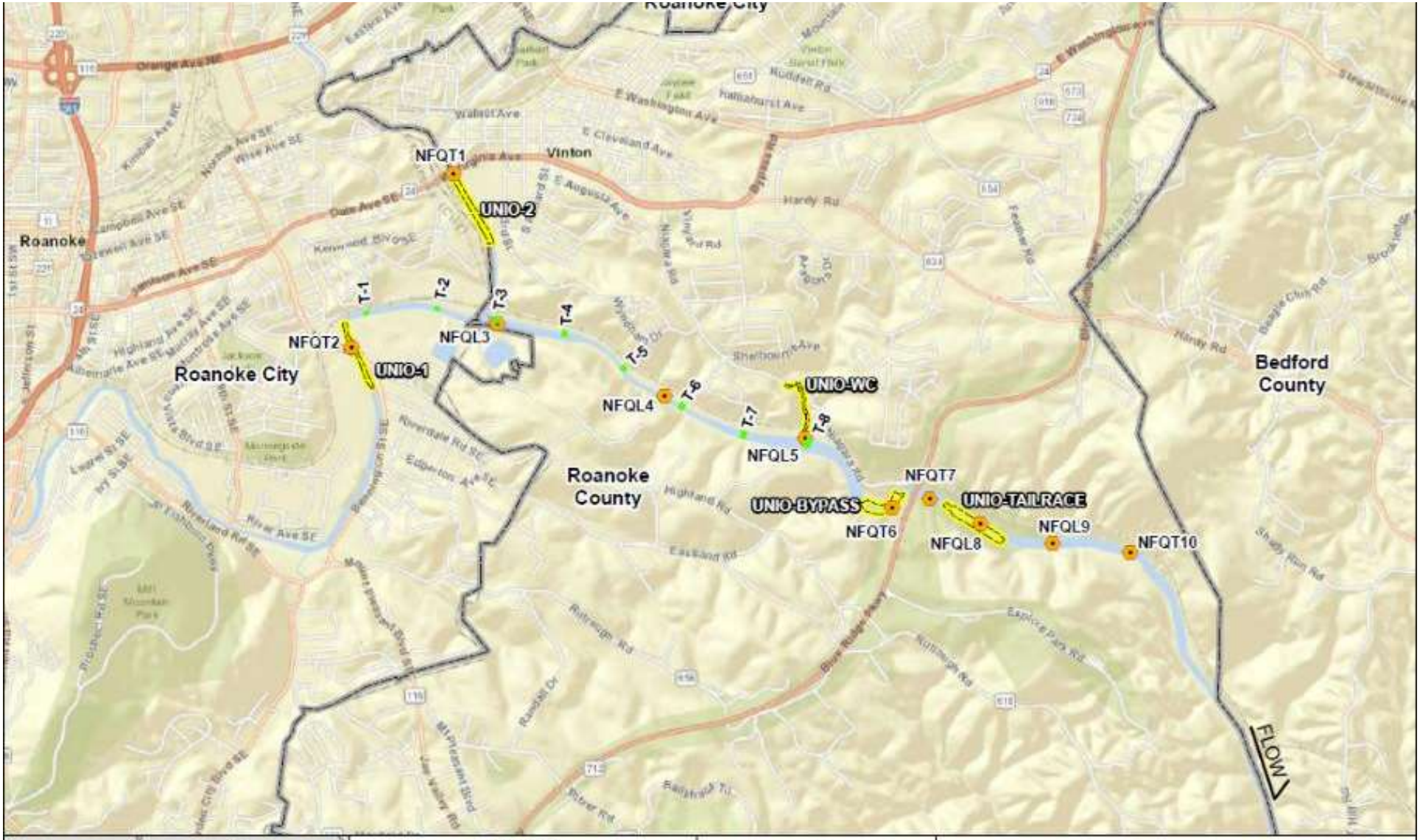
Study Status

- Appalachian completed study activities for the Benthic Aquatic Resources Study in accordance with the schedule and methods described in the RSP and SPD.
  - Completed fall 2020 and spring 2021 field sampling
  - Taxonomic identification was completed summer 2021
  - Mussel survey completed in 2020 and reported in the ISR, no further discussion provided

Benthic Aquatic Resources Study

Macroinvertebrate and Crayfish Study Methods

- September 15-16 and October 5, 2020 – fall index period
- June 3-4, 2021 - spring index period
- Quantitative Transect Samples
  - 5 riffle/run sites along 100-m transects, 2 above and 3 below Niagara dam
  - Each site consists of 6 kick net sets composited into one sample
  - Each sample equals approximately 2 square meters
  - Crayfish data supplemented with seine hauls
- Qualitative Abbreviated Samples
  - 5 pool sites, 3 above and 2 below Niagara dam
  - 20 dip-net grabs of representative habitats in proportion to their availability
  - Each sample covers approximately 1 linear meter of habitat



Legend

- Macroinvertebrate Sample Location
- Mussel Survey Transect
- Mussel Survey Area
- County Boundary

N

0 0.5 1

Kilometers

Scale: 1:39,370

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Niagara Dam Benthic Aquatic Resource Study

Figure 1

Overall Niagara project area including quantitative (NFQT) and qualitative (NFQL) macroinvertebrate survey sites and transect (T) and abbreviated (UNIO) mussel survey sites on the Roanoke River in Roanoke County, Virginia

Benthic Aquatic Resources Study

Macroinvertebrate Study Results

- Sites Upstream of Niagara Dam
  - 38 macroinvertebrate taxa collected from 2 quantitative sites and 3 qualitative sites
  - Average fall 2020 VSCI scores at riffle/run sites was 48.1 and for pool sites was 34.7
  - Average spring 2021 VSCI scores at riffle/run sites was 44.1 and pool sites was 20.6
- Sites downstream of Niagara Dam
  - 45 macroinvertebrate taxa from 3 quantitative and 2 qualitative sites
  - Average fall 2020 VSCI scores at riffle/run sites was 39.0 and for pool sites was 42.8
  - Average spring 2021 VSCI scores at riffle/run sites was 38.1 and for pool sites was 41.1

Benthic Aquatic Resources Study

Crayfish Study Results

- 5 species of crayfish collected and identified in the field during survey efforts at 8 of the 10 sites
- *Native Species*
  - Collected two native species upstream and one downstream of dam
  - Appalachian Brook Crayfish (*Cambarus bartoni bartoni*)
  - Atlantic Slope Crayfish (*Cambarus longulus*)
- *Invasive Species*
  - Collected two species upstream and three species downstream of dam
  - Ozark Crayfish (*Faxonius ozarkae*) – present at all sites where crayfish collected
  - Virile Crayfish (*Faxonius virilis*)
  - Red Swamp Crayfish (*Procambarus clarkii*)

Atlantic Slope Crayfish

Virile Crayfish

Benthic Aquatic Resources Study

Macroinvertebrate Study - Summary

- VSCI scores indicate impaired conditions above and below Niagara Dam in both fall and spring samples

- Crayfish community diversity and abundance was low compared to the number of known crayfish species in Virginia

- More invasive crayfish species were documented in the Project boundary than native species

Variances from FERC-approved Study Plan

- The macroinvertebrate and mussel sampling efforts were completed in accordance with the RSP and SPD.

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Water Quality Study

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Water Quality Study

Study Goal: Conduct a study to support an analysis of the potential Project-related effects on water quality

Specific Objectives:

- Gather baseline water quality data sufficient to determine consistency of existing Project operations with applicable Virginia state water quality standards and designated uses
- Provide data to determine the presence and extent, if any, of temperature or dissolved oxygen (DO) stratification in the Niagara impoundment
- Provide data to support a Virginia Water Protection Permit application (CWA Section 401 Certification)
- Provide information to support evaluation of whether additional or modified protection, mitigation, and enhancement (PM&E) measures may be appropriate for the protection of water quality at the Project

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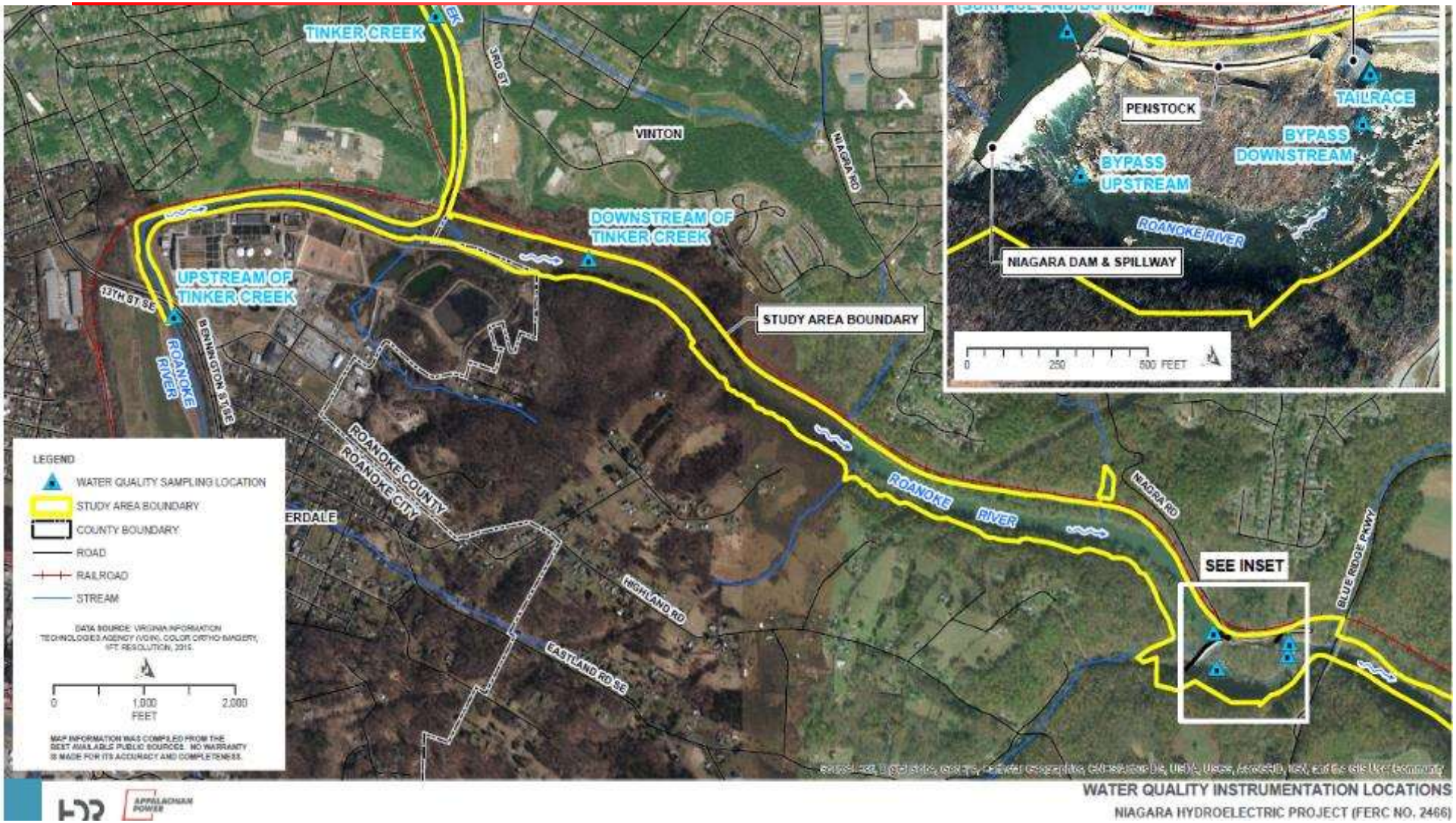
Water Quality Study Area



WATER QUALITY INSTRUMENTATION LOCATIONS

NIAGARA HYDROELECTRIC PROJECT (FERC NO. 2466)

Water Quality Study

Study Status

Appalachian has initiated and completed the Water Quality Study in accordance with the schedule and methods described in the RSP and SPD

Study Periods

2020: July 29 – November 10

- 13th Street Bridge
- Tinker Creek
- Downstream of Tinker Creek
- Forebay
- Tailrace
- Bypass reach (2 locations)

2021: June 29 – October 27

- 13th Street Bridge (USGS data)
- Tinker Creek (USGS data)
- Forebay (vertical profiles)
- Tailrace
- Bypass reach (2 locations)

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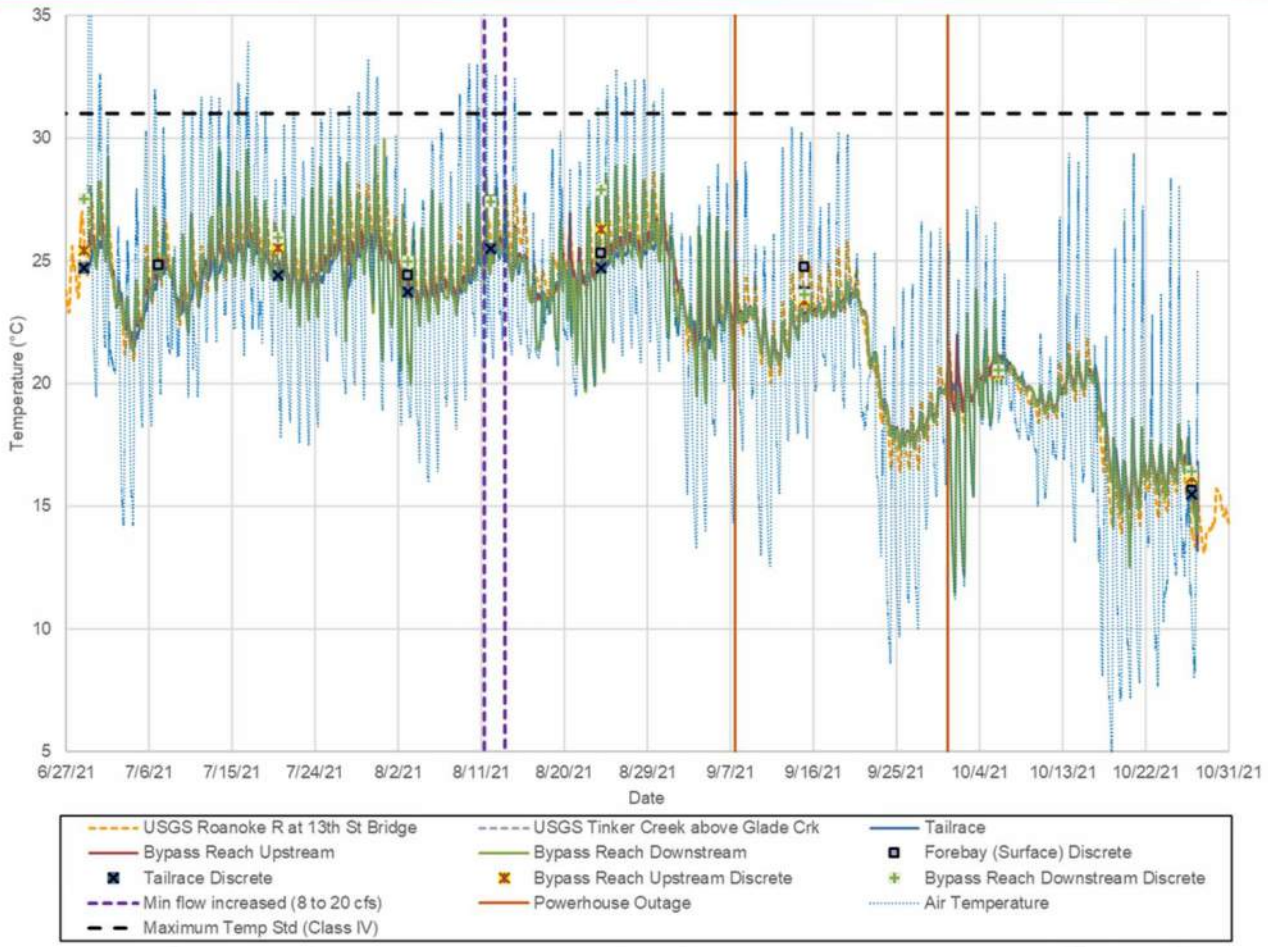
Water Temperatures



