Reusens Hydroelectric Project
(FERC No. 2376)

DRAFT
Application for License
Major Project – Existing Dam

Exhibit E – Environmental Report

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 GENERAL DESCRIPTION OF PROJECT LOCALE

The Reusens Hydroelectric Project (Project) is located on the James River at river mile (RM) 265 near the City of Lynchburg, (Figure 1-1).[1] The James River originates in the Allegheny Mountains at the confluence of the Jackson and Cowpasture Rivers near Clifton Forge, Virginia. From its headwaters, the James River flows in a southeasterly direction, traversing the Blue Ridge Mountains, the Piedmont Plateau, and the Coastal Plain/Tidewater region where it discharges into the Chesapeake Bay near Hampton, VA, 340 miles from its origin.

The James River Basin covers about 10,060 square miles in eastern Virginia and is Virginia's largest river (JRA, 2018). The entire James River Basin contains a total of 27,643 miles of streams and 43 square miles of lakes and reservoirs. The James River upstream of the Project dam drains an area of about 3,290 square miles (USGS, 2018a). From its origin to the Project, the James River mainstem flows approximately 73 river miles, and is fed by approximately 46 named streams of 909 river miles in total length (USGS, 2015). The Project reservoir receives inflow from James River upstream of the Project, as well six named tributaries, Judith Creek, Burks Creek, Johns Creek, Widemouth Creek, Salt Creek, and Crab Creek, as well as several unnamed tributaries are within the Project boundary (Figure 1-2). Downstream of the Project, the James River accepts flows from many large to small tributaries before draining into the Chesapeake Bay.

The James River mainstem contains five FERC-licensed and one FERC-exempt hydroelectric projects that are currently operating, including the Project. These include from upstream to downstream: Cushaw (FERC No. 906), Bedford (FERC No. 5596), Big Island (FERC No. 2902), Coleman Falls (FERC No. 5456; FERC-exempt), Holcomb Rock (FERC No. 2901), and Reusens (FERC No. 2376). As such, the Project inflows are received from the Holcomb Rock Project, which is immediately upstream of the Project reservoir. Project discharge enters the upper impoundment of the Lynchburg Dam, also known as the Scotts Mill's Dam. The Scott's Mill Dam is located 3.7 river miles downstream of the Reusens Dam and causes the James River to backwater to the Project (FERC, 1994). At the Scott's Mill Dam there is a proposed hydroelectric project, FERC No. 14867. Near the City of Richmond, Virginia, there is a series of three dams. Two of the dams are notched/breached and the other is intact with a fish passage facility (Figure 1-1).

The climate of the area is characterized by mild winters and warm, humid summers. The average annual temperature is 56.4°F, with average monthly temperatures varying widely. Temperatures may rise to over 100°F in the summer and may fall to near -10°F in the winter. The average annual precipitation is 41.5 inches, with average annual snowfall of about 12.7 inches (NOAA, 2018).

The topography of the James River basin varies throughout the four physiographic provinces that it spans. The Valley and Ridge Province extends from the Appalachian Plateau in West Virginia to the Blue Ridge Province. The Blue Ridge Province, a remnant of a former highland, differs from the Valley and Ridge Province. It is a province of rugged terrain with steep slopes and narrow ridges in the north and broad moderate slopes in the south. The Piedmont Province extends to the Fall Line and has scattered hills and small mountains, gradually turning into gently rolling slopes and lower elevation in the eastern portion of the province. The Fall Zone separates

[1] River mile is measured from the James River confluence with the Chesapeake Bay.

the Coastal Plain Province from the Piedmont. The Fall Zone is a three-mile stretch of river running through Richmond where the river descends 84 feet as it flows from the resistant rocks of the Piedmont to the softer sediments of the Coastal Plain (VDEQ and VDCR, 2017). The Blue Ridge front rises abruptly above the Piedmont to mark the division between the Piedmont and Blue Ridge provinces.

The Blue Ridge Province is a highly dissected mountain plateau bounded by two mountain chains. The Blue Ridge Mountains are on the east and range in elevation from 3,000 to 4,000 feet msl with a few peaks reaching almost 6,000 feet msl. The Unaka and Great Smoky Mountains are along the western border, and elevations range from 3,000 to 6,000 feet msl. Between these two boundary mountain chains are several cross ridges and broad intermountain valley floors that give the area its rugged character. The crest of the eastern Blue Ridge Mountains marks the Eastern Continental Divide. The mountains are characterized by strong relief and slopes ranging from moderately steep to very steep (JMU, 2018a).

The Project resides in the Northern Inner Piedmont ecoregion, which is a part of the Piedmont physiographic Province of Virginia (EPA, 2003). The Northern Inner Piedmont is a dissected upland composed of hills, irregular plains, and isolated ridges and mountains. Elevations typically range from 200 to 1,000 feet but higher elevations of up to 2,000 feet occur on scattered monadnocks near the western boundary (Woods et al. 1999). Local relief near the Project is typically 500 to 1500 feet. The Northern Inner Piedmont is characteristically underlain by highly deformed and deeply weathered Cambrian and Proterozoic feldspathic gneiss, schist, and melange. It is intruded by plutons and is veneered by clay-rich weathering products (i.e., saprolite). Ultisols occur widely and have developed from residuum; they are typically clay-rich, acid, and relatively low in base saturation. Higher, more westerly soils have a mesic temperature regime (Woods et al. 1999).

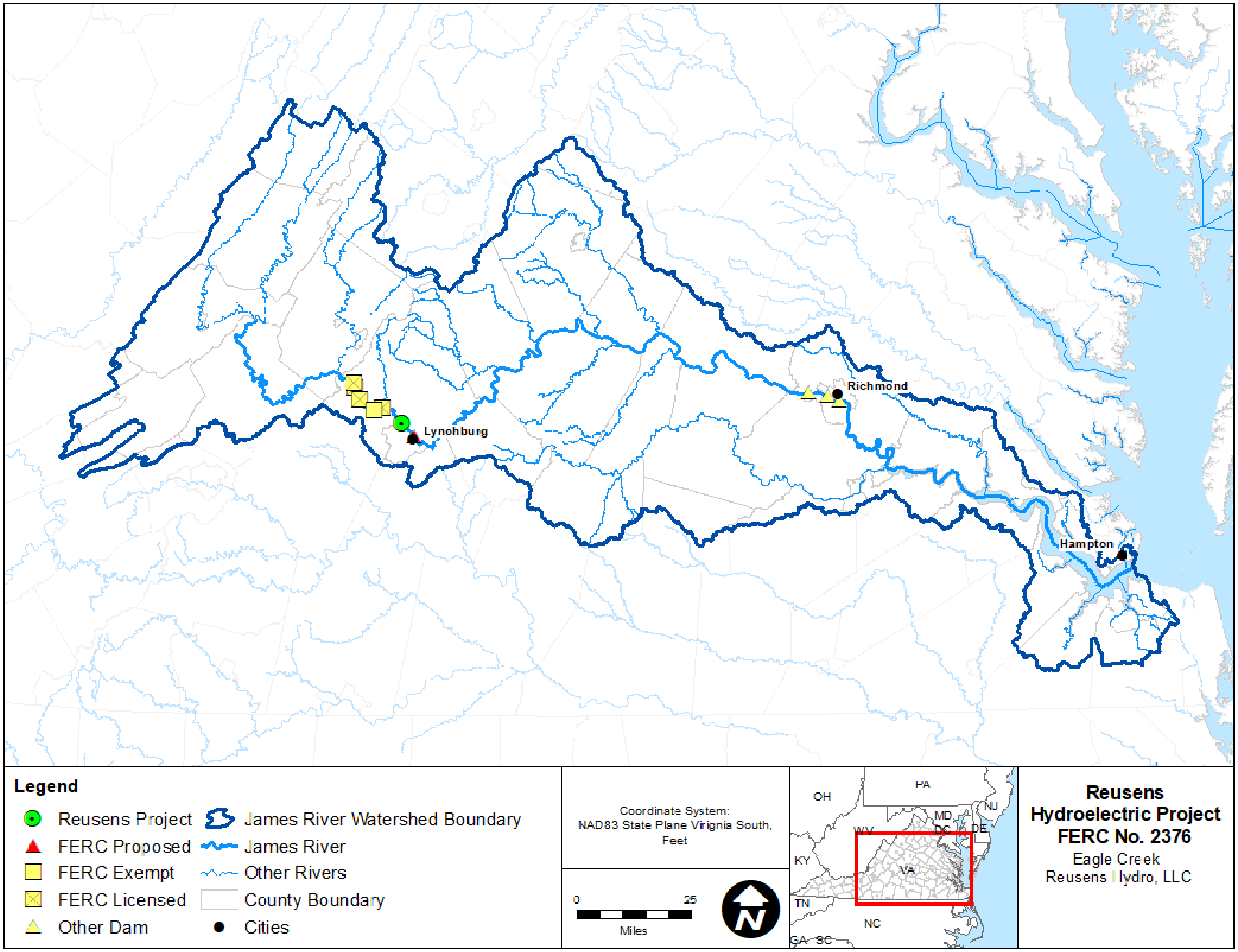


Figure 1-1. Location of the Reusens Hydroelectric Project within the James River Basin.

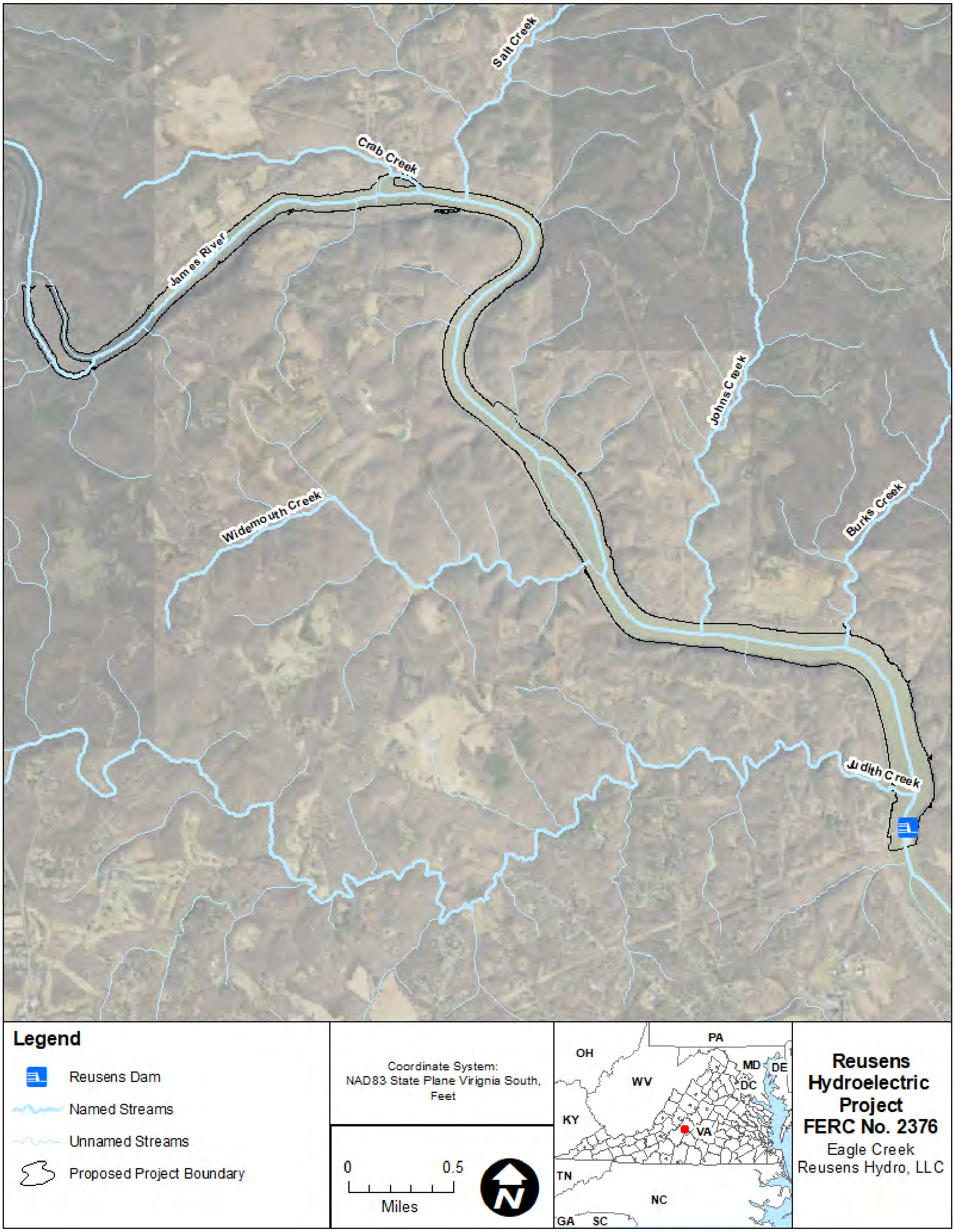


Figure 1-2. Hydrography of the Project area.

2 GEOLOGY AND SOIL RESOURCES

2.1 Geology

The rocks of the central crystalline Appalachians are in basically parallel geologic terranes orientated in a southwest to northeast direction. From northwest to southeast, the geologic terrane crossing the James River basin in the vicinity of the Project is the Piedmont terrane. There are two distinct divisions to the Piedmont rocks, one a set of Late Proterozoic and Paleozoic igneous and metamorphic rocks, and a second of lower Mesozoic sedimentary rocks deposited in graben basins faulted into the igneous and metamorphic rocks (JMU, 2018a).

The Late Proterozoic and Paleozoic igneous and metamorphic rocks include three main components. First, the roots of several volcanic island chains such as in the Charlotte/Chopawamsic belt, and Carolina slate and Eastern slate belts. Second, several small continental fragments that are possibly Grenville in age (1.1-1.0 bya) running west of Richmond. Lastly, the Inner piedmont belt running just east of the Blue Ridge Province (JMU, 2018a).

The Project is located entirely within the Inner Piedmont belt. The Inner Piedmont belt is a faultbounded composite stack of thrust sheets containing a variety of gneisses, schists, amphibolites, sparse ultramafic bodies, and intrusive granitoids. The Inner Piedmont is the Proto-Atlantic divergent continental margin shelf, slope and rise sediments, with some oceanic lithosphere fragments (JMU, 2000). In addition, numerous late Paleozoic granite intrusions cut through the region, mostly in the eastern half. These were generated in the Taconic orogeny (dated at 320 mya), and the Alleghenian orogeny. Because these rocks have been deformed and metamorphosed, often several times, they are very complex. They also contain many economically important mineral deposits, including gold, talc, kyanite, and feldspar (JMU, 2018a).

Figure 2.1-1 illustrates the bedrock lithography of the Project vicinity. Bedrock of the Project vicinity is entirely Proterozoic gneiss and granite. More specifically, augen gneiss, felsic gneiss, biotite gneiss, mafic gneiss, granitic gneiss, granite, and gneiss underlay the Project area.

The Project is within an area of relatively low seismicity in the Piedmont and Blue Ridge geographic provinces. Within a 50-mile radius of the Project, 5 earthquakes of body wave magnitude ≥2.5 have occurred (USGS, n.d.). U.S. Geological Survey (USGS) seismic hazard maps indicate a peak horizontal ground acceleration in the Project area of 0.06 to 0.14 g2 with a recurrence interval of 2,475 years (2 percent probability of exceedance in 50 years [USGS, 2014]).

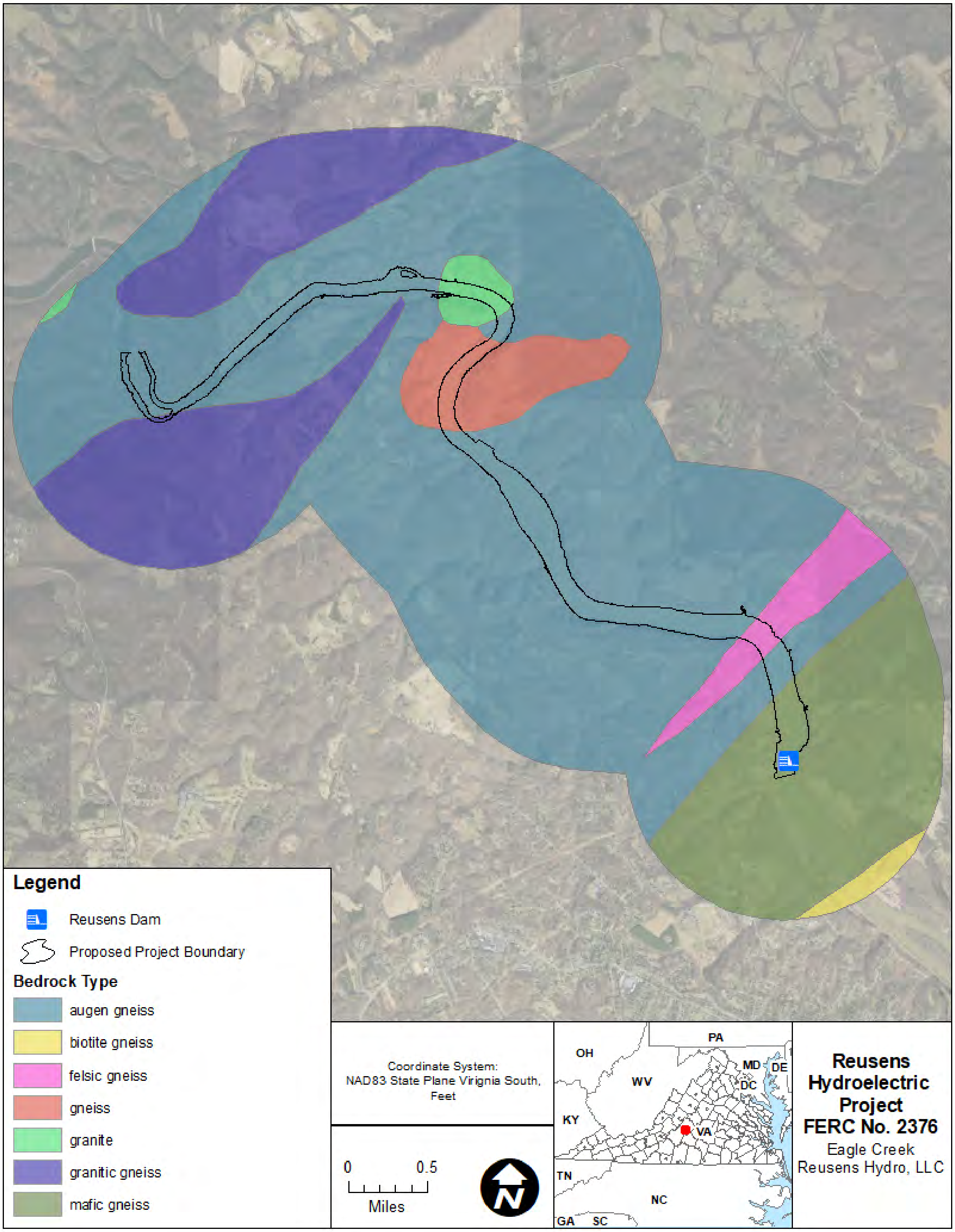


Figure 2.1-1. Bedrock geology of the Project area.

2.2 Soils

Figure 2.2-1 presents the soils of the Project area, and Table 2.2-1 lists the soils within 200 feet of the Project boundary. Overall, there are 26 soil types in the Project boundary. The top five most abundant soil types in the Project area are: Stott Knob-Rhodhiss, Spriggs loam, Combs loam, Speedwell loam, and Colvard sandy loam. Erodibility (K-Factor whole soil) of the soils in the Project area range from 0.05 to 0.37,[2] which indicates that the soils in the Project boundary have very low to moderate susceptible to erosion by water (Table 2.2-1) (USDA, 2019).

The reservoir that supports the Project extends 7.2 river miles upstream, with a total shoreline length of approximately 14.6 miles. In the immediate Project vicinity, the shoreline and streambanks upstream of the Project have a steep slope, particularly along the western bank. Along the entire western bank is a CSX rail line. Aside from the rail line the streambanks are predominantly mature woody vegetation. Downstream of the project the shoreline slope is also steep with bedrock walls and steep vegetated banks. There are no areas of active erosion in the immediate Project vicinity.

2.2.1 Soil Sampling

In 2016, the Appalachian Power Company performed surficial soil sampling in proximity to the transformers, in the switchyard, sumps located in Powerhouse A, and sediment from an outfall connected to the transformer area for residual polychlorinated biphenyls (PCBs).5[3] In addition, surficial soil sampling was also performed along the south property boundary to assess the presence of residual polycyclic aromatic hydrocarbons (PAHs) (Letter from D. Jelinek, REM, and T. Helfrich, PE, Burns and McDonald, Blue Ash, OH to T. Webb, Director, American Electric Power Service Corporation, Columbus, OH). In total, 14 locations were sampled within the transformer/switch yard area, three locations within the Powerhouse A sump area, one transformer outfall location, and seven locations along the south end property boundary. Surficial soil samples were collected using a hand auger, and sump samples were collected by a stainless-steel shovel. All samples were placed into appropriate laboratory-supplied containers, packed in a cooler with ice, and shipped to a Virginia Environmental Laboratory Accreditation certified laboratory (TestAmerica Laboratories, Inc. in North Canton, Ohio). Sump and surficial soil samples in the transformer/switch yard area were subsequently analyzed following EPA Solid Waste (SW)-846 Method 8082A for PCBs,[4] and southend samples were analyzed following EPA SW-846 Method 8082A and EPA SW-846 Method 8270D for PCBs and PAHs, respectively.[5]

PCBs were detected within the sump and outfall locations. Levels within these locations ranged from 0.012 mg/kg to a maximum of 0.55 mg/kg for the PCB analytes detected. The analyte detected include: PCB 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268. The same PCB analytes detected in the sump and outfall locations were also detected in the samples taken

[2] K-Factor whole soil estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (K_{sat}). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

[3] The Appalachian Power Company was the previous licensee for the Reusens Hydroelectric Project.

[4] EPA SW-846 Method 8082A is a method used to determine the concentration on PCBs in a sample by gas chromatography.

[5] EPA SW-846 Method 8270D is a method used to determine the concentration of semivolatile organic compounds by gas chromatography/mass spectrometry.

within the transformer/switchyard, where levels ranged from 0.01 to 1.2 mg/kg. These data indicate that PCB levels in these locations are less than EPA Toxic Control Substance Act standards (as provided in 40 CFR Part 761 for PCBs), EPA Regional Screening Level Standards for Commercial/Industrial Soil (RSL) for PCBs, and VDEQ Voluntary Remediation Program Tier III levels.[6]

PAHs were detected in soil samples collected from the along the southern boundary of the property. Sixteen PAH analytes were detected, which include: Acenaphthene, Acenaphthylene, Anthracene, Benzo[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, ndeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene, Pyrene. PAHs levels detected were less than 0.1 mg/kg for all analytes. The detected concentrations were not in excess of the RSL and VRP Tier III, which range from 3 to 23,000 mg/kg depending on the analyte.

[6] EPA Toxic Control Substance Act clean up threshold standard is 10 mg/kg, the EPA Regional Screening Level Standards for Commercial/Industrial Soil (RSL) for PCBs range from 1.5 to 10 mg/kg depending on the PCB depending on the PCB analyte, and VDEQ Voluntary Remediation Program Tier III threshold levels are the same as the EPA Regional Screening Level Standards for Commercial/Industrial Soil (RSL) for PCBs.

Table 2.2-1. Soil types within 200 feet of the Project boundary.

Soil Map Unit Symbol	Soil Name and Description	Area		Erodibility (K_w Factor)[1]
		Acres	Percent	
37E	Stott Knob-Rhodhiss complex, 25 to 50 percent slopes, very stony	101.3	22.5	0.37
35E	Spriggs loam, 25 to 50 percent slopes, very stony	68.7	15.2	0.32
9A	Combs loam, 0 to 3 percent slopes, frequently flooded	52.1	11.6	0.32
33A	Speedwell loam, 0 to 3 percent slopes, frequently flooded	50.7	11.2	0.32
32A	Colvard sandy loam, 0 to 2 percent slopes, frequently flooded	44.8	9.9	0.2
13E	Edneyville gravelly fine sandy loam, 25 to 60 percent slopes, extremely stony	39.5	8.8	0.05
29E	Perrowville fine sandy loam, 25 to 60 percent slopes	36.9	8.2	0.17
11E	Edneytown loam, 25 to 60 percent slopes	11.0	2.4	0.37
2E	Ashe gravelly sandy loam, 25 to 60 percent slopes, very stony	9.0	2	0.05
16E	Hayesville loam, 25 to 45 percent slopes	7.1	1.6	0.28
5E	Clifford loam, 25 to 50 percent slopes	6.5	1.4	0.37
WkF	Wilkes loam, 25 to 60 percent slopes	5.6	1.3	0.37
CT	Chewacla-Toccoa complex	4.7	1.1	0.24
23D	Minnieville loam, 15 to 25 percent slopes	3.5	0.8	0.37
WkE	Wilkes loam, 15 to 25 percent slopes	2.4	0.5	0.37
6E	Clifford loam, 25 to 50 percent slopes, very stony	2.0	0.4	0.37
34E	Spriggs loam, 25 to 50 percent slopes	1.6	0.4	0.32
6D	Clifford loam, 15 to 25 percent slopes, very stony	0.7	0.2	0.37

Soil Map Unit Symbol	Soil Name and Description	Area		Erodibility (K_w Factor)[1]
		Acres	Percent	
45D	Wintergreen clay loam, 15 to 25 percent slopes, severely eroded	0.7	0.2	0.2
26E	Spriggs fine sandy loam, 25 to 60 percent slopes	0.6	0.1	0.24
45C	Wintergreen clay loam, 7 to 15 percent slopes, severely eroded	0.4	0.1	0.2
33C	Wintergreen fine sandy loam, 7 to 15 percent slopes	0.2	0.1	0.2
46B	Wintergreen loam, 2 to 7 percent slopes	0.2	<0.1	0.32
46C	Wintergreen loam, 7 to 15 percent slopes	0.2	<0.1	0.32
47D	Wintergreen loam, 15 to 25 percent slopes, very stony	0.1	<0.1	0.32
23C	Minnieville loam, 7 to 15 percent slopes	0.0	<0.1	0.37

Source: USDA, 2019

1. Erosion factor K_w (whole soil) indicates the erodibility of the soil from rill and/or sheet erosion. Values of K range from 0.02 (low erodibility) to 0.69 (high erodibility).

.

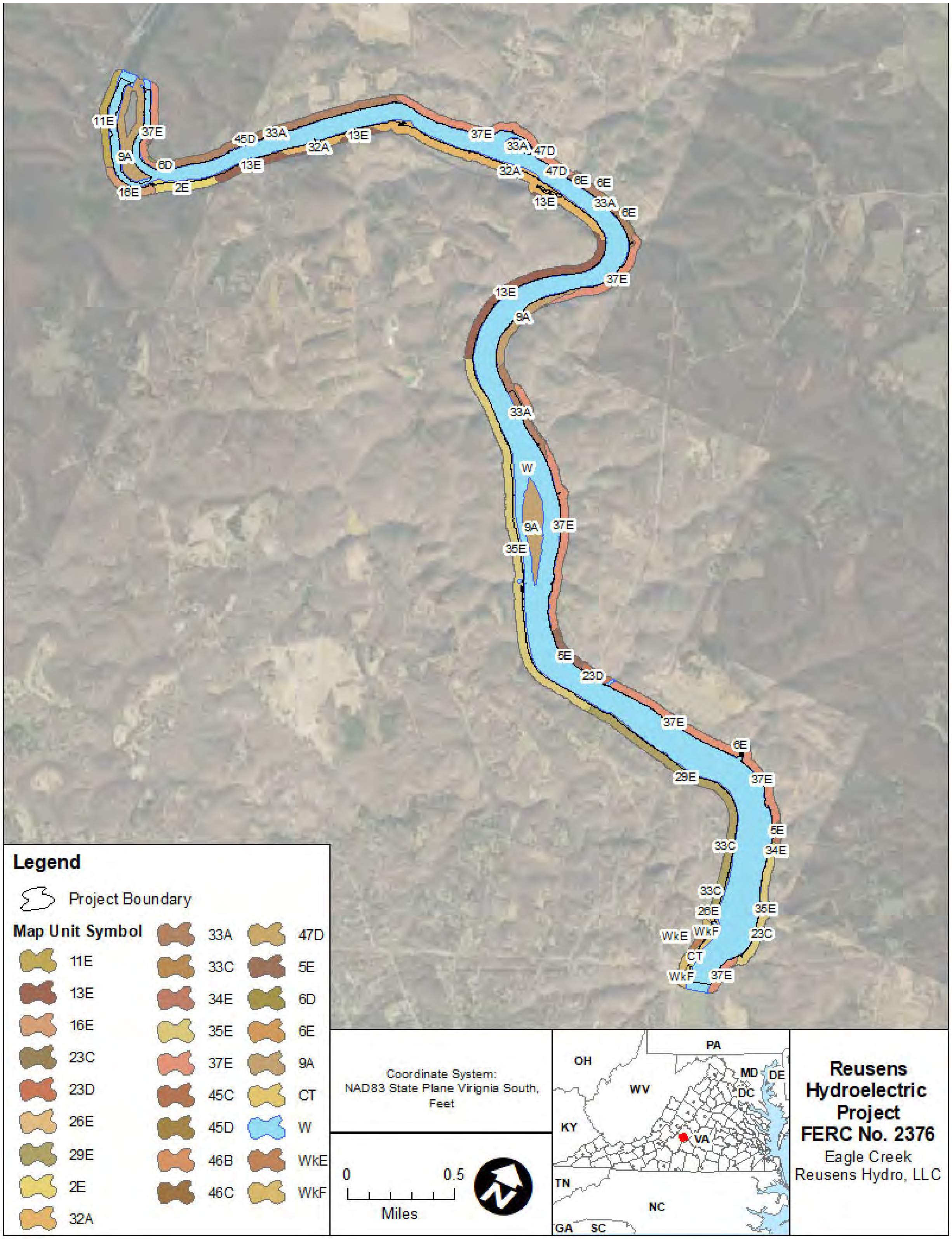


Figure 2.2-1. Soils of the Project area.

2.3 Geology and Soils Resources Study Requests and Results

Reusens Hydro did not receive any study requests germane to geology and soils resources.

2.4 Existing and Proposed PM&E Measures for Geology and Soils Resources

Reusens Hydro proposes to continue to operate the Project as currently licensed, with an hourly averaged minimum flow of 333 cfs or inflow to the Project reservoir, whichever is less to be passed downstream of the Project.

2.5 Agency Proposed PM&E Measures for Geology and Soil Resources

Reusens Hydro did not receive any requests for proposed protection, mitigation or enhancement measures pertaining to geology and soil resources.

2.6 Description of Continuing Impacts on Geology and Soils Resources by Continued Project Operation

Soil instability in the Project area is not a concern due to well-established riparian and upland vegetation and the low to moderate susceptibility of the soils in the Project area to erosion by water. Therefore, effects on geology and soils of continued Project operation would reflect the existing condition because Reusens is not proposing changes in how the Project is operated. Reusens Hydro also does not propose any other ground disturbing activities that would adversely impact geology and resources in the Project area.

3 WATER RESOURCES

3.1 Water Quantity

3.1.1 Hydrology and Streamflow

The Reusens Hydroelectric Project is situated on the James River in Bedford and Amherst Counties, Virginia. Flows into the Project area are determined by operations of five hydroelectric projects upstream of the Project, supplemented by contributing inflow from various tributaries (see *Section 1 – General Description of the Project Locale*). Figure 3.1.1-1 shows the hydroelectric projects, USGS streamflow gages on the James River, and major contributing tributaries to the James River upstream of the Project.

3.1.2 Project Inflow and Outflow

At the Project dam, the James River has a drainage area of 3,290 square miles. A majority of the inflow to the Project is provided by the James River upstream of the Project reservoir. In addition, six perennial tributaries (Judith Creek, Burks Creek, Johns Creek, Widemouth Creek, Salt Creek, and Crab Creek) provide some inflow to the impoundment, but only represent approximately 0.7 percent of the total upstream drainage area. Figure 3.1.2-1 illustrates the waterbodies that contribute inflow to the Project.

Approximately 7.2 river miles upstream of the Project dam the USGS operates a streamflow gage on the James River (USGS Gage No. 02025500 James River at Holcomb Rock), that records gage elevation and stream flow. The gage has a drainage area of about 3,256 square miles (Figure 3.1.2-1). The gage has a period of record from October 1, 1990, to present for streamflow and February 2,2021 to present for gage height. Table 3.1.2-1 provides the minimum, mean, and maximum recorded flows from March 1, 1994, to May 20, 2021 of the James River at the Project dam prorated by 1.01 to account for the intervening drainage between the gage and the Project dam. Over the period analyzed, mean monthly flows ranged from 1,418 cfs to 6,166 cfs at the Project dam. The highest mean monthly flows generally occur in March, and the lowest mean monthly flows occur in August. The maximum instantaneous flow at the dam was 117,160 cfs, which occurred in January of 1996, and the lowest instantaneous flow was 13 cfs, which occurred in November of 2008. The average annual flow at the Project is 3,799 cfs. Figures 2.3-1 through 2.3-4 in *Exhibit B – Project Operations and Utilization* present flow durations curves at the Project dam.

The USGS calculated the 7-day 10-year low flow statistic (7Q10) for the USGS Gage James River at Holcomb Rock, VA (USGS Gage No. 02025500) to be 424 cfs (USGS, 2011). The 7Q10 is a low-flow statistic that is the lowest 7-day average flow that occurs (on average) once every 10 years. Prorated for the intervening drainage between the gage and the Project, the 7Q10 flow at the Project dam is 428 cfs. This 7Q10 flow at the Project dam is equaled or exceeded approximately 99.5 percent of the time.

Most inflow is passed downstream of the Project during a typical day. For instance, in 2020, Reusens Hydro monitored water levels downstream of the Project from June through October as a part of *Study 1 – Instream Flow Assessment* (Figure 3.1.2-2). These data collectively show that downstream water levels, generally follow the hydrograph of the upstream USGS Holcomb Rock gage.

3.1.3 Project Reservoir and Water Levels

The Project dam creates a reservoir that has a surface area of approximately 500 acres and a gross storage capacity 6,869 acre-ft at a normal water surface elevation of 550 feet NAVD88. At the lower normal minimum operating elevation of 546.3 feet NAVD88 the reservoir has a gross storage capacity of 5,182 acre-ft; therefore, the Project has 1,687 acre-ft of usable storage. At an average annual inflow of 3,799 cfs about 7,535 acre-ft of water passes the Project daily, and Project reservoir could refill approximately 4.5 times between the normal lower and upper operating limits.

Figures 3.1.3-1 and 3.1.3-2 present the reservoir water surface elevation duration curve and daily water level change frequency curve as measured at the Project forebay.[7] The median water level observed in the Project forebay is 549.74 ft NAVD88, and between 549.01 to 550.46 ft NAVD88 represents the middle 95% of the observed water levels (Figure 3.1-2). On a daily basis, the median water surface elevation change within the forebay was 0.34 ft, with the middle 95% of daily water surface elevation change range between 0.09 to 1.24 ft (Figure 3.1-3).

[7] Data for the period 2007 to 2011. Between 2007 and 2011 the Project was operating between 13.1 to 20.3 percent to the time.

Table 3.1.2-1. Estimated minimum, maximum and mean flows at the Project from March 1994 to May 2021.[1]

Month/ Time Period	Instantaneous		Average		Mean
	Minimum	Maximum	Minimum	Maximum	
January	97	117,160	1,251	23,035	4,890
February	125	50,399	1,934	17,117	5,267
March	352	41,006	2,192	20,362	6,166
April	403	53,126	1,858	23,233	6,021
May	148	54,338	1,603	19,018	5,422
June	92	88,678	653	16,583	3,570
July	125	32,118	600	6,046	1,754
August	94	28,684	469	4,712	1,418
September	26	72,619	424	13,837	2,186
October	37	34,340	572	8,625	1,823
November	13	52,116	674	14,146	2,826
December	77	56,055	1,242	16,995	4,314
Annual	–[2]	–	1,096	15,350	3,799[3]

Source: USGS (2021), as modified by Reusens Hydro.

1. The statistics presented are based on instantaneous, 15-minute observations from USGS Gage No. 0205500 James River at Holcomb Rock, VA from March 1, 1994, through May 20, 2021, prorated by 1.01 to account for the intervening drainage between the gage and Project dam.
2. "–" indicates a corresponding value for the table cell is not applicable.
3. Based on years 1995 through 2020.