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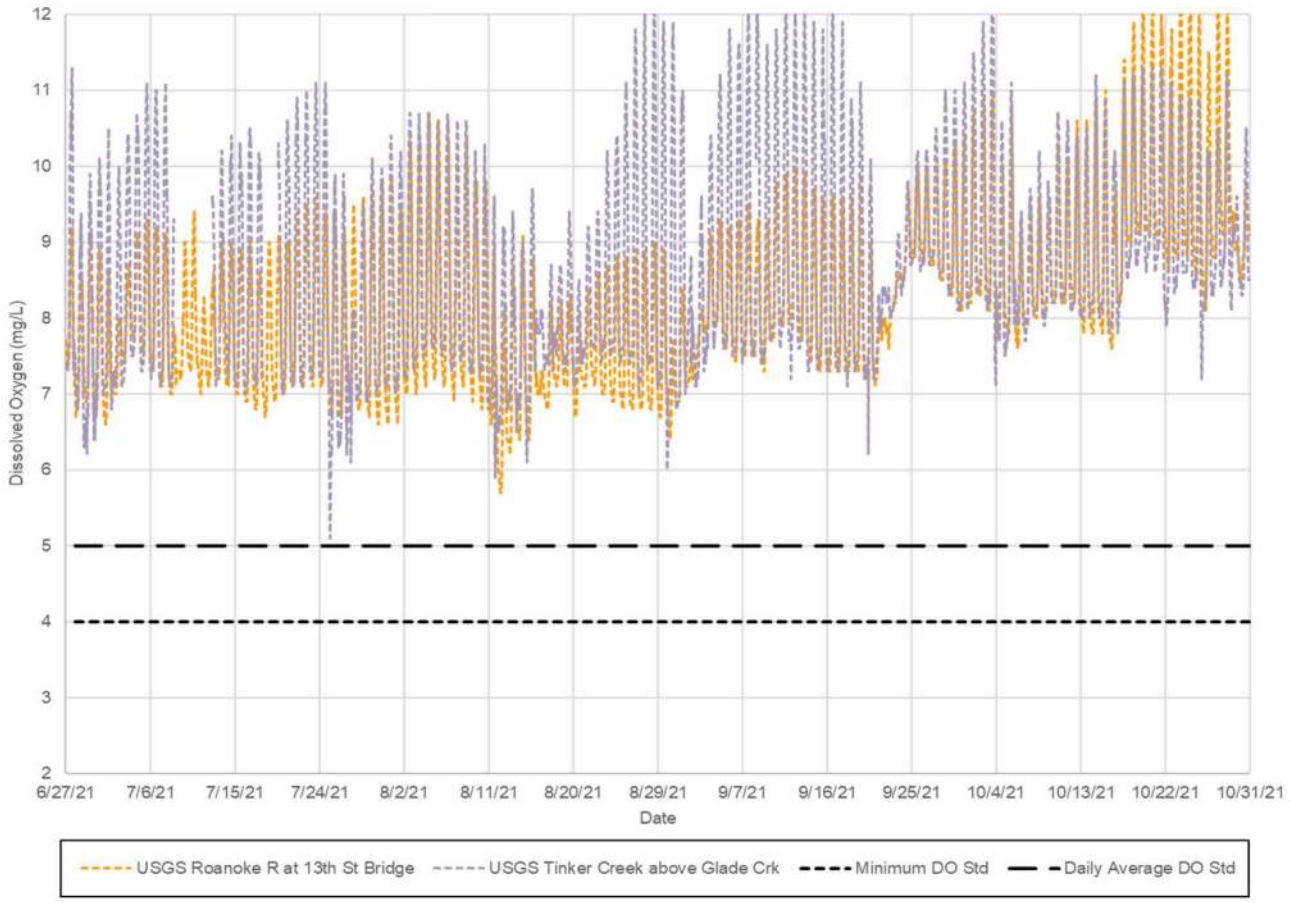
Dissolved Oxygen Upstream Monitoring



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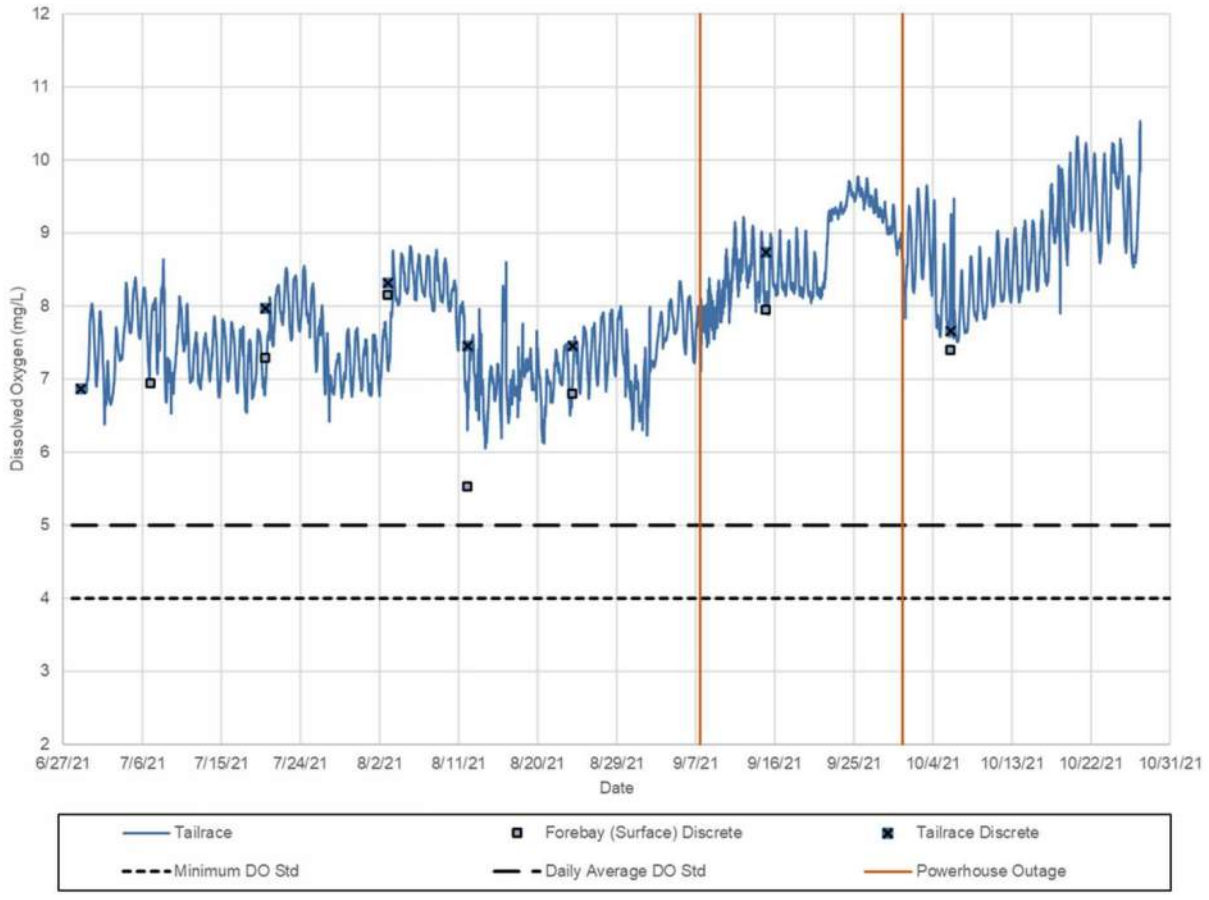
Dissolved Oxygen Forebay and Tailrace



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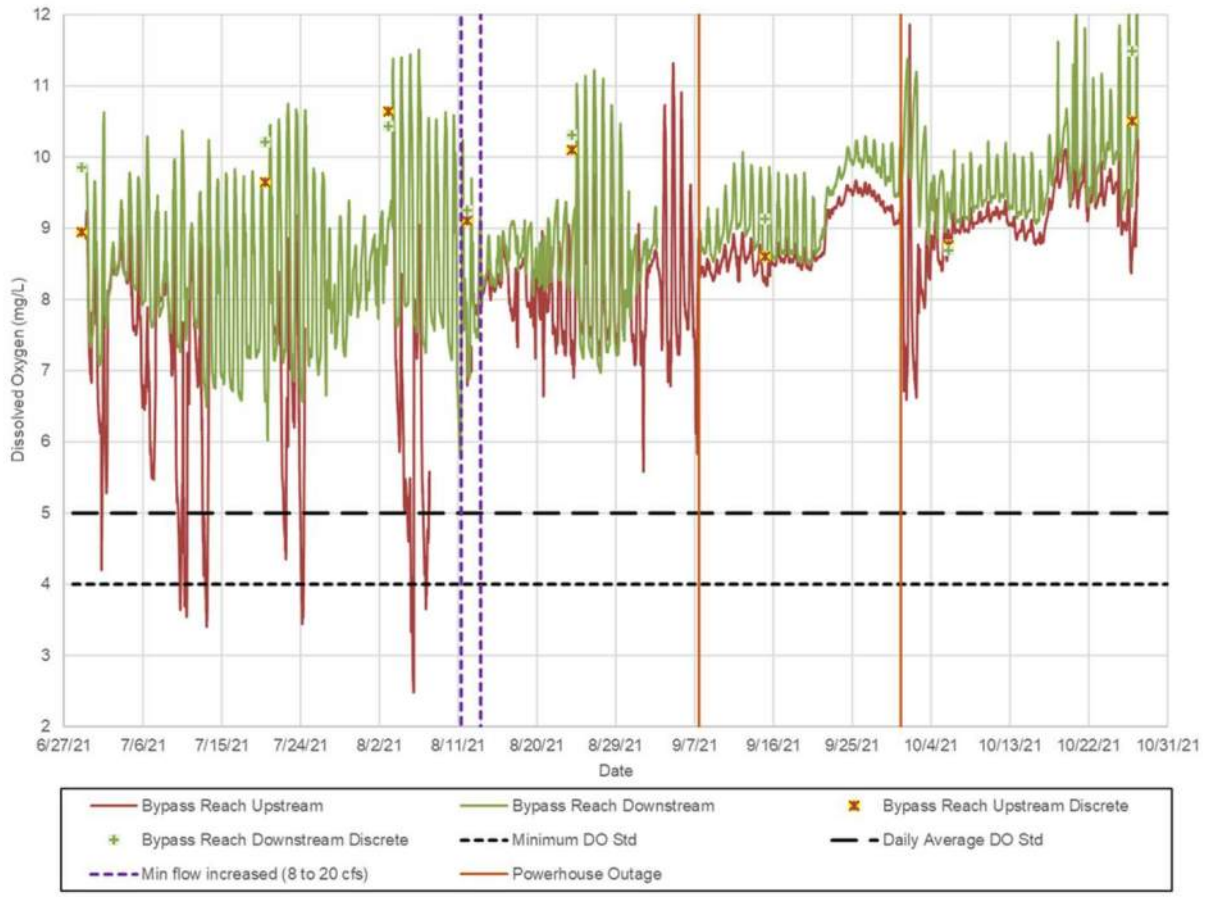
Dissolved Oxygen Bypass Reach



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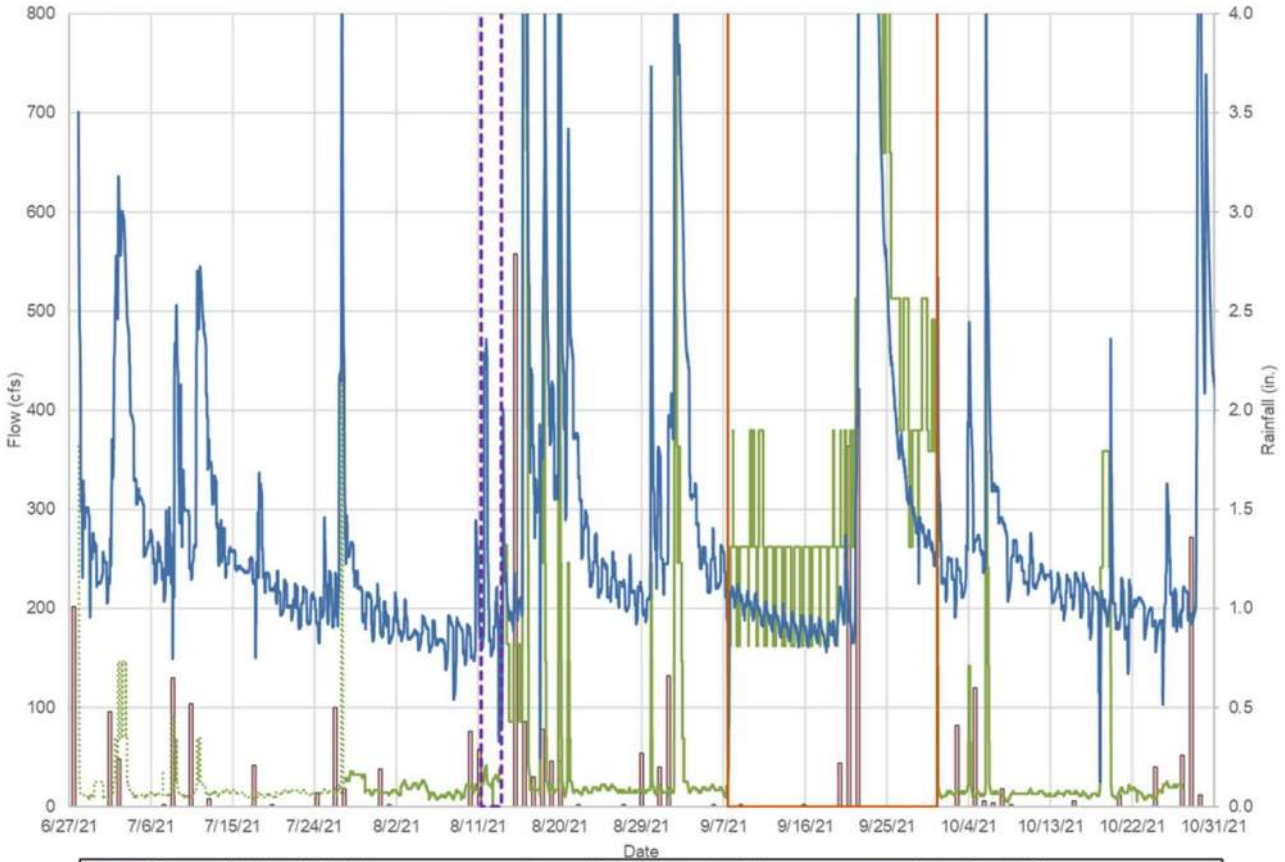
Bypass Reach Flows