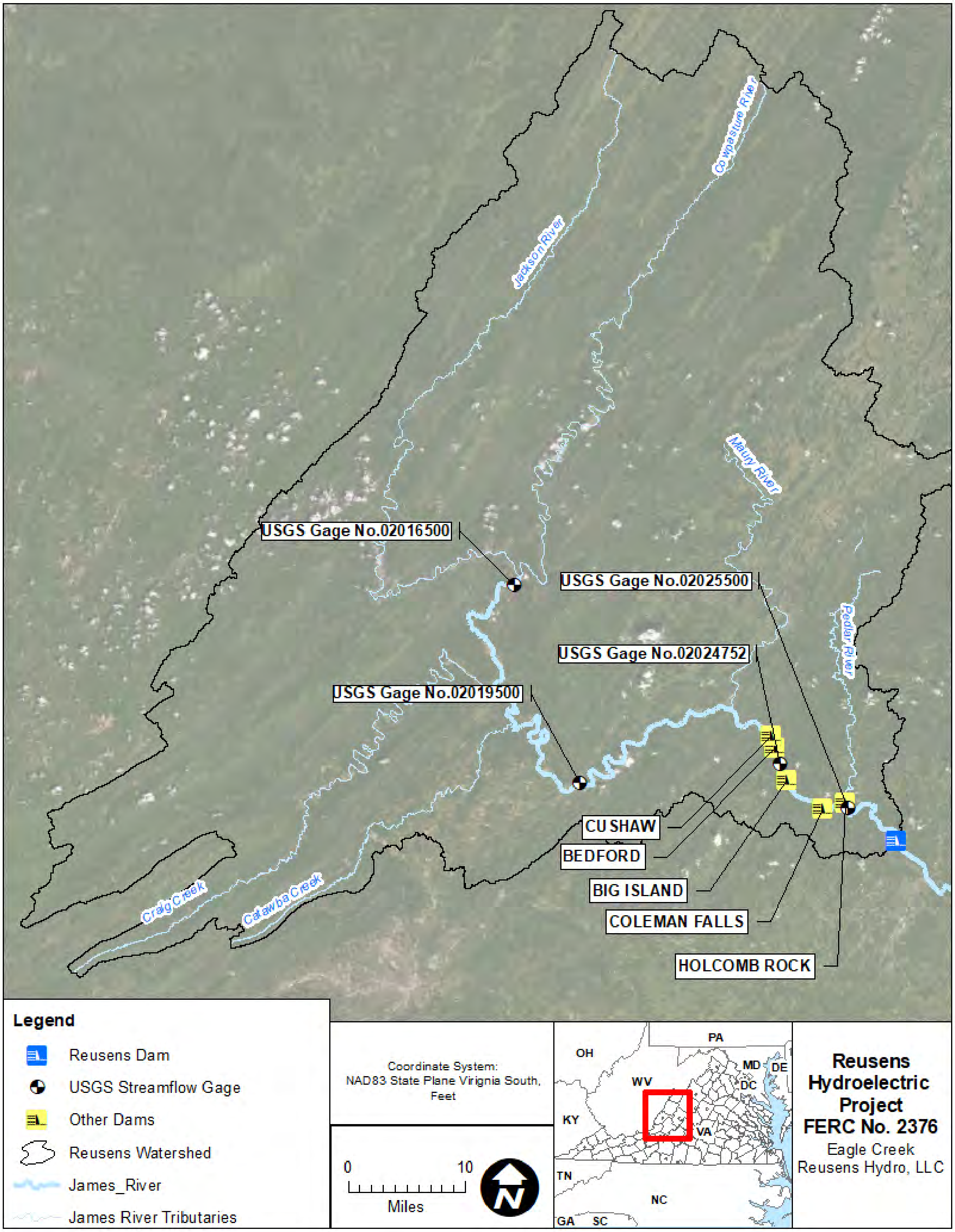
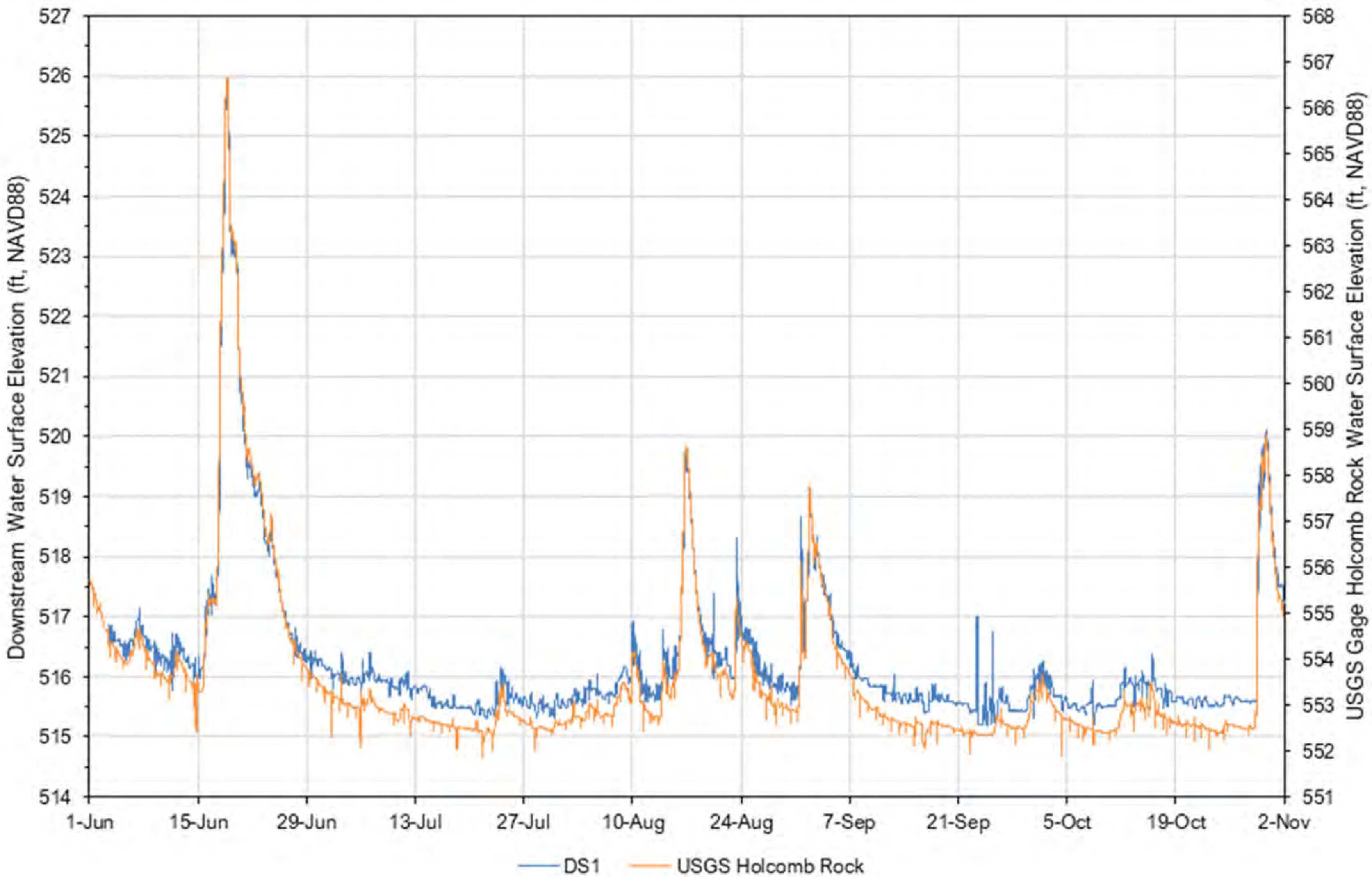


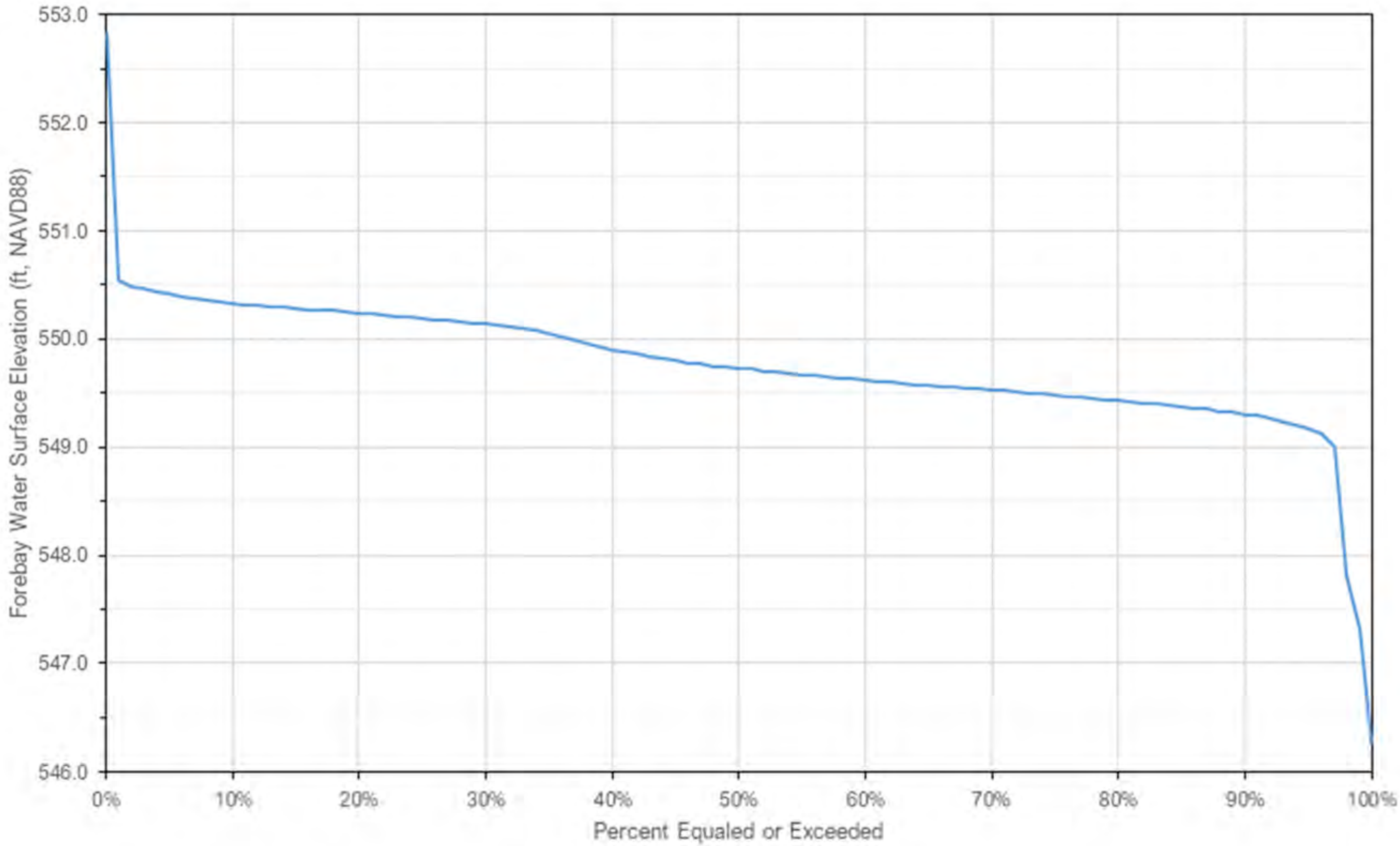
Figure 3.1.1-1. Hydroelectric projects, USGS streamflow gages on the James River, and major contributing tributaries to the James River upstream of the Project.

Figure 3.1.2-1. Waterbodies that contribute inflow to the Project reservoir.



Note: DS1 water level monitoring station is 0.8 river miles downstream of Reusens Dam.

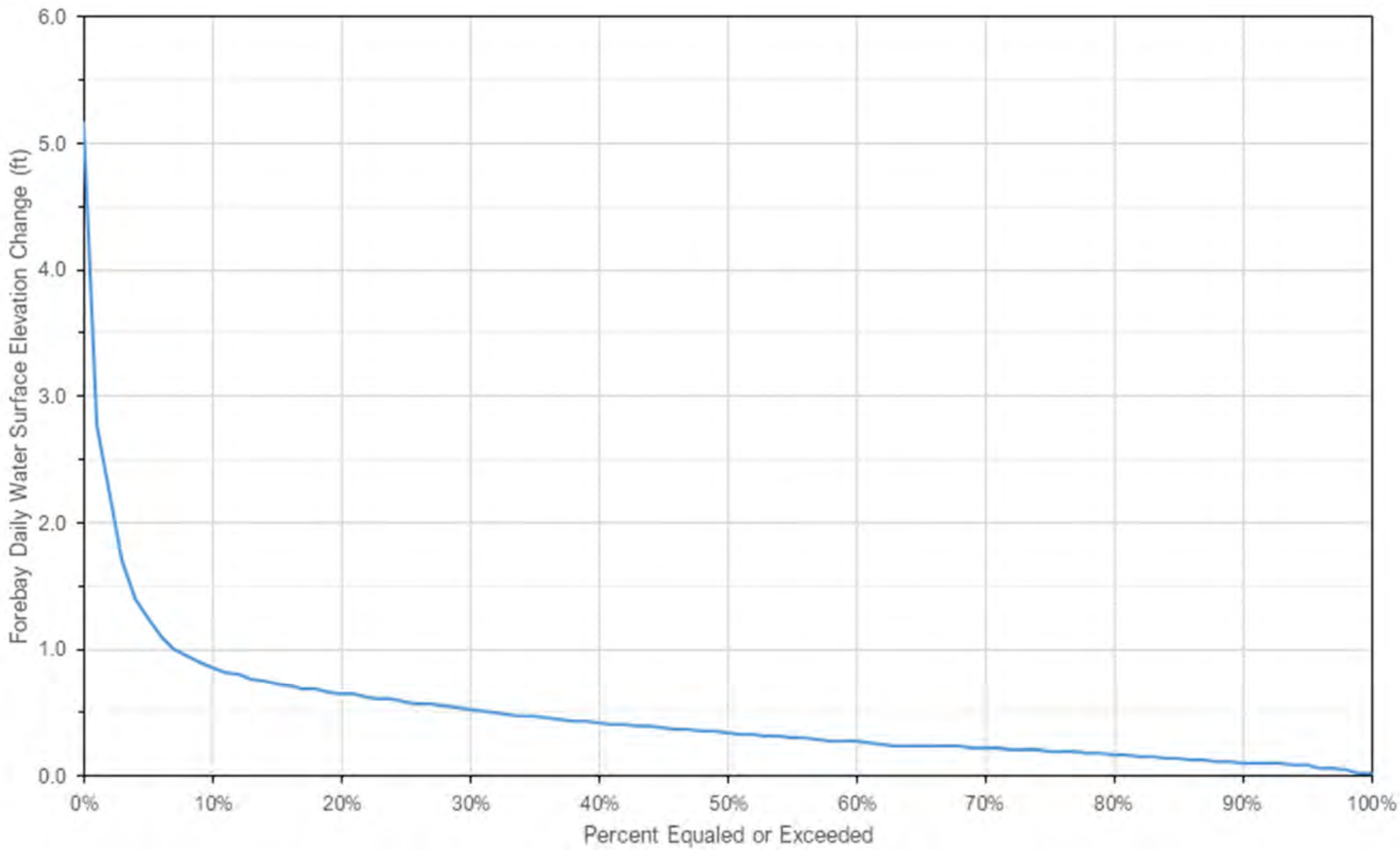
Figure 3.1.2-2. Project inflow and downstream water levels.



Note: Project was operating 13.1 to 20.3 percent of the time with at most 3 units operable.

Source: Reusens Hydro (2019), as modified by Reusens Hydro.

Figure 3.1.3-1. Water surface elevation duration curve for the Project forebay from 2007 through to 2011.



Note: Project was operating 13.1 to 20.3 percent of the time with at most 3 units operable.

Source: Reusens Hydro (2019)

Figure 3.1.3-2. Daily forebay water surface elevation change frequency curve based on hourly water surface elevations from 2007 through 2011.

3.2 Water Use

Project waters are used for hydroelectric generation, public recreation, and public water supply. According to reports by VDEQ, there is a moderate to high potential for growth in the James River watershed (VDEQ 2018a). Residential, commercial, and industrial growth is expected along the U.S. Route 501 corridor from Natural Bridge through Big Island to Lynchburg. Growth of the manufacturing industry is dependent on infrastructural expansion, which is dependent on the capacity of existing facilities. In the immediate area around the Project boundary, however, growth is significantly limited along the river left bank due to the CSX railroad right-of-way. Along the river-right bank, growth is limited primarily to residential development on parcels held in private ownership.

3.2.1 Water Discharges and Withdrawals

Section 402 of the Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) program to limit pollutant discharges into streams, rivers, and bays. In the Commonwealth of Virginia, VDEQ administers the program as the Virginia Pollutant Discharge Elimination System (VPDES). VDEQ issues VPDES permits for all point source discharges to surface waters. VDEQ issues two types of VPDES permits: individual and general permits. VDEQ issues individual permits to both municipal and industrial facilities. Individual permit requirements include special conditions, effluent limitations, and monitoring requirements for each facility on a site-specific basis in order to meet applicable water quality standards. Examples of individual permits are those issued to wastewater and sewage treatment facilities. General permits are permits written for a general class of dischargers, which include: single family home septic, seafood processing, petroleum contaminated sites and hydrostatic tests, stormwater discharge, non-metallic mineral mining, animal feed operations, concrete facilities, vehicle wash and laundry, non-contact cooling water, pesticides, nutrient trading, and potable water treatment. The EPA maintains authority to review applications and permits for "major" dischargers, a distinction based on discharge quantity and content.

Figure 3.2.1-1 shows the location of active VPDES individual permits in the James River watershed upstream of the Project dam. The closest VPDES individual permit is the Boonsboro Country Club Sewage Treatment Plan (VPDES Permit No. VA0091162), which is authorized to discharge 0.015 million gallons per day of effluent into an unnamed tributary of Judith Creek, which is a tributary of the James River and the Reusens reservoir. Judith Creek’s confluence with the James River is 0.2 river miles upstream of the Project dam. The outflow of the Boonsboro Country Club Sewage Treatment Plan is located approximately 6.0 river miles upstream from the creek’s confluence with the James River. The Reusens Hydroelectric Project also has a VPDES individual permit (VPDES Permit No. VA0087114). The permit authorizes Reusens to discharge into the James River 0.177 million gallons per day of turbine/generator bearing component cooling water.

Waters of the Project reservoir are withdrawn by the City of Lynchburg for municipal water supply at their Abert Pump Station, which is located approximately 3.6 miles upstream of the Project dam. The Abert Pump Station was constructed in 1974 (City of Lynchburg, 2014). In addition, the City of Lynchburg also withdraws water from the James River approximately 4.2 miles downstream of the Project dam at their Downtown Pump Station. Both the Abert and Downtown pumping stations are used during periods of greater water demand. The primary source of the City of Lynchburg municipal water supply is Pedlar Reservoir, which is located approximately 22 miles northeast of the Project and outside the Project boundary (FERC, 1994; City of Lynchburg, 2014). The City's Downtown Pumping Station is located outside of the Project boundary and downstream of the Lynchburg Dam, colloquially referred to as the Scott's Mill Dam.

By Letter Order dated April 14, 2014, the Commission approved a non-project use of project waters under Article 202 of the current license for the Amherst County Service Authority (ACSA) to install a tertiary water withdraw facility to withdraw 3 million gallons per day from the Project reservoir during emergency drought conditions (FERC, 2014). At present, ACSA has yet to construct the intake facility. The intake of ACSA would be located approximately one mile upstream of the Project dam on the northeast bank of the James River. The ACSA tertiary facility would only be used when ACSA primary and secondary facilities cannot meet their demand for municipal water. The ACSA primary water source is Harris Creek, and its secondary water source is Graham Creek, both of which are located outside the proposed Project boundary, and Project watershed.

3.2.2 Proposed Uses of Project Waters

On June 17, 2020, Scott's Mill Hydro, LLC (SM Hydro) filed with the Commission a 10-MW exemption application for a proposed hydropower facility at the existing Lynchburg Dam,[8] approximately 3.7 river miles downstream of the Project dam. The Commission subsequently issued a tendering notice of SM hydro's application, which solicited from stakeholder additional study requests.[9] In response, Reusens Hydro filed comments and study requests.[10] On October 28, 2020, the Commission issued a deficiency letter and gave SM Hydro the option to refile an exemption application or an application original license.[11] On March 31, 2021, SM Hydro refiled their exemption application.[12] In general, SM Hydro's proposal would include raising the Lynchburg dam by 2 feet to an elevation of about 516 ft NAVD88, constructing a powerhouse with total install generating capacity 4.5 MW, operating in run-of-river mode, and implementing a myriad of environmental measures. Since the refiling of the exemption application and at the time of this writing (July 2021) there has been no other filings made by the Commission in the public record. Although proposed to operate in run-of-river mode, the proposed downstream hydroelectric project would capitalize on the peaking flows of Project waters.

[8] FERC e-library Accession No. 20200617-5055
[9] FERC e-library Accession No. 20200624-3021
[10] FERC e-library Accession No. 20200817-5194
[11] FERC e-library Accession No. 20201028-3005
[12] FERC e-library Accession No. 20210331-5533

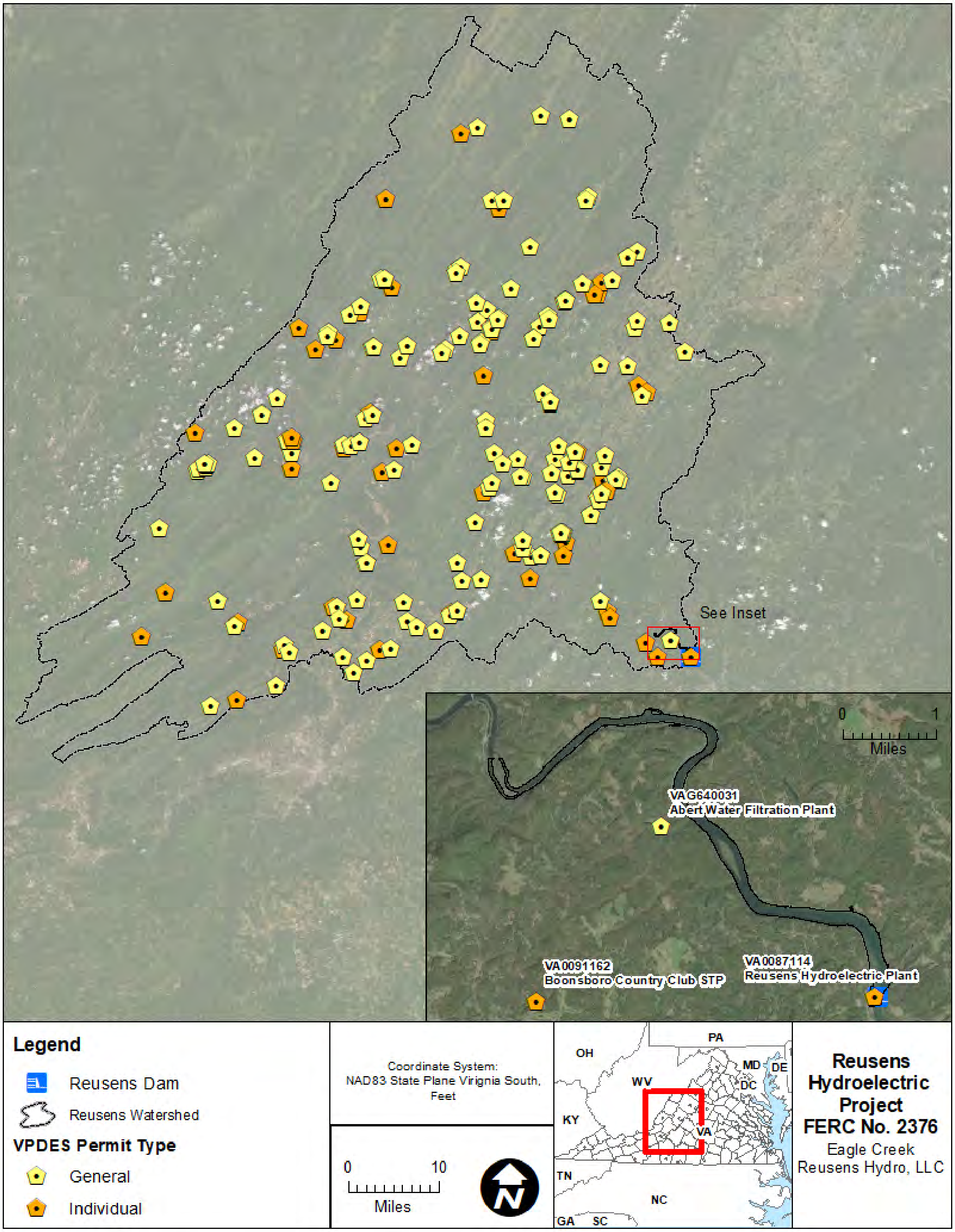


Figure 3.2.1-1. Active VPDES Permittees in the James River watershed upstream of the Project.

3.3 Water Quality

3.3.1 Water Quality Standards

The State Water Control Law mandates the protection of existing high-quality state waters and provides for the restoration of all other state waters so they will permit reasonable public uses and will support the growth of aquatic life. The adoption of water quality standards under Section 62.1-44.15(3a) of the law is one of the State Water Control Board's methods of accomplishing the law's purpose. Water quality standards consist of statements that describe water quality requirements. They also contain numeric limits for specific physical, chemical, biological or radiological characteristics of water. These statements and numeric limits describe water quality necessary to meet and maintain uses such as swimming and other water-based recreation, public water supply, and the propagation and growth of aquatic life. Standards include general and specific descriptions, because not all requirements for water quality protection can be numerically defined.

The reach of the James River upstream and downstream of the Project is classified as Sections 11g and 11h, Class III, under the Virginia Water Quality Standards 9 VAC 25-260, as “Nontidal Waters (Coastal and Piedmont Zones)” (Virginia Law, 2018). These reaches include James River and its tributaries from the Business Route 29 bridge in Lynchburg to Reusens Dam and the James River and its tributaries, excluding the Pedlar River, from Reusens Dam to Coleman Dam. All state waters, including wetlands, are designated for the following uses: recreational uses (e.g., swimming and boating), the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish). Numeric and descriptive water quality standards associated of non-tidal waters are included in Table 3.3.1-1.

Table 3.3.1-1. Applicable water quality standards for non-tidal waters.

Parameter	Administrative Code	Criteria
General Criteria	9VAC25-260-20	State waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water, or which are inimical or harmful to human, animal, plant, or aquatic life. Specific substances to be controlled include, but are not limited to: floating debris, oil, scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled. Conditions within mixing zones established according to 9VAC25-260-20 B do not violate the provisions of this subsection.
Streamflow	9VAC25-260-40	Man-made alterations in stream flow shall not contravene designated uses including protection of the propagation and growth of aquatic life.
Dissolved Oxygen	9VAC25-260-50	Instantaneous minimum not less than 4.0 mg/L Daily average not less than 5.0 mg/L
pH	9VAC25-260-50	No less than 6.0 and not greater than 9.0
Water Temperature	9VAC25-260-50	Maximum not to exceed 32°C
	9VAC25-260-60	Any rise above natural temperature shall not exceed 3°C except in the case of Class VI waters (natural trout waters), where it shall not exceed 1°C. However, the Board can, on a case-by-case basis, impose a more stringent limit on the rise above natural temperature. Natural temperature is defined as that temperature of a body of water (measured as the arithmetic average over one hour) due solely to natural conditions without the influence of any point-source discharge.
	9VAC25-260-70	The maximum hourly temperature change shall not exceed 2°C, except in the case of Class VI waters (natural trout waters) where it shall not exceed 0.5°C. These criteria shall apply beyond the boundaries of mixing zones and are in addition to temperature changes caused by natural conditions.
Bacteria	9VAC25-260-170	*E. coli* bacteria shall not exceed a monthly geometric mean of 126 CFU/100 ml in freshwater. If there are insufficient data to calculate monthly geometric means in freshwater, no more than 10% of the total samples in the assessment period shall exceed 235 *E. coli* CFU/100 ml. If there are insufficient data to calculate monthly geometric means in transition and saltwater,

Parameter	Administrative Code	Criteria
		no more than 10% of the total samples in the assessment period shall exceed enterococci 104 CFU/100 ml.
Methylmercury (Fish Tissue)	9VAC25-260-140	No greater than 0.30 µg/L

3.3.1 Clean Water Act, Section 303(d) Listing of Impaired Waters, and Section 305(d) Assessment and Reporting

Under section 303(d) of the CWA, and in adherence with federal water quality planning and management regulations (40 C.F.R. Part 130), all states are required to develop lists of impaired waters, commonly referred to as the 303(d) list. The list includes lakes, ponds, rivers, and streams whose water quality does not meet state-defined water quality standards. Each state's list must be updated every two years and submitted to the United States Environmental Protection Agency (EPA) for approval. The CWA requires a Total Maximum Daily Load (TMDL) plan to be developed for waters on the list and to provide a schedule for TMDL completion. A TMDL is a regulatory term of the CWA that describes a plan for bringing impaired waters into compliance with approved water quality standards and designated uses. TMDLs specify the maximum amount of a pollutant a waterbody can receive while still attaining the approved water quality standards and designated uses.

VDEQ is responsible for water monitoring, water quality assessments, and water regulations of the Commonwealth. VDEQ, based on EPA guidance, created a categorical classification to determine whether a water body or water body segment attain all water quality standards and applicable designated uses. Each water body or water body segment may be listed in the following categories or subcategories:

- Category 1 – waterbody or waterbody segment is attaining all associated designated uses and no designated use is threatened.
  - Category 1A – waters are attaining all uses and a TMDL has been developed for one or more uses.
- Category 2 – available data and/or other information indicate that some, but not all designated uses are supported.
  - Category 2A – waters are supporting all uses for which they are monitored.
  - Category 2B – waters are of concern to the state but no water quality standard exists for a specific pollutant, or the water exceeds a state screening value or toxicity test.
  - Category 2C – waters are now attaining the use(s) for which they were originally 303(d) listed and the TMDL is EPA approved but other applicable use(s) were not monitored and assessed.
- Category 3 - insufficient data and/or information to determine whether any designated uses are met.
  - Category 3A - no data are available within the data window of the current assessment to determine if any designated use is attained, and the water was not previously listed as impaired.
  - Category 3B - some data exist but are insufficient to determine support of designated uses. Such waters will be prioritized for follow-up monitoring, as resources allow.

  - Category 3C- data collected by a citizen monitoring or another organization indicating water quality problems may exist but the methodology and/or data quality has not been approved for a determination of support of designated use(s). These waters are considered as having insufficient data with observed effects. Such waters will be prioritized by VDEQ for follow-up monitoring.
  - Category 3D - data collected by a citizen monitoring or other organization indicating designated use(s) are being attained but the methodology and/or data quality has not been approved for such a determination.
- Category 4 – water is impaired or threatened but a TMDL is not required
  - Category 4A – water is impaired or threatened for one or more designated uses but does not require a TMDL. A new TMDL is not necessary to address the newly identified impaired tributaries if TMDL modeling, source identification and reductions cover the entire watershed and the TMDL has been approved by EPA. These waters are primarily related to shellfish and/or recreational bacteria impairments but could include benthic impairments.
  - Category 4B – water is impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements (such as VPDES limits under a compliance schedule) are reasonably expected to result in attainment of water quality standards by the next reporting period or permit cycle.
  - Category 4C – water is impaired or threatened for one or more designated uses but does not require a TMDL because the impairment is not caused by a pollutant and/or is determined to be caused by natural conditions.
  - Category 4D – part(s) of a water quality standard is attained for a pollutant with a TMDL, but the remaining criteria for the standard were not assessed due to insufficient information. (Only to be applied to dissolved oxygen in tidal waters of the Chesapeake Bay).
- Category 5 – Waters are impaired or threatened and a TMDL is needed.
  - Category 5A – a water quality standard is not attained. The water is impaired or threatened for one or more designated uses (excluding shellfish use) by a pollutant(s) and requires a TMDL (303d list).
  - Category 5B – the water quality standard for shellfish use is not attained. One or more pollutants causing impairment require TMDL development.
  - Category 5C – the water quality standard is not attained due to “suspected” natural conditions. The water is impaired for one or more designated uses by a pollutant(s) and may require a TMDL (303d list). Water quality standards for these waters may be re-evaluated due to the presence of natural conditions.
  - Category 5D – the water quality standard is not attained where TMDLs for a pollutant(s) have been developed but one or more pollutants are still causing impairment requiring additional TMDL development.

- Category 5E – effluent limited facilities are not expected to meet compliance schedules by next permit cycle or reporting period.
- Category 5F – the water quality standard is attained for a pollutant(s) with a TMDL and 303(d) delisting approved but the water remains impaired for additional pollutant(s) requiring TMDL development.
- Category 5R – the Water Quality Standard is not attained and the water is impaired, and implementation of an EPA-approved restoration plan is expected to result in attainment. A status update will be provided each 303(d) cycle to evaluate progress.
- Category 5M – the water quality standard is not attained for mercury primarily due to atmospheric deposition.

Section 305(b) of the CWA directs states to periodically prepare a report that provides the water quality assessment results in a state. The most recent report for the Commonwealth of Virginia is the draft *2020 Water Quality Assessment Integrated Report*, which provides the results of Virginia's water quality assessments during the time period January 1, 2013, through December 31, 2018, and describes the extensive efforts to monitor, assess, and improve water quality in the waters of the Commonwealth (VDEQ, VDCR and VDH, 2020).VDEQ, VDCR and VDH (2020) identifies bacteria and non-point source pollutants as primary significant and suspected causes and sources of river segment impairment within the James River basin.

In the vicinity of the Project, there are two assessment units that encompass Project waters. Assessment Unit ID VAC-H03R_JMS06A02 extends 8.3 river miles of upstream from Reusens dam to Holcomb Rock dam. In addition, Assessment Unit ID VAC-H03R_JMS04A02 encompasses Project tailwaters from the Reusens dam to 4.2 miles downstream to the Route 29 bridge. Both assessment units of the James River that encompass the Project are listed as Category 5D, and impaired for fish consumption due to PCB in fish tissue and recreation due to elevated levels of Escherichia coli (e-coli) bacteria. Aquatic life, wildlife, and public water supply designated uses are fully supported in these segments (VDEQ, VDCR and VDH, 2020). The fish consumption impairment listing is based on 2004 fish tissue analyses where elevated levels of PCBs greater than the 0.00064 human health standard were measured among fish sampled from several VDEQ monitoring stations throughout the James River, from Big Island dam downstream to the I-95 bridge near Richmond, VA. The source of the PCBs is unknown (VDEQ, VDCR and VDH, 2020). The recreation use impairment listing is based on 2001 data that found five and eight of 36 Escherichia coli bacteria samples exceeded the 235 cfs/100 ml instantaneous water quality standard within segments VAC-H03R_JMS06A02 and VAC-H03R_JMS04A02, respectively (VADEQ, 2020). VDEQ identified combined sewer overflows, discharges from municipal separate storm sewer systems (MS4s), municipal point source discharges, waste from pets, livestock, on-site waste treatment systems (i.e, septic systems), unspecified domestic waste, wildlife, and waterfowl, as sources of the impairment.

Total Maximum Daily Load

Currently, there is a fish consumption advisory for the assessment units that encompass the Project. The advisory recommends that no more than two meals per month of gizzard shad, carp, American eel, flathead catfish, or quillback carpsucker be consumed. VDEQ has established a High Priory Level for a TMDL to be developed to address PCBs in fish tissues in the James

River. VDEQ anticipates the development of a TMDL to address PCBs in fish tissue by 2022 (VDEQ, VDCR and VDH, 2020). Levels of PCBs detected in fish in the Project vicinity is further discussed in *Section 4 - Fish and Aquatic Resources*. In May of 2017, a TMDL for the segment of the James River encompassed by the Project for E. coli was completed (MapTech, 2017).

3.3.2 Historic and Existing Water Quality Data

Water quality of the James River has been monitored by VDEQ, USGS, and other entities. Below is a summary of the existing water quality data collected by the various entities in the Project vicinity on the James River. Discrete and continuous water quality data were also collected by Reusens Hydro over the course of the relicensing process. These data are presented in *Section 3.4 - Study Requests*.

Instantaneous Monitoring

In the Project vicinity, water quality has been periodically monitored by VDEQ. VDEQ maintains a water quality monitoring station on the James River approximately 7.6 river miles upstream of the Project, near USGS Gage No. 02025500 James River near Holcomb Rock, VA, and at the Monacan Park boat ramp, about 3.2 river miles upstream of the Reusens dam. In addition, VDEQ also collected surface water quality data at two sites 0.6 and 0.7 river miles downstream of the Project dam, respectively. Collectively, these monitoring stations encompass the entire Project area. Figure 3.3.2-1 and Table 3.3.2-1 provide the location and period of record of water quality data available at these two locations.

Table 3.3.2-1 summarizes the available water quality data from 1994 to 2021 for the three VDEQ monitoring stations that encompass the Project area. Over the period of record analyzed, 60 different parameters have been collected or measured in the James River in the vicinity of the Project. These include various metals, organics, nutrients, solids, and other chemical and physical properties. These data indicate that water temperatures, dissolved oxygen concentrations, and pH level in the Project area range from 0.2 to 29.6°C, 6.5 to 16.7 mg/L, and 6.7 to 8.7 respectively. Furthermore, between the three stations, mean water temperature, mean dissolved oxygen, and mean pH levels range from 15.9 to 23.7°C, 7.4 to 10.1mg/L, and 7.8 to 7.9, respectively. Collectively, these data collected by VDEQ indicate waters of the James River in the vicinity of the Project are consistent with the water temperature, dissolved oxygen, and pH state surface water quality standards for non-tidal waters (see section 3.3.1, *Water Quality Standards).*

Furthermore, SM Hydro performed water temperature and dissolved oxygen monitoring as a part of the licensing studies for the proposed Scott’s Mill Hydroelectric Project (FERC Project No. 14425) on the James River (SM Hydro, 2017). These locations are described and pictured in Table 3.3.2-1 and Figure 3.3.2-1, respectively. In the immediate vicinity of the Reusens Project, SM Hydro (2017) collected instantaneous water temperature and dissolved oxygen measurements immediately upstream and downstream of the Project in September 2016 during hot (+90°F) and dry conditions (no rain within 4 days). Upstream of the Reusens dam, the water temperature was 31.5°C and the dissolved oxygen levels were 9.6 mg/L and 130.4 percent saturation. Downstream of the Reusens Project, water temperatures were measured to be 27.5°C, and dissolved oxygen levels were 7.6 mg/L and 96.0 percent saturation (SM Hydro, 2017).