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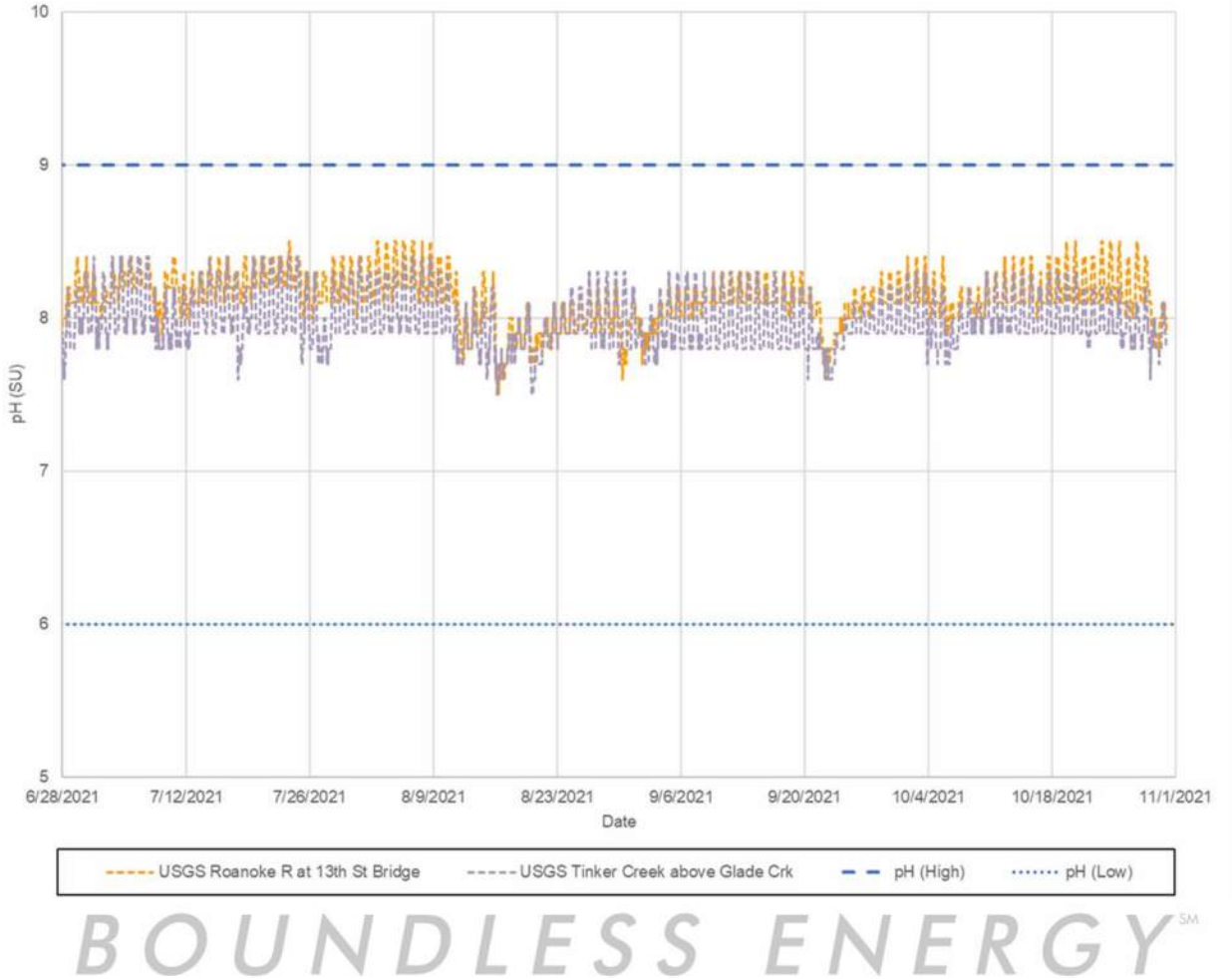
Upstream Monitoring - pH



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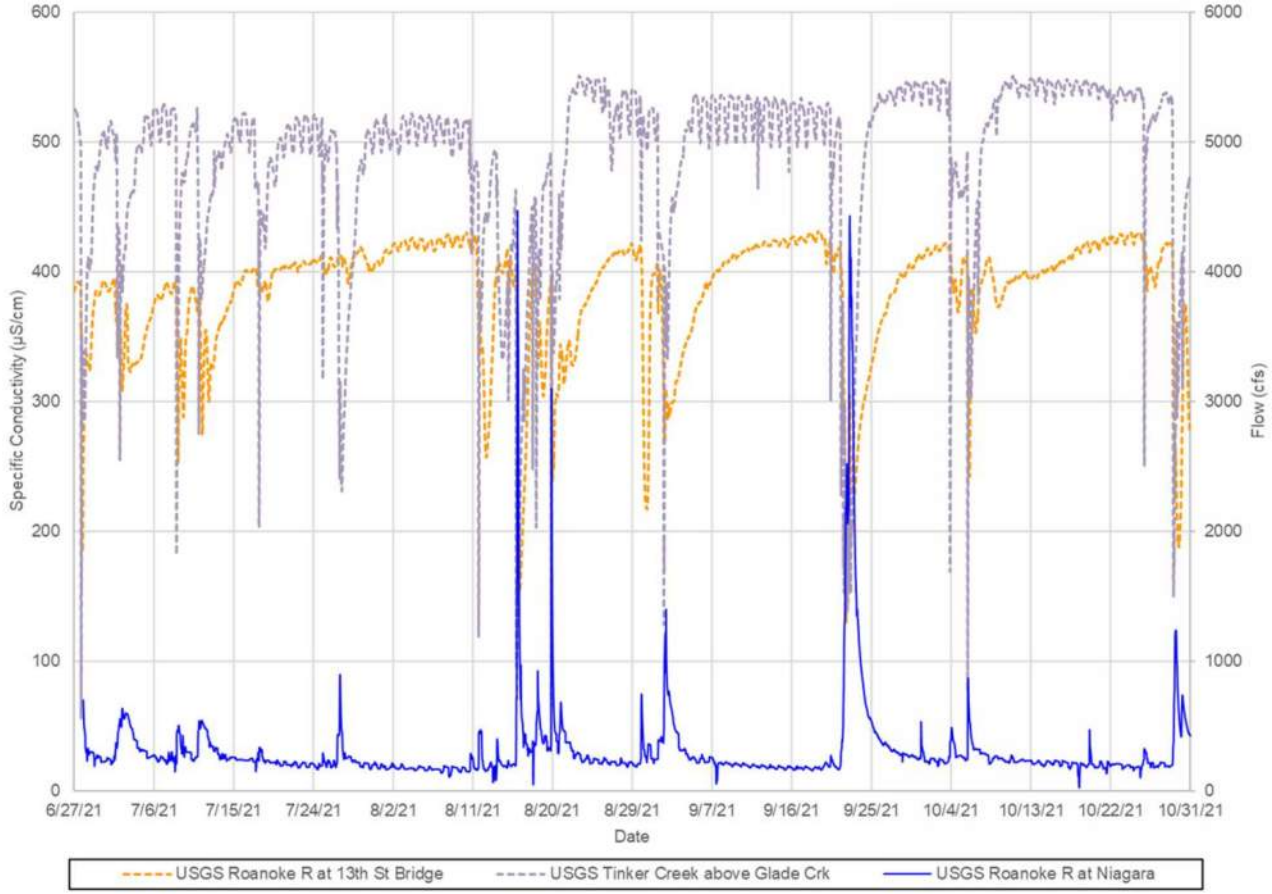
Upstream Monitoring Specific Conductivity



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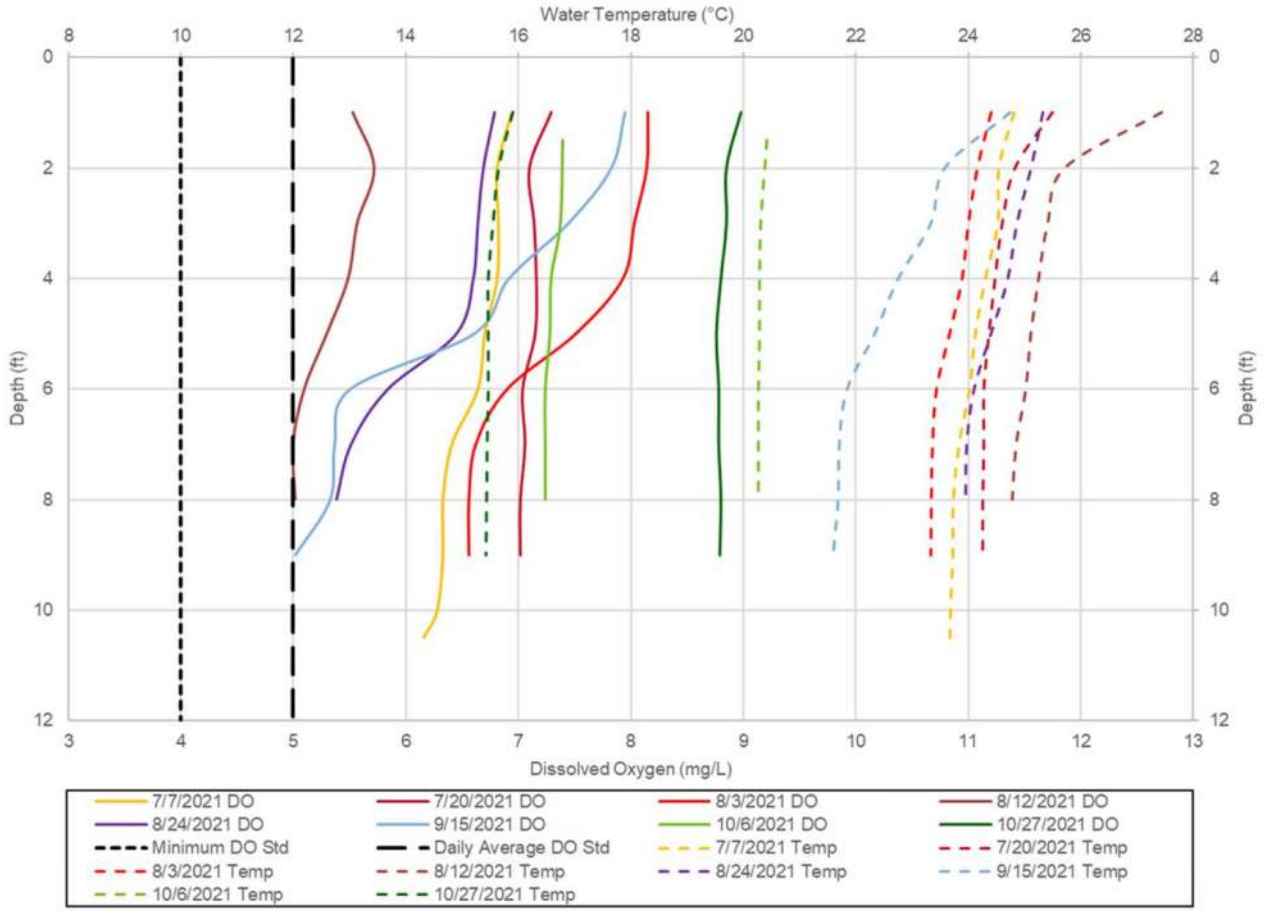
Forebay Vertical Profiles Temperature and DO



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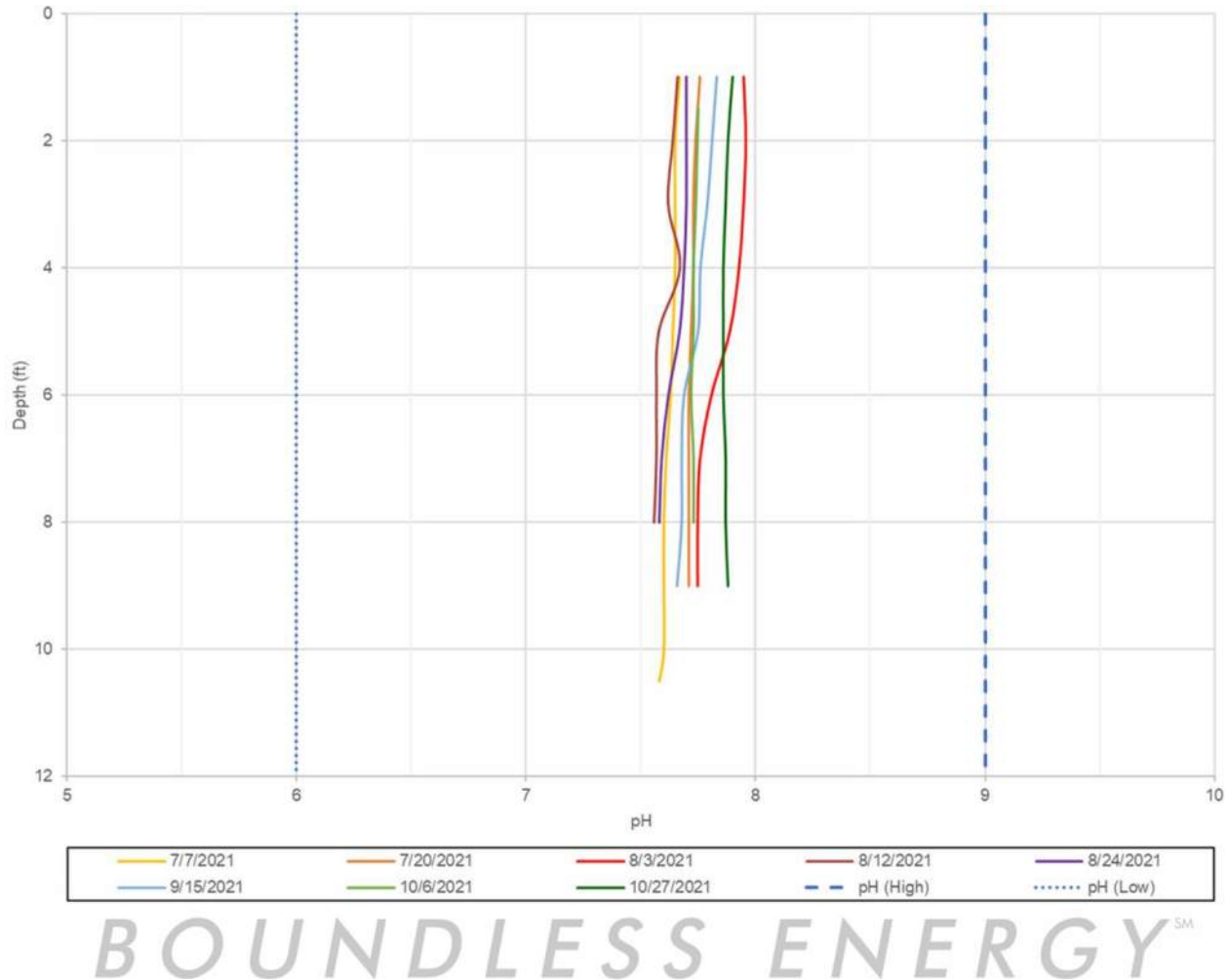
Forebay Vertical Profiles
pH