Continuous Monitoring

The USGS continuously monitored water temperature (°C) and specific conductivity (µS/cm) on a daily basis at the USGS Gage No. 02025500 James River near Holcomb Rock, VA upstream of the Project starting in late February of 2007 through early November 2008. The continuous water temperature data demonstrates seasonal warming and cooling of the James River in the vicinity of the Project (Figure 3.3.2-2). On average, the warmest water temperatures are observed in August whereas the coolest occur in January. Specific conductivity in the vicinity of the Project appears to variable (Figure 3.3.2-2). On average, specific conductivity in the vicinity of the Project appears to be highest in October and lowest in January.

River Sediment Sampling

In September 2010, VDEQ collected sediment of the James River using a Petit Ponar grab sampler at their monitoring station 21VASWCB-2BJMS264.58, downstream of the Project (Table 3.3.2-1). The sediment was subsequently analyzed for metal concentrations. Table 3.3.2- 3 present the results of VDEQ sediment metal analysis.

SM Hydro collected river sediment behind the Lynchburg Dam (37.4249, -79.1408). Samples were collected using a hand auger and extensions, from the soil/sediment surface to a depth of approximately three feet. Samples were composited (mixed) in the field and were then sent to the Cape Fear Analytical laboratory (in Wilmington, NC) for PCB analysis using US Environmental Protection Agency (USEPA) Method 1668A (low-level PCB / 209 congener analysis). Results of the analysis indicates PCB concentrations in the sediment of James River behind the Lynchburg Dam range from 9 to 75 picograms/per gram of sediment, or 0.000009 to 0.000075 ppm (SM Hydro, 2017).

Table 3.3.2-1 Surface water quality monitoring stations established by entities other than Reusens Hydro.

Organization	Station ID	Station Location (Latitude, Longitude)	Distance from Project Dam	Period of Record	Sample Frequency
VDEQ	21VASWCB-2-JMS270.84	37.5031, -79.2622	7.6 river miles upstream	1974 to 2021	Intermittent from 1974 to 1994; About once every 2 months starting 2001 to 2021
VDEQ	21VASWCB-2BJMS267.05	37.4921, -79.2217	3.2 river miles upstream	2020	Two to three days in May and June
VDEQ	21VASWCB-2BJMS264.58	37.4539, -79.1794	0.7 river miles downstream	2010	September 21 and 22, 2010
VDEQ	21VASWCB-2BJMS263.24	37.4561, -79.1795	0.6 river miles downstream	2017 to 2019	July 2017, February and September 2018; February 2019
SM Hydro	001	37.4632, -79.1871	At Project Powerhouse A	2016	1 day, September 9, 2016
SM Hydro	002	37.4622, -79.1866	0.06 river mile downstream	2016	1 day, September 9, 2016
SM Hydro	Cross-Section	37.4268, -79.1414	3.6 river miles downstream	2016	1 day, September 12, 2016
SM Hydro	Vertical Profiles	37.4268, -79.1414	3.6 river miles downstream	2016	1 day, September 12, 2016

Source: NWQMC (2021); Scott's Mill (2017)

Table 3.3.2-2. Water quality monitoring data for stations 21VASWCB-2-JMS270.84, 21VASWCB-2BJMS264.58 and 21VASWCB-2BJMS263.24 from 1994 - 2021.[1]

Parameter	Units	21VASWCB-2-JMS270.84 (Upstream)				21VASWCB-2BJMS267.05 (Upstream)				21VASWCB-2BJMS264.58 (Downstream)				21VASWCB-2BJMS263.24 (Downstream)			
		Count	Min	Mean	Max	Count	Min	Mean	Max	Count	Min	Mean	Max	Count	Min	Mean	Max
4,4'-Methylenebis(2-chloroaniline)	mg/L	1	0.01	0.01	0.01												
Acid Neutralization Potential As %CaCO3	mg/L									1	120	120.00	120.00				
Acidity, (H+)	mg/L									1	2.31	2.31	2.31				
Alkalinity, total	mg/L									1	115	115.00	115.00				
Aluminum	µg/L									3	0.06	20.65	48.80				
Ammonia	mg/L	22	0.04	0.05	0.10					3	0.01	0.03	0.04				
Antimony	µg/L									3	0.01	0.10	0.20				
Arsenic	µg/L									3	0.1	0.50	0.70				
Barium	µg/L									3	0.02	46.67	70.40				
Beryllium	µg/L									3	0.02	0.08	0.20				
Biochemical oxygen demand, standard	mg/L	1	3	3.00	3.00												
Cadmium	µg/L									3	0.02	0.05	0.10				
Calcium	mg/L									3	0.01	32.64	49.60				
Chloride	mg/L									1	24.8	24.80	24.80				
Chlorophyll a, corrected for pheophytin	µg/L	18	0.5	3.13	15.44					1	1.28	1.28	1.28				
Chlorophyll a, uncorrected for pheophytin	µg/L	18	0.5	3.49	19.56					1	1.36	1.36	1.36				
Chlorophyll b	µg/L	18	0.5	0.69	2.70					1	0.1	0.10	0.10				
Chlorophyll c	µg/L	18	0.5	0.64	2.45					1	0.1	0.10	0.10				
Chromium	µg/L									3	0.04	1.15	2.70				
Copper	µg/L									3	0.3	0.73	1.00				
Dissolved oxygen (DO)	mg/L	68	6.5	10.09	16.17					2	7.3	7.40	7.50				
Enterococcus	cfu/100	43	10	170.93	800.00					1	10	10.00	10.00				
Escherichia coli	cfu/100	106	10	150.67	5794.00					1	10	10.00	10.00				
Fecal Coliform	cfu/100	127	25	175.59	2800.00	5	10.00	417.40	1785.00	1	25	25.00	25.00				
Fixed dissolved solids	mg/L									1	290	290.00	290.00				
Fixed suspended solids	mg/L	21	3	4.67	30.00					1	2	2.00	2.00				
Hardness, Ca, Mg	mg/L	62	10	110.00	180.00												
Hardness, carbonate	mg/L									3	1	104.67	158.00				
Iron	µg/L									3	4	42.07	96.40				
Kjeldahl nitrogen	mg/L	100	0.03	0.40	3.40					1	0.4	0.40	0.40				
Lead	µg/L									3	0.01	0.07	0.10				
Magnesium	mg/L									3	0.01	5.60	8.41				

Parameter	Units	21VASWCB-2-JMS270.84 (Upstream)				21VASWCB-2BJMS267.05 (Upstream)				21VASWCB-2BJMS264.58 (Downstream)				21VASWCB-2BJMS263.24 (Downstream)			
		Count	**Min**	**Mean**	**Max**	**Count**	**Min**	**Mean**	**Max**	**Count**	**Min**	**Mean**	**Max**	**Count**	**Min**	**Mean**	**Max**
Manganese	µg/L									3	0.02	17.24	29.60				
Mercury	ng/L									3	0.7	2.53	5.50				
Nickel	µg/L									3	0.08	1.29	1.90				
Nitrate	mg/L	22	0.04	0.09	0.39					3	0.04	0.04	0.05				
Nitrite	mg/L	22	0.01	0.01	0.01					3	0.004	0.01	0.01				
Nitrogen	mg/L	103	0.2	0.54	4.38					2	0.35	0.36	0.36				
Organic carbon	mg/L	9	1.94	3.76	5.41					1	5.78	5.78	5.78	8	2	3.31	4.04
Orthophosphate	mg/L	22	0.02	0.10	0.31					2	0.01	0.01	0.01				
pH	None	122	6.7	7.85	8.71	10	7.76	7.98	8.35	3	7.7	7.77	7.82	4	7.8	7.90	8.10
Pheophytin a	µg/L	18	0.5	0.91	5.68					1	0.1	0.10	0.10				
Pheophytin ratio	%	12	1.512	2.00	3.35					1	1.699	1.70	1.70				
Phosphorus	mg/L	127	0.01	0.06	0.56					2	0.01	0.02	0.02				
Potassium	mg/L									1	4.81	4.81	4.81				
Salinity	‰	1	0.29	0.29	0.29												
Selenium	µg/L									3	0.3	0.40	0.50				
Silver	µg/L									3	0.004	0.01	0.01				
Sodium	mg/L									1	42.3	42.30	42.30				
Specific conductance	µS/cm	143	1.9	299.44	581.00	10	125.00	210.50	297.00	3	494	499.33	505.00	4	230	268.33	374.00
Sulfate	mg/L									1	88	88.00	88.00				
Tannin and Lignin	mg/L	1	0.41	0.41	0.41												
Temperature, water	C	122	0.2	15.88	29.60	10	13.12	21.91	29.59	2	23.5	23.70	23.90	4	3.24	15.90	29.51
Thallium	µg/L									3	0.01	0.01	0.01				
Total fixed solids	mg/L	21	5	185.57	337.00					1	291	291.00	291.00				
Total solids	mg/L	131	5	204.56	411.00					2	320	324.00	328.00				
Total suspended solids	mg/L	140	0.86	17.21	322.00					5	0.5	15.91	73.70	16	0.12	44.74	172.00
Total volatile solids	mg/L	41	3	15.95	51.00					3	1	22.67	37.00				
Turbidity	NTU	124	0.2	9.80	228.00					1	1.62	1.62	1.62				
Zinc	µg/L									3	0.4	2.33	5.60				

Source: NWQMC (2021)

1. 1 Empty table cells indicate no water quality data was collected for the associated parameter.

Table 4.3.3-5. Results of VDEQ sediment sampling and analysis at monitoring station 21VASWCB-2BJMS264.58 in September 2010.

Metal	Result (mg/kg)
Copper	8.69
Iron	17900
Lead	13.5
Manganese	294
Nickel	16.5
Selenium	0.43[1]
Silver	0.24[1]
Thallium	0.15[1]
Zinc	111
Mercury	0.001
Aluminum	7000
Antimony	0.23[1]
Arsenic	1.78[1]
Beryllium	0.73[1]
Cadmium	0.38[1]
Chromium	13.1

Source: NWQMC (2021)

1. Analyte detected above the minimum detection limit but below the method quantification limit.

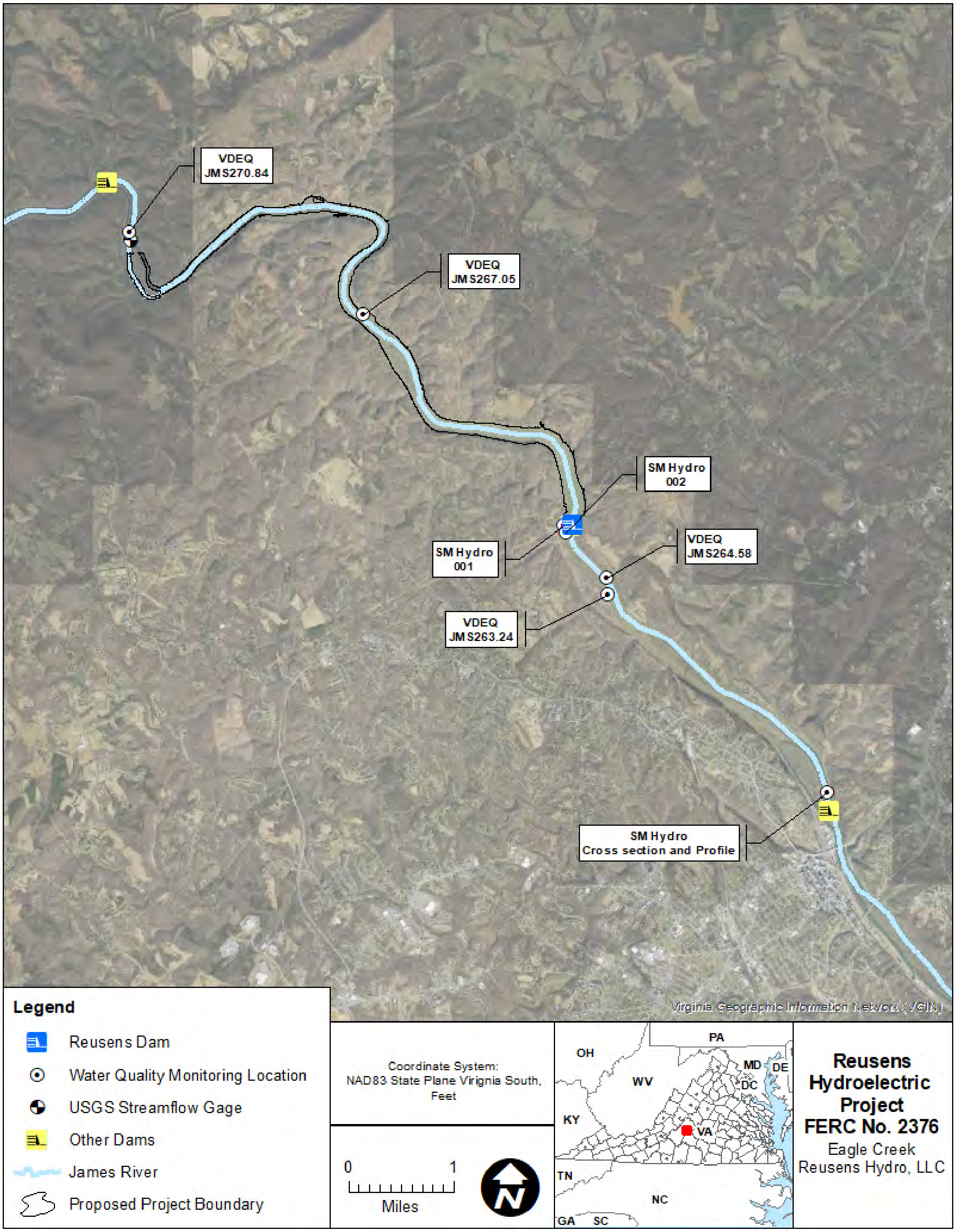
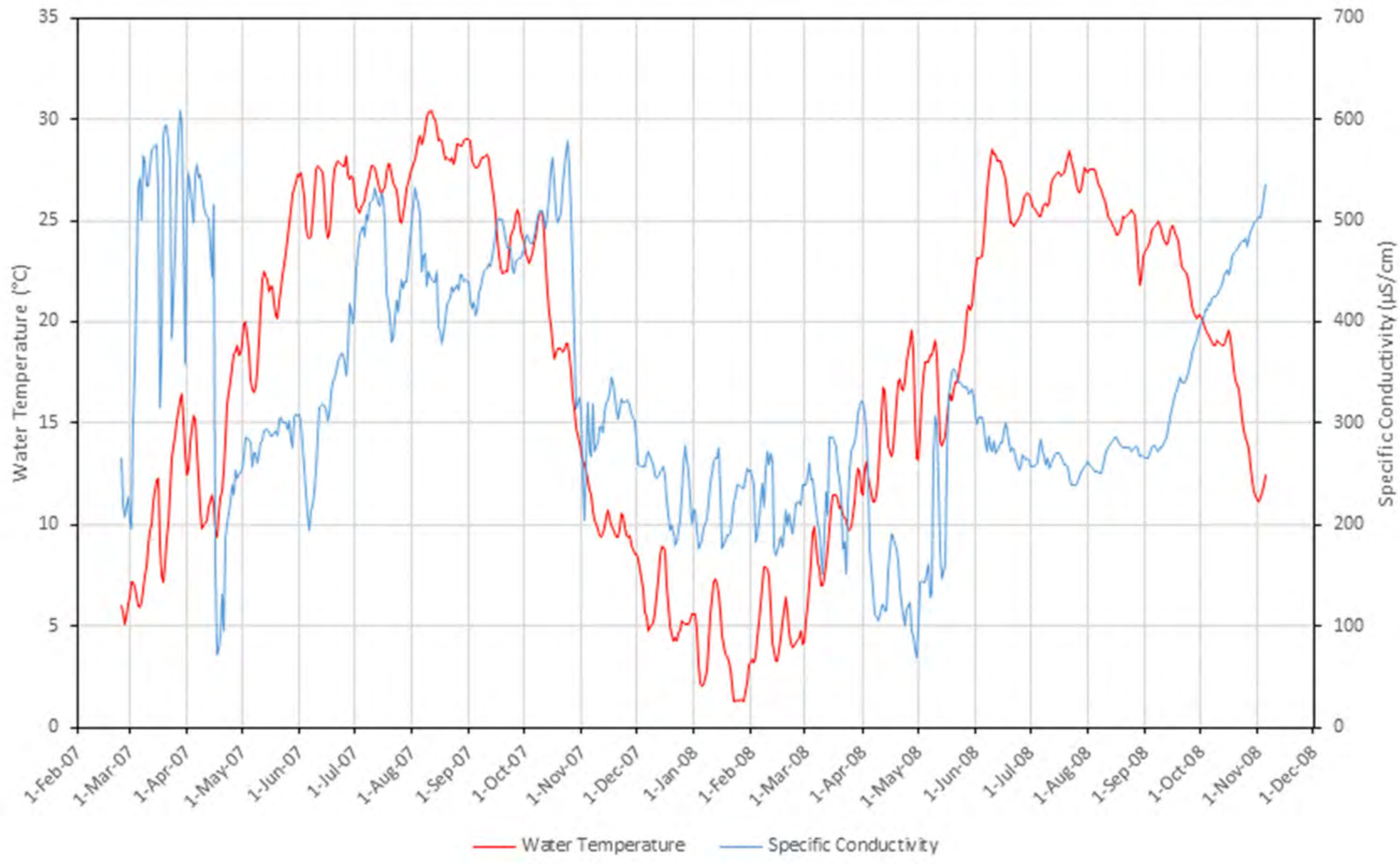


Figure 3.3.2-1. Water quality monitoring locations in the Project area of entities other than Reusens Hydro.



Source: Reusens Hydro (2019)

Figure 4.3.3-2. Continuous water temperature and specific conductivity data collected at USGS Gage No. 02025500 James River near Holcomb Rock, VA from October 2007 to November 2008.

3.4 Study Requests and Results

Reusens Hydro did not receive any study request pertaining to water quantity, water use or water quality. However, Reusens Hydro proposed to perform a Baseline Water Quality Monitoring Study in support the Section 401 Water Quality Certification process. Reusens Hydro subsequently prepared a Draft Study Plan, which is enclosed in this license application as Attachment 1 – Draft Study Plan, distributed it to the resource agencies, and held a conference call with the resource agencies to discuss the DSP. Reusens Hydro subsequently revised the DSP, as appropriate, and addressed the resource agencies comments on the DSP to form the Final Study Plan (Attachment 2). Documentation of these consultation activities are provided in Appendix A. The Baseline Water Quality Monitoring Study was then performed following the FSP.

3.4.1 Baseline Water Quality Monitoring Study

A baseline water quality study was conducted from June through October of 2020 in the Project area and included the use of discrete and continuous water temperature and dissolved oxygen monitoring, discrete pH sampling, Secchi disk transparency, nutrient and chlorophyll-a sampling. These data were collected at various location throughout the Project area and included the tailrace, forebay, and upper reservoir (Figure 3.4.1-1). Water temperature and dissolved oxygen were continuously measured within the tailrace, forebay and upper reservoir. Vertical profiles of water temperature, dissolved oxygen, and pH were collected in the forebay, Secchi disk transparency, nutrients and chlorophyll-a were sampled in the forebay. The full study report for the baseline water quality study is provided as an attachment to this license application.

Temperature and Dissolved Oxygen

Continuous water temperature and DO data were recorded within the Project forebay, tailrace, and upper reservoir (Figure 3.4.1-2). Overall, water temperatures among the upper reservoir, forebay, and tailrace areas over the study period generally correlate with similar temporal and diel warming and cooling trends, such that water temperatures generally exhibit a typical warming trend in the summer and cooling in the fall among the monitoring locations and appear to be highly influenced by precipitation events. Maximum water temperatures ranged from 30.8 to 31.7°C, and minimum temperatures ranged from 14.2 to 14.7°C (Table 3.4.1-1). On average, monthly water temperatures ranged between 17.2 to 29.1°C. Vertical profiles indicate the water column in the Project forebay was generally thermally uniform with some slight surface warming but was not strong enough to result in any thermal stratification through the study period (Figure 3.4.1-3).

Concentrations and percent saturation levels of dissolved oxygen exhibited a similar pattern throughout the study area among the three sampling locations (Figures 3.4.1-4 and 3.4.1-5). For instance, dissolved oxygen concentrations began to slowly decline at the beginning of the study period, but then increased rapidly as a result of a rain event that increased river flows and substantially decreased water temperatures. During July through mid-August, however, dissolved oxygen concentrations and levels were at their maximum within the forebay and tailrace areas, whereas they were at their lowest within the upper reservoir. From mid-August through the end of the study period dissolved oxygen concentrations gradually increased, whereas percent saturation remained relatively consistent. During this period, concentrations and levels were consistently higher within the upper reservoir than the forebay and tailrace areas. Over the study period dissolved oxygen concentrations ranged between 6.0 to 13.8 mg/L (80.7 to 189.6 percent saturation), with average monthly levels that ranged between 7.7 and 9.6 mg/L (97.0 to 100.8 percent saturation) among the study stations (Table 3.4.1-2). DO level throughout the water column of the forebay indicate that dissolved oxygen concentrations and percent saturation levels throughout the water column are well-oxygenated, are generally uniform over the study period, and reflect similar values measured by the continuous data loggers (Figures 3.4.1-6 and 3.4.1-7). However, in July, dissolved oxygen concentrations and percent saturation levels demonstrated a clinograde oxygen profile typical of eutrophic lakes and reservoirs such that high levels occur within the epilimnion, and rapid oxygen consumption occurs within the metalimnion.

pH

The monthly discrete pH sampling indicates that the waters of the Project's upper reservoir, forebay and tailrace areas are slightly basic (Table 3.4.1-3). pH levels of the Project area range between 7.9 to 8.6 and are generally at their highest in July (Table 3.4.1-3). Overall, the average pH of the water quality monitoring stations was 8.2 during the study period.

Figures 3.4.1-8 provide the results of pH levels throughout the water column of the forebay area over the study period. These data indicate that pH levels within the forebay are slightly basic. These data also indicate that pH is likely affected by high level of primary production, as indicated by chlorophyll-a, in July and August.

Secchi Transparency, Nutrients, and Chlorophyll-a

Secchi depth measurements were collected during each visit to the forebay water quality monitoring station to determine the depth of the euphotic zone and to support the collection of nutrient and chlorophyll-a samples and an analysis of the trophic state of the Project reservoir. the Secchi depth measurements indicate that the euphotic zone average depth is approximately 2.5 m but can be as shallow as 1.0 m and as deep as 3.6 m (Table 3.4.1-4).

Over the duration of the study, levels of chlorophyll-a, orthophosphate, and total phosphorus were mostly below the analysis method reporting limit, but all samples for nitrate+nitrite and total nitrogen were measured at detectable levels. Overall, chlorophyll-a levels ranged from below the reporting limit to 14.6 mg/m, nitrate+nitrite levels ranged from 0.11 to 0.28 mg/L, orthophosphate was undetected by the analysis method, total Kjeldahl nitrogen ranged from 0.58 to 0.83 mg/L, total nitrogen ranged from 0.56 to 1.10 mg/L, and total phosphorus like orthophosphate was undetected by the analysis method. Collectively, the trophic state of the Project reservoir based on Secchi depth, chlorophyll-a and total phosphorus measures ranged between mesotrophic to eutrophic during the study period, with trophic state index values ranging from 39.6 to 67.4 (Table 3.4.1-4).

Table 3.4.1-1. Summary statistics of the continuous water temperature (°C) dataset.

Statistic	Month				
	Jun	Jul	Aug	Sep	Oct
Upstream (RWQ-US)					
Minimum	15.9	24.3	21.0	17.8	14.2
Maximum	26.4	30.9	28.9	19.5	19.5
Mean	21.8	28.3	25.8	21.5	17.2
Median	22.3	28.4	26.4	22.3	17.4
Forebay (RWQ-FB)					
Minimum	16.0	24.5	21.4	18.2	14.6
Maximum	26.8	30.8	29.6	25.1	21.2
Mean	22.2	28.6	26.1	21.9	17.5
Median	22.6	28.6	26.6	22.8	17.6
Tailrace (RWQ-TR)					
Minimum	16.1	24.1	21.5	18.5	14.7
Maximum	27.0	31.7	29.9	25.2	20.8
Mean	22.2	29.1	26.4	21.7	17.6
Median	22.7	29.3	27.2	22.8	17.6

Table 3.4.1-2. Summary statistics of the continuous dissolved oxygen concentration (mg/L) and percent saturation (in parentheses) dataset.

Statistic	Month				
	Jun	**Jul**	**Aug**	**Sep**	**Oct**
Upstream (RWQ-US)					
Minimum	7.8 (92.7)	6.5 (86.3)	7.2 (91.0)	7.8 (92.2)	8.5 (89.4)
Maximum	11.2 (118.1)	9.0 (121.9)	9.5 (110.1)	10.0 (110.5)	11.1 (117.5)
Mean	9.1 (105.3)	7.9 (103.6)	8.1 (101.7)	8.8 (100.7)	9.6 (100.8)
Median	8.8 (104.5)	7.8 (102.9)	8.1 (101.1)	8.7 (100.9)	9.5 (101.0)
Forebay (RWQ-FB)					
Minimum	7.5 (90.2)	6.2 (80.7)	6.0 (78.4)	6.5 (77.8)	8.0 (84.6)
Maximum	10.7 (117.1)	11.4 (155.1)	9.4 (115.0)	9.3 (106.2)	10.6 (105.7)
Mean	9.0 (104.9)	8.4 (110.5)	7.7 (97.0)	8.1 (94.0)	9.0 (95.6)
Median	8.9 (104.9)	8.3 (107.6)	7.6 (96.8)	8.2 (94.4)	9.01 (95.7)
Tailrace (RWQ-TR)					
Minimum	6.9 (94.3)	6.7 (90.2)	6.8 (86.6)	7.2 (87.8)	7.3 (79.1)
Maximum	11.2 (130.9)	13.8 (189.6)	9.6 (125.1)	9.1 (105.8)	10.4 (109.1)
Mean	9.0 (105.7)	9.5 (126.8)	8.0 (100.6)	8.5 (97.9)	9.1 (96.5)
Median	9.0 (105.2)	9.4 (124.7)	7.9 (99.7)	8.5 (97.8)	9.1 (97.1)

Table 3.4.1-3. pH levels of the Project area during the study period.

Station	Month				
	Jun	Jul	Aug	Sep	Oct
RWQ-US[1]	–	8.2	8.2	8.1	8.3
RWQ-FB	8.2	8.6	8.3	8.0	8.2
RWQ-TR	8.3	8.5	8.2	7.9	8.1

1. "-" indicates no pH reading was taken for the station and month.

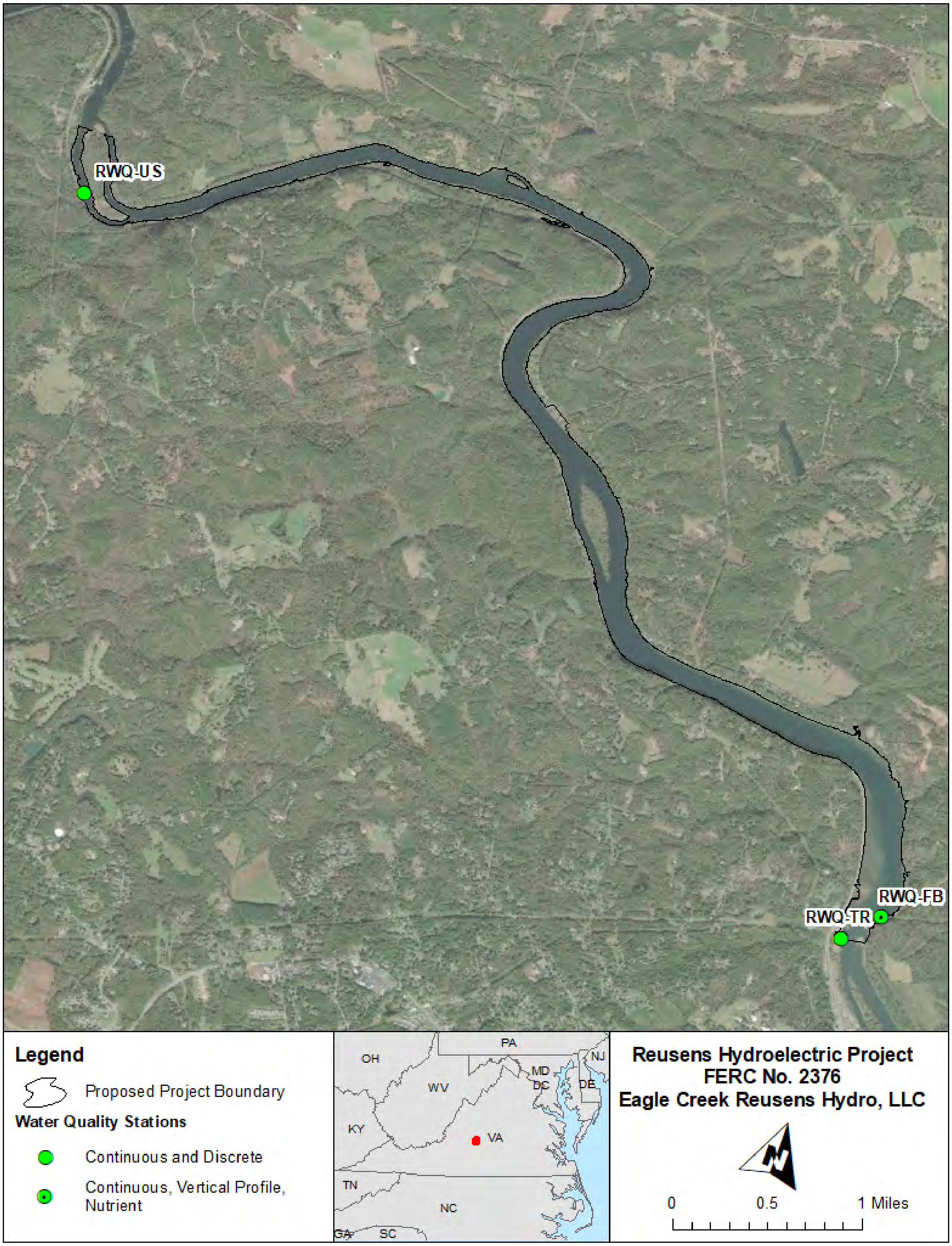


Figure 3.4.1-1. Water quality study monitoring locations.

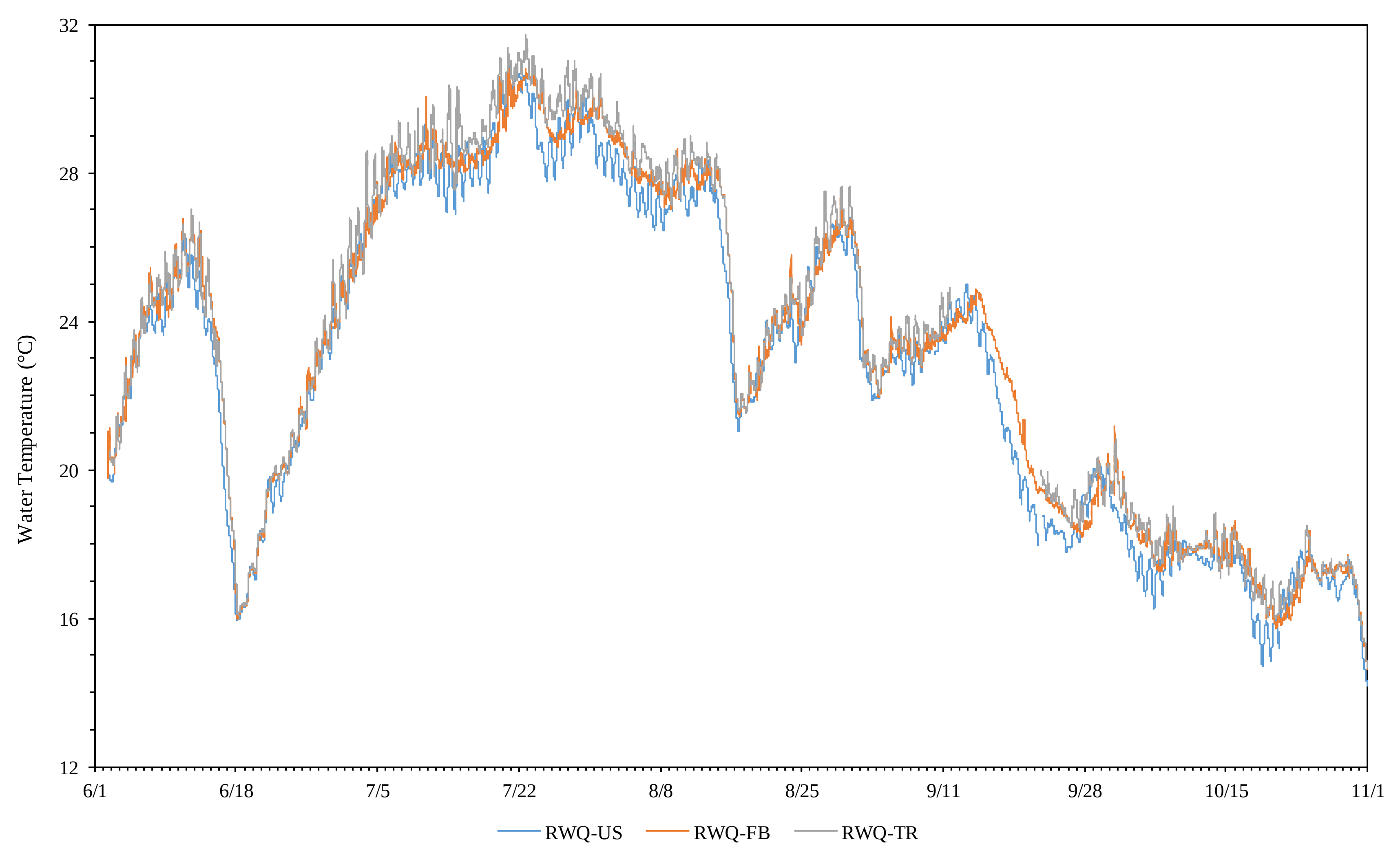


Figure 3.4.1-2. Instantaneous water temperatures (°C) of the Project's upper impoundment, forebay, and tailrace during the study period.

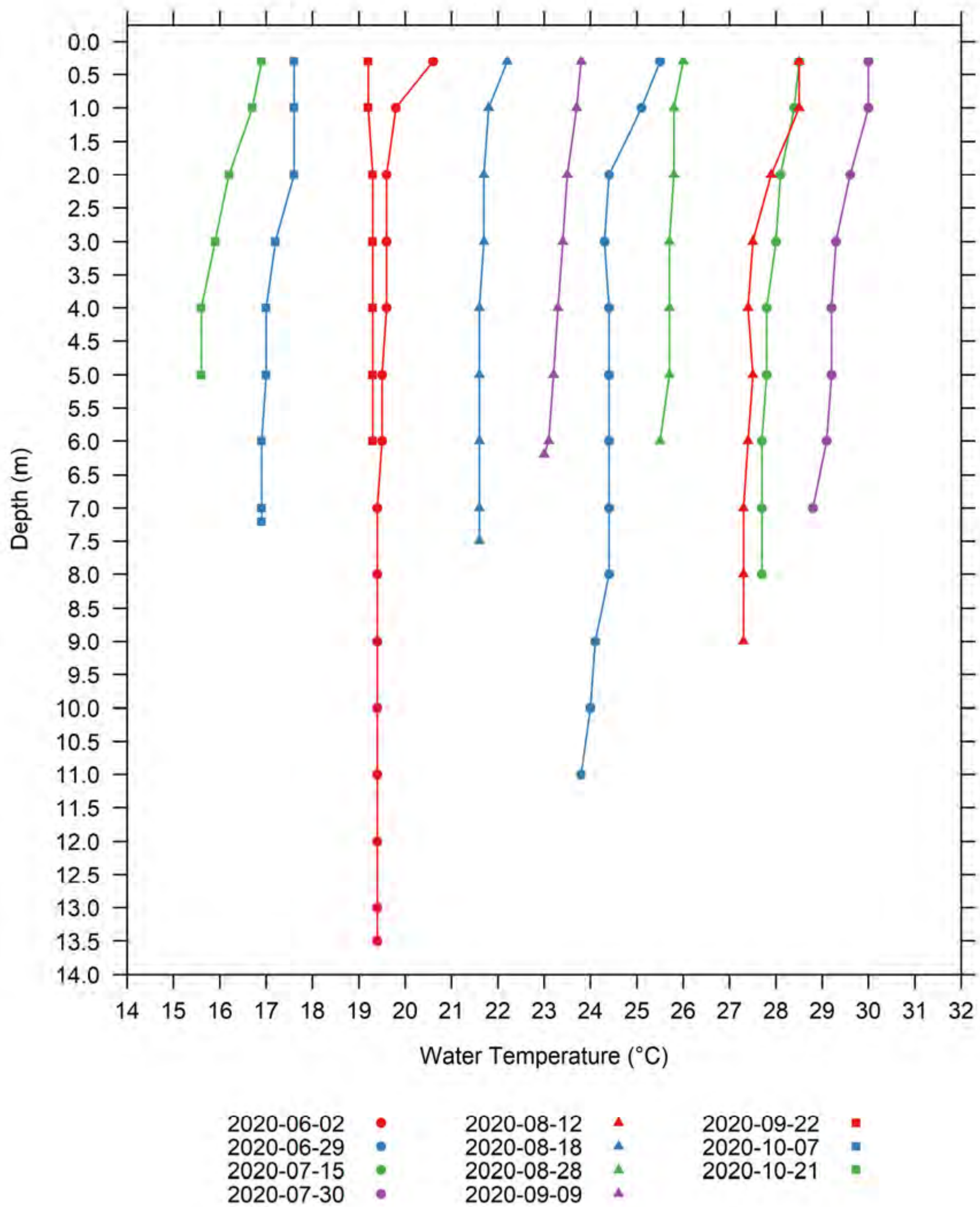


Figure 3.4.1-3. Water temperature vertical profiles collected in the forebay area of the Project.

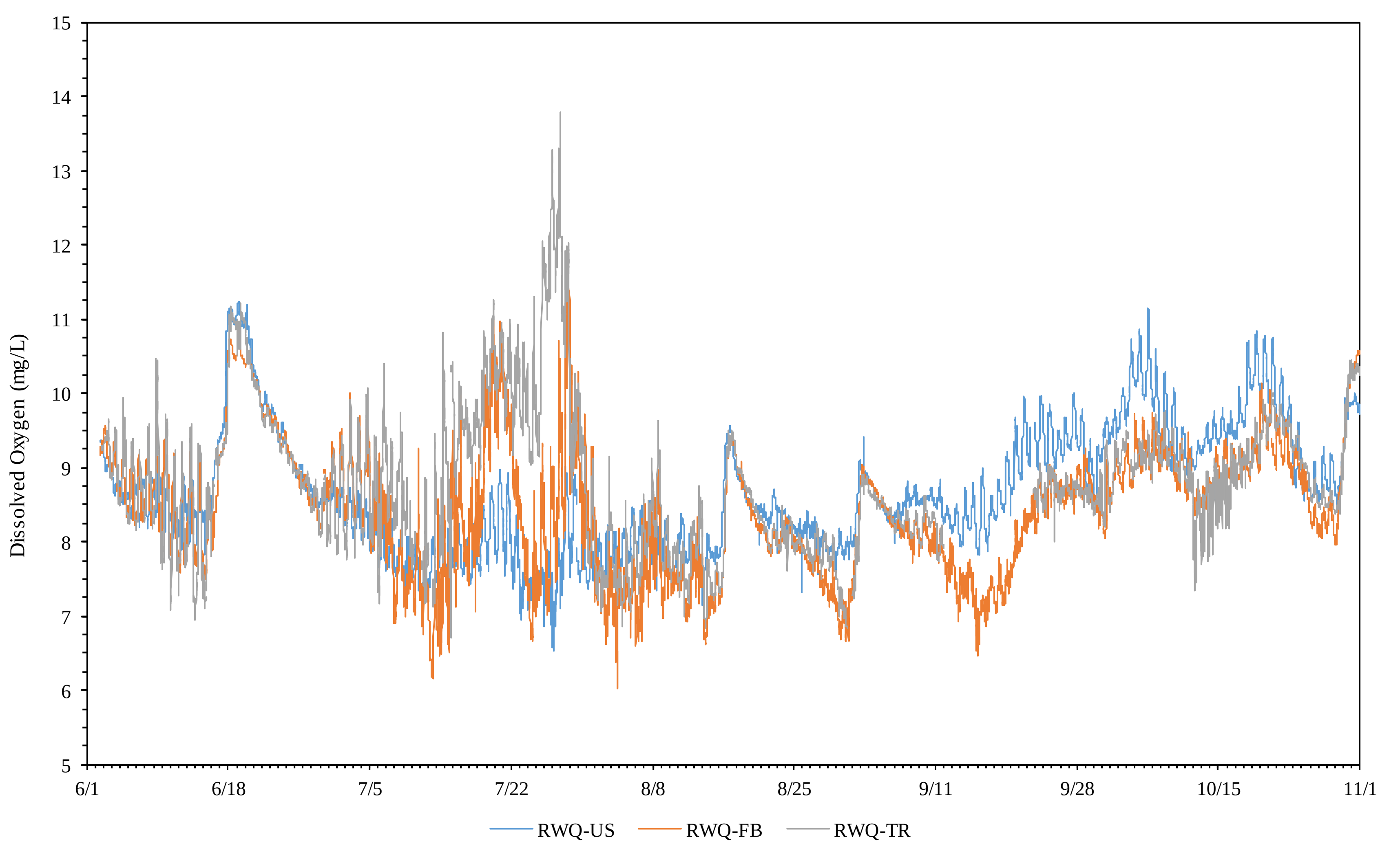


Figure 3.4.1-4. Dissolved oxygen concentrations (mg/L) within Project's upper impoundment, forebay, and tailrace during the study period.

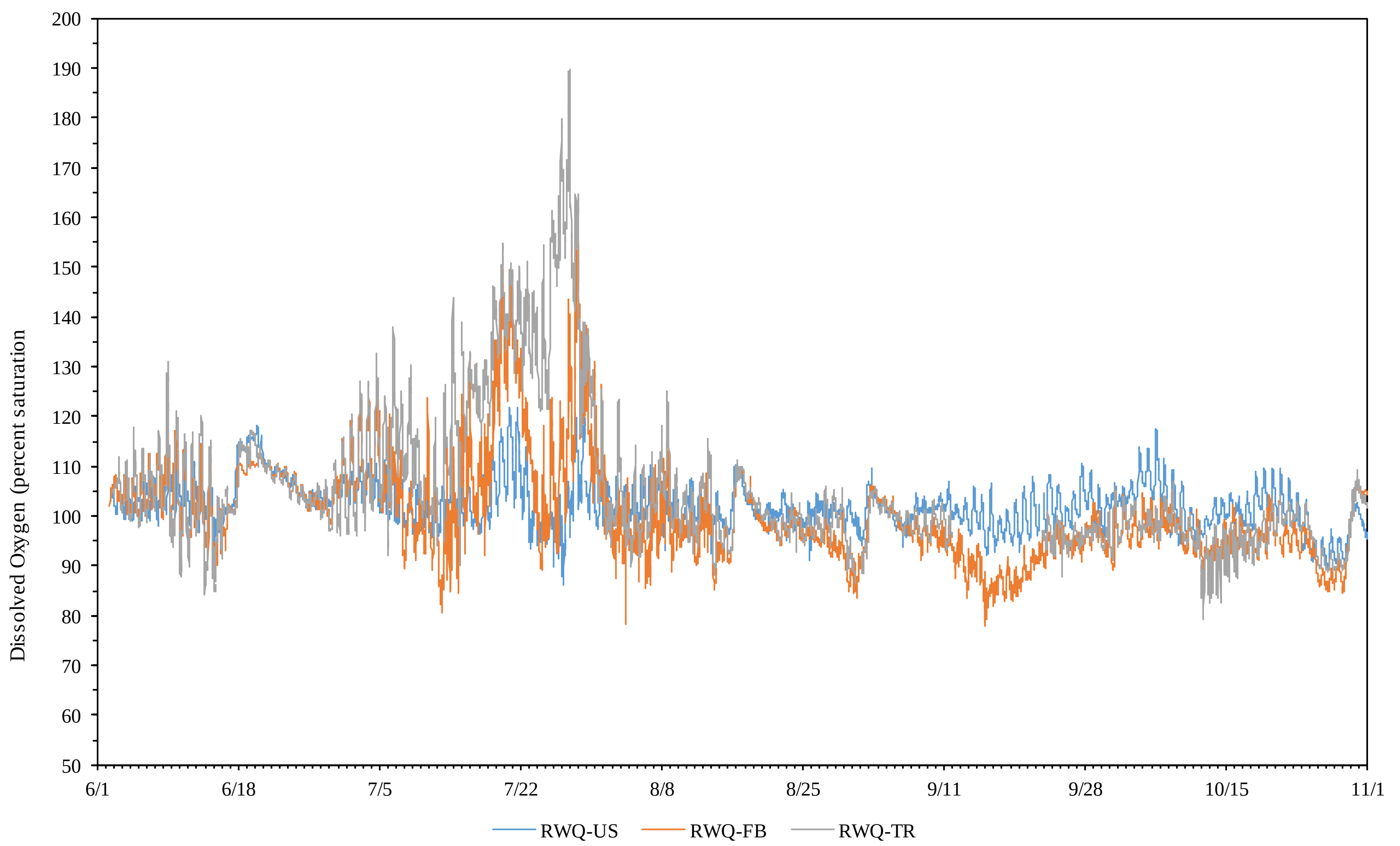


Figure 3.4.1-5. Dissolved oxygen levels (percent saturation) within the Project forebay, upper reservoir and tailrace during the study period.

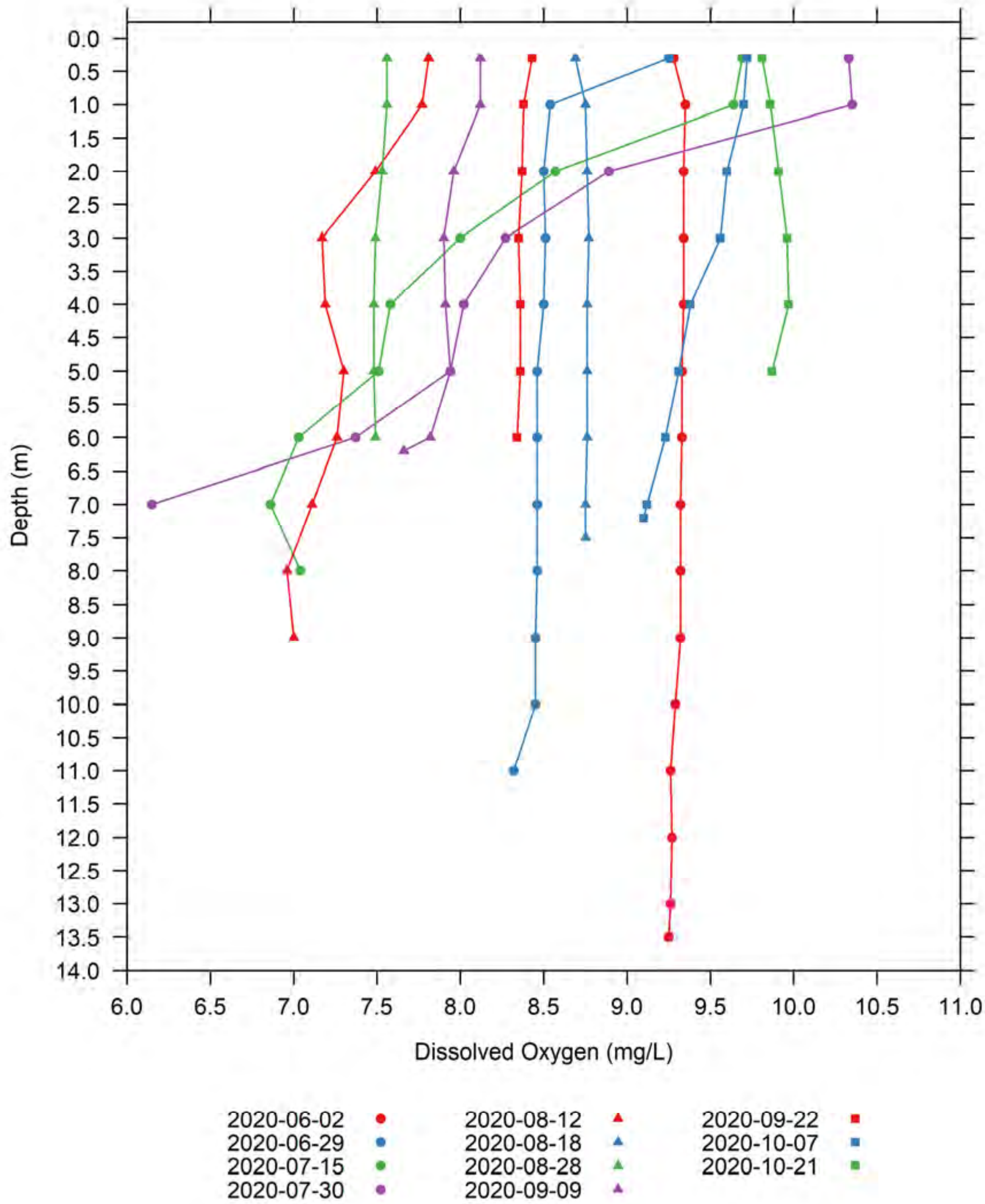


Figure 3.4.1-6. Dissolved oxygen concentration (mg/L) vertical profiles collected in the forebay area of the Project.

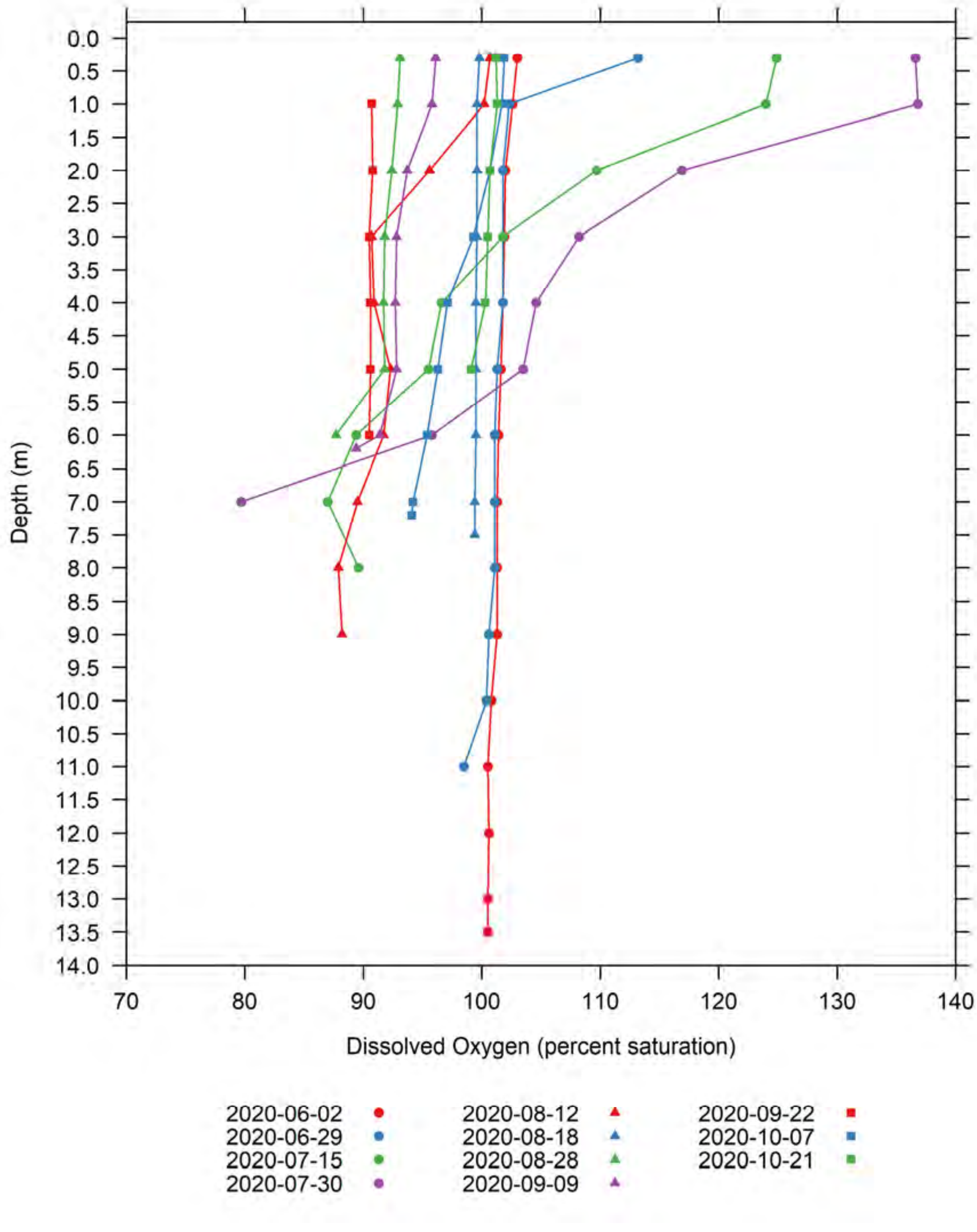


Figure 3.4.1-7. Dissolved oxygen percent saturation vertical profiles collected in the forebay area of the Project.

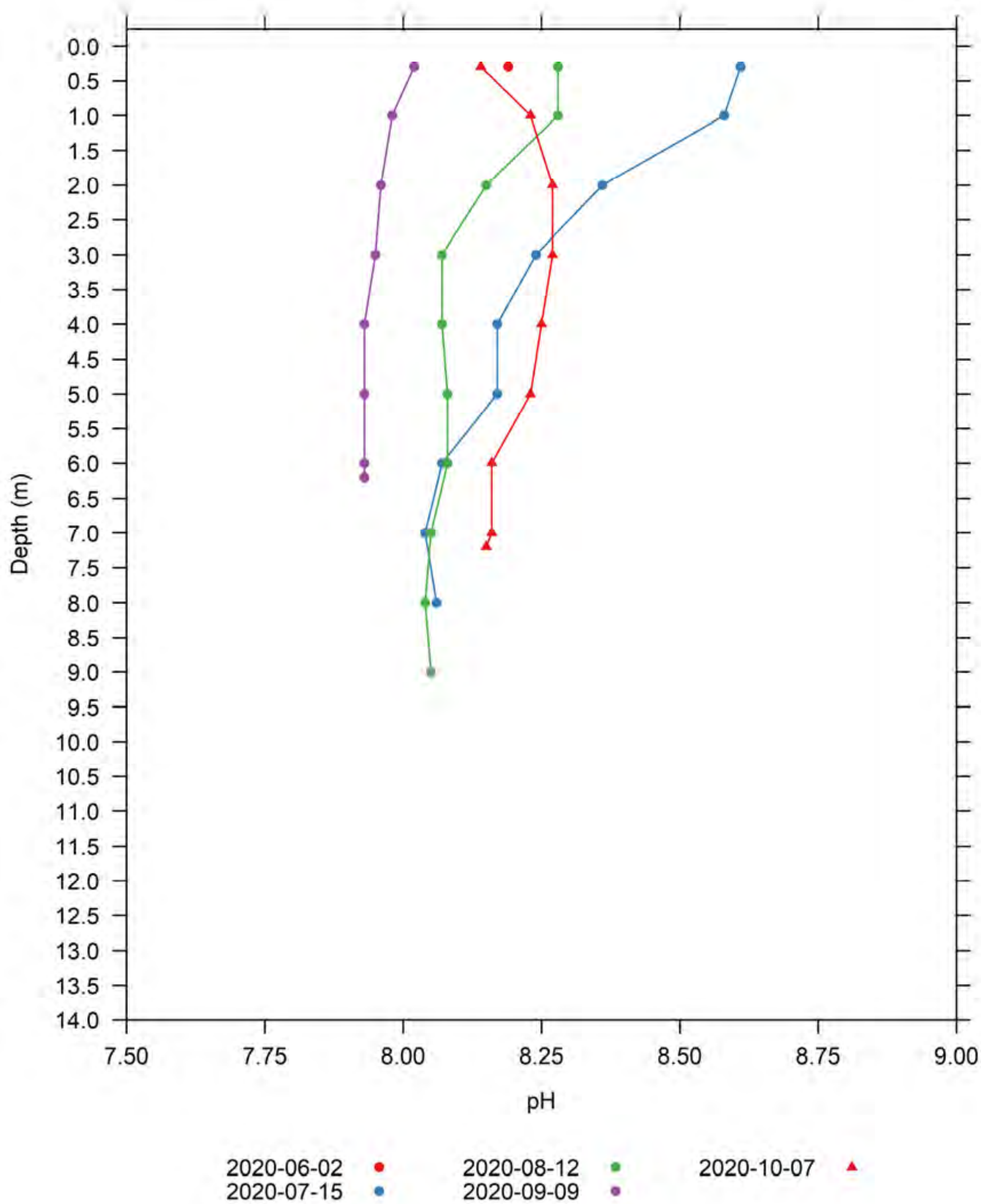


Figure 3.4.1-8. pH vertical profiles collected in the forebay area of the Project.

3.5 Existing and Proposed PM&E Measures for Existing Water Resources

Reusens Hydro proposes to continue to operate the Project as it is currently licensed, which includes the continuation of the current minimum flow requirement determined by License Article 401. Article 401 requires Reusens Hydro to provide downstream on an average hourly basis 333 cfs or reservoir inflow, whichever is less. Reusens Hydro also proposes to maintain forebay water surface elevations at or above 547.00 ft NAVD88, as require for License Article 402, and provide the required minimum flow downstream of the Project via a spillway gate when the turbine-generator units shut down, as required by License Article 406.

3.6 Agency Proposed PM&E Measures for Existing Water Resources

[*to be completed for the Final License Application*]

3.7 Description of Continuing Impacts on Water Resources by Continued Project Operation

Reusens Hydro proposes to continue to operate the Project in peaking mode as currently licensed and provide an average hourly basis 333 cfs or reservoir inflow, whichever is less to the James River downstream of the Project, and maintain the reservoir water surface elevation at or above 547 ft NAVD88.

During the 2020 study season, water quality was examined using continuous, discrete and nutrient monitoring to document the existing condition of the water quality of the James River in the Project area (see Attachment 3 – Draft Study Report, Study 4 – Baseline Water Quality Monitoring Study). As a part of the baseline water quality monitoring study consistency with Virginia surface water quality standards and effects of Project operations on surface water quality was evaluated. Detailed analyses regarding the consistency with Virginia surface water quality standards is provided in section 4.4 and effects on surface water quality from operations is presented in section 4.5 of the water quality study report, respectively. The consistency with surface water quality standards analysis evaluated water temperature, dissolved oxygen, and pH. The water temperature analysis examined whether the waters of the Project area ever exceed 32°C, whether there was a rise above the natural temperature by more than 3°C, and whether or not the maximum hourly water temperature change had exceeded 2°C within the mixing zone of the tailrace. The results of this analysis indicated that Project-affected waters never exceed 32°C, average hourly water temperature never exceeded 3°C as it flowed through the Project area, and the maximum hourly temperature changed never exceeded 2°C within the tailrace mixing zone. The dissolved oxygen consistency with surface water quality standards analysis compared instantaneous minimum and the minimum daily average dissolved oxygen concentration to Virginia dissolved oxygen standards, 4.0 and 5.0 mg/L, respectively. Overall, instantaneous minimum and minimum daily average never fell below the dissolved oxygen standard thresholds. The pH analysis also compared the discrete pH measurements collected during the study in comparison to lower and upper pH thresholds (6.0 and 9.0) stipulated Virginia water quality standards. Like water temperature and dissolved oxygen, pH levels over the duration of the study never fell below or rose above the thresholds. Collectively, the data collected indicate that under the existing condition, waters of the James River in the Project area are consistent with Virginia water quality standards. Therefore, because Reusens Hydro is proposing to continue operate the Project as it is currently licensed, Reusens Hydro expects that consistency with Virginia surface water quality standards would be maintained and continue to reflect the existing condition.

Potential effects of Project operations on surface water quality of the James River in the Project area were evaluated by comparing Project generation and the continuous water temperature and dissolved oxygen data. These data are presented in time-series plots in Appendices B, C, and D of the study report, (see Attachment 3 – Draft Study Report, Study 4 – Baseline Water Quality Monitoring Study). Collectively, these data indicate an indiscernible effect on water temperature and dissolved oxygen. For instance, Figures 3.7-1 and 3.7-2 show the cycling of one and two turbine-generating units in relation to the water temperature and dissolved oxygen continuous time-series, respectively, during a period of the study when river flows were near their lowest, water and air temperatures at their highest, and no high flow events or significant rainfall occurred recently. These data demonstrate that as operations change, the water temperatures are generally similar among the three monitoring stations and dissolved oxygen levels remain well-oxygenated without exhibiting sharp increases or decreases that would otherwise occur concurrently with the peaking. These data also indicate that water temperature and dissolved oxygen appear to respond more to effects of inflow to the Project rather than by Project operations. Therefore, it is likely similar trends in water quality would be observed over the next license term.

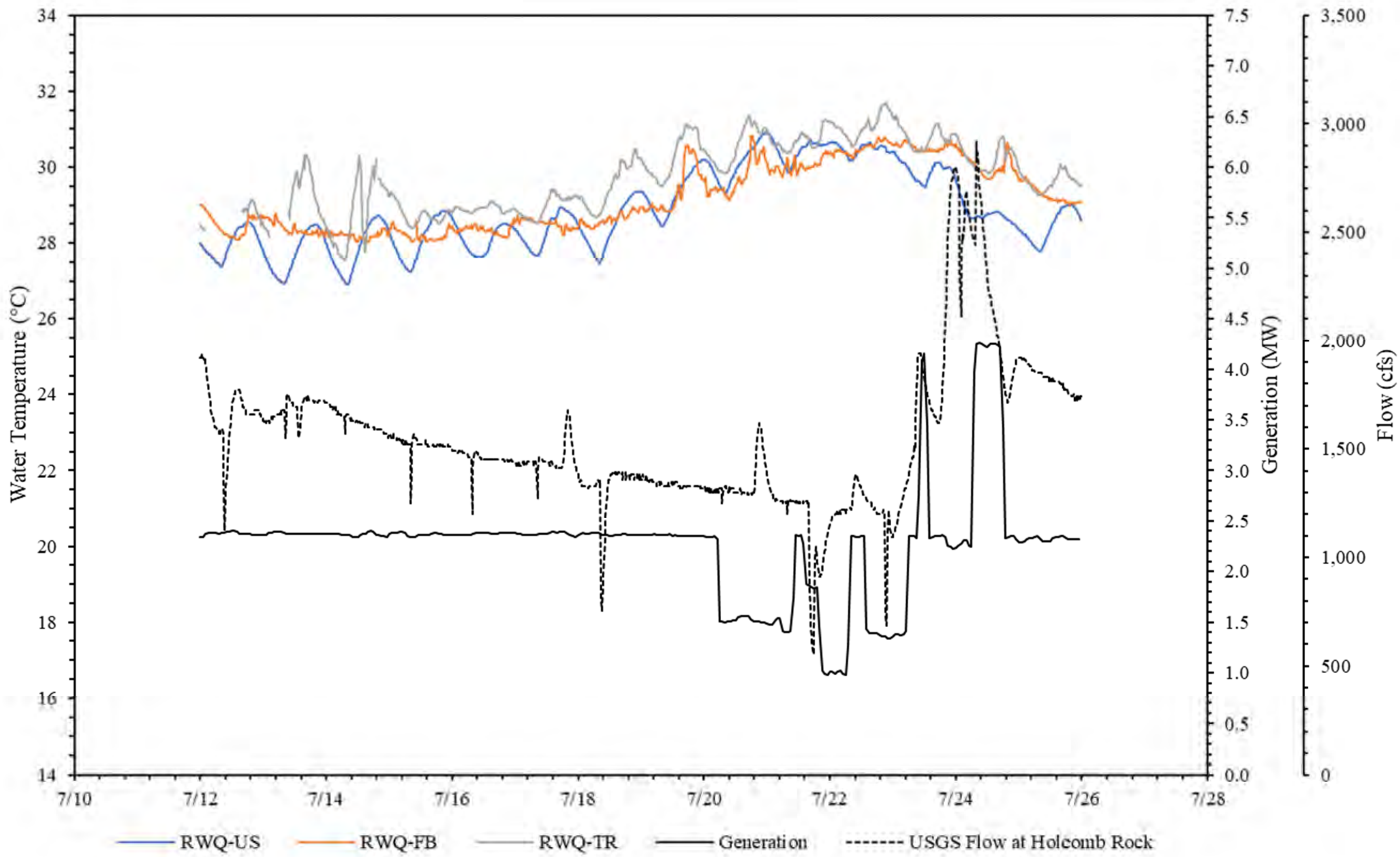


Figure 3.7-1: Continuous water temperature time-series in comparison to Project generation and inflow from July 12 to July 26, 2020.

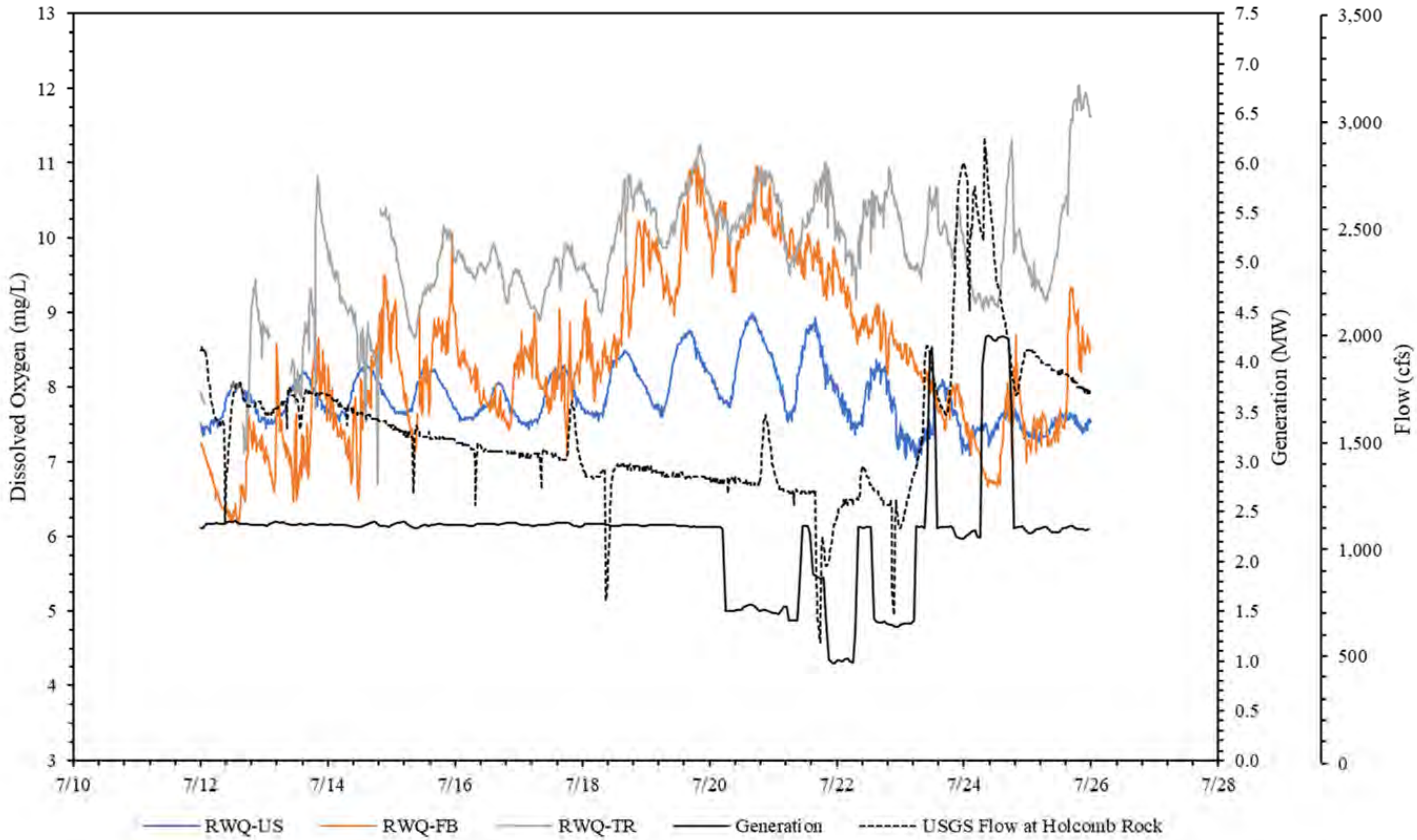


Figure 3.7-2: Continuous dissolved oxygen (mg/L) time-series in comparison to Project generation and inflow from July 12 to July 26, 2020.

4 AQUATIC AND FISHERIES RESOURCES

4.1 Aquatic Habitat

4.1.1 Non-Tidal James River – Headwaters to Richmond

The James River is the third largest tributary to the Chesapeake Bay and the largest river located entirely within Virginia. The Upper James River, from the headwaters downstream to Lynchburg, which encompasses the Project, flows through the Blue Ridge Mountains and into the Piedmont physiographic province. This upper section is characterized by cool water with mainly swift boulder-filled rapids and pool/run complexes with gravel/cobble substrates (VDGIF, 2015).

The Middle James River, from Lynchburg downstream to Bosher Dam in Henrico, VA flows through the Piedmont Plateau. This section is the flattest portion of the non-tidal James River, and is composed of mild to moderate rapids and long sandy runs (VDGIF, 2015). Below the Middle River, the character of the river changes dramatically. The 9-mile stretch of the James River that flows through Richmond, VA (colloquially known as the "fall-line") separates the non-tidal and tidal portions of the James River and contains various habitat types including rocky outcrops, large runs, deep pools, shallow riffles, and intense rapids (VDGIF 2015).

4.1.2 Project Area

Reservoir

The Project impoundment represents the majority of available aquatic habitat at the Project. The reservoir is approximately 500 acres in area, has a total volume of 6,869 acre-ft at 550.00 ft NAVD88, and offers approximately 16 miles of shoreline. Within the reservoir there is a large, vegetated island called Chestnut Island approximately 2.5 river miles upstream of the Project dam, and has an area of nearly 22 acres (Figure 4.1.2-1). A smaller, unnamed vegetated island is located at the confluence of the Crab Creek and the James River, approximately 4.9 river miles upstream of the Project dam, and has a surface area of about 2.4 acres (Figure 4.1.2-1). The depth of the impoundment is variable with deeper areas located near the Project dam (approximately 14 m) and shallow areas located at the upper extent of the impoundment (< 1 m). The substrate is also variable with a mixture of sand, gravel, pebble, cobble and boulders. The coarser substrate (boulder, cobble and gravel) is prevalent in the upper, riverine portion of the reservoir, whereas fine-grain substrate (sand and silt) is the dominant type downstream toward the Project dam. Riparian vegetation along the shoreline is well-established, and often overhangs the reservoir, which provides shaded cover and large woody debris. A 2.2-mile-long tract of riprap aligns the river-right shoreline upstream of the Project dam, and serves as bank armoring for the railroad -right-of-way. Figure 4.1.2-1 presents a photograph location map of representative photographs of the Project reservoir and Figures 4.1.2-2 through 4.1.2-7 provides a photograph of the Project reservoir upstream of the Project dam.

Tailwater

The tailwater area extends downstream of the Project dam approximately 0.1 miles and has a surface area of about 9 acres. Depth of the tailwater area varies but generally ranges from less than 1 to approximately 4 meters. The substrate mainly consists of scoured cobble and boulder. The eastern shoreline is predominately a steep rock face, and the western shoreline is armored with riprap near Powerhouse A. Further downstream, the shoreline is sparsely vegetated and the substrate along the shoreline is sand. During periods of lower flows, two cobble and boulder shoals emerge. One shoal, about 0.3 acres in area separates turbine discharges from Powerhouse A from the main channel. The other, and larger shoal begins approximately 300 feet downstream of the dam along the eastern shoreline, and is about 1 acre in area. Figure 4.1.2-8 provides a photograph of the tailwater area near the powerhouse downstream of the Project.

Downstream Area

The portion of the James River that is downstream of the Project's tailwater is an impounded 3.7-mile reach created by the Lynchburg Dam. The impoundment created by the Lynchburg Dam backwaters up to the base of the Project Dam (FERC, 1994). Figure 4.1.2-9 shows the 3.7-mile reach of the James River downstream of the Project. The impoundment is approximately 270 acres in area and has an average and maximum depth of approximately 9 and 26 feet, respectively. Therefore, the total volume of the impoundment is approximately 2,430 acre-ft. The impoundment has six islands that for the majority of the 3.7-mile reach divides the river into two channels – a wider river left and a narrow river right channel – with some braids that intertwine the two the main channels. The majority of the reach has well established riparian vegetation and a plethora of coarse woody debris deposited along the shoreline. Gravel bars are also ubiquitous around the upstream and downstream ends of the islands. Substrate of the reach range in sizes from boulder to gravel with some areas of sand and silt. Figures 4.1.2-10 through 4.1.2-14 present representative photographs of the 3.7-mile reach of the James River downstream of the Project.

Figure 4.1.2-1. Locations of representative photographs of the Project reservoir.

Figure 4.1.2-2. Representative photograph of the upper riverine reservoir.

Figure 4.1.2-3. Representative photograph of the upper reservoir.

Figure 4.1.2-4. Representative photograph of the middle reservoir looking upstream.

Note: Chestnut Island in the background.

Figure 4.1.2-4. Representative photograph of the middle reservoir looking downstream.

Figure 4.1.2-6. Representative photograph of the lower reservoir looking at river-right shoreline.

Figure 4.1.2-7. Representative photograph of the lower reservoir looking upstream.

Figure 4.1.2-8. Representative photograph of the Project's tailwater.