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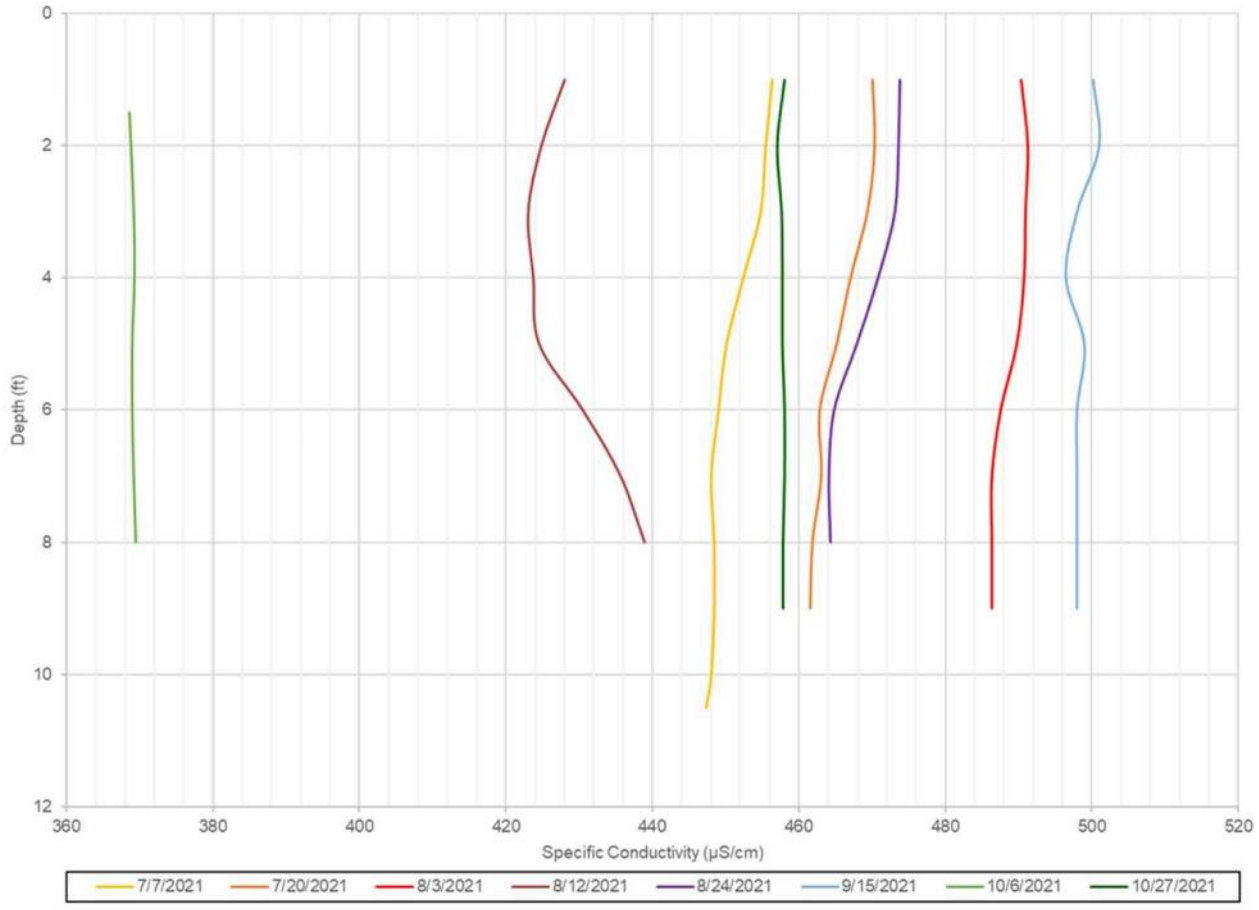
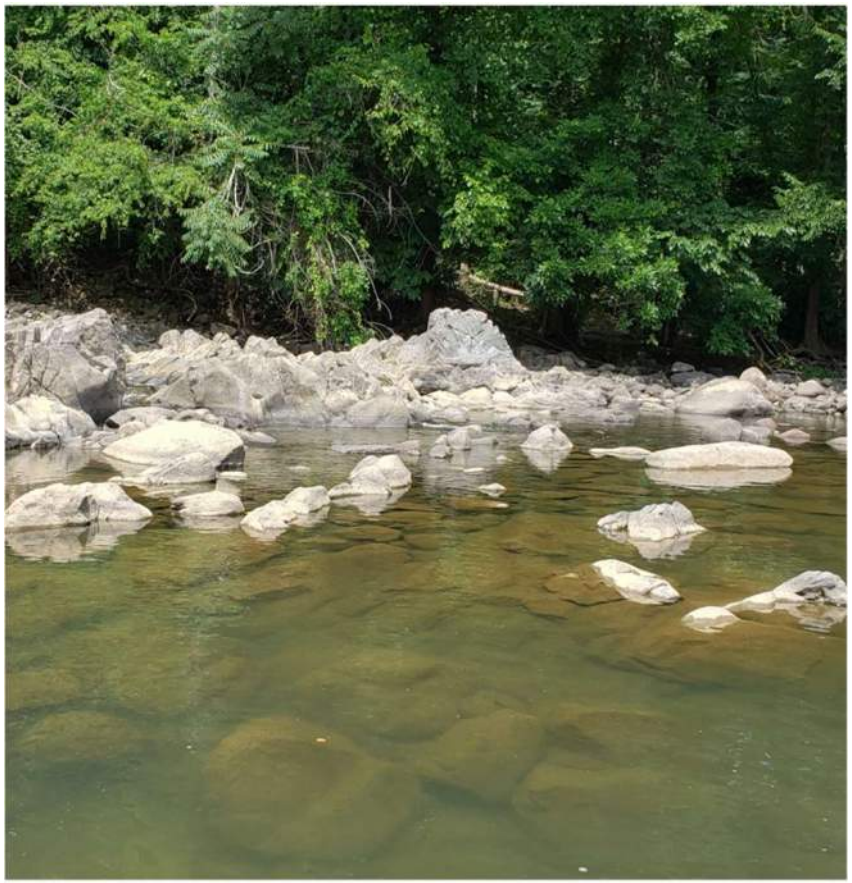
Forebay Vertical Profiles Specific Conductivity



Water Quality Study Summary and Conclusions

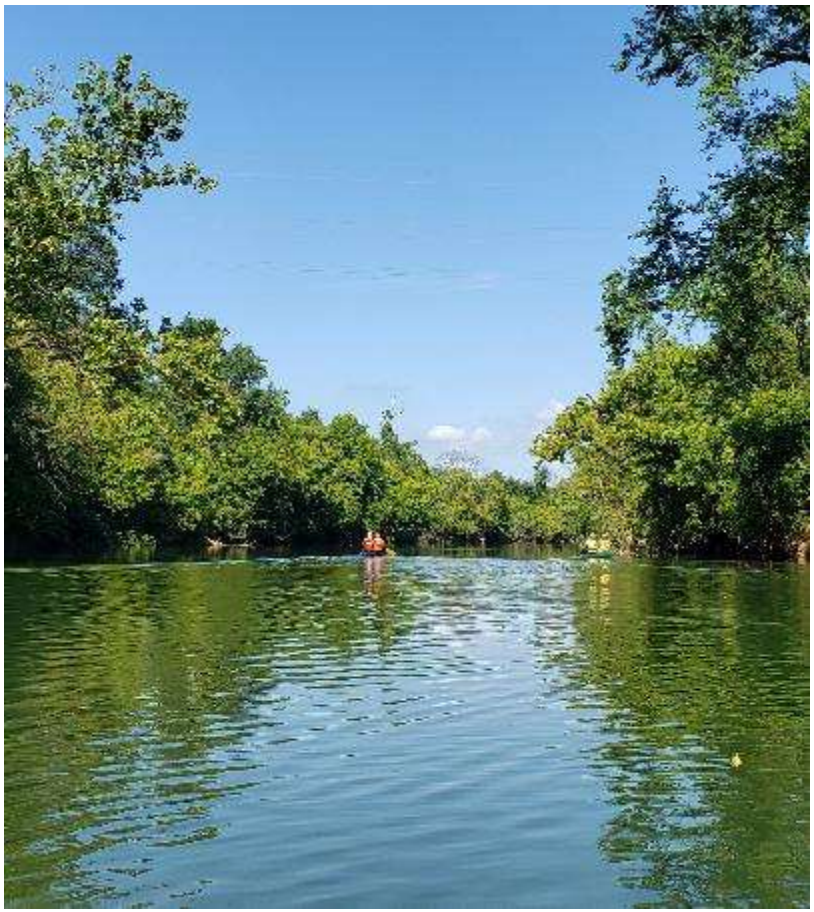
- Water temperatures, DO concentrations, and pH measurements largely met Virginia Class IV (Roanoke River) and Class VII (Tinker Creek) water quality standards during 2021
- The exception was the instantaneous DO standard (4 mg/l) at the upstream bypass reach monitoring location during the hottest portion of the summer when bypass flows were at the 8.0 cfs minimum required flow release
- Increasing the bypass reach flow to ~20 cfs resulted in increased DO concentrations at this location



Niagara Bypass Reach min flow 7.01.2021

Water Quality Study Summary and Conclusions

- pH and specific conductivity ranges are suitable for aquatic species
- Little to no thermal or DO stratification at the reservoir and forebay monitoring locations except during periods of low Project inflows or powerhouse outages
- As a result, no need for additional PM&E measures to protect water quality at the Project



Variances from FERC-approved Study Plan

- Based on the results and findings from the 2020 study, FERC approved a study modification requiring additional water quality data collection at Niagara in 2021.
  - Bypass reach (continuous monitoring; 2 locations)
  - Tailrace (continuous monitoring)
  - Forebay (vertical profiles during download events)
  - 13th Street Bridge (include data from USGS gaging location)
  - Tinker Creek (include data from USGS gaging location)

Afternoon break

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Bypass Reach Flow and Aquatic Habitat Study

Niagara Bypass Reach 24 cfs 6.30.2021

Bypass Reach Flow and Aquatic Habitat Study

Study Goal: Conduct a flow and habitat assessment of the Project's tailrace and bypass reach using desktop, field survey, and hydraulic/habitat modeling methodologies

Specific Objectives

- Delineate and quantify aquatic habitats and substrate types within the bypass reach
- Identify and characterize locations of habitat management interest within the bypass reach
- Determine surface water travel times and water surface elevation responses at various gate openings to:
  - Evaluate potential available habitat at the existing 8 cfs minimum bypass flow requirement
  - Evaluate potential seasonal minimum flow releases in the bypass reach

Bypass Reach Flow and Aquatic Habitat Study

Study Status

Appalachian initiated the Bypass Reach Flow and Aquatic Habitat Study in accordance with the methods described in the RSP and SPD

Study Periods

2020

- Completed desktop habitat mapping and evaluation of Project inflows
- Assembled/Developed Habitat Suitability Index (HSI) criteria
- Developed a model calibration target flow recommendation
- Study update presented at the ISR meeting during January 2021

2021

- Collected field data during 4 target calibration flow events
- Developed 2-D hydraulic model
- Developed habitat results for species of interest at the 4 target calibration flows

NIAGARA DEVELOPMENT BYPASS REACH STUDY AREA

NIAGARA HYDROELECTRIC PROJECT (FERC NO. 2466)

ROANOKE COUNTY, VIRGINIA

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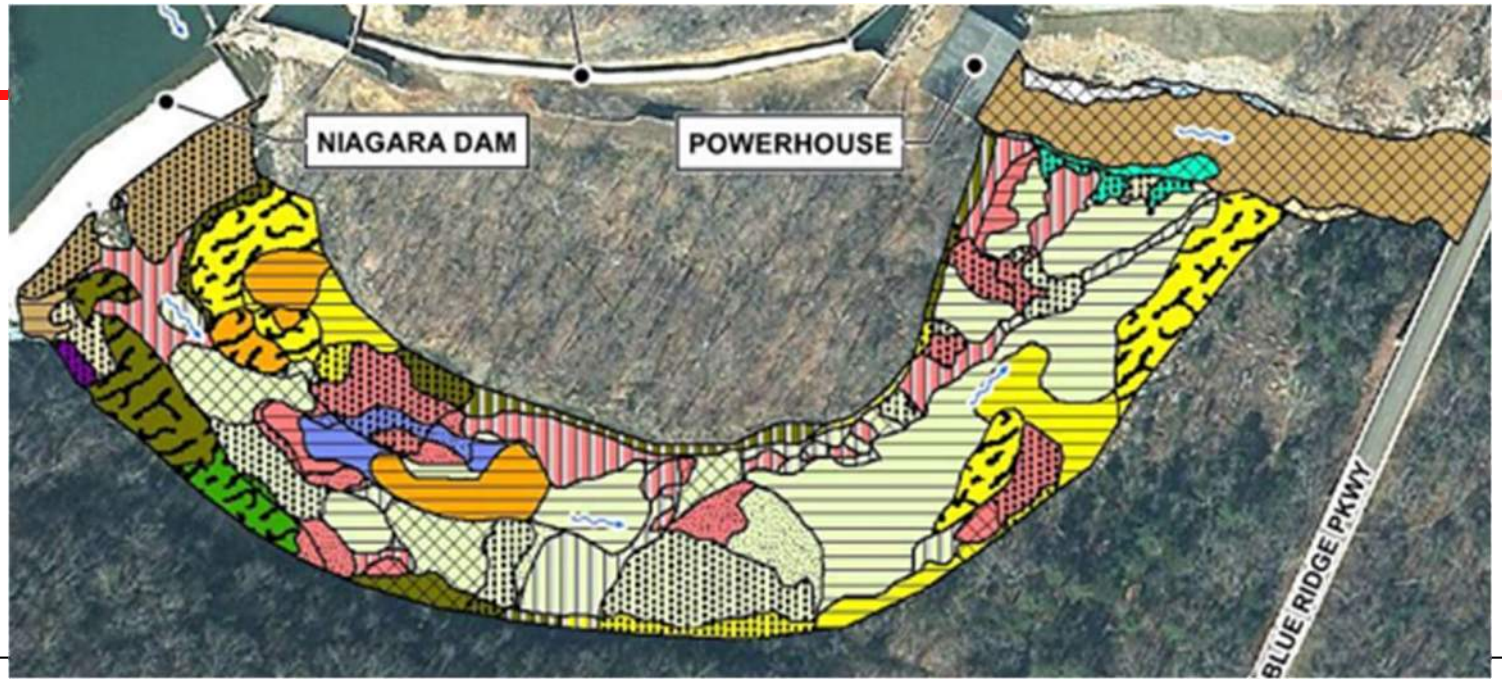
Desktop Habitat Delineation



Mesohabitat Type	Cover, Substrate Catagories	
Glide	No Cover, and Boulder	No Cover, and Sand
Pool	No Cover, and Boulder, Bedrock, or Woody Debris	No Cover, and Small Boulder
Riffle	No Cover, and Cobble	Overhead Veg and Boulder, Bedrock, or Woody Debris
Run	No Cover, and Gravel	Overhead Veg, and Cobble
Shoal	No Cover, and Mud or Bedrock	Overhead Veg, and Gravel
Upland		Overhead Veg, and Sand

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Summary of Aquatic Habitat Characteristics

Habitat Characteristics	Bypass	
	Area (ac.)	Percent
Cover		
Instream Cover	4.16	60.6
Overhead Vegetation	1.88	27.3
No Cover	0.83	12.1
Total	6.87	100.0
Substrate		
Boulder, Bedrock, or Woody Debris	4.34	63.2
Cobble	1.78	25.9
Mud or Flat Bedrock	0.35	5.2
Gravel	0.31	4.5
Sand	0.09	1.3
Total	6.87	100.0
Mesohabitat		
Shoal	2.20	32.1
Pool	1.65	24.1
Riffle	1.08	15.8
Upland	1.08	15.8
Run	0.49	7.2
Glide	0.35	5.1
Total	6.87	100.0

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Species of Interest RLP and Guilds

Species or Guild	Life Stage/ Category	Representative
Roanoke Logperch	Adult	--
	Subadult	--
	Young-of-Year	--
Shallow-Slow Guild	Fine substrate, no cover	Redbreast Sunfish spawning
	All substrate with aquatic vegetation	Silver Redhorse Young-of-Year
	Coarse substrate	Generic shallow-slow guild
Shallow-Fast Guild	Moderate velocity with coarse substrate	Generic shallow-fast guild
Deep-Slow Guild	Cover	Redbreast Sunfish Adult
	No cover	Generic deep-slow guild
Deep-Fast Guild	Slightly weighted for fine substrate, Cover	Silver Redhorse adult
	Coarse-mixed substrate	Shorthead Redhorse adult

Redbreast Sunfish
Courtesy: Virginia DWR

Silver Redhorse
Courtesy: USGS

Shorthead Redhorse
Courtesy: Iowa DNR

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Roanoke Logperch Habitat Suitability Indices

Habitat Suitability Criteria	Habitat Suitability Index
Mean Velocity (centimeters/second [cm/s])	**Adult**
0-10	0.15
11-20	0.40
21-30	0.81
31-40	0.90
41-50	1.00
51-60	0.73
61-70	0.83
>70	0.49
Depth (cm)	**Adult**
0-10	0
11-20	0.02
21-30	0.15
31-40	0.56
41-50	1.00
51-60	0.63
61-70	0.62
>70	0.21
Substrate	**Adult**
Silt (≤0.06 millimeters [mm])	0
Sand (0.07-2.00 mm)	0
Gravel (3-64 mm)	0.36
Cobble (65-256 mm)	1.00
Boulder/Bedrock (>256 mm)	0.56

Adult criteria based on Ensign et al. (1998) and Ensign et al. (2000)

Male Roanoke Logperch
Courtesy: The Roanoke Star News

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Roanoke Logperch Habitat Suitability Indices

Habitat Suitability Criteria	Habitat Suitability Index	
Mean Velocity (cm/s)	**Subadult**	**YOY**
0	0.00	0.27
1-4	0.00	1.00
4-10	1.00	0.09
11-40	0.17	0.00
>41	0.24	0.00
Depth (cm)	**Subadult**	**YOY**
0-15	0.00	0.06
16-30	0.67	1.00
31-50	1.00	0.00
>51	0.25	0.00
Substrate (rank)[1]	**Subadult**	**YOY**
<3	0.00	0.00
4-6	1.00	1.00
7	0.67	0.00
8-9	0.10	0.00

Subadult and YOY criteria based on Rosenberger and Angermeier (2003)

Rankings: 0-3=organic matter, clay, and silt; 4-6=sand, small gravel, large gravel; 7=cobble; 8-9=boulder and bedrock.