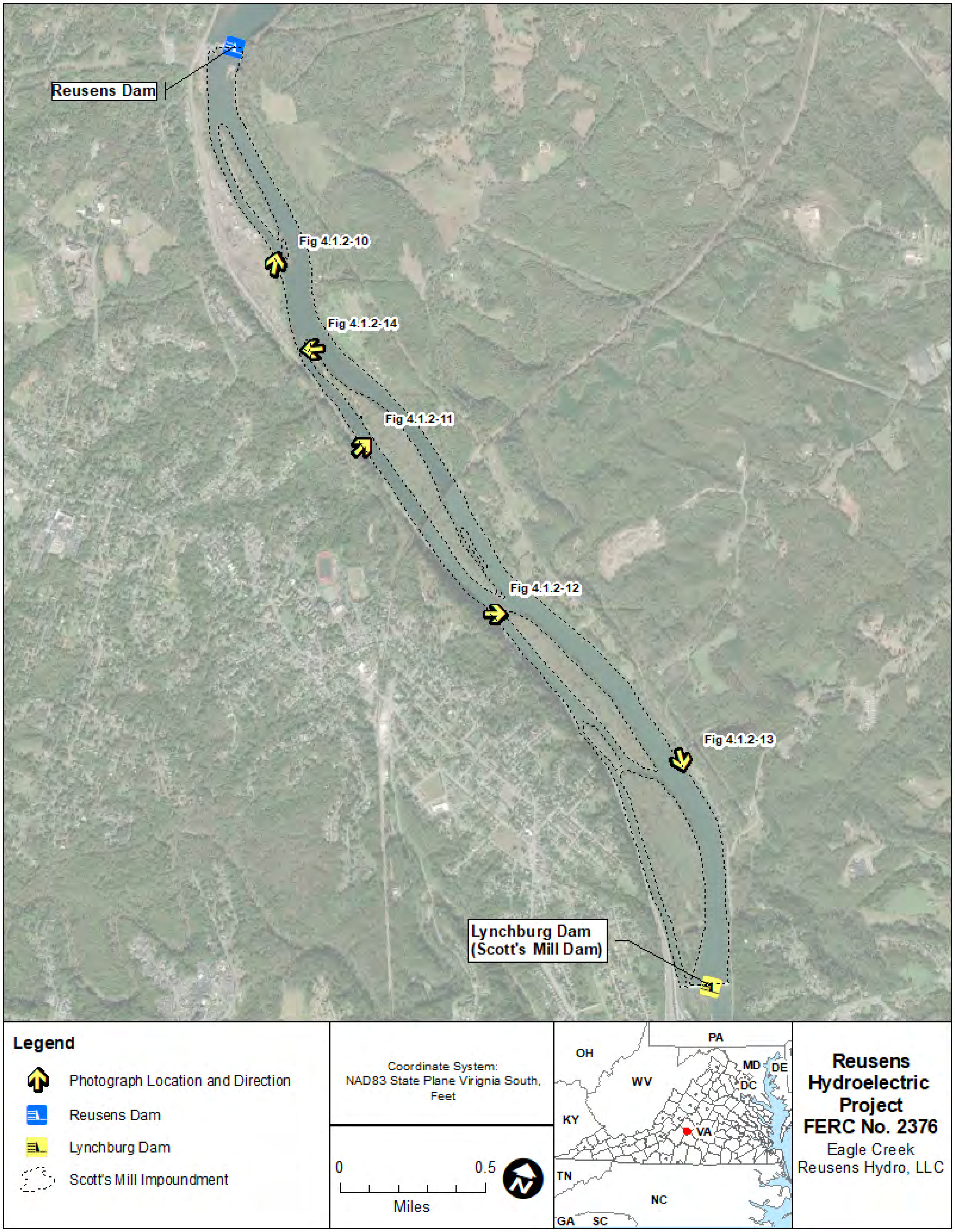


Figure 4.1.2-9. Locations of representative photographs of the Lynchburg (Scott's Mill) Dam impoundment downstream of the Project.

Figure 4.1.2-10. Representative photograph of the upper Lynchburg (Scott's Mill) Dam impoundment.

Figure 4.1.2-11. Representative photograph of the middle Lynchburg (Scott's Mill) Dam impoundment.

Figure 4.1.2-12. Representative photograph of the middle Lynchburg (Scott's Mill) Dam impoundment.

Figure 4.1.2-13. Representative photograph of the lower Lynchburg (Scott's Mill) Dam impoundment.

Figure 4.1.2-14. Representative photograph of a gravel bar within the Lynchburg (Scott's Mill) Dam impoundment.

4.2 Fish Community

4.2.1 Resident Species

From 2010 through 2019, excluding 2011,[13] VDWR sampled the fish community of the James River within the Project reservoir using boat electrofishing annually (Figure 4.2.1-1). VDWR's sampling reach of the Reusens reservoir is referred to as 'Monacan Pool.' During each sampling event, the amount of sampling effort ranged from 1.00 to 1.52 hours. Across all sampling events, a total of 31 species from 7 families were identified, with the majority that belong to the centrachidae, catostomidae, and cyprinidae families (Table 4.2.1-1). Of the 31 species, 4 were collected every year, which indicates those species are common in the area. These species include redbreast sunfish, rockbass, smallmouth and spotted bass. However, based on catch per unit effort (CPUE), weighted to account for the presence in the overall collection, the most abundant species in the Project area are smallmouth bass (CPUE = 56.3), bluegill (CPUE = 18.2), rockbass (CPUE = 17.0), and shorthead redhorse (CPUE = 16.7).

VDWR also sampled the James River downstream of the Project in the reach impounded by the Lynchburg Dam (Figure 4.2.1-1). The reach is referred to as 'Red n' Dots,' named after a now closed country store on the river in the area. The reach was sampled consecutively by VDWR using boat electrofishing from 1991 through 2000. Table 4.2.1-2 presents results of VDWR boat electrofishing sampling of the Red n' Dots reach. Among sampling years 1994 through 2000,[14] 34 species from 8 families were collected with only two species (American eel and bluegill) present in each sample year. Based on a weighted mean CPUE, the most abundant species present downstream of the Project dam from 1994 through 2000 were bluegill (CPUE = 61.9), smallmouth bass (CPUE = 53.2), spottail shiner (CPUE = 29.9), and spotted bass (CPUE = 35.6).

4.2.2 Game Species

The James River in the vicinity of the Project provides an excellent smallmouth bass fishery, with additional angling opportunities for muskellunge and catfish. In 2020, the VDWR collected fish using an electrofishing boat at nine sites within the Upper James River basin, from Lick Run to the Lynchburg Dam which encompass the Monacan Pool and Red n' Dots reaches (VDGIF, 2021). A total of 1,091 smallmouth bass, ranging from 3 to 22 inches, were collected. Juvenile smallmouth bass (individuals less than 7 inches) made up 14 percent of all smallmouth bass collected. The majority of adult smallmouth bass collected in 2020 samples were between 7 and 16 inches, with approximately 29 percent of adult smallmouth bass collected between 14 and 22 inches. Catch rates of adult smallmouth bass in 2020 averaged 64 per hour.

In addition, a total of 865 sunfish, 45 muskellunge (musky or muskie), 141 catfish (channel and flathead) were collected in 2020 within the Upper James River. Rock bass were the most abundant sunfish collected and ranged from 3 to 9 inches in length. Redbreast and bluegill were also commonly collected and also ranged from 2 to 8 inches in length. The muskies collected ranged from 22 to 45 inches in length (VDGIF, 2021). The two catfish species collected, channel and flathead, ranged in size from 4 to 29 inches and 3 to 45 inches, respectively.

---

[13] The Project reservoir in 2011 was not sampled by VDWR.

[14] 1994 through 2000 sample years are presented because the Project was relicensed in 1994.

4.2.3 Diadromous Species

Diadromous fish species that include American shad, alewife, blueback herring, striped bass, sea lamprey and American eel occur in the James River. Between 1989 and 1993 three mainstem dams on the James River in the fall zone were breached or notched, which facilitated upstream fish passage into additional habitat up to Bosher Dam. In 1999, a fish passage facility was installed at Bosher Dam, reopening 137 miles of the upper James River to the next upstream dam in Lynchburg, VA (Scotts Mill) to diadromous fishes (Hilton et al., 2014). Scotts Mill Dam in Lynchburg, VA represents the upper extent diadromous species may migrate, except American eel.

Fish community sampling of the James River performed within the Project reservoir and downstream and upstream of the Project indicate the only diadromous fish species present in the area is the catadromous American eel. As a part of the Cushaw Hydroelectric Project relicensing in 2004 and 2005, Dominion Energy sampled for American eel downstream of Scotts Mill Dam, within the Bedford Hydroelectric Project (FERC No. 5596) reservoir (approximately 17.5 river miles upstream of the Project) and within the Cushaw reservoir (approximately 18.7 river miles upstream of the Project. Twenty-eight eels were collected at the Lynchburg site, five at Bedford site, and no eels were collected within the Cushaw reservoir (FERC, 2008). In addition, sampling performed by the Appalachian Power Company (the former Reusens Hydroelectric Project licensee) during the previous relicensing of the Reusens Project collected only five eels in the Project's reservoir (APC, 1991). The more recent fish community survey data collected by VDWR with the Project reservoir and downstream of the Lynchburg Dam indicate that American eel are the only diadromous species present in the James River in the general area of the Project. These data collected by VDWR indicate American eel are in very low abundances within the Project reservoir, with only 4 individuals collected during two sampling events (2012 and 2019) over a 9-year effort of annual sampling (Table 4.2.3-1). Further downstream of the Lynchburg Dam, American eel have been collected during VDWR's annual sampling and their abundances are greater (Table 4.2.3-1).

In an effort to reintroduce and enhance American shad in the James River, VDWR began a shad restoration program in 1992 which continued through spring 2017. The program consisted of stocking into the James River upstream of Richmond, VA hatchery-reared fry raised from springtime Pamunkey River (and later from the Potomac River) brood stock. The program had stocked, on an annual basis, a few thousand to nearly 10 million American shad fry in the James River. The goal of the restoration program was to re-establish and enhance self-sustaining American shad runs in the James River. However, due to bottlenecks to recovery occurring in areas outside of VDWR's jurisdiction and given a lack of expected response (reestablishment of American Shad runs to the James River upstream of Bosher Dam and recovery of the James River American Shad population), despite decades-long stocking efforts, VDWR will not be stocking American Shad in the foreseeable future (VDGIF, 2018).

4.2.4 Polychlorinated Biphenyls in Fish Tissue

VDEQ sampled fish tissue of various species at 25 sites throughout the James River between 2014 and 2017 (VDEQ, N.d). The nearest upstream site relative to the Project is located downstream of the Big Island Hydroelectric Project (FERC No. 2902), approximately 20 river miles upstream of Reusens dam. The nearest downstream site relative to the Project is located below the Lynchburg dam, approximately 5.0 river miles downstream of the Project dam. Summary statistics of the sampling results are presented in Table 4.2.1-1. Levels of PCB in the tissue of American eel, blue catfish, common carp, channel catfish, flathead catfish, gizzard, largemouth bass, quillback carpsucker were above VDEQ screening level of 20 ppb. Only rock bass, smallmouth bass, and white perch had levels below the 20 ppb screening level threshold.

Table 4.2.1-1. Presence and abundance (CPUE) of fish species in the Project reservoir collected by VDWR for years 2010 through 2019.

Species	Monacan Pool										Mean Weighted CPUE
	Year		2010	2012	2013	2014	2015	2016	2017	2018	2019	
	Effort (hrs)		1.04	1.03	1.00	1.00	1.35	1.52	1.04	1.04	1.51	
Anguillidae											
American eel		-	2.9	-	-	-	-	-	-	0.7	0.4
Catostomidae											
Shorthead redhorse		-	50.5	6.0	11.0	34.1	30.9	7.7	-	9.9	9.9
Northern hogsucker		10.6	10.7	-	4.0	6.7	11.2	2.9	11.5	25.2	25.2
Golden redhorse		1.9	7.8	-	18.0	18.5	9.2	-	1.0	3.3	3.3
Centrachidae											
Smallmouth bass		9.6	79.6	58.0	72.0	50.4	82.9	30.8	59.6	64.2	56.3
Bluegill		11.5	39.8	-	30.0	31.1	7.2	19.2	3.9	21.2	18.2
Rock bass		19.2	29.1	8.0	11.0	25.9	21.7	24.0	1.0	12.6	17
Spotted bass		2.9	16.5	9.0	10.0	8.2	7.2	5.8	8.7	13.9	9.1
Green sunfish		5.8	25.2	-	25.0	8.2	2.0	2.9	-	0.7	7.7
Redbreast sunfish		6.7	19.4	4.0	13.0	5.2	8.6	7.7	1.0	4.0	7.7
Largemouth bass		-	5.8	-	5.0	1.5	0.7	2.9	-	-	1.8
Redear sunfish		-	-	-	-	1.5	-	-	-	2.0	0.4
Black crappie		-	-	-	1.0	0.7	0.7	-	-	-	0.3
Pumpkinseed sunfish		-	-	-	-	-	-	1.9	-	-	0.2
Clupeidae											
Gizzard shad		68.3	-	-	2.0	-	4.6	17.3	-	5.3	10.8
Cyprinidae											
Bull Chub		3.9	11.7	-	2.0	5.2	11.8	3.9	9.6	11.3	6.6
Telescope shiner		3.9	37.9	-	3.0	-	-	-	-	-	5

Species		**Monacan Pool**									**Mean Weighted CPUE**
	Year	**2010**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
	Effort (hrs)	**1.04**	**1.03**	**1.00**	**1.00**	**1.35**	**1.52**	**1.04**	**1.04**	**1.51**	
Comely shiner		13.5	8.7	-	-	-	-	-	-	-	2.5
Common carp		-	9.7	-	4.0	-	-	-	-	-	1.5
Spottail shiner		9.6	2.9	-	1.0	-	-	-	-	-	1.5
Central stoneroller		1.0	1.9	-	1.0	1.5	0.7	-	-	0.7	0.7
Crescent shiner		-	4.9	-	-	-	-	-	-	-	0.5
White shiner		-	4.9	-	-	-	-	-	-	-	0.5
Mimic shiner		-	2.9	-	-	-	-	-	-	-	0.3
Roseyface shiner		2.9	-	-	-	-	-	-	-	-	0.3
Fallfish		1.0	-	-	1.0	-	-	-	-	-	0.2
Satinfin shiner		1.9	-	-	-	-	-	-	-	-	0.2
Esocidae											
Muskellunge		-	-	-	1.0	3.0	0.7	1.9	1.9	2.0	1.2
Ictaluridae											
Channel catfish		-	2.9	-	6.0	14.8	13.2	17.3	3.9	11.9	7.8
Flathead catfish		-	1.9	-	2.0	5.9	2.6	5.8	1.9	7.3	3.1
Lepisosteidae											
Longnose gar		-	-	-	1.0	1.5	-	-	-	-	0.3

Source: FERC Accession No. 20210331-5533, as modified by Reusens Hydro

Note: VDWR did not sampling the Project reservoir in 2011.

"-" indicates species was not collected in the year sampled or reported.

Table 4.2.1-2. Presence and abundance (CPUE) of fish species between the Project dam and the Lynchburg Dam (Red n' Dots) collected by VDWR for years 1994 through 2001.

Species	Red n' Dots								Weighted Mean CPUE
	Year	1994	1995	1996	1997	1998	1999	2000	
	Effort (hrs)	0.83	0.98	1.02	1.05	1.19	1.24	1.15	
Anguillidae									
American eel		1.2	4.06	8.82	10.48	13.47	9.68	11.31	8.4
Catostomidae									
Golden redhorse		10.83	6.09	18.62	-	-	8.88	-	6.3
Shorthead redhorse		1.2	5.08	23.52	-	1.68	4.84	-	5.2
Northern hogsucker		-	-	1.96	0.95	-	-	-	0.4
White sucker		-	-	-	0.95	-	1.61	-	0.4
Quillback sucker		1.2	-	-	-	-	-	-	0.2
Centrachidae									
Bluegill		65.0	99.6	49.0	21.9	29.5	89.6	79.2	61.9
Smallmouth bass		22.9	10.2	54.9	25.7	94.3	164.6	-	53.2
Spotted bass		4.8	8.1	49.0	37.1	26.1	83.9	-	29.9
Green sunfish		-	-	-	1.9	31.2	71.0	-	14.9
Rock bass		12.0	10.2	11.8	4.8	24.4	27.4	-	12.9
Redbreast sunfish		2.4	5.1	15.7	6.7	5.1	33.9	-	9.8
Largemouth bass		2.4	6.1	2.0	1.0	1.7	17.8	-	4.4
Redear sunfish		-	1.0	1.0	-	-	3.2	-	0.7
Pumpkinseed		2.4	-	-	-	-	-	-	0.3
Clupeidae									
Gizzard shad		1.2	2.03	-	-	-	-	-	0.5
Cyprinidae									
Spottail shiner		-	-	248.95	-	-	-	-	35.6

Species		**Red n' Dots**							**Weighted Mean CPUE**
	Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	
	Effort (hrs)	**0.83**	**0.98**	**1.02**	**1.05**	**1.19**	**1.24**	**1.15**	
Roseyface shiner		-	3.05	53.91	25.71	-	-	-	11.8
Bluntnose minnow		-	21.33	10.78	-	-	8.07	-	5.7
Comely shiner		-	4.06	28.42	2.86	-	-	-	5
Common carp		12.03	-	3.92	0.95	-	4.03	13.05	4.9
Telescope shiner		-	-	9.8	8.57	-	-	-	2.6
Satinfin shiner		-	-	7.84	-	-	-	-	1.1
Central stoneroller		-	-	3.92	-	-	-	-	0.6
River chub		-	3.05	-	-	-	-	-	0.4
Bull chub		-	-	1.96	-	-	-	-	0.3
Crescent shiner		-	-	1.96	-	-	-	-	0.3
Mimic shiner		-	-	-	-	-	1.61	-	0.2
Common shiner		-	1.02	-	-	-	-	-	0.1
Rosefin shiner		-	-	0.98	-	-	-	-	0.1
Ictaluridae									
Channel catfish		2.41	-	1.96	1.9	-	-	4.35	1.5
Lepisosteidae									
Longnose gar		-	1.02	-	-	-	-	-	0.1
Percidae									
Shield darter		-	-	3.92	1.9	-	-	-	0.8
Roanoke darter		-	-	0.98	-	-	-	-	0.1

Source: FERC Accession No. 20210331-5533, as modified by Reusens Hydro

Note: "-" indicates species was not collected in the year sampled or reported.

Table 4.2.3-1. Abundance of American eel collected within the Project Reservoir and downstream of the Lynchburg Dam, as sampled by VDWR from 2010 through 2019.

VDWR Sampling Reach	Metric	Sample Year									
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Monacan Pool	CPUE	-	-	2.9	-	-	-	-	-	-	0.7
	Count	-	-	3	-	-	-	-	-	-	1
Lynchburg	CPUE	7.0	7.8	5.0	-	12.2	0.8	5.7	3.8	0.8	1.0
	Count	7	8	5	-	12	1	8	6	1	1

Source: FERC Accession No. 20210331-5533, as modified by Reusens Hydro

Note: “-“ indicates species was not collected in the year sampled or reported.

Table 4.2.4-1. Summary statistics of PCB levels in fish tissue of specimens collected upstream and downstream of the Project.

Species	PCB$_{total}$ (ng/g or ppb)							
	Site 10 Below Big Island Hydroelectric Project				Site 11 Below Lynchburg Dam			
	Count	Minimum	Maximum	Mean	Count	Minimum	Maximum	Mean
American Eel	1	477.11	477.11	477.11	1.00	130.62	130.62	130.62
Blue Catfish	1	24.45	24.45	24.45	-	-	-	-
Common Carp	2	32.18	68.03	50.11	4.00	90.28	170.36	121.21
Channel Catfish	2	11.13	18.56	14.84	1.00	34.67	34.67	34.67
Flathead Catfish	1	54.15	54.15	54.15	4.00	32.70	540.68	211.71
Gizzard Shad	1	144.92	144.92	144.92	-	-	-	-
Largemouth Bass	1	31.08	31.08	31.08	-	-	-	-
Quillback Carpsucker	1	28.92	28.92	28.92	3.00	51.78	97.01	74.17
Rockbass	1	0.60	0.60	0.60	-	-	-	-
Smallmouth Bass	1	0.73	0.73	0.73	1.00	0.00	0.00	0.00
White Perch	2	10.38	13.00	11.69	-	-	-	-

Source: VDEQ, n.d.

Note “-“ indicates species was not sampled.

Figure 4.2.1-1. VDWR boat electrofishing reaches on the James River in the vicinity of the Project.

4.3 Freshwater Mussels

Various freshwater mussel surveys have been performed in the James both upstream and downstream of the Project in support of other FERC relicensing studies, bridge replacement, riverbank protection. Figure 4.3-1 shows the general location of the various freshwater mussel sampling efforts that are further discussed below.

In October of 2018, Ostby and Beaty (2018) performed a freshwater mussel survey and relocation effort as a part of a streambank protection project on the James River near Lynchburg, VA, approximately 6.9 river miles downstream of the Project dam. The survey involved the search for mussels over a 1,349-m stretch of river outwards 15-m from the shoreline. The result of this survey effort detected no rare species and native species: the eastern elliptio (*Elliptio complanta*) and northern lance (*E. fisheriana*). The overall CPUE (no. live mussels/per person-hour of search time) was 19.4.

From 2015 through 2017, the Virginia Department of Transportation (VDOT) removed the Route 501 bridge that spans the James River downstream of the Cushaw Hydroelectric Project (FERC No. 906) and rebuilt the bridge so that it spans the river approximately 0.4 miles upstream of the Bedford Hydroelectric Project (FERC No. 5996). Prior to the demolition of the old bridge and construction of the new bridge, VDOT performed a review of the environmental resources and consulted with the resource agencies regarding the bridge project (VDOT, 2011). VDOT performed a field visit to the site and only observed shell fragments of the Asian clam; no evidence of other mussel species was observed (VDOT, 2011).

A recent survey for freshwater mussels on the mainstem of the James River near the Project occurred in 2016, located in the tailwaters of the Project and downstream within the Scott's Mill Dam impoundment (TOE, 2016). After initial habitat evaluations, TOE (2016) targeted appropriate habitat for the mussel survey, which encompassed 11 selected sites over a total of 2.5 river miles. Overall, the only two species collected were eastern elliptio and the northern lance. Both species are common freshwater species. The data collected by TOE (2016) indicates that the eastern elliptio is more abundant than and the northern lance in that reach of the James River with overall catch per unit efforts of 15.1 and 0.3, respectively.

Ostby (2008) performed a freshwater mussel survey in the vicinity of an Amherst County Service Authority proposed water supply intake within the Project reservoir, approximately 1.0 river miles upstream of the Project dam. This survey indicated that the paper pondshell (*Utterbackia imbecillis*) mussel occurs in the James River.

A freshwater mussel study was also performed upstream of the Project as a part of the Cushaw Hydroelectric Project relicensing proceeding (FERC, 2008). As a part of that study, a 4.5-mile-long reach of the James River from 0.28 mile downstream of the confluence of the Maury River in Rockbridge County, Virginia to the boat ramp on Rocky Row Run just upstream of the Cushaw dam was surveyed. The survey was performed with assistance from Biologists of VDWR and the Virginia Cooperative Fish and Wildlife Research Unit. Three sites of suitable mussel habitat along the reach were searched using snorkeling or visual observation with and without a view scope. No live mussel specimens were collected at any of the three sites, only relic mussel shells. Those mussel shells tentatively identified as eastern elliptio, lanceolate elliptio taxa,[15] triangle floater, and the Atlantic pigtoe mussel. The exotic Asian clam was found at all three sites (FERC, 2008).

Reusens Hydro also performed a freshwater mussel survey within the Project reservoir and tailwater area during the summer of 2020. This study is discussed in section 4.5 *Aquatic and Fisheries Resources Study Requests and Results*.

[15] Species are grouped into the Lanceolate Elliptio complex because the taxonomic distinction between the northern lance (*Elliptio fisheriana*) and the Atlantic spike (*Elliptio producta*) is under debate.

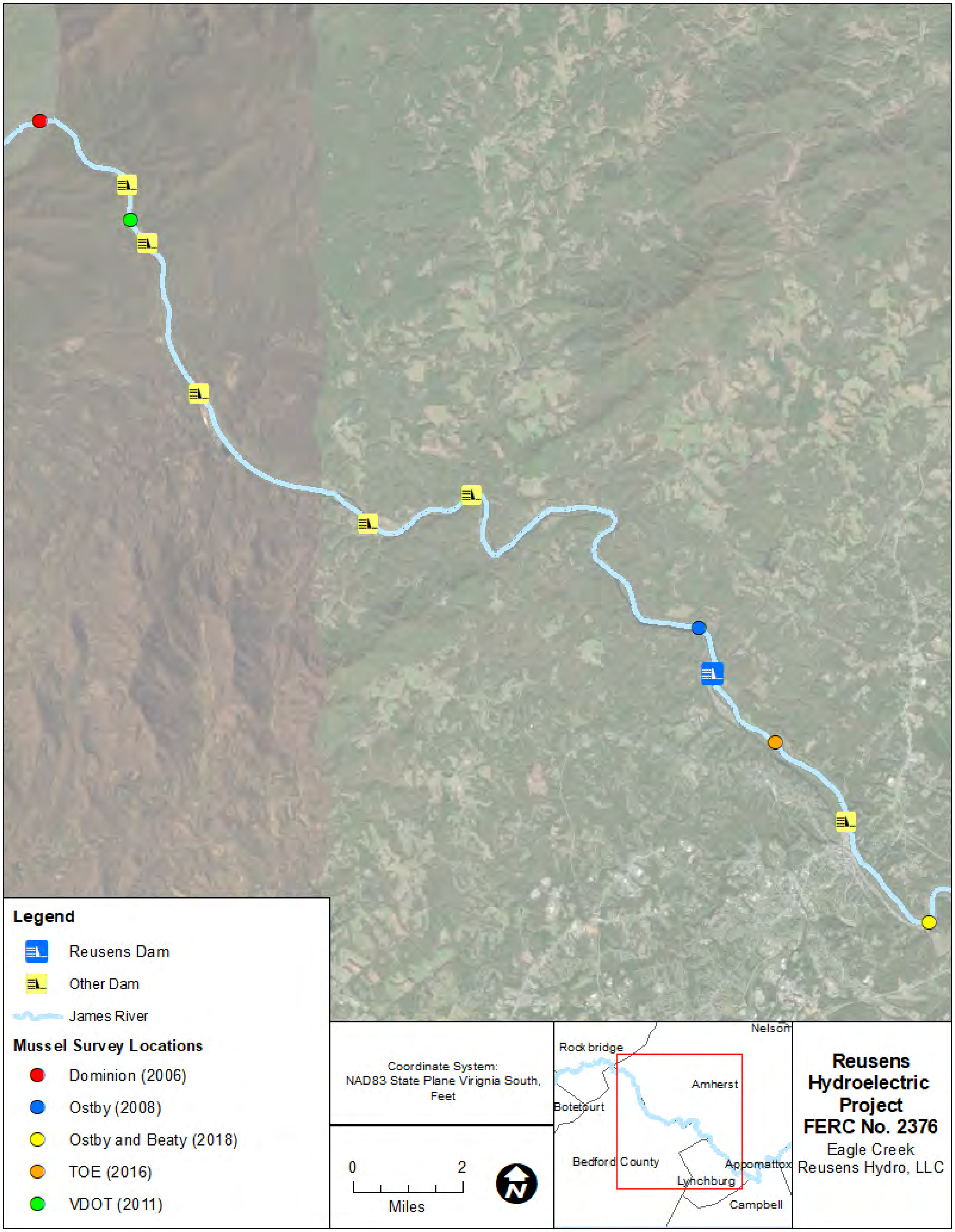


Figure 4.3-1. General locations of the freshwater mussel sampling efforts upstream, at, and downstream of the Project.

4.4 Coastal Zone Management Act

VDEQ is the state agency that requires all federal actions in the Virginia's coastal zone, or ones that may affect coastal resources, are consistent with Virginia's coastal laws and enforceable policies un the Coastal Zone Management Act (CZMA). Reusens Hydro will consult with VDEQ, requesting consistency review with the CZMA, for the final license application.

4.5 Study Requests and Results

Reusens Hydro received three study requests germane to aquatic and fisheries resources: an instream flow assessment by VDWR, a freshwater mussel assessment by VDWR, and a fish passage assessment by VDWR. Reusens Hydro subsequently prepared a Draft Study Plan, which is enclosed in this license application as Attachment 1 – Draft Study Plan, distributed it to the resource agencies. The DSP presents the rationale for adopting, adopting with modification, or not adopting the study requests received. Reusens Hydro then held a conference call with the resource agencies to discuss the DSP. Reusens Hydro subsequently revised the DSP, as appropriate, and addressed the resource agencies comments on the DSP to form the Final Study Plan (FSP; Attachment 2). Documentation of these consultation activities are provided in Appendix A. As a result of the study planning development and consultation process, Reusens Hydro performed an Instream Flow Assessment, Freshwater Mussel Survey, and Desktop Entrainment and Turbine Mortality Study, following the FSP. Study reports of the performed studies are presented in Attachment 3 – Draft Study Reports. Results of the Instream Flow Assessment, Freshwater Mussel Survey, and Desktop Entrainment and Turbine Mortality Study are presented below.

4.5.1 Instream Flow Assessment

[*Data collection is complete, while analysis is on-going. Results will be provided with the Final License Application or as soon as possible*].

4.5.2 Freshwater Mussel Survey

A freshwater mussel survey was conducted in early October 2020 in the Project area. The mussel survey was performed by a qualified malacologist. The survey area was first searched to identify locations of potentially suitable mussel habitat. Then, qualitative presence/absence surveys of the identified potential mussel habitat were then performed. Species richness was determined for each sampling location where live or dead specimens were found. Catch-per-unit-effort (CPUE) was calculated as the number of specimens found divided by the total time searching expressed as person-hours for each location.[16]

A total of twelve sites were surveyed, consisting of three in the riverine upper reservoir, four in the lacustrine middle impoundment, three in the lacustrine lower impoundment, and two in the tailwater area (Figure 4.5.2-1). Most of the sites were relatively shallow and had cobble and sand substrate. In total, 18.75 person-hours were expended during the qualitative survey, but no live specimens were found (Table 4.5.2-1). Site 11 was the only site where shell fragments were

[16] A person-hour is calculated at the sum of hours each person participating in the search for mussel spent searching divided by the number of people.

found and identified as Eastern elliptio (*Elliptio complanate*), Carolina lance (*Elliptio angustata*), and Northern lance (*Elliptio fisheriana*) discovered (Figure 2.3-3). Therefore, the overall abundance of live freshwater mussels in the study area is zero (CPUE = 0).

Other non-target mollusks were observed. These include: the Asian clam (*Corbicula fluminea*), Virginia river snail (*Elimia virginica*), *Physa* spp., Crusted mudalia snail (*Leptoxis carinata*), *Ferrissia* species. The Asian clam and Virginia river snail were abundant and ubiquitous throughout the study area and were observed at almost every site surveyed. *Physa* species, the Crusted mudalia snail, and *Ferrissia* species were also observed at the riverine upper reservoir sites, but infrequently encountered.

Table 4.5.2-1. Habitat description and the number of freshwater mussels observed at each survey site.

Site	Habitat Types	Relative Depth	Dominant Substrate	Habitat Quality	Search Time (person-hours)	Count of Live Mussels	Catch per Unit Effort	Taxa Observed
1	Run, riffle, pool	Shallow	Cobble	Good	1.00	0	0	*Corbicula fluminea*, *Elimia virginica*
2	Run, riffle, pool	Moderate	Cobble	Good	1.00	0	0	*Corbicula fluminea*, *Elimia virginica*, *Physa* spp.
3	Run, riffle, pool	Moderate	Cobble	Good	1.00	0	0	*Corbicula fluminea*, *Elimia virginica*, *Leptoxis carinata*, *Ferrissia* spp.
4	Run, riffle, pool	Moderate	Silt	Poor	0.75	0	0	None
5	Pool	Shallow	Pebble	Good	1.50	0	0	*Corbicula fluminea*, *Elimia virginica*
6	Pool	Shallow	Cobble	Fair	0.10	0	0	*Corbicula fluminea*, *Elimia virginica*
7	Pool	Very Shallow	Sand	Good	0.30	0	0	*Corbicula fluminea*, *Elimia virginica*
8	Pool	Shallow	Sand	Poor	0.50	0	0	*Corbicula fluminea*
9	Pool	Shallow	Sand	Poor	0.10	0	0	*Corbicula fluminea*
10	Pool	Very Shallow	Silt	Poor	0.50	0	0	*Corbicula fluminea*
11	Run, riffle, pool	Shallow	Pebble, Gravel, Cobble	Excellent	6.00	0	0	*Elliptio complanate*,[1] *Elliptio angustata*,[1] *Elliptio fisheriana*,[1] *Corbicula fluminea*, *Elimia virginica*
12	Run, riffle, pool	Shallow	Mixed	Good	6.00	0	0	*Corbicula fluminea*

[1.] Only shell fragments were observed.

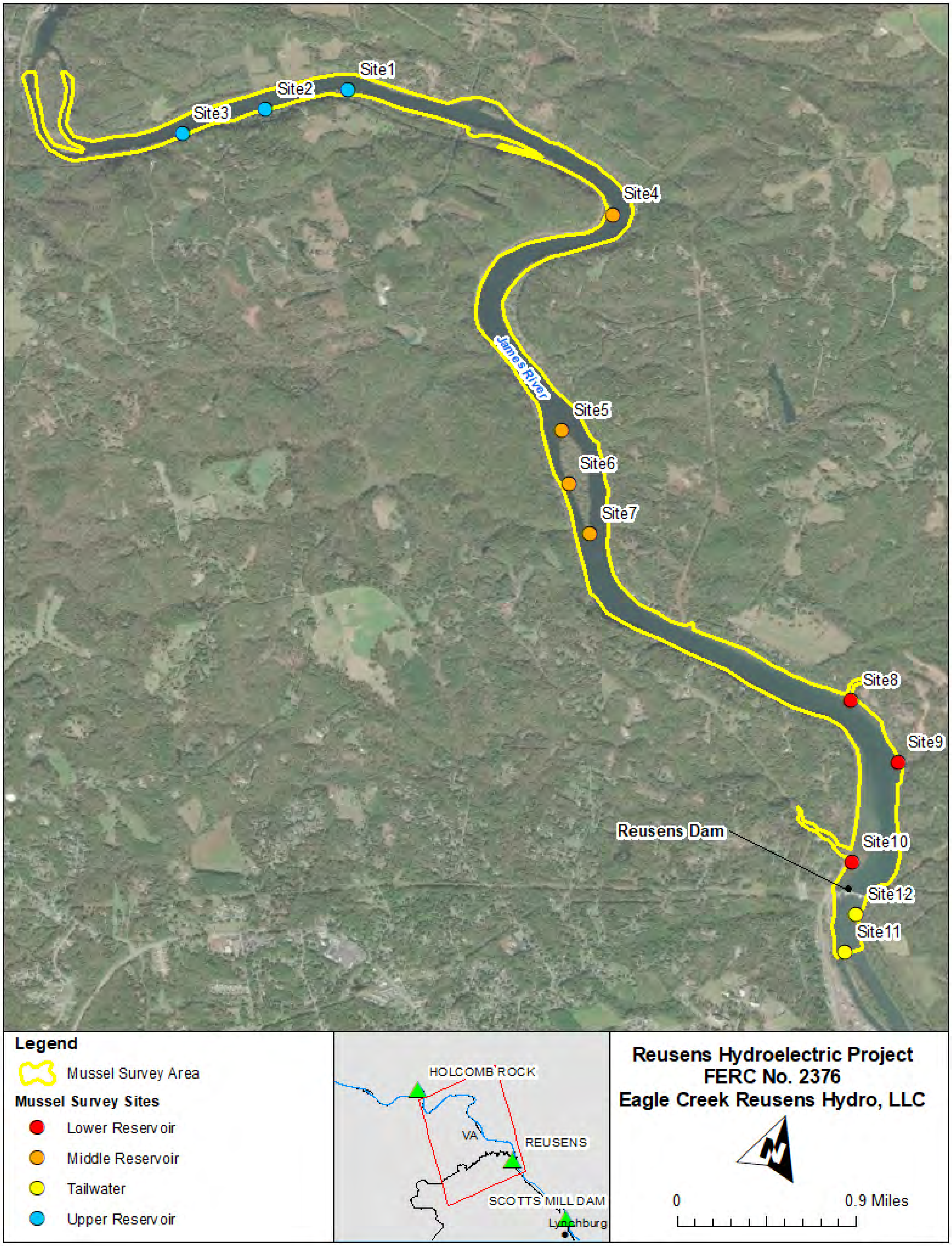


Figure 4.5.2-1. Freshwater mussel survey sites in the Project area

4.5.3 Desktop Entrainment and Turbine Mortality Study

The Desktop Entrainment and Turbine Mortality study considered and evaluated physical characteristics, operations, and environmental factors to determine the characteristics and attributes of the Project that influence entrainment and turbine mortality Based on the fish community information, and in consultation with the resource agencies, target species were selected for the subsequent entrainment and turbine mortality evaluation. Each of these species represents a functional group based upon ecological guilds and those that are recreationally important. The target species that were selected include: bull chub, common carp, gizzard shad, shorthead redhorse, bluegill, smallmouth bass, channel catfish, muskellunge, American eel, northern hogsuck, and central stoneroller. The potential for each target species to be impinged or become entrained at the Project was assessed considering propensity of the target species to occur in the vicinity of the intake based on the species habitat preferences and habitat near the intakes, the swimming ability of the target species relative to estimates of intake velocities, and body width relatively to the trashrack clear spacing. The potential of impingement and entrainment was then qualified as none, low, moderate, or high.

The overall potential for impingement for the target species ranged from ‘none’ to ‘high’ (Table 4.5.3-1). Most of the target species have body widths that are less than the clear spacing of the trashracks of both intakes at Powerhouses A and B; therefore, they are too small to become impinged. Some species, like common carp and channel catfish have body widths that can exceed the trashrack clear spacing; thus, were qualified as having ‘moderate’ impingement potential. The only species that qualified as having ‘high’ impingement potential was the muskie. However, common carp, channel catfish, and muskie have swimming abilities that would allow most individuals to escape becoming impinged. The overall entrainment potential at Powerhouse B for the target species also ranged from ‘none’ to ‘high’ (Table 4.5.3-1). Similar to Powerhouse A, the entrainment potential for bull chub, northern hogsucker, and central stoneroller was qualified as ‘none’ due to limiting habitat requirements, and silver phase American eel was qualified as ‘high’ because of its downstream migration. Gizzard shad and channel catfish overall entrainment potential was qualified as ‘moderate’ because of their propensity to occur near the intake and swimming abilities. The entrainment potential for the other target species was qualified as ‘low’.