Male Roanoke Logperch
Courtesy: The Roanoke Star News

Niagara 2-D Hydraulic Model Calibration Flows

Measured Bypass Flows:

- Day 1, Minimum: 7 cfs
- Day 2, Low: 24 cfs
- Day 3, Middle: 33 cfs
- Day 4, High: 91 cfs

Generation Flows:

- Day 1: 225 cfs
- Day 2: 185 cfs
- Day 3: 175 cfs
- Day 4: 218 cfs

Niagara Spillway min flow
6.30.2021

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Niagara 2-D Hydraulic Model
Water Surface Elevation Monitoring

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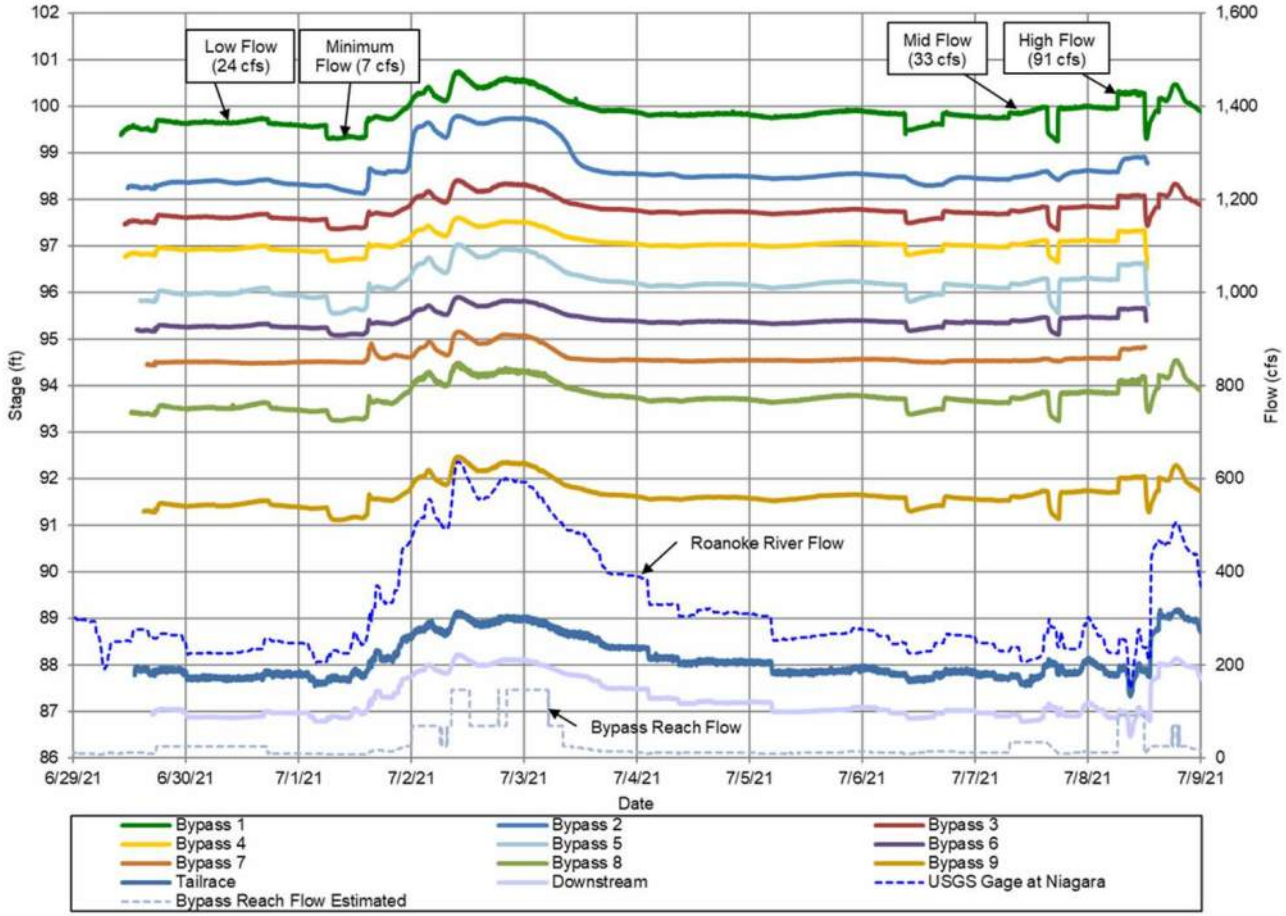
Niagara 2-D Hydraulic Model
Water Surface Elevation Monitoring



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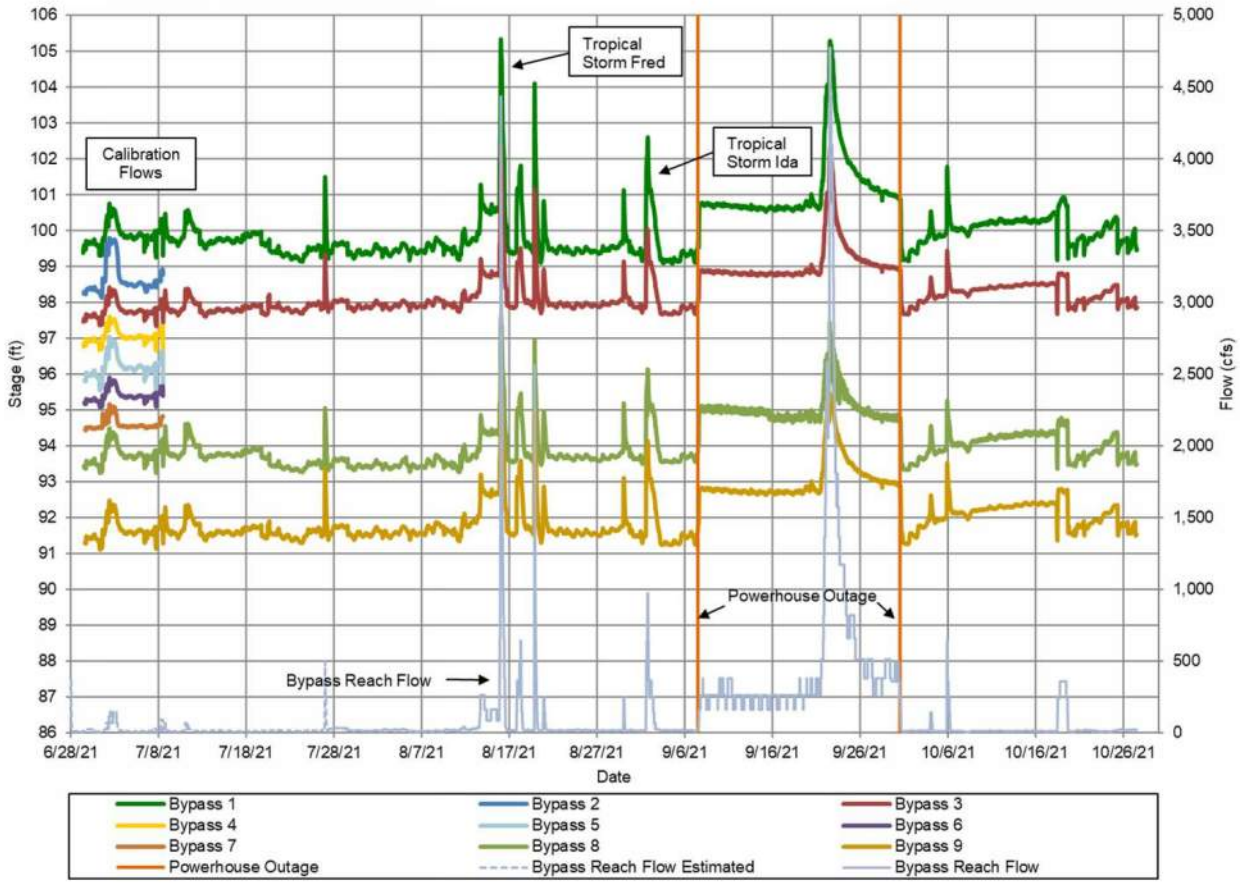
Niagara Bypass Reach Flows and Water Surface Elevations



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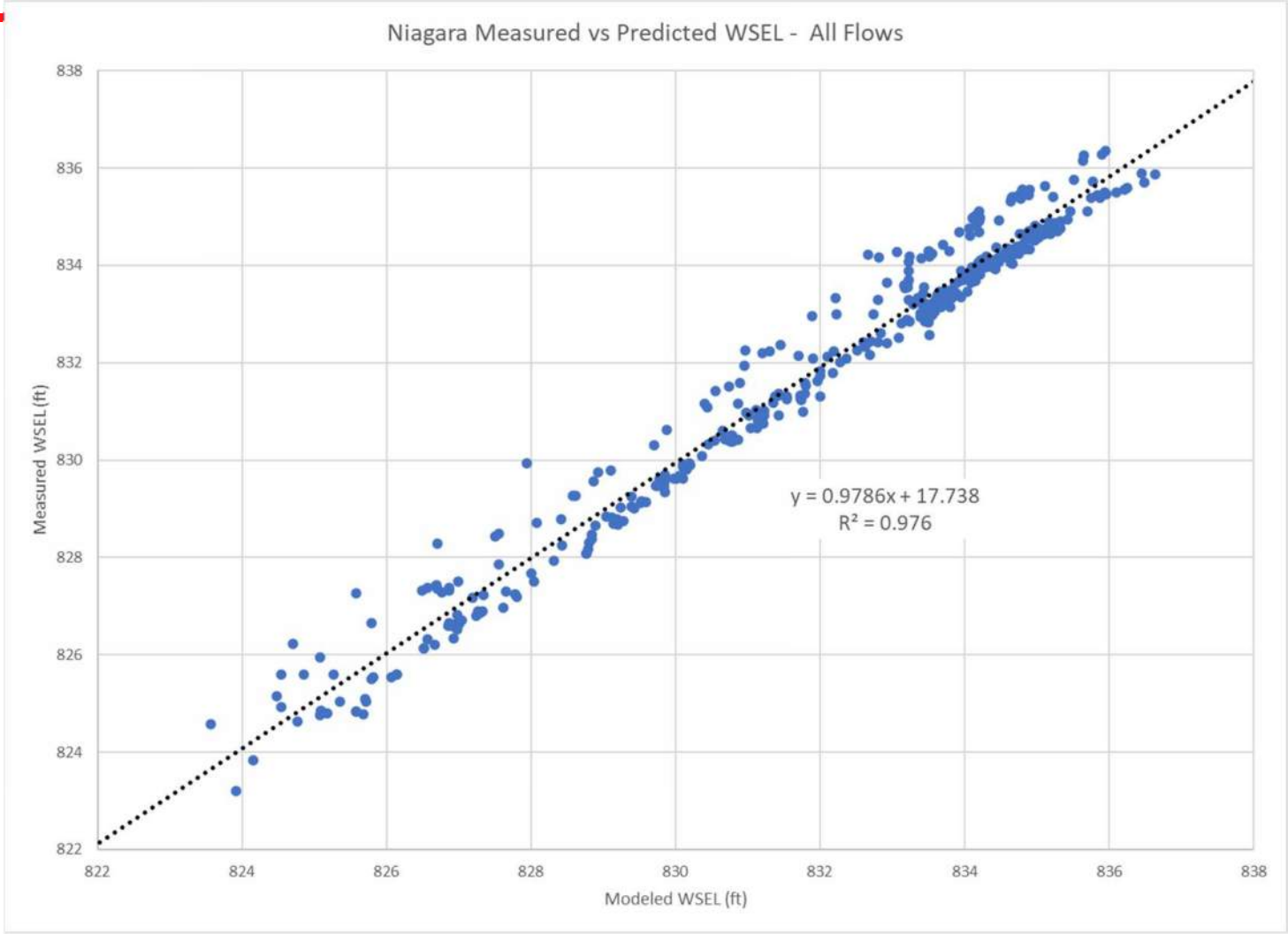
Niagara 2-D Hydraulic Model
Calibration Results – Water Surface Elevation



Niagara 2-D Hydraulic Model Calibration Results – Travel Time

Bypass Reach Flow	Level Logger Time (hr:min)	Model Time (hr:min)	Delta (hr:min)
Day 1 (Minimum)	N/A	N/A	N/A
Day 2 (Low)	0:33	0:46	+0:13
Day 3 (Mid)	0:34	0:34	+0:00
Day 4 (High)	0:16	0:15	-0:01

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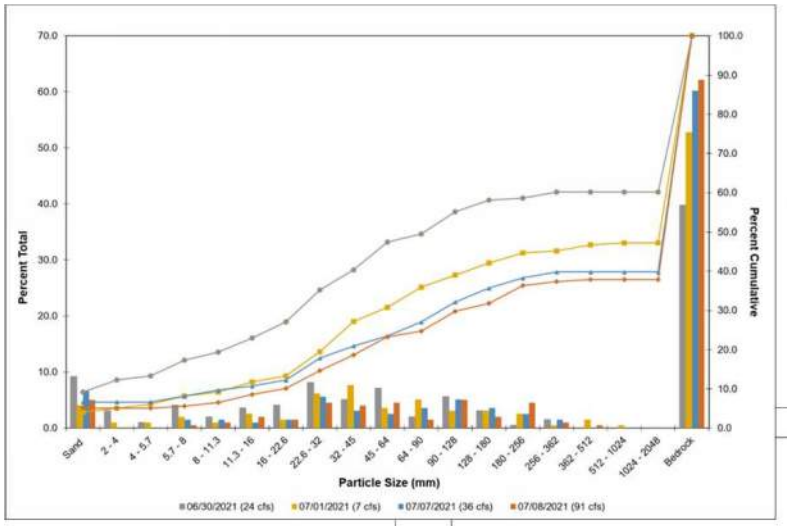
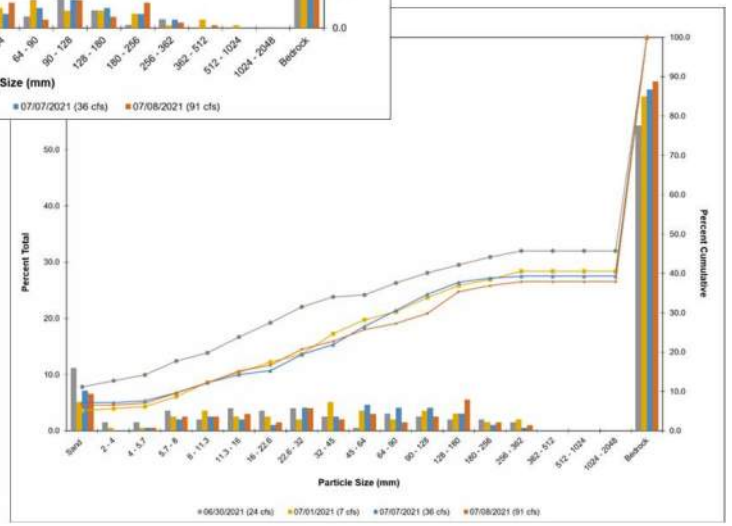
Particle Size Distribution Results



Upstream Transect

Downstream Transect



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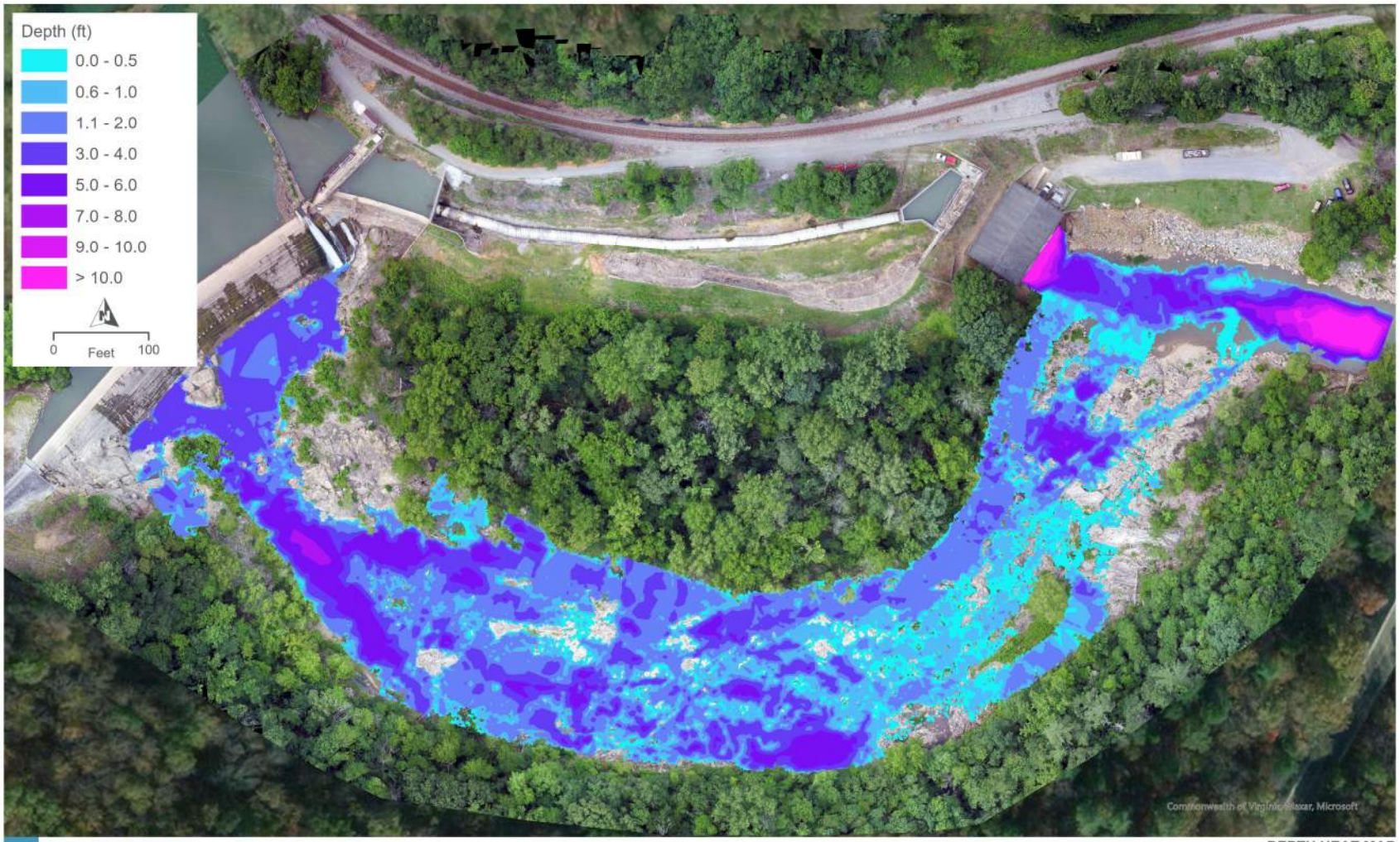
Niagara 2-D Hydraulic Model Calibration Results – Depth



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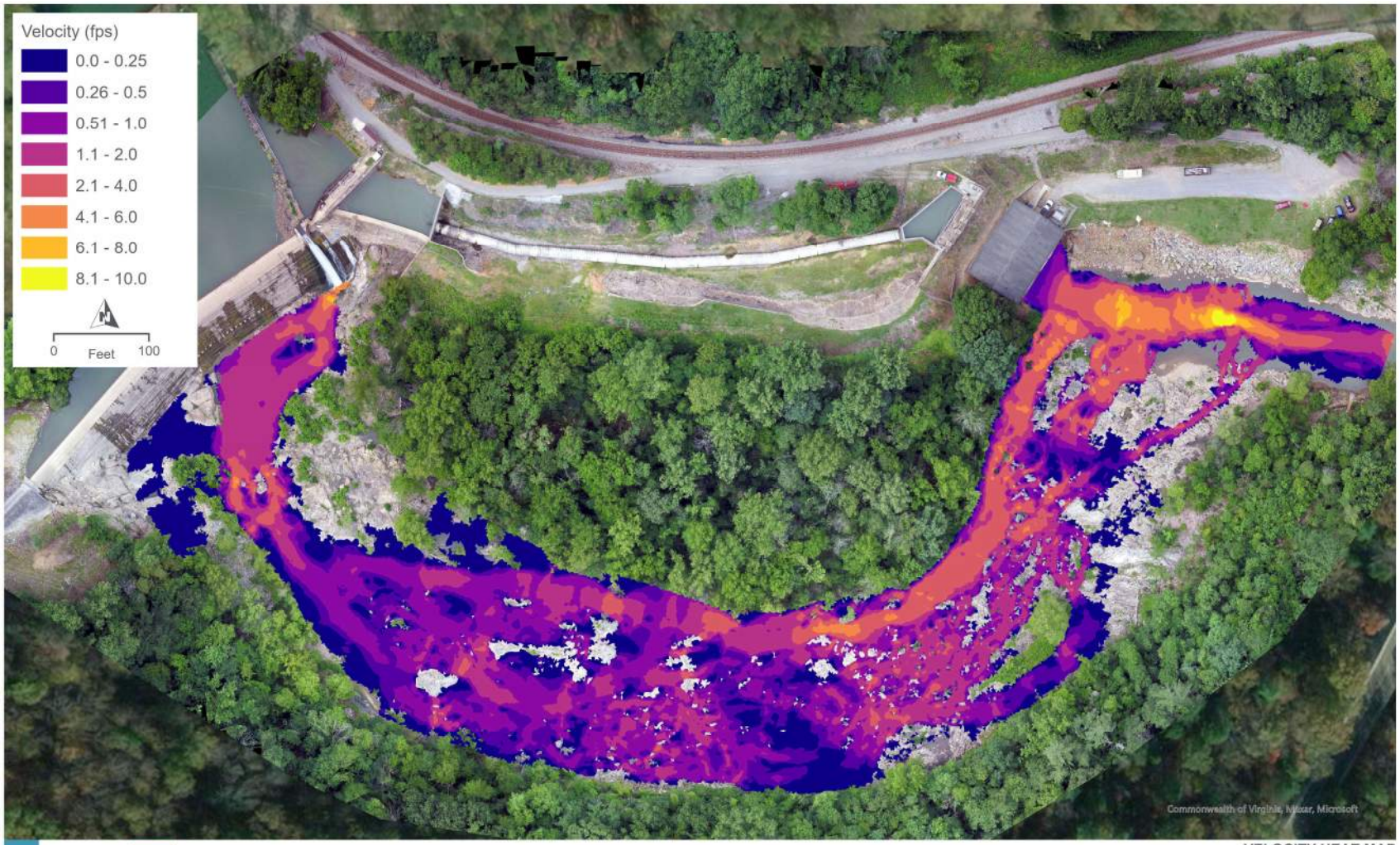
Niagara 2-D Hydraulic Model Calibration Results – Velocity



HDR AMERICAN ELECTRIC POWER

VELOCITY HEAT MAP

DAY 4. BYPASS: 91 CFS, GENERATION: 218 CFS

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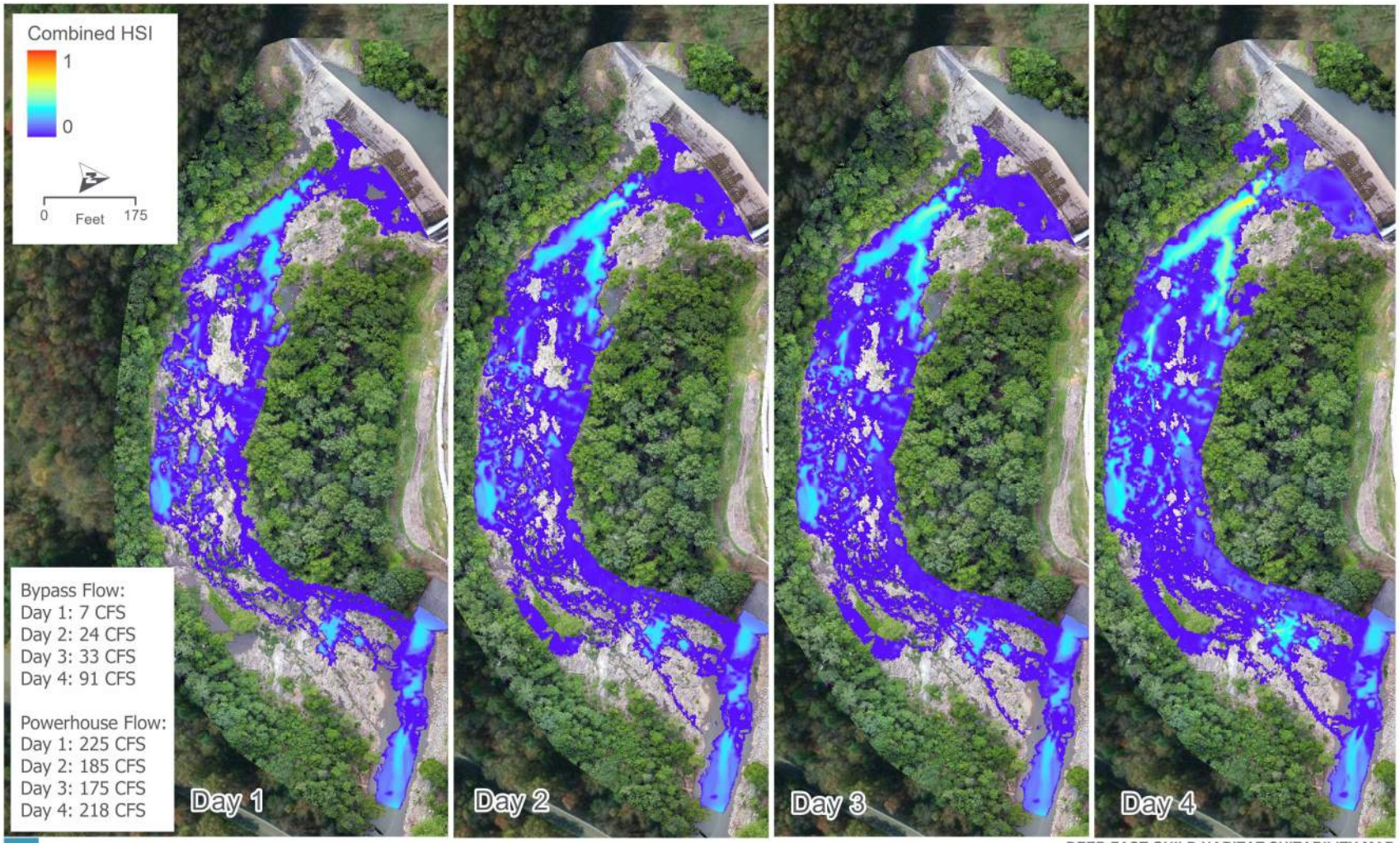
Habitat Results: Deep-Fast Guild



DEEP-FAST GUILD HABITAT SUITABILITY MAP
CATEGORY: COARSE-MIXED SUBSTRATE

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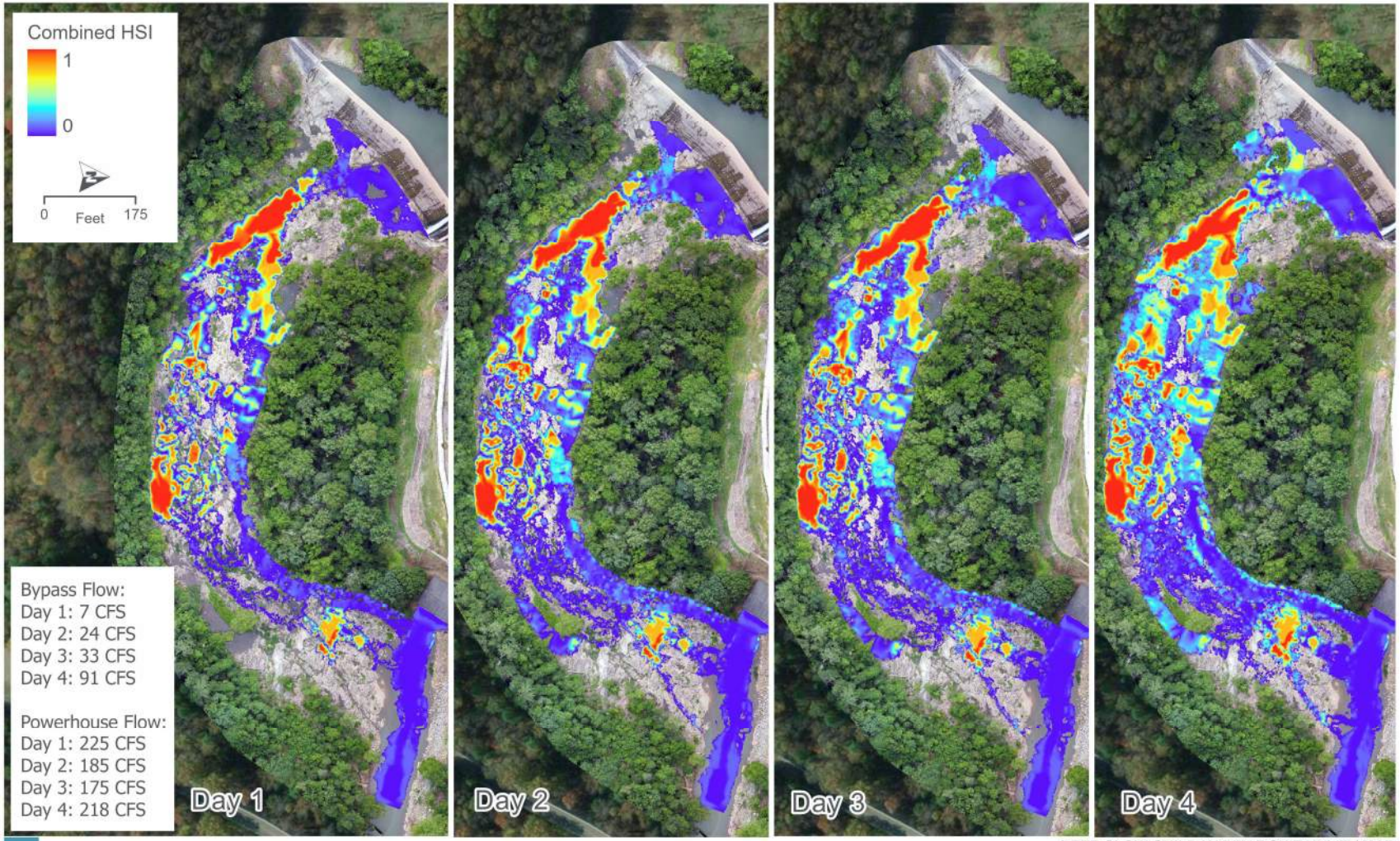
Habitat Results: Deep-Slow Guild