Using a blade strike model develop by Franke et al. (1997), the probability of turbine passage survival at the Project were estimated for the target species whose entrainment potential qualified as low, moderate or high. Table 4.5.3-2 presents the estimated turbine survival rates for those target species and associated life stages susceptible to entrainment at maximum discharge, discharge at peak efficiency and at minimum discharge, the associated turbine efficiencies, and λ equal to 0.1 and 0.2. Table 4.5.3-2 also presents the calculated turbine survival estimates for each target species and life stage relative to a qualitative turbine passage survival category, adapted from NAI (2016), such that calculated survival estimates that range from 90 to 100, 80 to 90, and < 80 percent are qualified as high, moderate, and low turbine passage survival, respectively. These data show that, if entrained, turbine passage survival of juvenile fish would be Low-Moderate to High. Similarly, the overall rating of turbine passage survival for adult fish ranged from Low to Moderate-High, with fish species attaining larger size as adults (e.g., American eel and musky.) having Low overall survival ratings.

Although the blade strike model results in this study suggest that turbine passage survival of American eel would be low, other research suggest that blade strike models may not be very applicable to predicting turbine passage survival of American eel. For instance, Pflugrath et al. (2020) performed a comprehensive review of the research conducted on the development of biological response models to predict the probability of injuries or mortality when fish are exposed to stressors during passage through turbines or other hydropower structures. Pflugrath et al. (2020) concluded that American eel seems resistant to blade strike impacts. Pflugrath et al. (2020) results are supported by recent field-based American eel downstream passage assessments and turbine passage survival studies performed at the Vernon Hydroelectric Project (FERC No. 1904), which has operation characteristics and Francis turbines very similar to the Project. There, both balloon- and radio tagged adult American eel were subject to turbine passage through the Francis units (NAI, 2017a). Results of the passage trials revealed that turbine passage survival ranged from 92.9 to 93.5 percent, which is much higher relative to the 24.4 to 65.1 percent estimated by the Franke et al. (1997) blade strike model for fish of comparable size (NAI, 2017b). Therefore, it is probable that American eel passage survival is significantly higher at the Project than estimated by the blade strike model in this study.

Table 4.5.3-1. Overall entrainment and impingement potential of the target species at Powerhouses A and B.

Species	Life stage	Potential to Occur Near Intake		Intake Velocity		Impingement Potential		Entrainment Potential	
		A	B	A (0.4-2.0 fps)	B (0.8-3.5 fps)	A	B	A	B
Bull chub	Adult	None	None	Low	Low	None	None	None	None
	Juvenile	None	None	Low	Low			None	None
Common carp	Adult	High	Moderate	Low	Low	Moderate	Moderate	Low	Low
	Juvenile	High	Moderate	Low	Low			Low	Low
Gizzard shad	Adult	High	High	Low	Moderate	None	None	Low	Moderate
	Juvenile	High	Moderate	Low	Moderate			Low	Moderate
Shorthead redhorse	Adult	Low	Low	Low	Low	None	None	Low	Low
	Juvenile	Low	Low	Low	Low			Low	Low
Bluegill	Adult	Moderate	Low	Low	Moderate	None	None	Low	Low
	Juvenile	Moderate	Low	Low	Moderate			Low	Low
Smallmouth bass	Adult	Moderate	Low	Low	Low	None	None	Low	Low
	Juvenile	Moderate	Low	Low	Low			Low	Low
Channel catfish	Adult	High	Moderate	Low	Moderate	Moderate	Moderate	Low	Moderate
	Juvenile	Moderate	Moderate	Low	Moderate			Low	Moderate
Muskellunge	Adult	Moderate	Low	Low	Low	High	High	Low	Low

Species	Life stage	Potential to Occur Near Intake		Intake Velocity		Impingement Potential		Entrainment Potential	
		A	B	A (0.4-2.0 fps)	B (0.8-3.5 fps)	A	B	A	B
	Juvenile	Moderate	Low	Low	Low			Low	Low
American eel	Adult	High	High	Low	Moderate	None	None	High	High
	Juvenile	Low	Low	Low	Moderate			Low	Low
Northern hogsucker	Adult	None	None	Low	Low	None	None	None	None
	Juvenile	None	None	Low	Low			None	None
Central stoneroller	Adult	None	None	Low	Moderate	None	None	None	None
	Juvenile	None	None	Low	Moderate			None	None

Table 4.5.3-2. Estimated survival rates through the Project's Francis turbines (Units 1 - 5) for the target species and life stages susceptible to entrainment.

Species	Life Stage	Approximate Size Range (inch)	Predicted Turbine Passage Survival (percent)[1]	Qualitative Turbine Survival Category
Common carp	Juvenile	1 – 14	76.4 – 99.2	Low – High
	Adult	14 – 28	52.9 – 89.0	Low - Moderate
Gizzard shad	Juvenile	1 – 7	88.2 – 99.2	Moderate - High
	Adult	7 – 14	76.4 – 94.5	Low - High
Shorthead redhorse	Juvenile	1 – 8	86.5 – 99.2	Moderate - High
	Adult	8 – 14	76.4 – 93.7	Low - High
Bluegill	Juvenile	1 – 4	93.3 – 99.2	High
	Adult	4 – 8	86.5 – 96.9	Moderate - High
Smallmouth bass	Juvenile	3 – 7	88.2 – 97.6	Moderate - High
	Adult	8 – 22	63.0 – 93.7	Low - High
Channel cat	Juvenile	3 – 10	83.2 – 97.6	Moderate - High
	Adult	10 – 26	56.2 – 92.1	Low - High
Muskellunge	Juvenile	14 – 27	54.6 – 89.0	Low - Moderate
	Adult	27 – 50	15.9 – 78.8	Low
American eel	Juvenile	4 – 9	84.9 – 96.9	Moderate - High
	Adult	9 – 40	32.7 – 92.9	Low - High

1. Encompasses the range of discharge type, discharge, efficiency, and λ; see Table 3.1-7 of the study report in Attachment 3.

4.6 Existing and Proposed PM&E Measures for Existing Aquatic and Fisheries Resources

Reusens Hydro proposes to continue to operate the Project as it is currently licensed, which includes the continuation of the current minimum flow requirement determined by License Article 401. Article 401 requires Reusens Hydro to provide downstream on an average hourly basis 333 cfs or reservoir inflow, whichever is less. Reusens Hydro also proposes to maintain forebay water surface elevations at or above 547.00 ft NAVD88, as required by License Article 402, and provide the required minimum flow downstream of the Project via a spillway gate when the turbine-generator units shut down, as required by License Article 406.

4.7 Agency Proposed PM&E Measures for Existing Aquatic and Fisheries Resources

[*to be completed for the Final License Application*]

4.8 Description of Continuing Impacts on Aquatic and Fisheries by Continued Project Operation

[*Environmental effects germane to aquatic habitat will be evaluated and discussed when the instream flow assessment is complete*]

Various mussel surveys performed throughout the James River in the general area of the Project revealed that the freshwater mussel species present are native and relatively common. The mussel surveyed performed by Reusens Hydro revealed that overall, based upon substrate characteristics, habitat exists at most of the study sites for most freshwater mussel species, including rare species, that are known to occupy the James River. However, despite the sufficient effort extended to visually examine all suitable habitats, evidence of only three common freshwater mussels was observed downriver from the dam. Therefore, operation of the Project is unlikely to affect freshwater mussel species present in the vicinity of the Project, including protected species as they are unlikely to occur in the reach of the James River occupied within the Project boundary.

The existing fish community in the vicinity of the Project is mostly warm water species, with the American eel being the only diadromous species documented in the area. Fish community data collected in the vicinity of the Project indicates the existing fish community is diverse with smallmouth bass, bluegill, rock bass, and spottail shiner are those species that are generally among the most abundant. The overall potential of entrainment for resident species at the Project is generally low, with only smaller individuals most apt to become entrained due to lower swimming abilities. However, turbine passage survival is expected to be high, likely greater than 93 percent. The potential for American eel entrainment remains high, but only because the species unique life history compels it to emigrate downriver to the ocean at some point during its life cycle. While the blade strike model estimate of turbine passage survival of American eel passage at the Project is low, especially for larger individuals, empirical data from a recent field-based turbine passage study of American eel at a hydroelectric Project with nearly identical turbines as those at the Project indicate that American eel passage survival at the Project would likely be greater than 92 percent. Because Reusens Hydro is not proposing to change Project operations, continued impacts on the existing fish community from entrainment and turbine mortality would reflect existing levels, and the fish community would likely reflect the existing community over the next license term. Furthermore, because American eel abundance are extremely low in the Project area, and turbine survival would be expected to be high any turbine-induced mortality would likely be insignificant on the panmictic population of American eel.

Currently, the Scotts Mill Dam located 3.7 river miles downstream of the Project, represents the upper limit diadromous fish species may ascend in the James River, expect for American eel. The fish community data indicate that American eel can reach into the Upper James River basin, but are in extremely low abundance near the Project, and downstream of the Scott's Mill Dam. Operation of the Project would continue without effecting diadromous fish species known to occur in the lower James River, because under the existing condition, these species cannot physically make their way to the Project dam.

5 WILDLIFE RESOURCES

The upland habitat along the approximate 16 miles of reservoir shoreline of the James River consists of oak-hickory forests, rural, and sparsely developed areas with some open fields. Along the river-left bank the upland habitat extent is bound by the CSX railway, whereas the upland area along the river-right bank is predominantly continuous forest with some residential development and open space outside the Project boundary.

A large diversity of animals could be expected to occur in the Project vicinity. A complete list of mammals, amphibians and reptiles, and bird species that have ranges that include the Project area was compiled using the VDGIF's Virginia Fish and Wildlife Information Service on-line tool (http://vafwis.org/fwis), using a 3-mile search radius around Chestnut Island, encompassing the entire project boundary. Tables 5.0-1 through 5.0-4 contain a comprehensive list of these species. Species listed in these tables may or may not have habitat adjacent to the Project or occur within those habitats, if present.

Recreational important game species in the Project area include white-tailed deer, black bear, fox and gray squirrel, eastern cottontail rabbit, wild turkey, ruffed grouse, bobwhite quail, mourning dove, mallard duck, and wood duck (FERC. 1994).

Table 5.0-1. Mammal species that occur or have a potential to occur in the Project area.

Common Name	Scientific Name
Shrew, American pygmy	*Sorex hoyi*
Shrew, northern short-tailed	*Blarina brevicauda kirtlandi*
Shrew, least	*Cryptotis parva*
Mole, hairy-tailed	*Parascalops breweri*
Mole, eastern	*Scalopus aquaticus aquaticus*
Mole, star-nosed	*Condylura cristata cristata*
Bat, little brown	*Myotis lucifugus*
Bat, northern long-eared	*Myotis septentrionalis*
Bat, silver-haired	*Lasionycteris noctivagans*
Bat, tri-colored	*Perimyotis subflavus*
Bat, big brown	*Eptesicus fuscus*
Bat, eastern red	*Lasiurus borealis*
Bat, hoary	*Lasiurus cinereus*
Bear, American black	*Ursus americanus*
Raccoon	*Procyon lotor lotor*
Weasel, least	*Mustela nivalis allegheniensis*
Weasel, long-tailed	*Mustela frenata noveboracensis*
Mink, common	*Neovison vison mink*
Otter, northern river	*Lontra canadensis lataxina*
Skunk, eastern spotted	*Spilogale putorius putorius*
Skunk, striped	*Mephitis mephitis mephitis*
Fox, red	*Vulpes vulpes fulva*
Fox, common gray	*Urocyon cinereoargenteus cinereoargenteus*
Bobcat	*Lynx rufus rufus*
Woodchuck	*Marmota monax monax*
Chipmunk, Fisher's eastern	*Tamias striatus fisheri*
Squirrel, northern gray	*Sciurus carolinensis pennsylvanicus*
Squirrel, talkative red	*Tamiasciurus hudsonicus loquax*
Squirrel, red	*Tamiasciurus hudsonicus abieticola*
Squirrel, eastern fox	*Sciurus niger vulpinus*

Common Name	Scientific Name
Squirrel, southern flying	*Glaucomys volans volans*
Beaver, American	*Castor canadensis*
Mouse, eastern harvest	*Reithrodontomys humulis humulis*
Mouse, deer	*Peromyscus maniculatus nubiterrae*
Mouse, northern white-footed	*Peromyscus leucopus noveboracensis*
Mouse, Lewis' golden	*Ochrotomys nuttalli nuttalli*
Rat, hispid cotton	*Sigmodon hispidus virginianus*
Woodrat, Allegheny	*Neotoma magister*
Vole, meadow	*Microtus pennsylvanicus pennsylvanicus*
Lemming, Stone's southern bog	*Synaptomys cooperi stonei*
Vole, southern red-backed	*Myodes gapperi*
Vole, pine	*Microtus pinetorum scalopsoides*
Muskrat, common	*Ondatra zibethicus zibethicus*
Muskrat, large-toothed	*Ondatra zibethicus macrodon*
Rat, black	*Rattus rattus rattus*
Rat, Norway	*Rattus norvegicus norvegicus*
Mouse, house	*Mus musculus musculus*
Mouse, meadow jumping	*Zapus hudsonius americanus*
Mouse, woodland jumping	*Napaeozapus insignis roanensis*
Cottontail, eastern	*Sylvilagus floridanus mallurus*
Cottontail, Appalachian	*Sylvilagus obscurus*
Deer, white-tailed	*Odocoileus virginianus*
Beaver, Carolina	*Castor canadensis carolinensis*
Coyote	*Canis latrans*
Opossum, Virginia	*Didelphis virginiana virginiana*
Shrew, smoky	*Sorex fumeus*
Shrew, southeastern	*Sorex longirostris longirostris*

Source: VDWR (2021)

Table 5.0-2. Amphibian species that occur or have the potential to occur in the Project area.

Common Name	Scientific Name
Bullfrog, American	*Lithobates catesbeianus*
Treefrog, Cope's gray	*Hyla chrysoscelis*
Treefrog, gray	*Hyla versicolor*
Frog, green	*Lithobates clamitans*
Frog, eastern cricket	*Acris crepitans*
Frog, pickerel	*Lithobates palustris*
Frog, Coastal Plains leopard	*Lithobates sphenocephalus utricularius*
Frog, upland chorus	*Pseudacris feriarum*
Frog, wood	*Lithobates sylvaticus*
Salamander, mole	*Ambystoma talpoideum*
Salamander, black-bellied	*Desmognathus quadramaculatus*
Salamander, cave	*Eurycea lucifuga*
Salamander, four-toed	*Hemidactylium scutatum*
Salamander, long-tailed	*Eurycea longicauda longicauda*
Salamander, marbled	*Ambystoma opacum*
Salamander, Allegheny mountain dusky	*Desmognathus ochrophaeus*
Salamander, northern dusky	*Desmognathus fuscus*
Salamander, Peaks of Otter	*Plethodon hubrichti*
Salamander, eastern red-backed	*Plethodon cinereus*
Salamander, northern slimy	*Plethodon glutinosus*
Salamander, spotted	*Ambystoma maculatum*
Salamander, southern two-lined	*Eurycea cirrigera*
Salamander, three-lined	*Eurycea guttolineata*
Salamander, valley and ridge	*Plethodon hoffmani*
Toad, eastern American	*Anaxyrus americanus americanus*
Toad, eastern narrow-mouthed	*Gastrophryne carolinensis*
Spadefoot, eastern	*Scaphiopus holbrookii*
Toad, Fowler's	*Anaxyrus fowleri*
Newt, red-spotted	*Notophthalmus viridescens viridescens*
Salamander, Blue Ridge red	*Pseudotriton ruber nitidus*

Common Name	**Scientific Name**
Salamander, northern red	*Pseudotriton ruber ruber*
Peeper, spring	*Pseudacris crucifer*
Salamander, seal	*Desmognathus monticola*
Salamander, northern spring	*Gyrinophilus porphyriticus porphyriticus*
Salamander, white-spotted slimy	*Plethodon cylindraceus*

Source: VDWR (2021)

Table 5.0-3. Reptile species that occur or have the potential to occur in the Project area.

Common Name	**Scientific Name**
Lizard, eastern fence	*Sceloporus undulatus*
Skink, northern coal	*Plestiodon anthracinus anthracinus*
Skink, common five-lined	*Plestiodon fasciatus*
Skink, southeastern five-lined	*Plestiodon inexpectatus*
Skink, broad-headed	*Plestiodon laticeps*
Skink, little brown	*Scincella lateralis*
Racerunner, eastern six-lined	*Aspidoscelis sexlineata sexlineata*
Rattlesnake, timber	*Crotalus horridus*
Copperhead, eastern	*Agkistrodon contortrix*
Racer, northern black	*Coluber constrictor constrictor*
Wormsnake, eastern	*Carphophis amoenus amoenus*
Snake, northern ring-necked	*Diadophis punctatus edwardsii*
Cornsnake, red	*Pantherophis guttatus*
Ratsnake, eastern	*Pantherophis alleghaniensis*
Snake, eastern hog-nosed	*Heterodon platirhinos*
Kingsnake, eastern	*Lampropeltis getula*
Kingsnake, northern mole	*Lampropeltis rhombomaculata*
Milksnake, eastern	*Lampropeltis triangulum*
Kingsnake, scarlet	*Lampropeltis elapsoides*
Snake, queen	*Regina septemvittata*
Watersnake, northern	*Nerodia sipedon sipedon*
Greensnake, northern rough	*Opheodrys aestivus aestivus*
Greensnake, smooth	*Opheodrys vernalis*
Brownsnake, Dekay's	*Storeria dekayi*
Snake, northern red-bellied	*Storeria occipitomaculata occipitomaculata*
Snake, southeastern crowned	*Tantilla coronata*
Gartersnake, eastern	*Thamnophis sirtalis sirtalis*
Ribbonsnake, common	*Thamnophis saurita saurita*
Earthsnake, eastern smooth	*Virginia valeriae valeriae*
Turtle, snapping	*Chelydra serpentina*

Common Name	**Scientific Name**
Turtle, southeastern mud	*Kinosternon subrubrum subrubrum*
Turtle, eastern musk	*Sternotherus odoratus*
Cooter, eastern river	*Pseudemys concinna concinna*
Turtle, eastern painted	*Chrysemys picta picta*
Turtle, woodland box	*Terrapene carolina carolina*
Slider, red-eared	*Trachemys scripta elegans*
Gecko, Mediterranean	*Hemidactylus turcicus*

Source: VDWR (2021)

Table 5.0-4. Bird species that occur or have the potential to occur in the Project area.

Common Name	Scientific Name
Grebe, pied-billed	*Podilymbus podiceps*
Cormorant, double-crested	*Phalacrocorax auritus*
Heron, great blue	*Ardea herodias herodias*
Heron, green	*Butorides virescens*
Egret, cattle	*Bubulcus ibis*
Egret, great	*Ardea alba egretta*
Night-heron, black-crowned	*Nycticorax nycticorax hoactii*
Night-heron, yellow-crowned	*Nyctanassa violacea violacea*
Bittern, least	*Ixobrychus exilis exilis*
Stork, wood	*Mycteria americana*
Ibis, glossy	*Plegadis falcinellus*
Goose, Canada	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Duck, American black	*Anas rubripes*
Gadwall	*Mareca strepera*
Teal, blue-winged	*Spatula discors*
Duck, wood	*Aix sponsa*
Scoter, white-winged	*Melanitta fusca deglandi*
Duck, ruddy	*Oxyura jamaicensis*
Vulture, turkey	*Cathartes aura*
Vulture, black	*Coragyps atratus*
Goshawk, northern	*Accipiter gentilis*
Hawk, sharp-shinned	*Accipiter striatus velox*
Hawk, Cooper's	*Accipiter cooperii*
Hawk, red-tailed	*Buteo jamaicensis*
Hawk, red-shouldered	*Buteo lineatus lineatus*
Hawk, broad-winged	*Buteo platypterus*
Hawk, rough-legged	*Buteo lagopus johannis*
Eagle, golden	*Aquila chrysaetos*
Eagle, bald	*Haliaeetus leucocephalus*
Harrier, northern	*Circus hudsonius*

Common Name	**Scientific Name**
Osprey	*Pandion haliaetus carolinensis*
Falcon, peregrine	*Falco peregrinus*
Merlin	*Falco columbarius*
Kestrel, American	*Falco sparverius sparverius*
Grouse, ruffed	*Bonasa umbellus*
Bobwhite, northern	*Colinus virginianus*
Pheasant, ring-necked	*Phasianus colchicus*
Turkey, wild	*Meleagris gallopavo silvestris*
Limpkin	*Aramus guarauna*
Rail, king	*Rallus elegans*
Rail, Virginia	*Rallus limicola*
Sora	*Porzana carolina*
Moorhen, common	*Gallinula chloropus cachinnans*
Coot, American	*Fulica americana*
Killdeer	*Charadrius vociferus*
Sandpiper, upland	*Bartramia longicauda*
Sandpiper, solitary	*Tringa solitaria*
Sandpiper, spotted	*Actitis macularia*
Phalarope, red-necked	*Phalaropus lobatus*
Woodcock, American	*Scolopax minor*
Snipe, Wilson's	*Gallinago delicata*
Dowitcher, short-billed	*Limnodromus griseus*
Tern, Caspian	*Hydroprogne caspia*
Pigeon, rock	*Columba livia*
Dove, mourning	*Zenaida macroura carolinensis*
Dove, Common Ground	*Columbina passerina*
Cuckoo, yellow-billed	*Coccyzus americanus*
Cuckoo, black-billed	*Coccyzus erythropthalmus*
Owl, barn	*Tyto alba pratincola*
Screech-owl, eastern	*Megascops asio*
Owl, great horned	*Bubo virginianus*
Owl, barred	*Strix varia*

Common Name	**Scientific Name**
Owl, short-eared	*Asio flammeus*
Chuck-will's-widow	*Antrostomus carolinensis*
Whip-poor-will, Eastern	*Antrostomus vociferus*
Nighthawk, common	*Chordeiles minor*
Swift, chimney	*Chaetura pelagica*
Hummingbird, ruby-throated	*Archilochus colubris*
Hummingbird, rufous	*Selasphorus rufus*
Kingfisher, belted	*Megaceryle alcyon*
Flicker, northern	*Colaptes auratus*
Woodpecker, pileated	*Dryocopus pileatus*
Woodpecker, red-bellied	*Melanerpes carolinus*
Woodpecker, red-headed	*Melanerpes erythrocephalus*
Sapsucker, yellow-bellied	*Sphyrapicus varius*
Woodpecker, hairy	*Dryobates villosus*
Woodpecker, downy	*Dryobates pubescens*
Kingbird, eastern	*Tyrannus tyrannus*
Flycatcher, great crested	*Myiarchus crinitus*
Phoebe, eastern	*Sayornis phoebe*
Flycatcher, Acadian	*Empidonax virescens*
Flycatcher, willow	*Empidonax traillii*
Flycatcher, least	*Empidonax minimus*
Wood-Pewee, Eastern	*Contopus virens*
Lark, horned	*Eremophila alpestris*
Swallow, tree	*Tachycineta bicolor*
Swallow, bank	*Riparia riparia*
Swallow, northern rough-winged	*Stelgidopteryx serripennis*
Swallow, barn	*Hirundo rustica*
Swallow, cliff	*Petrochelidon pyrrhonota pyrrhonota*
Martin, purple	*Progne subis*
Jay, blue	*Cyanocitta cristata*
Raven, common	*Corvus corax*
Crow, American	*Corvus brachyrhynchos*

Common Name	**Scientific Name**
Crow, fish	*Corvus ossifragus*
Chickadee, Carolina	*Poecile carolinensis*
Titmouse, tufted	*Baeolophus bicolor*
Nuthatch, white-breasted	*Sitta carolinensis*
Nuthatch, red-breasted	*Sitta canadensis*
Nuthatch, brown-headed	*Sitta pusilla*
Creeper, brown	*Certhia americana*
Wren, house	*Troglodytes aedon*
Wren, winter	*Troglodytes troglodytes*
Wren, Carolina	*Thryothorus ludovicianus*
Wren, marsh	*Cistothorus palustris*
Mockingbird, northern	*Mimus polyglottos*
Catbird, gray	*Dumetella carolinensis*
Thrasher, brown	*Toxostoma rufum*
Robin, American	*Turdus migratorius*
Thrush, wood	*Hylocichla mustelina*
Thrush, hermit	*Catharus guttatus*
Thrush, Swainson's	*Catharus ustulatus*
Veery	*Catharus fuscescens*
Bluebird, eastern	*Sialia sialis*
Gnatcatcher, blue-gray	*Polioptila caerulea*
Kinglet, golden-crowned	*Regulus satrapa*
Kinglet, ruby-crowned	*Regulus calendula*
Waxwing, Bohemian	*Bombycilla garrulus*
Waxwing, cedar	*Bombycilla cedrorum*
Shrike, migrant loggerhead	*Lanius ludovicianus migrans*
Shrike, loggerhead	*Lanius ludovicianus*
Starling, European	*Sturnus vulgaris*
Vireo, white-eyed	*Vireo griseus*
Vireo, yellow-throated	*Vireo flavifrons*
Vireo, blue-headed	*Vireo solitarius*
Vireo, red-eyed	*Vireo olivaceus*

Common Name	Scientific Name
Vireo, warbling	*Vireo gilvus gilvus*
Warbler, black-and-white	*Mniotilta varia*
Warbler, prothonotary	*Protonotaria citrea*
Warbler, worm-eating	*Helmitheros vermivorus*
Warbler, golden-winged	*Vermivora chrysoptera*
Warbler, blue-winged	*Vermivora cyanoptera*
Warbler, Tennessee	*Oreothlypis peregrina*
Warbler, Nashville	*Leiothlypis ruficapilla*
Parula, northern	*Setophaga americana*
Warbler, yellow	*Setophaga petechia*
Warbler, magnolia	*Setophaga magnolia*
Warbler, Cape May	*Setophaga tigrina*
Warbler, black-throated blue	*Setophaga caerulescens*
Warbler, yellow-rumped	*Setophaga coronata*
Warbler, black-throated green	*Setophaga virens*
Warbler, cerulean	*Setophaga cerulea*
Warbler, blackburnian	*Setophaga fusca*
Warbler, yellow-throated	*Setophaga dominica*
Warbler, chestnut-sided	*Setophaga pensylvanica*
Warbler, blackpoll	*Setophaga striata*
Warbler, pine	*Setophaga pinus*
Warbler, prairie	*Setophaga discolor*
Warbler, palm	*Setophaga palmarum*
Ovenbird	*Seiurus aurocapilla*
Waterthrush, northern	*Parkesia noveboracensis*
Waterthrush, Louisiana	*Parkesia motacilla*
Warbler, Kentucky	*Geothlypis formosa*
Yellowthroat, common	*Geothlypis trichas*
Chat, yellow-breasted	*Icteria virens virens*
Warbler, hooded	*Setophaga citrina*
Warbler, Canada	*Cardellina canadensis*
Redstart, American	*Setophaga ruticilla*

Common Name	Scientific Name
Sparrow, house	*Passer domesticus*
Bobolink	*Dolichonyx oryzivorus*
Meadowlark, eastern	*Sturnella magna*
Blackbird, red-winged	*Agelaius phoeniceus*
Oriole, orchard	*Icterus spurius*
Oriole, Baltimore	*Icterus galbula*
Blackbird, rusty	*Euphagus carolinus*
Grackle, common	*Quiscalus quiscula*
Cowbird, brown-headed	*Molothrus ater*
Tanager, scarlet	*Piranga olivacea*
Tanager, summer	*Piranga rubra*
Cardinal, northern	*Cardinalis cardinalis*
Grosbeak, rose-breasted	*Pheucticus ludovicianus*
Grosbeak, black-headed	*Pheucticus melanocephalus*
Grosbeak, blue	*Passerina caerulea*
Bunting, indigo	*Passerina cyanea*
Dickcissel	*Spiza americana*
Grosbeak, evening	*Coccothraustes vespertinus*
Finch, purple	*Haemorhous purpureus*
Finch, house	*Haemorhous mexicanus*
Grosbeak, pine	*Pinicola enucleator*
Siskin, pine	*Spinus pinus*
Goldfinch, American	*Spinus tristis*
Crossbill, red	*Loxia curvirostra*
Crossbill, white-winged	*Loxia leucoptera*
Towhee, eastern	*Pipilo erythrophthalmus*
Sparrow, savannah	*Passerculus sandwichensis*
Sparrow, grasshopper	*Ammodramus savannarum pratensis*
Sparrow, Henslow's	*Centronyx henslowii*
Sparrow, vesper	*Pooecetes gramineus*
Junco, dark-eyed	*Junco hyemalis*
Sparrow, chipping	*Spizella passerina*

Common Name	Scientific Name
Sparrow, field	*Spizella pusilla*
Sparrow, white-crowned	*Zonotrichia leucophrys*
Sparrow, white-throated	*Zonotrichia albicollis*
Sparrow, fox	*Passerella iliaca*
Sparrow, swamp	*Melospiza georgiana*
Sparrow, song	*Melospiza melodia*
Bunting, snow	*Plectrophenax nivalis nivalis*

Source: VDWR (2021)

5.1 Study Requests and Results

Reusens Hydro did not receive any study requests pertaining to wildlife resources.

5.2 Existing and Proposed PM&E Measures for Existing Wildlife Resources

In accordance with existing license article 407, Reusens Hydro is currently implementing a Wildlife Management Plan (WMP) filed with the Commission on February 25, 1993. Under the WMP, Reusens Hydro performs annual inspections of Chestnut Island for evidence of increased human disturbance and erosion. Chestnut Island is about 19 acres in acre and located approximately 0.4 miles downstream of Monacan Park (Figure 5.2-1). If any such disturbance or erosion is observed or planned Reusens Hydro is to consult with VDWR. In addition, every five years after the license issuance Reusens Hydro is required to consult with VDWR and the FWS regarding the success of the WMP and proposing, if necessary, revisions to the WMP. The most recent report was filed with the Commission on November 11, 2015, which indicates no changes have occurred to the wildlife habitat on Chestnut Island (APC, 2015).

Reusens Hydro does not propose any new protection, mitigation or enhancement measures germane to wildlife resources. Reusens Hydro proposes to discontinue the implementation of the WMP required by the current license Article 407 during the next license term. Reusens Hydro owns Chestnut Island and has no plans for development of the island.

Figure 5.2-1. Location of Chestnut Island.

5.3 Agency Proposed PM&E Measures for Existing Wildlife Resources

[*to be completed for the Final License Application*]

5.4 Description of Continuing Impacts on Wildlife Resources by Continued Project Operation

Reusens Hydro proposes to continue to operate the Project as currently licensed with the exception of discontinuing implementation of the existing WMP, required by the current License Article 407. Under the current license, the intent of the WMP is to maintain Chestnut Island in an undeveloped state, removing trash and other reuse, and protect the island from erosion so that existing wildlife use of the island would be maintained. Reusens Hydro owns Chestnut Island and has no plans for development of the island. Furthermore, over the duration of the current license, the monitoring and reporting conducted under the WMP has shown there has been little change to the island and existing wildlife uses are maintained.[17] In addition, Standard License Article 19 and 20 in Form L-3 would require Reusens Hydro to protect Project lands from erosion and remove refuse from the island as well as other Project lands. Therefore, the intent of the WMP would be accomplished by Standard License Articles 19 and 20 and Reusens Hydro's plans for no development of the island. Therefore, Reusens Hydro anticipates that continued operation of the Project without the WMP would maintain and ensure existing wildlife use of Project lands.

[17] See Accession Nos. 19990322-0323, 20040416-0224, 20100719-0047, and 20151112-5073.

6 BOTANICAL RESOURCES

The Project is located in the Northern Inner Piedmont ecoregion, of which the major forest community is Oak-Hickory-Pine Forest (Woods et al. 1999). Dominant tree species include hickory (*Carya spp*.), shortleaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*), white oak (*Quercus alba*) and post oak (*Quercus stellata*) (Wood et al. 1999). Other tree species commonly found in the Piedmont ecoregion of the Project area are maple, tulip poplar, sycamore, black walnut, butternut, black willow, box elder, red cedar, black locust, wild cherry, American beech, red maple, black gum, chestnut oak, black oak, red oak, Virginia pine, white pine, mulberry, hemlock, sourwood, and persimmon. Major understory species include dogwood, American holly, American redbud, honeysuckle, papaw, musclewood, sassafras, huckleberry, hackberry, elderberry, gooseberry, Queen Anne's lace, ironweed, white fringe, juniper, goldenrod, moccasin flower, rhododendron, laurel, flaming azalea, milkweed, ferns, mosses, liverworts, and a myriad of small flowering plants (VDCR, 2016). Vines that are common to the area are wild yam, greenbriar, trumpet vine, Virginia creeper, wild grape, poison ivy, honeysuckle, virgin's bower, yellow jasmine, blackberry, and pokeberry (VDCR, 2016).

6.1 Study Requests and Results

Reusens Hydro did not receive any study requests pertaining to botanical resources within the Project area.

6.2 Existing and Proposed PM&E Measures for Existing Botanical Resources

Reusens Hydro does not propose any protection, mitigation, or enhancement measures relative to botanical resources.

6.3 Agency Proposed PM&E Measures for Existing Botanical Resources

[*to be completed for the Final License Application*]

6.4 Description of Continuing Impacts on Botanical Resources by Continued Project Operation

Reusens Hydro proposes to continue to operate the Project as currently licensed. Therefore, effects of project operation and maintenance on botanical resources would be similar to existing conditions.

7 WETLANDS, RIPARIAN AND LITTORAL HABITAT

Wetland, riparian, and littoral habitats within the Project boundary are associated with the margin and nearshore areas of the impoundment, bypassed reach, and downstream of the Project powerhouse. The FWS classification scheme for wetlands serves as the national standard for wetland classification and has been used to classify wetlands appearing in the National Wetlands Inventory (NWI). FWS defines wetlands as

> [...] lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water. For the purpose of the classification, wetlands must have one or more of these three attributes: (1) at least periodically, the land must support predominantly wetland plants; (2) the substrate is predominantly undrained hydric soil; and (3) rocky, gravelly, or sandy areas that are saturated with or covered by shallow water at some time during the growing season.

NWI data for the Project area suggests that there are three wetland types present: riverine, freshwater forested/shrub, and freshwater emergent wetland (Figure 7.0-1). Table 7-1 describes the wetlands found within the Project boundary. Overall, within the Project boundary there is approximately 120 acres of riverine wetland (i.e., the James River), 14 acres of freshwater forested/shrub wetland, and less than one acre of freshwater emergent wetland.

Riparian habitat is located along streams and rivers and provides important ecosystem functions related to hydrology and flooding, nutrient cycling, and plant and wildlife habitat. Vegetated riparian habitat within the Project vicinity is primarily forested and intact except the shoreline in portions of the CSX railroad right-of-way. Figures 4.1.2-2 to 4.1.2-7 show the intact forested riparian shoreline.

Littoral habitat in the Project area occurs in the reservoir, bypassed reach, and downstream of the Project where light can penetrate to the bottom and rooted vegetation can survive.

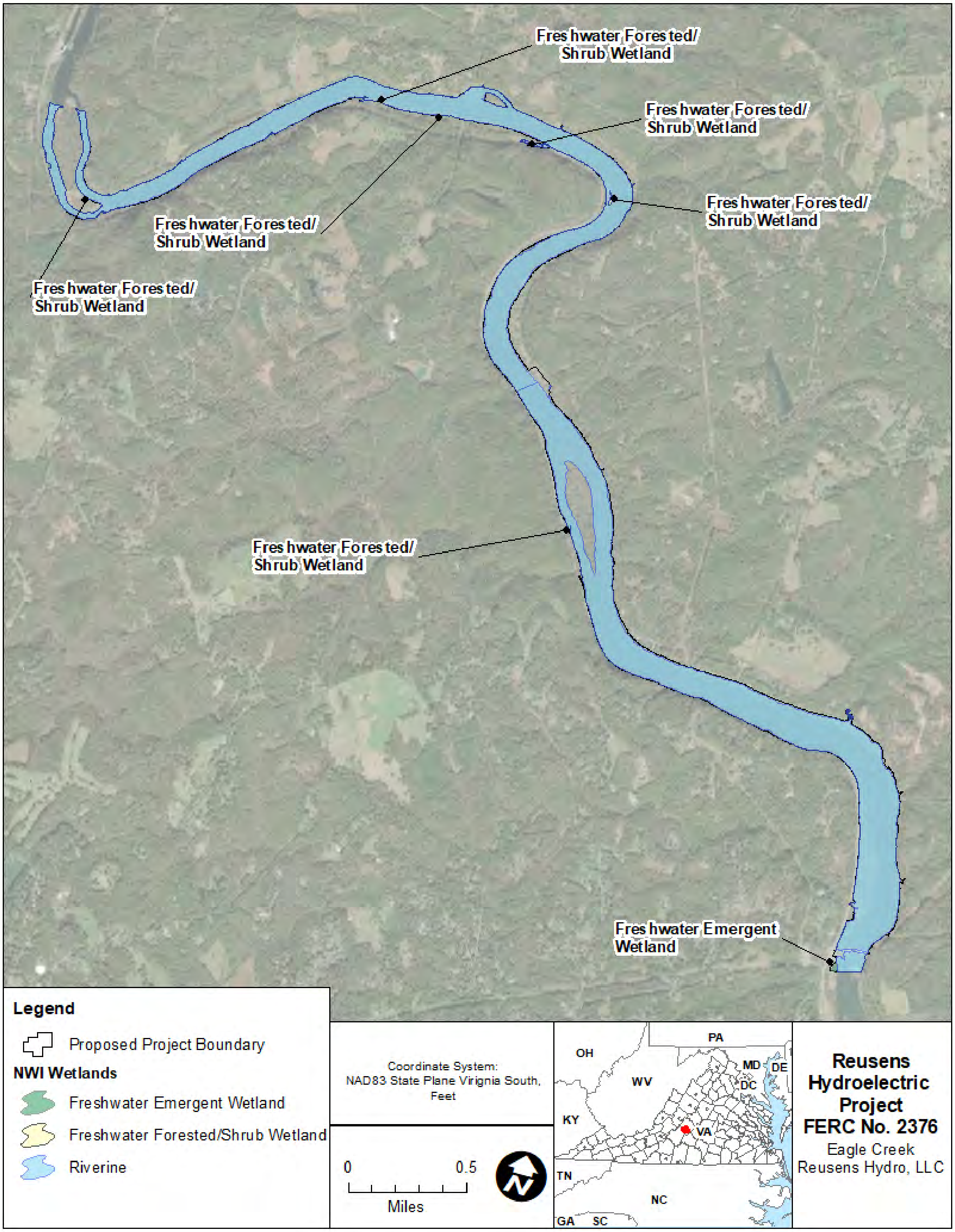


Figure 7.0-1. Wetlands in the Project boundary.

Table 7.0-1. NWI Wetlands within the Project boundary.

NWI Type	NWI Code	NWI Code Description	Area within Project Boundary (acres)
Freshwater Emergent	PEM1C	Palustrine, emergent, persistent, seasonally flooded	0.39
		Total	0.39
Freshwater Forested/Shrub	PFO1A	Palustrine, forested, broad-leaved deciduous, temporary flooded	0.37
	PFO1C	Palustrine, forested, broad-leaved deciduous, seasonally flooded	0.09
	PFO1F	Palustrine, forested, broad-leaved deciduous, semipermanently Flooded	0.06
	PFO1/SS1C	Palustrine, forested, broad-leaved deciduous/ scrub-shrub, seasonally flooded	0.01
	PFO1E	Palustrine, forested, broad-leaved deciduous, seasonally flooded/saturated	0.01
	PSS1/EM1E	Palustrine, scrub-shrub, broad-leaved deciduous, emergent, persistent, seasonally flooded/saturated	0.01
		Total	0.58
Riverine	R2UBHh	Riverine, lower perennial, unconsolidated bottom, permanently flooded, diked/impounded	272.03
	R2UBH	Riverine, lower perennial, unconsolidated bottom, permanently flooded	223.62
	R5UBH	Riverine, unknown perennial, unconsolidated bottom, permanently flooded	0.23
	R4SBC	Riverine, intermittent, streambed, seasonally flooded	0.03
	R2USC	Riverine, lower perennial, unconsolidated shore, seasonally flooded	<0.01
		Total	495.90

7.1 Study Requests and Results

Reusens Hydro did not receive any study requests pertaining to wetlands, riparian, or littoral habitat resources within the Project area.

7.2 Existing and Proposed PM&E Measures for Existing Wetland, Riparian, and Littoral Habitat Resources

Reusens Hydro does not propose any protection, mitigation, or enhancement measures relative to wetland, riparian, or littoral habitat.

7.3 Agency Proposed PM&E Measures for Existing Wetland, Riparian, and Littoral Habitat Resources

[*to be completed for the Final License Application*]

7.4 Description of Continuing Impacts on Wetland, Riparian, and Littoral Habitat Resources by Continued Project Operation

Reusens Hydro proposes to continue to operate the Project as it is currently licensed. Therefore, effects due to Project operation and maintenance on wetland, riparian, and littoral habitat would be similar to existing conditions.

8 RARE, THREATENED, AND ENDANGERED SPECIES

8.1 Federal Species

Reusens Hydro consulted the FWS Information for Planning and Consultation (IPaC) online tool to determine those federally listed species that have the potential to occur in the Project vicinity. IPaC identifies one mammal listed as threatened under the Endangered Species Act, the northern long-eared bat (*Myotis septentrionalis*), that could occur in the vicinity of the Project (FWS, 2021).

Northern Long-eared Bat Habitat

The Northern Long-eared bat is a medium sized, tawny brown bat that has a typical body length and wingspan of 3.7 inches and 9 to 10 inches, respectively. As its' name implies, the bat is aptly characterized by its distinctive long ears. Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. These hibernacula are various sized caves or mines with constant temperatures, high humidity, and no air currents. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats are likely flexible in selecting roosts based on suitability to retain bark or provide cavities or crevices, but are rarely found roosting in man-made structures, such as barns and sheds. These bats breed in late-summer and early-fall and give birth in the spring. Furthermore, the bats, like others, feed primarily on flying insects during dusk (FWS, 2015).

The most significant threat to the Northern long-eared bat is White Nose Syndrome (WNS). WNS is an emergent fungal disease that infects the skin of the bats muzzle and wings of hibernating bats. Other threats to the bat include degradation of hibernacula and roost habitat, and wind farm operation. The FWS indicates that degradation of hibernacula stems mostly from gate or other structure at the entrance of hibernacula, which can prevent bats from entering and changing the air circulation patterns within the hibernacula. Degradation to roost habitat is mostly from the remove of trees for construction and forest management. Impacts from wind farm operation is mortality associated with blade strike (FWS, 2015).

Figure 8.1.1-1-1 shows the locations of known northern long-eared bat hibernacula and maternity roost trees in Virginia in relation to the Project. Figure 8.1.1-1 indicates there are no known northern long-eared bat hibernacula and maternity roost trees in the Project vicinity, and the nearest location is approximately 32 miles northwest of the Project. The IPaC also indicates there are no designated critical habitat for Northern Long-eared bat near the Project.

Northern Long-eared Bat Final 4(d) Rule

Reusens Hydro expects that the Project is consistent with activities analyzed in the Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions (4(d) Rule). Nonetheless, Reusens Hydro will consult with the FWS regarding the Project's consistency with the 4(d) Rule for the final license application.

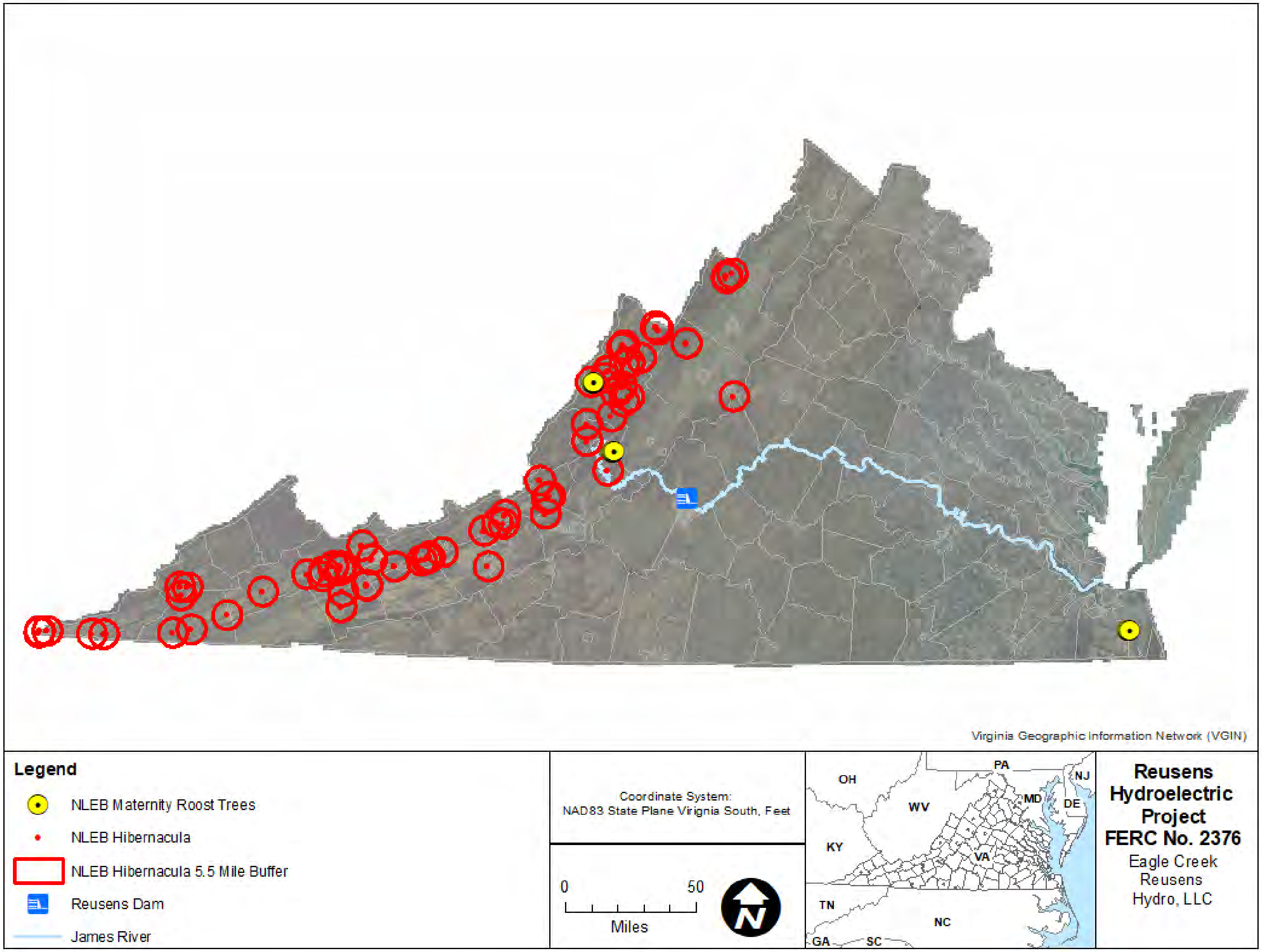


Figure 8.1.1-1. Location of known Northern long-eared bat hibernacula and maternity roost trees relative to the Project.

8.2 State Species

Reusens Hydro referenced VDCR's Natural Heritage Data Explorer to determine whether certain rare, threated, or endangered State listed species have the potential to occur in the Project vicinity. For this query, Reusens Hydro assumed the Project vicinity is the HUC12 watershed James River-Judith Creek (HUC12 020802030301) in the data explorer. Figure 8.2-1 shows the HUC12 watershed search area. In summary, VDCR's Natural Heritage Data Explorer indicates there is one State species listed as threatened: the yellow lance (*Elliptio lanceolata*).[18] A brief description of the species is provided below. No other listed State species have been identified that occur or have the potential to occur in the Project vicinity.

Yellow Lance (*Elliptio lanceolata*)

The yellow lance is a yellow, elongated mussel usually not more than 3.4 inches in length. It is a sand loving species often found buried deep in clean, coarse to medium sand and sometimes gravel (FWS, n.d.). The species is dependent on clean, moderate flowing water with high dissolved oxygen content in riverine or larger creek environments. Historically, the most robust populations existed in creeks and rivers with excellent water quality, and no populations appear to be extant below pollution point sources or areas with increased nutrient loading (FWS, n.d.). The largest threats to the future viability of the yellow lance are habitat degradation from stressors influencing water quality, water quantity, instream habitat, and habitat connectivity. The stressors identified that have led to the degradation of the yellow lance habitat include development, agricultural practices, forest management, barriers such as dams and impoundments, and invasive species (Federal Register, 2018).

[18] The yellow lance is also a Federally listed as Threatened. However, the FWS IPaC tool indicates the species is likely not present in the Project area (see Section 8.1 *Federal Species*). The FWS has designated critical habitat for the threatened mussel as wherever it has been found. FWS (n.d.) indicates there are no known extant populations on the mainstem of the James River. The only and nearest extant population within the James River basin is located approximately 60 miles west of the Project, in Johns Creek, Craig County, Virginia.

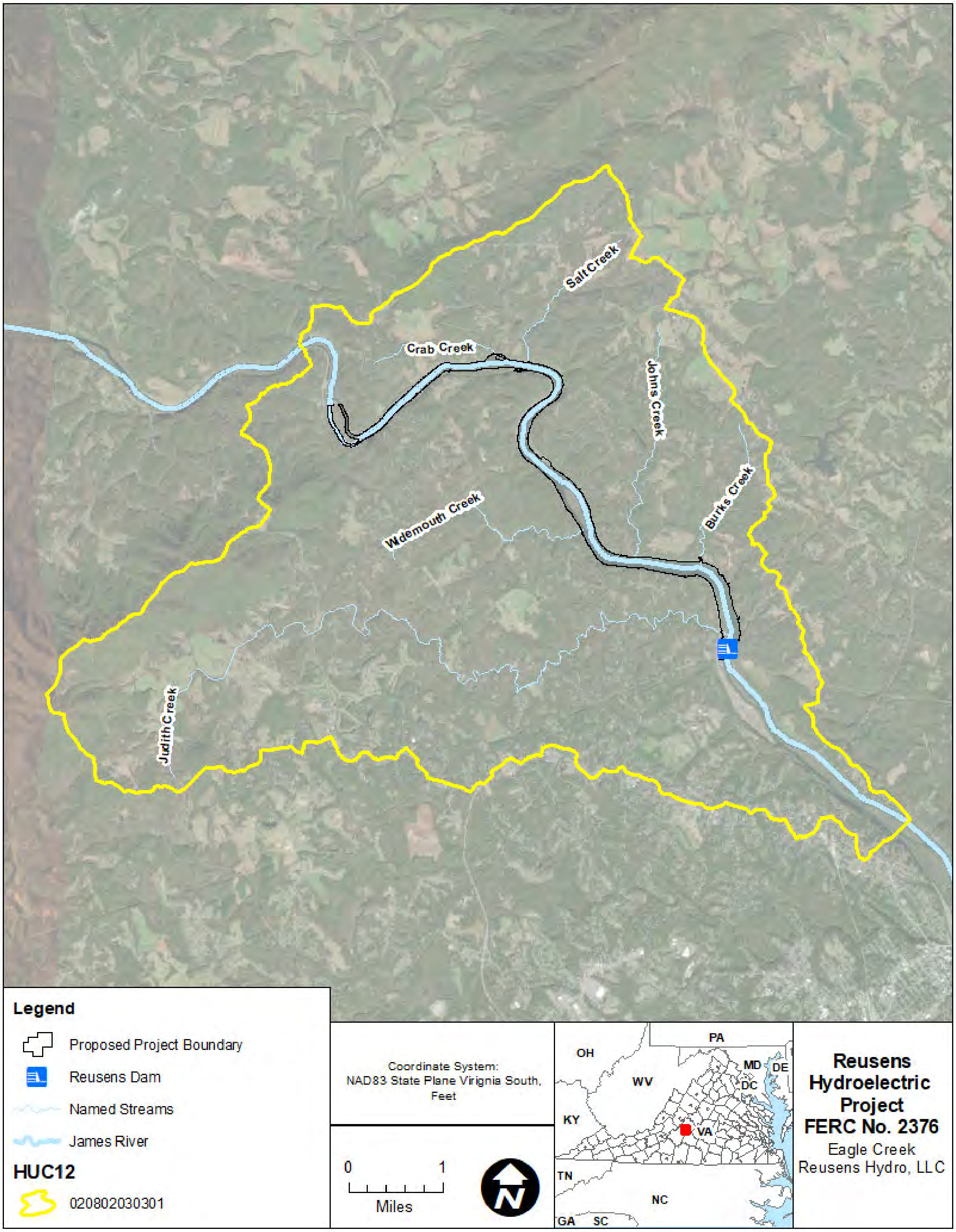


Figure 8.2-1. HUC12 watershed James River-Judith Creek (HUC12 020802030301) used to query VDCR's Natural Heritage Data Explorer for rare, threatened and endangered species.

8.3 Study Requests and Results

Reusens Hydro received one study request, from the FWS, specific to rare, threatened and endangered (RTE) species. The FWS requested surveys for ten RTE species that could occur in the Project area. These species included the: James River spinymussel, brook floater, green floater, Atlantic pigtoe, Northern long-eared bat, little brown bat, tri-colored bat, Peregrine falcon, loggerhead shrike, and the migrant loggerhead shrike. Reusens Hydro did not adopt the study request for the reasons discussed in the Draft Study Plan (Attachment 1) and Final Study Plan (Attachment 2). Since Reusens Hydro was proposing to conduct a freshwater mussel survey, which would determine the presence or absence of RTE species; Reusens Hydro did not propose a separate dedicated mussel survey for RTE species. As a result of the study planning development and consultation process, Reusens Hydro performed the Freshwater Mussel Survey. Study reports of the performed studies are presented in Attachment 3 – Draft Study Reports. Results of the Freshwater Mussel Survey is discussed in section 4.5.2 *Freshwater Mussel Survey*. The survey did not find any RTE mussel species in the Project area.

8.4 Existing and Proposed PM&E Measures for Rare, Threatened, and Endangered Species

Reusens Hydro does not propose any new protection, mitigation, or enhancement measures for RTE species.

8.5 Agency Proposed PM&E Measures for Rare, Threatened, and Endangered Species

[*to be completed for the Final License Application*]

8.6 Description of Continuing Impacts on Rare, Threatened, and Endangered Species by Continued Project Operation

There are no known occurrences of RTE species in the Project area. Reusens Hydro is not proposing any changes in Project operations or maintenance activities. As such, it is expected that continued Project operation would not impact RTE species.

9 HISTORICAL, CULTURAL, AND TRIBAL RESOURCES

9.1 Project History

Operation of the first hydroelectric generating station at the Project began in 1903. The Lynchburg Traction & Light Company constructed a generating station at the free-overflow granite block impoundment structure known as Judith Dam. The original powerhouse was located where the current Powerhouse A exists and housed two 750 kW generators; each connected by rope drives to two pairs of horizontal camelback turbines. In 1913, a 1.000 kW generating unit was added to the powerhouse, then under the ownership of the American Railways Company of Philadelphia, which acquired Lynchburg Traction & Light Company in 1910. Between 1924 and 1925, a joint venture between American Gas & Electric Company and the Appalachian Power Company acquired the American Railway Company. During the same period Powerhouse B was constructed, and two 1,000 kW vertical shaft generating units were installed within the new powerhouse. The Appalachian Electric Power Company (predecessor to the current Appalachian Power Company) was formed in 1926, and subsequently took over operation of the Project. From 1930 through 1931, the Project was rebuilt. The crest of the old Judith Dam was reduced by five feet, capped with concrete, and topped with the current eight floodgates. In addition, the existing generating units were installed, and the superstructure of Powerhouse A was enlarged. Except for various control, auxiliary equipment upgrades, rehabilitation of the generator units, there has been no major changes to the facilities since 1931.

9.2 Cultural Resources

The Virginia Cultural Resource Information System (VCRIS) map was referenced to identify any historic and archeological sites in the vicinity of the Project boundary. The only site identified by VCRIS within the Project boundary is the Project dam (DHR ID: 118-0218) (VDHR, 2020a). The Virginia Landmark Register and the National Register of Historic Places (National Register) were also reviewed to determine if any listed properties are present in the Project area. Although not located within the Project boundary or adjacent to the Project boundary, two properties listed on the National Register are near the Project, Hope Down and Bowling Eldridge House, which are described below. The location of these two properties listed on the National Register relative to the Project are shown in Figure 9.2-1.

Hope Dawn

In a pastoral setting above the James River, Hope Dawn is a compact early-19th-century farmhouse. It is a refined and well-preserved example of Piedmont Virginia’s Federal vernacular (VDHR, 2021). Figure 9.2-2 presents a photograph of Hope Dawn. Its finely crafted details and balanced proportions illustrate the high standards maintained by builders even for modest houses in relatively remote areas. Noteworthy features are the original porches, the Flemish-bond brickwork, and the finely detailed Federal mantels based on designs in Owen Biddle’s The Young Carpenter’s Assistant (1805). The construction date is uncertain. The house may have been standing when the property was acquired in 1827 by Dr. Howell Davies, a Lynchburg druggist, who used Hope Dawn as a country home. Preserved in front of the house is a short section of the old Bethel Road, an early turnpike. The road is still lined with its original stone retaining walls and dressed-stone gateposts (VDHR, 2021).

Bowling Eldridge House

The Bowling Eldridge House is a part of a L-shaped plantation seat is characteristic of the housing favored by the majority of the region's gentry in the early 19th century (VDHR, 2020b). Though it lacks the stylish frills of an architect-designed dwelling, the building has an inherent sophistication coming from the use of an established architectural vocabulary of forms and proportions. Figure 9.2-3 presents a photograph of the Bowling Eldridge House. The front was originally accented by a two-tier portico. The interior is highlighted by reeded woodwork, intricately carved stair brackets, and areas of original graining. The house was built ca. 1822 by Bowling Eldridge, a tobacco planter and mill owner. At its peak the plantation included nearly a thousand acres, sustained by some seventy slaves. The Eldridge family sold the place in 1869 after which the house suffered neglect during a century-long period of absentee landowners. The Bowling Eldridge House was relocated from Halifax to Bedford County. The house now sits atop a grassy knoll and overlooks the James River Valley across Route 794 in Bedford County near Lynchburg, much as it overlooked the Birch Creek Valley in Halifax County when it was also called "Ridgecrest" (VDHR, 2020b).

9.2.1 Area of Potential Effects

The Area of Potential Effects (APE) is defined as "The geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" [36 CFR Part 800.16(d)]. The APE is the maximum geographic area where a project could potentially have an effect on historic properties, if any are present.

For the purpose of the Section 106 consultation process, the Project APE is proposed to be the same as the Project boundary, as depicted in Exhibit G and Figure 9.2-1. The Project boundary is an appropriate APE because it encompasses the full nature and extent of the Project as described in Exhibit A. In brief, the Project boundary encompasses all the lands necessary for Project operation and maintenance activity. For instance, the Project boundary is where any ground disturbing activities would occur and encompasses where the Project structures are visible. Therefore, all effects on any potential historical, cultural, or tribal resource that may be present would occur within the Project boundary.

9.2.2 Section 106 of the National Historic Preservation Act of 1966

The Project is eligible for inclusion in the National Register of Historic Places because it is the only Virginia example of a large low-head hydroelectric facility and a major historical event in the development of hydroelectric projects in the United States, specifically the upgrading of the Project in the late 1920s and 1930 (FERC, 1994).

Federal agencies are required by the National Historic Preservation Act, the National Environmental Policy Act, and other provisions of Federal law to consider historic resources in the planning and execution of their projects. Section 106 of the National Historic Preservation Act and its implementing regulations at 36 CFR Part 800 requires Federal agencies to—clearly define the scope of their undertaking; develop an Area of Potential Effects; make a reasonable and good-faith effort to identify and evaluate historic properties; and assess the project's effects when historic properties are present. Consultation takes place with DHR, which serves as the State Historic Preservation Office (SHPO) in Virginia.

Reusens Hydro will use the VDHR's Electronic Project Information Exchange (ePIX) system (https://epix.dhr.virginia.gov/) to fulfill the consultation requirements of Section 106 of the National Historic Preservation Act (NHPA) of 1966. Documentation of this consultation will be completed for the Final License Application.

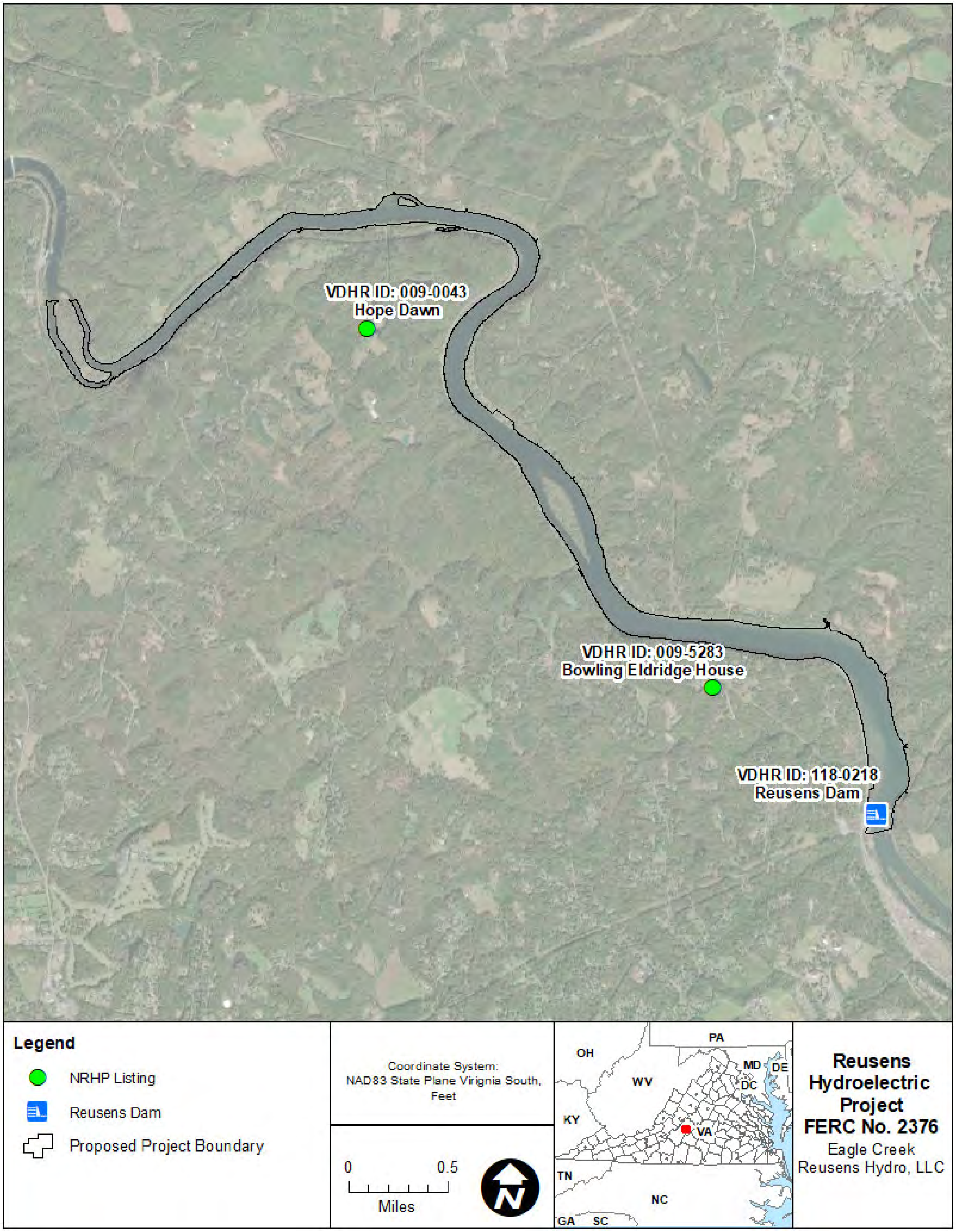


Figure 9.2-1. Cultural resources within the Project boundary and National Register of Historic Properties near the Project area determined using the Virginia Cultural Resource Information System (VCRIS), Virginia Landmark Register, and the National Register of Historic Places.

Figure 9.2-2. Representative photograph of Hope Dawn.

Figure 9.2-3. Representative photograph of the Bowling Eldridge House.

9.3 Tribal Resources

Reusens Hydro has kept the tribes listed in the Initial Statement abreast of the relicensing process. To date no tribe has actively participated in the Project relicensing. To date Reusens Hydro has not identified known tribal lands, tribal cultural sites, or tribal interests located in the immediate vicinity of the Project.

9.4 Study Requests and Results

Reusens Hydro did not receive any study requests pertaining to historical, cultural or tribal resources within the Project area.

9.5 Existing and Proposed PM&E Measures for Historical, Cultural and Tribal Resources

As required by existing license article 408, Reusens Hydro currently implements a Cultural Resources Management Plan (CRMP) as amended by Order Amending CRMP dated June 18, 1996.[19] The CRMP was developed in consultation with the Virginia Department of Historic Places. The CRMP includes procedures on the maintenance of exterior and interior structures. The CRMP also includes a monitoring and reporting component, which specifies that Reusens Hydro file every two years with the Commission copies of written consultations with Virginia State Historic Preservation Officer and large-scale photo documentation of the Project facilities. Reusens Hydro proposes to review and update, if necessary, the existing CRMP. Reusens Hydro does not propose any other protection, mitigation, or enhancement measures relative to historical, cultural or tribal resources.

9.6 Agency Proposed PM&E Measures for Historical, Cultural and Tribal Resources

[*to be completed for the Final License Application*]

9.7 Description of Continuing Impacts Historical, Cultural and Tribal Resources by Continued Project Operation

Reusens Hydro proposes to continue to operate the Project as currently licensed. No significant construction and/or modifications to Project facilities are proposed at this time for continued Project operation. Therefore, there are no anticipated impacts on any potential historical, cultural or tribal resources within the vicinity of the Project or APE. As such, no need for an avoidance or mitigation management plan has been identified for historical, cultural or tribal resources within the Project vicinity.

[19] The CRMP is available on FERC's e-library (Accession No. 19950622-0020).

10 RECREATION RESOURCES

10.1 Regional and Local Recreation

The James River, Virginia's longest river, is an important recreational resource of the Commonwealth of Virginia. It typically supports about 100,000 angling trips and about 50,000 boating trips annually, and segments of the James River are designated as a State Scenic River (Stanovick et al., 1991; VDCR, 2017). Public recreation opportunities within the James River Basin where the Project is located are numerous. The Project is within a short commute of major recreational areas that include the George Washington and Jefferson National Forests. Figure 10.1-1 shows these areas in relation to the Project. In the nearby City of Lynchburg there are also numerous recreation areas and trails (Figure 10.1-1).

The Project also has one federal trail system and one state proposed trail system that goes through the Project boundary. The federal trail system is the Captain John Smith Chesapeake Trail. The Captain John Smith Chesapeake Trail is a National Historic Trail, which includes the James River from its confluence with the Chesapeake Bay to Iron Gate, VA. The trail follows the route of Captain John Smith and his crew who set out to map Chesapeake Bay and its tributary rivers from 1607 through 1609. The proposed state trail system is the James River Heritage Trail. The James River Heritage Trail is a braided trail network that include the James River from the foothills of the Allegheny Mountains to the Chesapeake Bay. Trail segments follow the old Kanawha Canal towpath, park trails, scenic riverside roadways, and urban riverfront trails deep into the Commonwealth (VDCR, 2021).

10.2 Project Recreation Facilities and Opportunities

Figure 10.2-1 shows the location of Monacan Park, the only Project-related recreation facility. Monacan Park is located three miles upstream of the Reusens Dam alongside the Project impoundment. The park is owned by Reusens Hydro and leased and maintained by Amherst County, Virginia. The site provides a picnic shelter containing 11 picnic tables, seven grills, and 17 trash cans, a playground, permanent restroom facilities, a single lane concrete boat launch with a courtesy pier, and shoreline fishing. The boat launch provides boating and fishing access to the entire Project reservoir. The site also provides paved parking for 24 regular vehicles and 16 vehicles with trailers with a single Americans with Disabilities Act (ADA) designated accessible parking space (Kleinschmidt, 2015). Figures 10.2-2 through 10.2-5 provide photographs of the Monacan Park facilities.

The most recent FERC Form 80 filed (filed March 20, 2015) estimated that the Project had a total of 22,068 recreation days in 2014, with fishing being the most popular activity followed by boating and picnicking. On average, the Project was at 27 percent recreation capacity on a typical summer weekend (Kleinschmidt, 2015). The Project's reservoir provides fishing and boating opportunities for the public. The reservoir extends approximately 7 river miles upstream of the Project dam and supports a variety of game species including smallmouth bass, catfish, and pan fish. Foot access to the Project's tailwater access is only available on the river right shoreline. However, access to the tailwater is dangerous because of the CSX railroad right-of-way. Access to the Project tailwaters from the river left bank is prevented by private land ownership and very steep rock outcrops. Access to Project tailwaters from non-Project lands is mostly enjoyed by residents with private boat ramps downstream of the Project - between the Project dam and Lynchburg Dam.

To mitigate for the lack of safe tailwater access, the previous licensee, APC, contributed funds to VDCR to construct a boat ramp facility 4 river miles downstream of the Project, near the City of Lynchburg. This boat ramp is the Amherst Boat Landing depicted in Figure 10.2-1.

Voluntary Flow Releases

Since 1985, communities along the James River and beyond have come together during the early summer to participate in the James River Batteau Festival. The festival commemorates early colonial settlement and expansion in the James River basin through float trips on the James River using historically-accurate batteaus.[20] In support of the festival, Reusens Hydro provides voluntary flow releases, which range from 1,300 to 3,000 cfs, during the festival period in early summer. Put-in and take-out locations for the festival are located along the James River from Lynchburg to Richmond, VA. The nearest location relative to the Project is the Amherst Boat Landing (Figure 10.2-1).

[20] From the French, a bateau or batteau, is a shallow-draft, flat-bottomed boat used extensively across North America, especially in the colonial period and in the fur trade

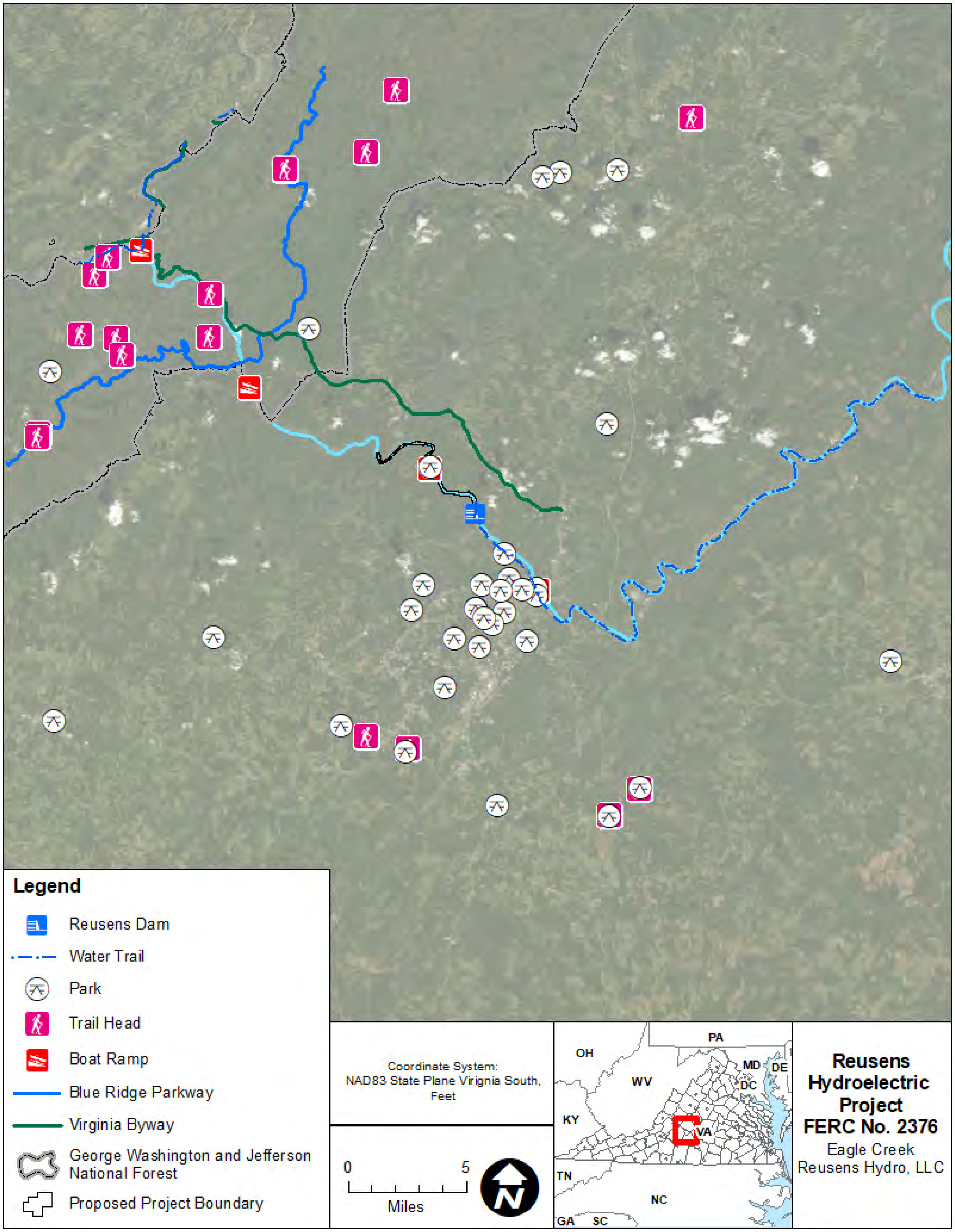


Figure 10.1-1. Regional recreation opportunities within 20-miles of the Project.