DEEP-SLOW GUILD HABITAT SUITABILITY MAP
CATEGORY: COVER

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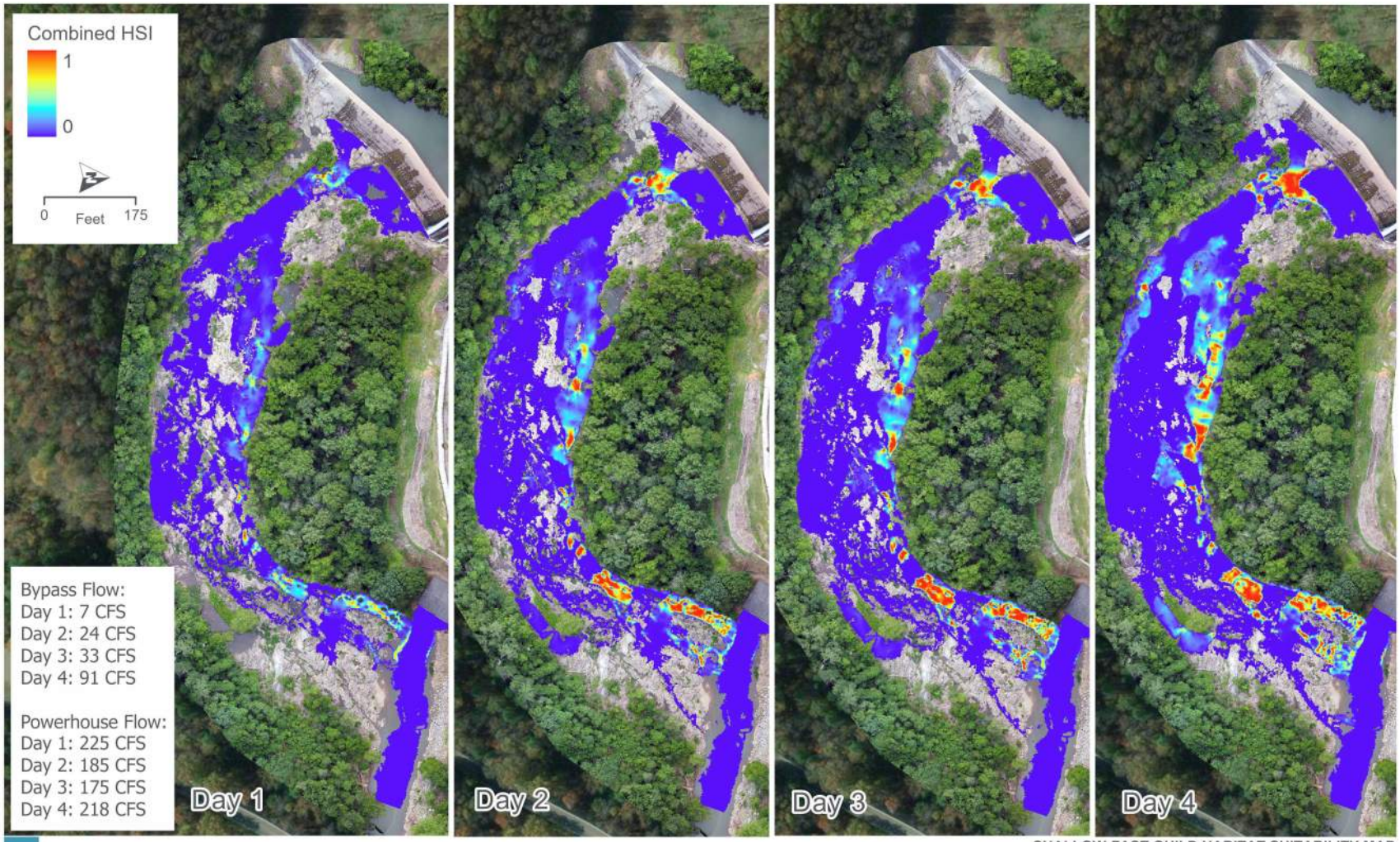
Habitat Results: Shallow-Fast Guild



SHALLOW-FAST GUILD HABITAT SUITABILITY MAP
CATEGORY: MODERATE VELOCITY WITH COARSE SUBSTRATE

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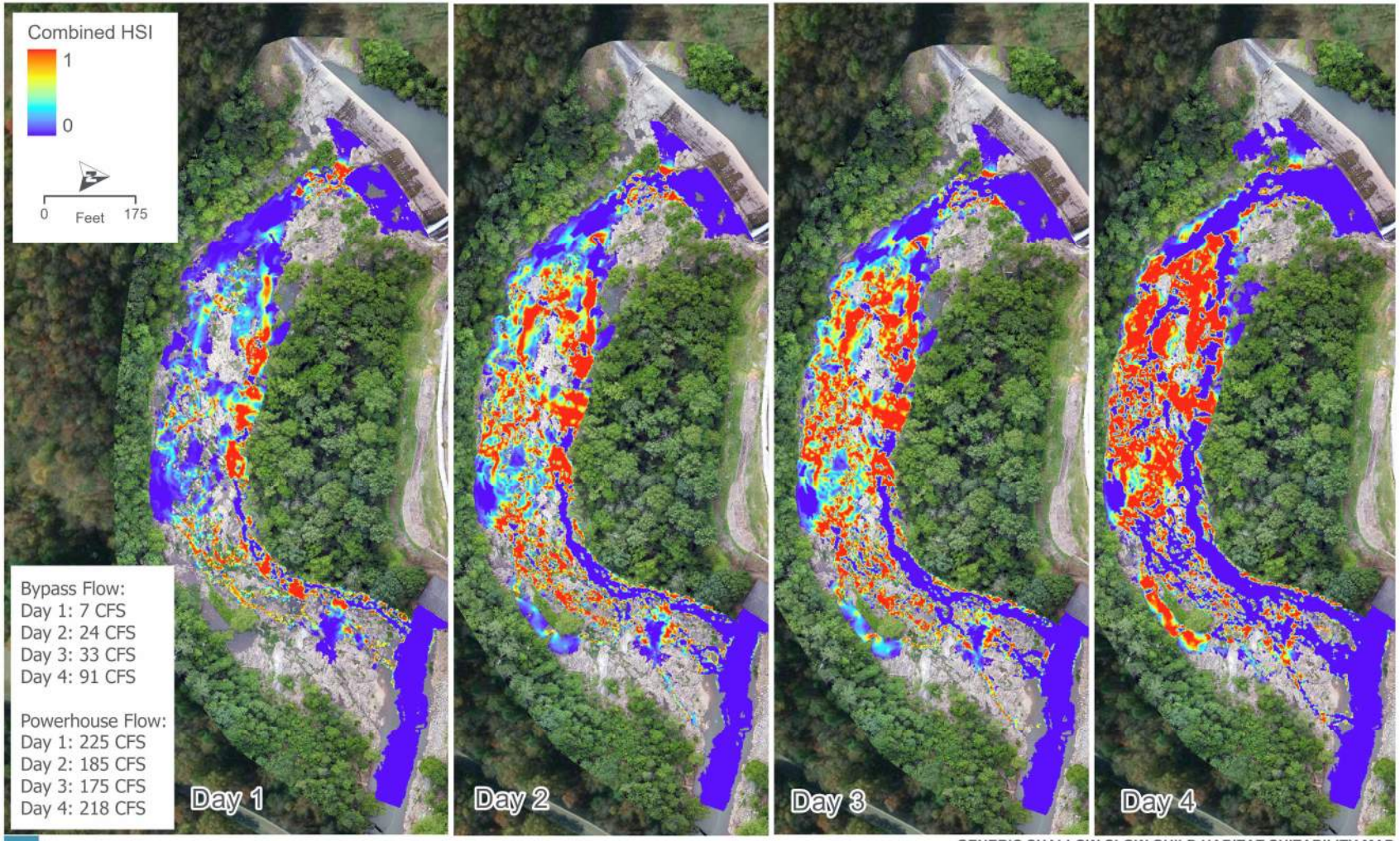
Habitat Results: Shallow-Slow Guild



GENERIC SHALLOW-SLOW GUILD HABITAT SUITABILITY MAP

CATEGORY: COARSE SUBSTRATE

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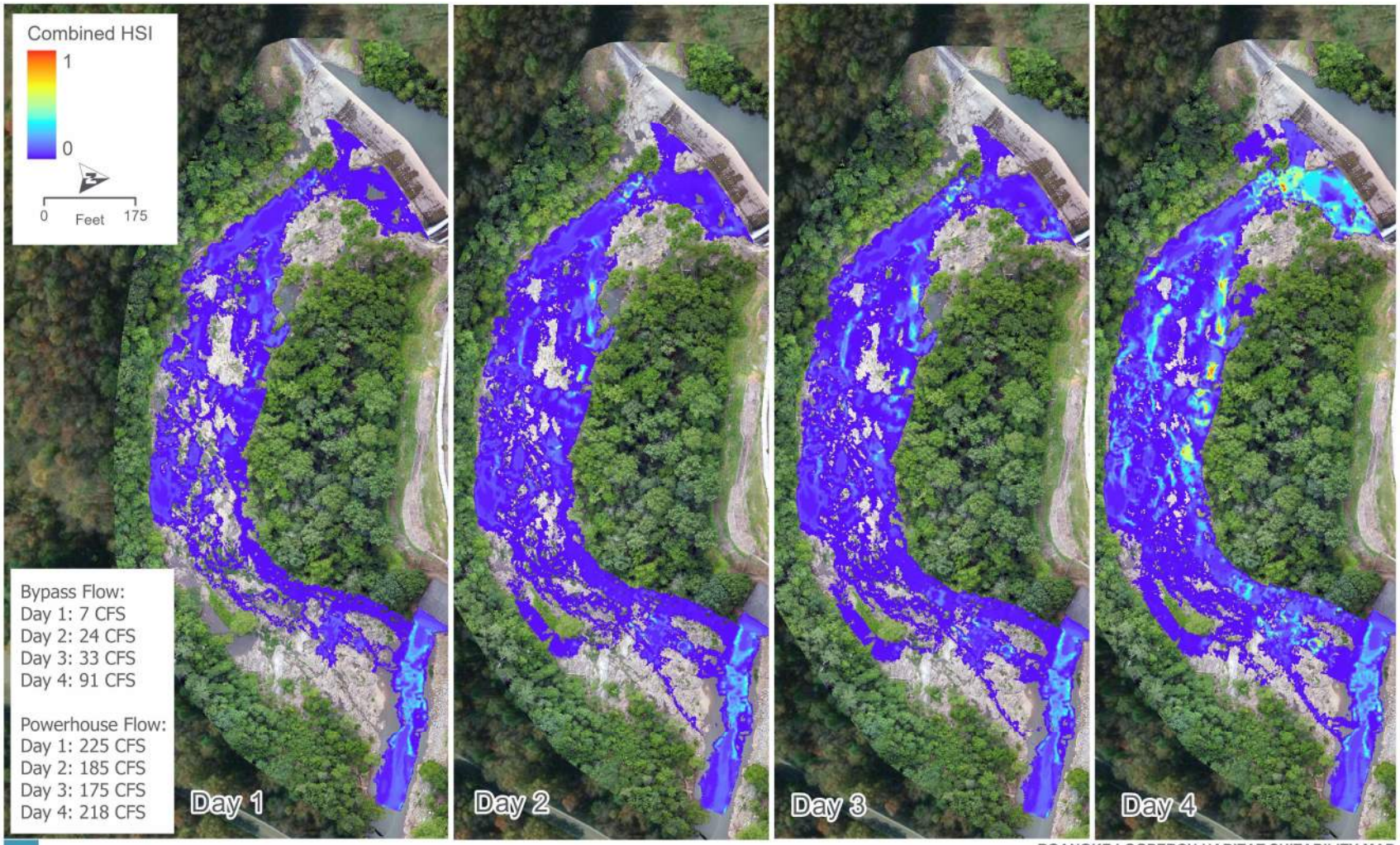
Habitat Results: RLP Adult



ROANOKE LOGPERCH HABITAT SUITABILITY MAP
LIFESTAGE: ADULT

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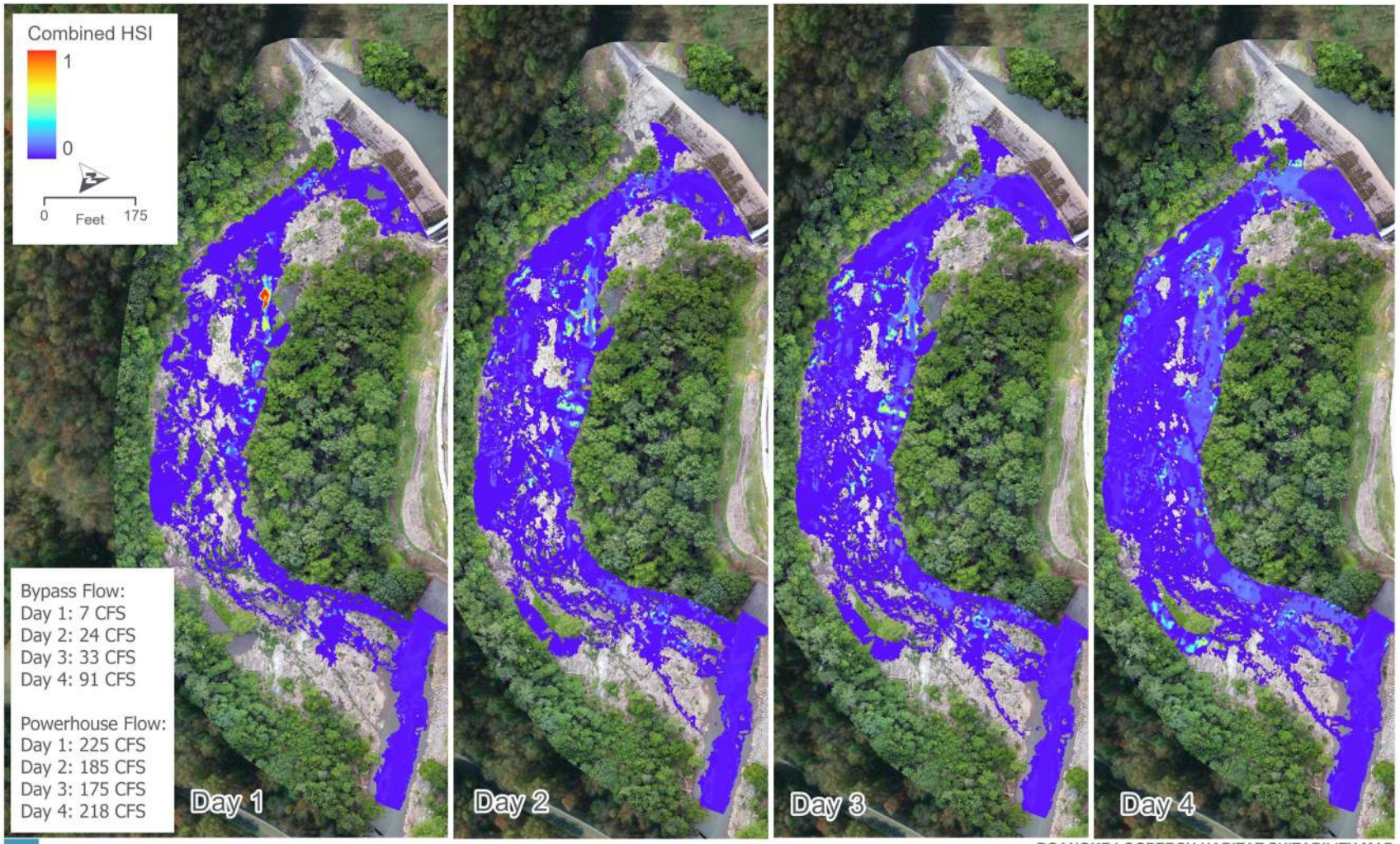
Habitat Results: RLP Subadult



ROANOKE LOGPERCH HABITAT SUITABILITY MAP
LIFESTAGE: SUBADULT

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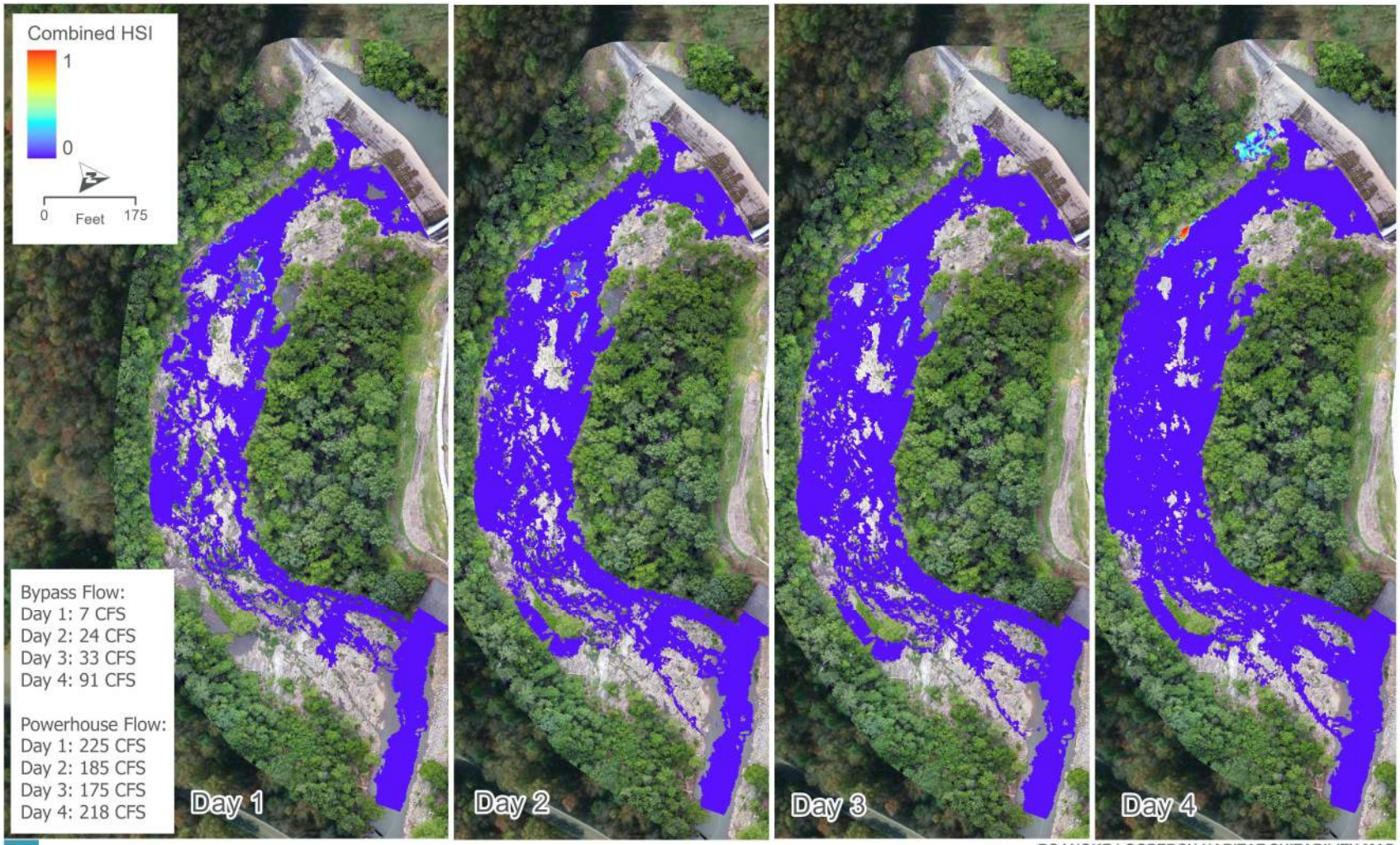
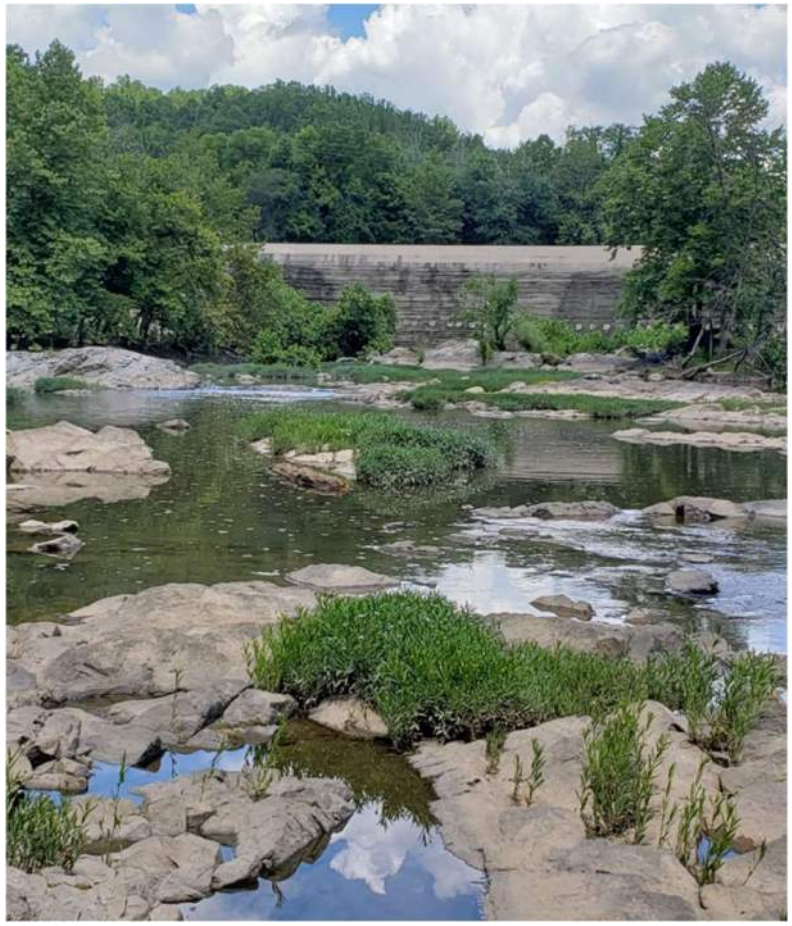
Habitat Results: RLP Young-of-Year



ROANOKE LOGPERCH HABITAT SUITABILITY MAP
LIFESTAGE: YOUNG-OF-YEAR

Niagara Bypass Reach Summary and Conclusions

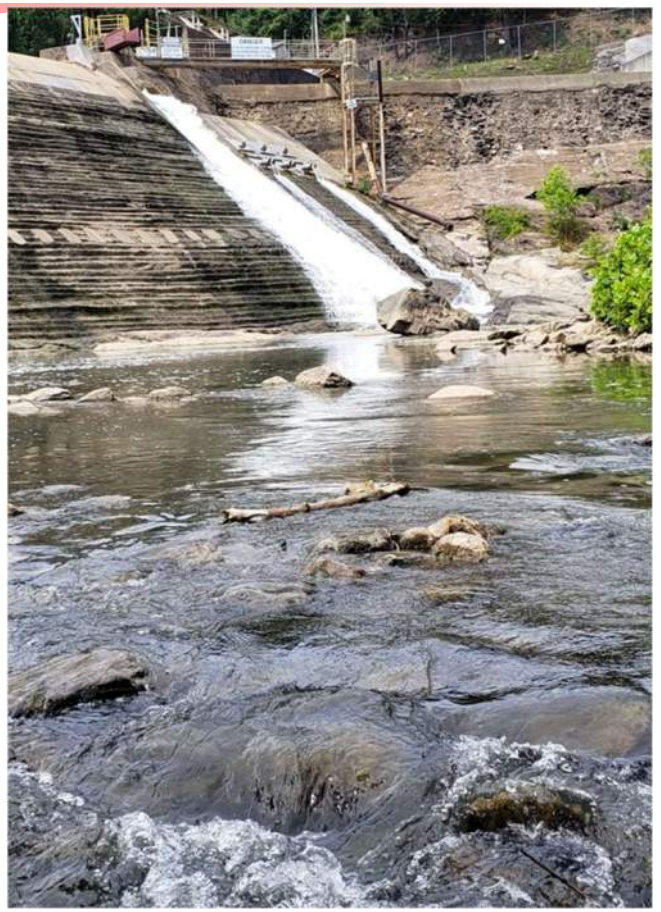
- A variety of habitat types are available in the bypass reach including shoals, shallow and deep pools, riffles, and runs
- Substrate is dominated by larger particle sizes: cobble, boulders, and irregular bedrock
- Over the calibration flow range, bypass reach average depths increased approximately 0.5 ft and average velocities increased approximately 0.8 ft/s
- Travel times varied from approximately 35 min (low flow) to 16 min (high flow)



Niagara Bypass Reach 24 cfs 6.30.2021

Niagara Bypass Reach Summary and Conclusions

- Habitat model results indicate suitable habitat for the four guilds and Roanoke Logperch stand alone target species under all four modeled flow scenarios
- Model results for species/life stages that prefer larger substrate sizes with cover generally had larger amounts of potential habitat available
- Potential available habitat generally increases as bypass flows increase with most of the incremental gain between the lowest modeled flow (7 cfs) and the two middle flows (24 – 33 cfs)



Niagara Spillway 24 cfs 6.30.2021

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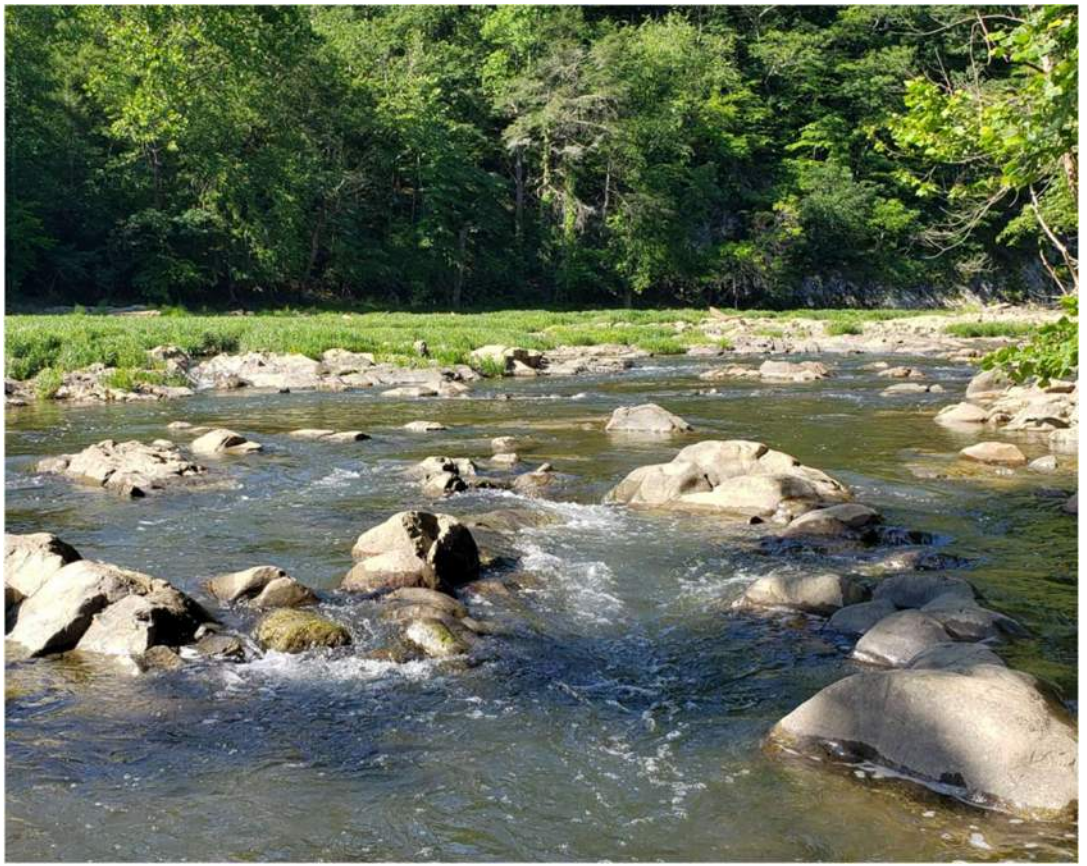
Niagara Bypass Reach Summary and Conclusions

- Model results for Roanoke Logperch indicate preferred habitat is primarily along the main flow path in the bypass reach, which is in agreement with data collected during 2021



Niagara Bypass Reach 24 cfs 6.30.2021

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Variances from FERC-approved Study Plan

The Bypass Reach Flow and Aquatic Habitat Study was conducted in conformance with the Commission's SPD.

Niagara Bypass Reach min flow 7.01.2021

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ISR Meeting: Stakeholder Participation

- Appalachian will file USR Meeting Summary with FERC by December 29, 2022.
- Stakeholders should file USR meeting summary disagreements with FERC by January 28, 2022.
- Stakeholders File Comments on the DLA with FERC by December 30, 2021.
- Appalachian will file the Final License Application (FLA) on February 28, 2022.
- Stakeholders can contact Appalachian with questions or comments:

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ebparcell@aep.com

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Closing

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