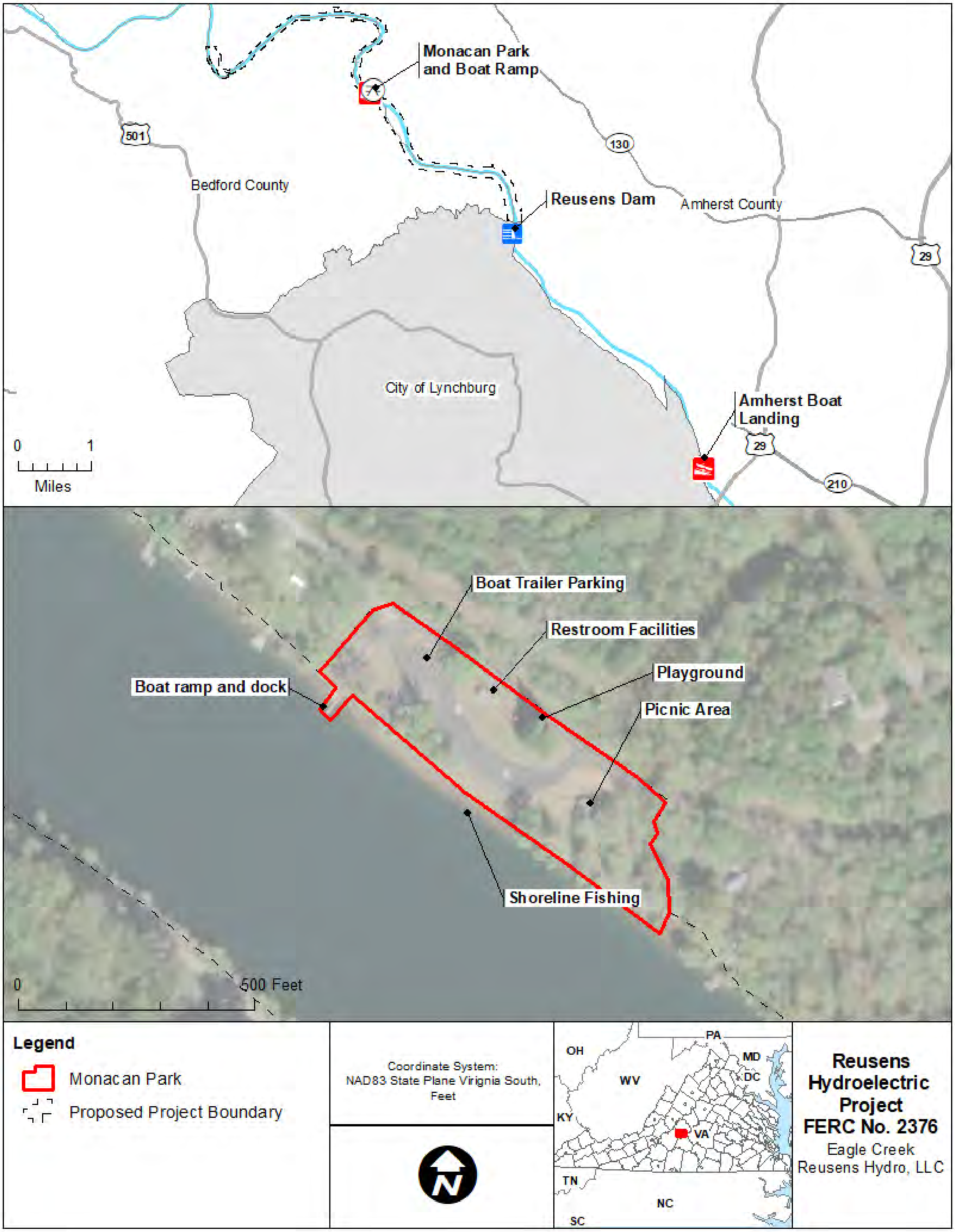


Figure 10.2-1. Project related recreation facilities.

Figure 10.2-2. Photograph of the Monacan Park boat ramp and dock.

Figure 10.2-3. Photograph of the Monacan Park restroom, playground, and picnic area.

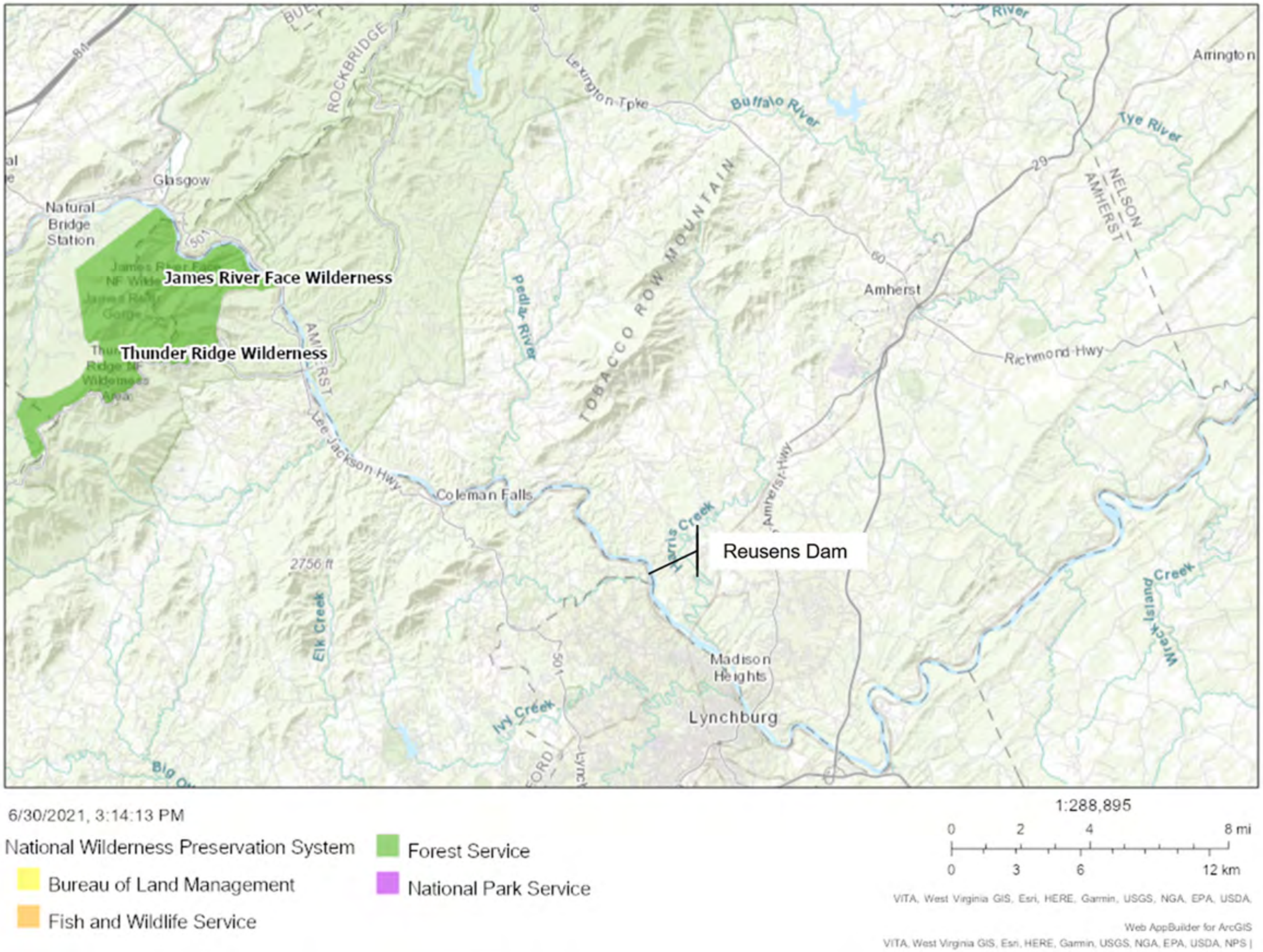
Figure 10.2-4. Photograph of the Monacan Park boat trailer parking area.

Figure 10.2-5. Photograph of the Monacan Park shoreline fishing area.

10.3 National Wild and Scenic River Systems and Wilderness Areas

Virginia has approximately 49,350 miles of river, but no designated or under study for being designated as a National Wild and Scenic River (NWSRS, n.d(a).; NWSRS, n.d (b)).

The Commonwealth of Virginia has 24 designated wildernesses under the Wilderness Act of 1964; none of which are within the Project boundary, or adjacent to the Project vicinity. The nearest wilderness areas at the James River Face Wilderness and the Thunder Ridge Wilderness, located within the George Washington and Jefferson National Forests (Figure 10.3-1).



Source: Wilderness Connect (2021), as modified by Reusens Hydro.

Figure 10.3-1. The nearest wilderness areas designed under the Wilderness Act of 1964 to the Project.

10.4 Study Requests and Results

Reusens Hydro received one study request germane to recreation resources at the Project from VDWR and supported by the FWS. Reusens Hydro subsequently prepared a Draft Study Plan, which is enclosed in this license application as Attachment 1 – Draft Study Plan, and distributed it to the resource agencies. The DSP presents the rationale for not adopting the recreation study recommended by VDWR. Reusens Hydro then held a conference call with the resource agencies to discuss the DSP. Reusens Hydro subsequently revised the DSP, as appropriate, and addressed the resource agencies' comments on the DSP to form the Final Study Plan (FSP; Attachment 2), which provided additional rationale for not adopting the study.

10.5 Existing and Proposed PM&E Measures for Recreation Resources

Reusens Hydro proposes to assess the need for modifications and modify the Monacan Park boat ramp so that it is usable during the range of Project operations. The Monacan Park boat ramp is on licensee-owned lands and maintained by the County. On June 29, 2021, Reusens Hydro collected preliminary information to inform this assessment. Reusens Hydro collected elevations along the centerline of the boat ramp outward into the James River approximately 75 feet and found that when the reservoir is at a normal maximum water surface elevation of 550.0 ft NAVD88, approximately 35 ft of the ramp is submerged, with a maximum depth of 4.7 feet. When the reservoir is at a normal minimum water surface elevation of 546.3 feet NAVD88, approximately, 15 feet of the ramp is submerged with a maximum depth of approximately one foot.

No other new protection, mitigation, or enhancement measures for recreation resources are being proposed, rather Reusens Hydro will continue to maintain the existing recreational facilities and continue to provide voluntary flow releases in support of James River Batteau Festival.

10.6 Agency Proposed PM&E Measures for Recreation Resources

Since commencement of the relicensing process, VDCR, VDWR, and the FWS have stated a canoe portage at the Project will be requested. Reusens Hydro proposed not to adopt such a recommendation because during the previous relicensing, and for some time after license issuance, the Licensee at the time, APC, and the resource agencies went to great lengths to identify and plan suitable canoe portage at the Project. These actions are memorialized in an Order Amending License and Deleting Article 410 dated February 7, 1995, which deleted the requirement of the Licensee to provide a canoe portage at the Project.[21] In addition, the effect of not providing river access downstream of the Project was already enhanced by the Licensee (APC) contributing funds to the VDCR to construct a boat ramp facility 4 river miles downstream of the Project, near the City of Lynchburg (Figure 10.2-2). This action is reflected in Order Amending License Article 411 issued May 10, 2001.[22] In summary, because the issue of providing a canoe portage at the Project was already addressed, and the infeasibility of providing a canoe portage has been mitigated there is no nexus to a provide a canoe portage at the Project.

[21] See FERC Accession No. 19950214-0179.
[22] See FERC Accession No. 20010514-0170.

10.7 Description of Continuing Impacts on Recreation Resources by Continued Project Operation

Reusens Hydro proposes to continue to maintain the existing recreational facilities. Therefore, recreation facilities and use at the Project during the next license term would be similar to existing condition.

11 LAND MANAGEMENT AND AESTHETIC RESOURCES

11.1 Land Use

Land use and land cover within the proposed Project boundary is predominantly open water (88.6 %) and deciduous forest (7.8 %) (Table 11.1-1; Figure 11.1-1). Within the Project boundary there are some developed lands, which represents 2.3 percent of the total area. These developed areas are the Project works. Land management activity performed by Reusens Hydro is confined to land within the Project boundary owned by Reusens Hydro, specifically Chestnut Island (see Figure 5.2-1 for the location of Chestnut Island within the Project boundary). Reusens Hydro periodically removes trash and other debris from Chestnut Island to maintain the island in a relatively undisturbed and undeveloped state. Reusens Hydro does not currently perform other land management activity on lands owned by Reusens Hydro, except for the Project works. Reusens Hydro also owns Monacan Park; however, maintenance of this parcel, which includes mowing, trash and rubbish removal, and general upkeep of the facilities is performed by the County of Amherst.

Within the flood plain and lands adjacent to the Project boundary, defined as the 100-year flood level, and 1,000 feet beyond the Project boundary, respectively, land cover is mostly open water and deciduous forest (Table 11.1-1). For a discussion of wetlands, see section 7, *Wetlands, Riparian, and Littoral Habitat.*

Table 11.1-1. Existing land use and land cover within the Project boundary.

Land Use Class	Land Use Class Description	Project Boundary		100-Yr Flood Plain		1,000-ft Buffer	
		Acres	%	Acres	%	Acres	%
Open Water	Areas of open water, generally with less than 25% cover of vegetation or soil.	477.3	88.6	505.1	65.0	547.9	22.0
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.	42.1	7.8	201.1	25.9	1,503.8	60.3
Developed, Medium Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.	5.6	1.0	7.2	0.9	13.3	0.5
Developed, Low Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.	4.2	0.8	9.7	1.3	41.1	1.6
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.	2.9	0.5	7.3	0.9	105.8	4.2

Land Use Class	**Land Use Class Description**	**Project Boundary**		**100-Yr Flood Plain**		**1,000-ft Buffer**	
		Acres	**%**	**Acres**	**%**	**Acres**	**%**
Developed, High Intensity	Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.	2.0	0.4	2.2	0.3	4.8	0.2
Hay/Pasture	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.	1.2	0.2	21.0	2.7	132.1	5.3
Herbaceous	Areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.	1.2	0.2	2.4	0.3	23.2	0.9
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0.8	0.1	1.4	0.2	1.6	0.1
Developed Open Space	Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious	0.7	0.1	16.5	2.1	86.3	3.5

Land Use Class	Land Use Class Description	Project Boundary		100-Yr Flood Plain		1,000-ft Buffer	
		Acres	%	Acres	%	Acres	%
	surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.						
Evergreen Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.	0.6	0.1	1.8	0.2	12.1	0.5
Woody Wetland	Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.	0.1	0.0	1.2	0.2	1.2	0.0
Scrub/Shrub	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.	0.0	0.0	0.1	0.0	20.6	0.8

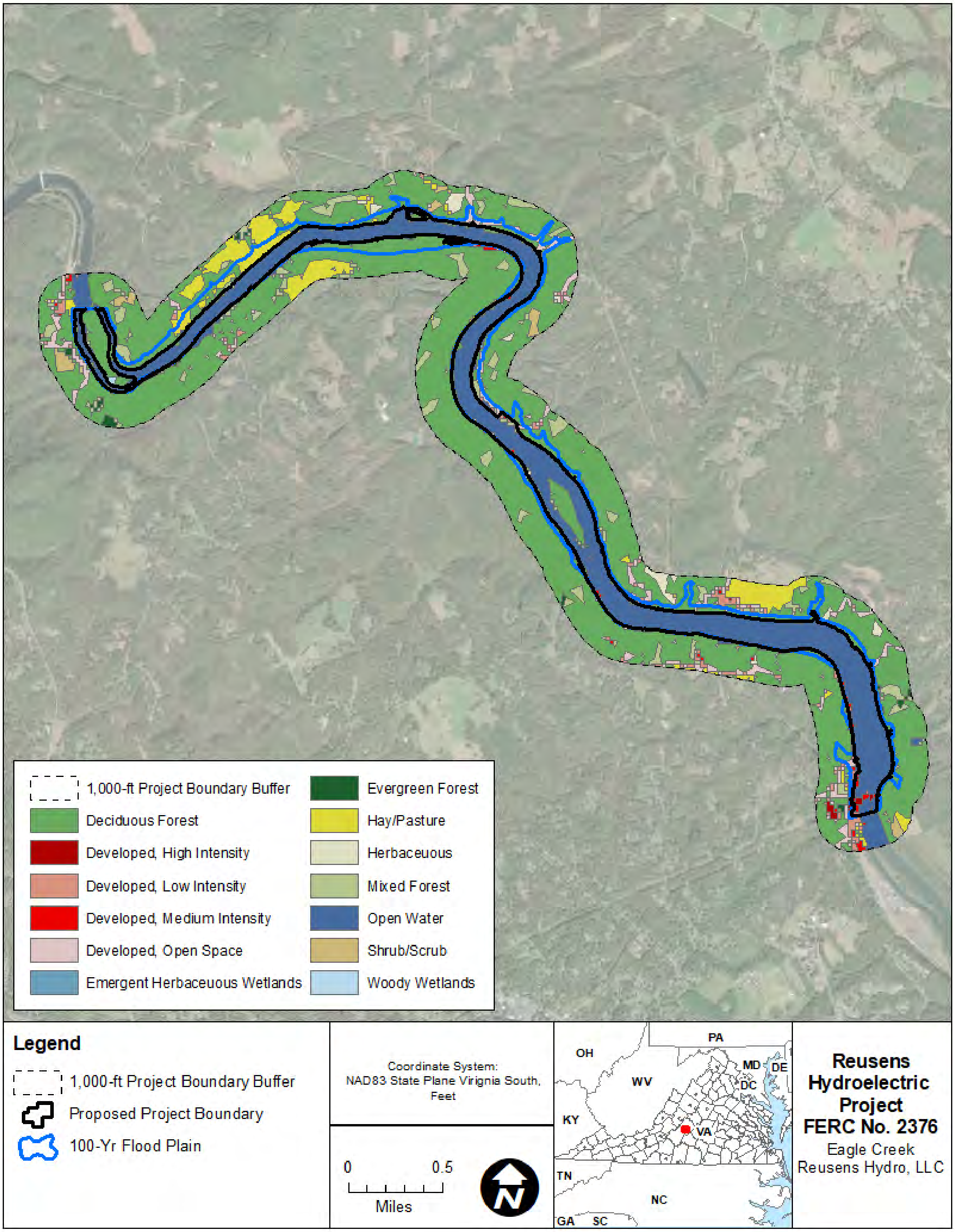


Figure 11.1-1. Exiting land use and land cover in the Project area.

11.2 Aesthetic Resources

Views of the Project area are limited to Monacan Park and the public road used to access the Project, which parallels the CSX railway and James River before turning west at the Project powerhouse. Figures 11.2-1 and 11.2-2 present views of the Project impoundment from Monacan Park and the powerhouse, respectively. At Monacan Park, the Project impoundment, both upstream and downstream, including Chestnut Island, can be seen. In addition, the Project powerhouse and dam and flood gates can be seen from the public road used (Hydro Street) to access the Project. The powerhouse exteriors are divided into bays of brick pilasters with segmented-arched window opening with concrete sills and wooden double hung sash windows. The dam is constructed of granite block and concrete and the flood gates are constructed of steel. The visual character of the Project facilities is maintained following a Cultural Resources Management Plan, which is described in section 9.5, *Existing and Proposed PM&E Measures for Historical, Cultural and Tribal Resources*.

Source: Teague (2008)

Figure 11.2-1. Photograph of the Project impoundment from Monacan Park.

Source: Google Earth (2015)

Figure 11.2-2. Photograph of the Project powerhouse from Hydro Street.

11.3 Shoreline Buffer Zone

The Project does not have a buffer zone around all or any part of the Project reservoir. Reusens Hydro owns very little upland around the Project reservoir. These parcels are limited to around Powerhouse A and the main dam abutment along the river left shoreline. Reusens Hydro also owns Monacan Park. The facilities at Monacan Park ensure public access to the Project reservoir. For a buffer zone to be established, Reusens Hydro would need to acquire all lands and rights immediately adjacent to the Project boundary. Such a large acquisition of private property would constrain the Project's economic viability, and not be in the best interest of the public.

11.4 Non-Project Shoreline Facilities on Project Lands and Waters

Reusens Hydro has an easement on the majority of lands within the Project boundary and does not own the lands beneath the reservoir. There is currently no policy in place for permitting the development of piers, docks, boat lands, bulkheads, and other shoreline facilities on Project lands and waters.

11.5 Land Management and Aesthetics Resources Study Requests and Results

Reusens Hydro did not receive any study requests pertaining to land management or aesthetic resources within the Project area.

11.6 Existing and Proposed PM&E Measures for Land Management and Aesthetic Resources

Reusens Hydro proposes to manage Project lands consistent with past uses and practices stipulated under the current license. No major construction or operational changes are proposed as part of this application. Reusens Hydro also proposes to continue to allow use of Project lands and recreation facilities for approved activities, as is required under the current license and would be required under any future license.

11.7 Agency Proposed PM&E Measures for Land Use and Aesthetic Resources

[*to be completed for the Final License Application*]

11.8 Description of Continuing Impacts on Land Use and Aesthetic Resources by Continued Project Operation

Because Reusens Hydro is proposing to continue to operate the Project as it is currently licensed, Reusens Hydro does not anticipate any adverse impacts germane to existing land management and aesthetic resources.

12 COMPLIANCE WITH COMMISSION-RECOGNIZED COMPREHENSIVE PLANS

12.1 Relevant Comprehensive Waterway Plans

Section 10(a)(2)(A) of the Federal Power Act (FPA), 16 United States Code (USC) § 803(a)(2)(A), requires the Federal Energy Regulatory Commission (FERC or the Commission) to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway affected by the project.

FERC Order No. 481-A, issued on April 27, 1988, established that the Commission will accord FPA Section 10(a)(2)(A) comprehensive plan status to any federal or state plan that:

- is a comprehensive study of one or more of the beneficial uses of a waterway or waterways;
- specifies the standards, the data, and the methodology used; and
- is filed with the Secretary of the Commission.

Based on the Commission's March 2021 revised list of comprehensive plans for the Commonwealth of Virginia, 32 of the 62 listed comprehensive plans pertain to the James River watershed. The Project's continued operation and the associated environmental protection, mitigation or enhancement measures proposed and analyzed herein would ensure continued consistency with the uses outlined in the plans listed below.

- Atlantic States Marine Fisheries Commission. 1995. Interstate fishery management plan for Atlantic striped bass. (Report No. 24). March 1995.
- Atlantic States Marine Fisheries Commission. 1998. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeon (Acipenser oxyrhynchus oxyrhynchus). (Report No. 31). July 1998.
- Atlantic States Marine Fisheries Commission. 1998. Interstate fishery management plan for Atlantic striped bass. (Report No. 34). January 1998.
- Atlantic States Marine Fisheries Commission. 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). April 1999.
- Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (Anguilla rostrata). (Report No. 36). April 2000.
- Atlantic States Marine Fisheries Commission. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000.
- Atlantic States Marine Fisheries Commission. 2008. Amendment 2 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2008.
- Atlantic States Marine Fisheries Commission. 2009. Amendment 2 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. May 2009.
- Atlantic States Marine Fisheries Commission. 2010. Amendment 3 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. February 2010.

- Atlantic States Marine Fisheries Commission. 2013. Amendment 3 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. August 2013.
- Atlantic States Marine Fisheries Commission. 2014. Amendment 4 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2014.
- Forest Service. 2004. Jefferson National Forest revised land and resource management plan. Department of Agriculture, Roanoke, Virginia. January 2004.
- Forest Service. 1993. George Washington National Forest revised land and resource management plan. Department of Agriculture, Harrisonburg, Virginia.
- National Marine Fisheries Service. 1998. Final Recovery Plan for the shortnose sturgeon (Acipenser brevirostrum). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. December 1998.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2016. Roanoke River Diadromous Fishes Restoration Plan. Raleigh, North Carolina. May 2016.
- National Oceanic and Atmospheric Administration. Virginia Institute of Marine Science. 1991. Chesapeake Bay national estuarine research reserve system in Virginia: Final environmental impact statement and final management plan. Department of Commerce, Washington, D.C.; Gloucester Point, Virginia. January 1991.
- National Park Service. 1993. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.
- National Park Service. 2010. Comprehensive management plan and environmental assessment for the Captain John Smith Chesapeake National Historic Trail. Annapolis, Maryland. September 2010.
- National Park Service. 2013. Blue Ridge Parkway Final General Management Plan/Environmental Impact Statement. Asheville, North Carolina. January 2013.
- National Park Service. 2013. Chesapeake Bay watershed public access plan. Annapolis, Maryland. January 2013.
- National Park Service. 2015. Roanoke Valley/Blue Ridge Parkway Trail Plan. Asheville, North Carolina. September 2015.
- U.S. Fish and Wildlife Service. 1989. Chesapeake Bay striped bass management plan. Annapolis, Maryland. December 1989.
- U.S. Fish and Wildlife Service. 1989. Chesapeake Bay Alosid (shad and river herring) management plan. Annapolis, Maryland. July 1989.
- U.S. Fish and Wildlife Service. 1992. Chesapeake Bay American eel fishery management plan. Annapolis, Maryland. December 18, 1992.
- U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.

- U.S. Fish and Wildlife Service. n.d. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.
- Virginia Department of Conservation and Recreation. The 2007 Virginia outdoors plan (SCORP). Richmond, Virginia.
- Virginia Department of Conservation and Historic Resources. 1984. The Upper James Scenic River, a report to the Governor and General Assembly. Richmond, Virginia. November 1984.
- Virginia Department of Conservation and Historic Resources. 1987. Lower James Scenic River, a report to the Governor and General Assembly. Richmond, Virginia. November 1987.
- Virginia Department of Conservation and Historic Resources. n.d. Virginia's scenic rivers. Richmond, Virginia.
- Virginia Department of Game and Inland Fisheries. 2015. Virginia’s 2015 Wildlife Action Plan. Henrico, Virginia. September 1, 2015.
- Virginia State Water Control Board. 1986. Minimum instream flow study – final report. Annandale, Virginia. February 1986.

13 DRAFT LICENSE APPLICATION COMMENTS AND RESPONSE SUMMARY

Attachment [*to be determined*] of the Final License Application will summarize the Reusens Hydro responses to Stage 2 Consultation comments on the Draft License Application received from stakeholders. Copies of the stakeholders' comment letters will be provided in the Final License Application, Exhibit E, Appendix A.

14 LITERATURE CITED

Appalachian Power Company (APC). 1991. Reusens Hydroelectric Project No. 2376 Application for License for Major Water Power Project Existing Dam. 332 pp.

APC. 2015. Appalachian Power Company Reusens Hydroelectric Project No. 2376 License Article 407 Wildlife Management Plan 5-Year Report. 78 pp.

City of Lynchburg. 2014. Comprehensive Plan, Planning for the Future, 2013-2030. Chapter 13 Public Utilities. 6 pp.

Eagle Creek Reusens Hydro, LLC (Reusens Hydro) 2019. Pre-Application Document Reusens Hydroelectric Project FERC No. 2376, Volume 1 of 3 Public. 292 pp.

Environmental Protection Agency (EPA). 2003. Level III and IV Ecoregions of EPA Region 3. <https://www.epa.gov/eco-research/ecoregion-download-files-state-region-3#pane-36> Accessed October 29, 2018.

Federal Energy Regulatory Commission (FERC). 1994. Environmental Assessment for Hydropower License, Reusens Hydroelectric Project FERC Project No. 2376-001 Virginia. Federal Energy Regulatory Commission, Office of Hydropower Licensing. Washington, D.C., 20426. 47 pp.

FERC. 2008. Final Environmental Assessment for New Hydropower License, Cushaw Hydroelectric Project, FERC Project No. 906-006. 124 pp.

FERC. 2014. Order Modifying and Approving Non-Project Use of Project Water: Water Withdrawal Under Article 202. Appalachian Power Company, Project No 2376-048. Federal Energy Regulatory Commission, Washington, D.C.

Federal Register. 2018. Endangered and Threatened Wildlife and Plants; Threatened Species Status for Yellow Lance. Volume 83, Number 64. Tuesday, April 3, 2018. 10 pp.

Franke, G., D. Webb, D. Mathur, P. Hopping, P. March, M. Headrick, I. Laczo, Y. Ventikos, and F. Sotiropulos. 1997. Development of Environmentally Advanced Hydropower Turbine System Design Concepts. 465 pp.

Google Earth. 2015. Street View, Hydro Street. Imagery Date: August 2015. Accessed November 9, 2018.

Hilton, E.J., J. Cimino, and A. Weaver. 2014. American Shad Habitat Plan for the Commonwealth of Virginia. 20 pp.

James Madison University (JMU). 2000. Paleozoic Suspect Terranes in the Piedmont of Virginia. <http://csmgeo.csm.jmu.edu/geollab/vageol/vahist/piedbelt.html>. Accessed October 30, 2018.

JMU. 2018. A Description of the Geology of Virginia. <http://csmgeo.csm.jmu.edu/ geollab/vageol/vahist/PhysProv.html>. Accessed March 16, 2018.

Kleinschmidt. 2015. FERC Form 80 Recreation Report, Reusens Project FERC No. 2376. March 2015. 21 pp.

MapTech, Inc. 2017. E. coli TMDL Development for the James River and Tributaries near Lynchburg, VA located in the Counties of Amherst, Bedford, and Campbell and in the City of Lynchburg. 355 pp.

National Oceanic and Atmospheric Administration (NOAA). 2018. SERCC NOAA NOWData, Lynchburg Intl AP, VA, 1987 through 2017. <http://sercc.com/nowdata.html> Accessed October 29, 2018.

National Water Quality Monitoring Council (NWQMC). 2021. Water Quality Portal. <https://www.waterqualitydata.us//>. Accessed on: June 8, 2021.

National Wild and Scenic River System (NWSRS). No Date (a). Explore Designated Rivers – Virginia. < https://www.rivers.gov/virginia.php> Accessed June 30, 2021.

National Wild and Scenic River System (NWSRS). No Date (b). Wild and Scenic River Studies. < https://www.rivers.gov/study.php>. Accessed June 30, 2021.

Normandeau Associates, Inc (NAI). 2016. ILP Study 23 Fish Impingement, Entrainment, and Survival Study. Final Study Report. Study Report. November 20, 2016. 88 pp.

NAI. 2017a. ILP Study 19 American Eel Downstream Passage Assessment. Final Study Report. February 28, 2017. 427 pp.

NAI. 2017b. ILP Study 23 Fish Impingement, Entrainment, and Survival Study. Supplement to Final Study Report. February 28, 2017. 13pp.

Ostby. B. 2008. Final Report: Survey for Protected Aquatic Mollusks at Selected Locations in the James River and Harris Creek, Amherst County, VA. 10 pp.

Ostby, B and B. Beaty. 2018. Relocation of Mussels for Amherst County Streambank Protection Project. 14 pp.

Pflugrath, B., R. Saylor, K. Engbrechet, R. Mueller, J. Stephenson, M. Bevelhimer, B, Pracheil, A. Colotelo. 2020. Biological Response Models Predicting Injury and Mortality of Fish During Downstream Passage through Hydropower Facilities. U.S. Department of Energy, Oak Ridge, TN. 139 pp.

Scott's Mill. 2017. Draft Application for Original License for Major Water Power Projects 5 Megawatts of Less Scott's Mill dam hydroelectric Project, FERC Project No. 14425. Appendix E. 112 pp.

Teageue, K. 2008. James River view from Monacan Park. <https://www.flickr.com/photos/retroweb/2935287023/in/photostream/>. Accessed November 9, 2018.

Three Oaks Engineering (TOE). 2016. James River Freshwater Mussel Survey Report, Scott's Mill Hydropower Project (FERC No. 144525). 20 pp.

U.S. Department of Agriculture. 2019. Web Soil Survey. https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.> Accessed June 2, 2021.

U.S. Fish and Wildlife Service (FWS). 2015. Northern Long-Eared Bat Mytois septentrionalis Fact Sheet. April 2015. 2 pp.

FWS. 2021. IPaC Information for Planning and Consultation. <https://ecos.fws.gov/ipac/>. Accessed June 18, 2021.

FWS. No Date. ECOS Environmental Conservation Online System, Yellow lance (*Elliptio lanceolate*) <https://ecos.fws.gov/ecp/species/4511> Accessed June 28, 2021.

U.S. Geological Survey (USGS). 2014. Two-percent probability of exceedance in 50 years map of peak ground acceleration. <https://earthquake.usgs.gov/static/lfs/nshm/conterminous/2014/2014pga2pct.pdf>. Accessed October 30, 2018.

USGS. 2015. USGS Streamer. < https://txpub.usgs.gov/DSS/streamer/web/>. Accessed October 29, 2018.

USGS. 2018a. StreamStats – Reusens Hydro Basin StreamStats Report. <https://streamstats.usgs.gov/ss/>.Accessed October 29, 2018.

USGS. N.d. Earthquake Catalog. <https://earthquake.usgs.gov/ earthquakes/search/>. Accessed October 30, 2018.

USGS. 2020. National Water information System: Web Interface, USGS 02025500 JAMES RIVER AT HOLCOMB ROCK, VA. <https://waterdata.usgs.gov/nwis/uv?02025500>. Accessed: March 20, 2021.

Virginia Department of Conservation and Recreation (VDCR). 2016. Overview of the Physiography and Vegetation of Virginia. <http://www.dcr.virginia.gov/natural-heritage/natural-communities/document/ncoverviewphys-veg.pdf. Accessed March 16, 2018.

VDCR. 2021. James River Heritage Trail. <https://www.dcr.virginia.gov/recreational-planning/trailjrh>. Accessed June 29, 2021.

Virginia Department of Environmental Quality. No Date. VDEQ. n.d. Fish Tissue Monitoring. < https://www.deq.virginia.gov/water/water-quality/monitoring/fish-tissue-monitoring> Accessed June 15, 2021.

Virginia Department of Environmental Quality (VDEQ) and Virginia Department of Conservation and Recreation (VDCR). 2017. Virginia 305(b)/303(d) Water Quality Integrated Report to Congress and the EPA Administrator for the Period January 1, 2009 to December 31, 2014. 2,317 pp.

Virginia Department of Environmental Quality (VDEQ), Virginia Department of Conservation and Recreation (VDCR), and Virginia Department of Health (VDH). 2020. Virginia 305(b)/303(d) Water Quality Integrated Report to Congress and the EPA Administrator for the Period January 1, 2013 to December 31, 2018.

Virginia Department of Game and Inland Fisheries (VDGIF). 2015. The Non-Tidal James River. Available at: https://www.dgif.virginia.gov/wpcontent/uploads/James-River-Non-Tidal-Report-2015.pdf. Accessed March 16, 2018.

VDGIF. 2018. On the Road to Recovery: American Shad Restoration. <https://www.dgif.virginia.gov/fishing/shad-restoration/>. Accessed November 6, 2018.

Virginia Department of Historic Resources (VDHR). 2020a. Virginia Cultural Resources Information System. <https://www.dhr.virginia.gov/v-cris/>. Accessed June 28, 2021.

VDHR. 2020b. VLR Online and National Register Listings 009-005283 Hope Dawn. < DHR – Virginia Department of Historic Resources » 009-5283 Bowling Eldridge House> Accessed June 28, 2021.

VDHR. 2021. VLR Online and National Register Listings 009-0043 Hope Dawn. < https://www.dhr.virginia.gov/historic-registers/009-0043/> Accessed June 28, 2021.

Virginia Department of Wildlife Resources (VDWR). 2021. Non-Tidal James River 2021. <https://dwr.virginia.gov/wp-content/uploads/media/James-River-Non-Tidal-Management-Report-2021.pdf> Accessed June 15, 2021. 18 pp.

VDWR. 2021. Fish and Wildlife Information Service. < https://services.dwr.virginia.gov/fwis/ > Accessed June 18, 2021.

Wilderness Connect. 2021.Online Maps. <https://wilderness.net/visit-wilderness/maps.php>. Accessed June 30, 2021.

Woods, A., J. Omernik, and D. Brown. 1999. Level III and IV Ecoregions of Delaware, Maryland, Pennsylvania, Virginia, and West Virginia. 61 pp.

APPENDIX A

Pre-filing consultation Summary

SUMMARY OF CONSULTATION WITH RESOURCES AGENCIES, TRIBES AND OTHER STAKEHOLDERS

Stage 1 Requirements

Reusens Hydro commenced the relicensing process by filing with the Commission and distributing to the resources agencies, tribes, and other stakeholders via e-mail a Notice of Intent (NOI) to relicense the Project, TLP authorization request, and Pre-Application Document (PAD) on February 28, 2019.[23] A copy of the e-mail distributing the NOI and PAD is included in this Appendix. On March 13, 2019, Reusens Hydro filed with the Commission proof that Reusens Hydro published a public notice in a local paper notifying the general public that Reusens Hydro filed the NOI and PAD.[24] Only two comment letters on the PAD were received– one from the FWS (filed with the Commission on March 29, 2019),[25] and the other from VDCR (via e-mail dated April 4, 2019), a copy of which is included in this Appendix. On April 16, 2019, the Commission issued a notice of Reusens Hydro's NOI, PAD,[26] and approval to use the TLP.[27] Reusens Hydro subsequently consulted with the resource agencies, tribes, and other stakeholders regarding the scheduling of a Joint Meeting and Site Visit via e-mail dated April 23, 2019. Reusens Hydro then scheduled a Joint Meeting and Site Visit, and filed with the Commission on May 3, 2019 notice of the Joint Meeting and Site Visit.[28] Reusens Hydro then held the Joint Meeting and Site Visit on August 16, 2018 and filed a meeting and site visit summary and audio recording of the meeting with the Commission on June 27, 2019,[29] which also included proof that a public notice of the joint meeting and site visit was published in the local paper. Subsequent to the joint meeting and site visit, Reusens Hydro received comments from VDCR by letter dated May 23, 2019 and from Virginia Department of Health by e-mail dated May 20, 2019; these letters are included in this Appendix. In addition, the FWS and VDWR provided study requests;[30] no other study requests were received. Reusens Hydro then commenced evaluating the study request and preparing a draft study plan. By e-mail dated March 26, 2020, Reusens Hydro scheduled a conference call for April 23, 2020 to discuss the draft study plan with stakeholders. By e-mail dated April 16, 2020, Reusens Hydro distributed the Draft Study Plan (DSP) and conference call information to stakeholders. Copies of the e-mails to schedule the conference call and distribute the DSP are enclosed. A copy of the DSP is within Attachment 1 of this application. Subsequently, Reusens Hydro received comments Amherst County Service Authority (ACSA), VDEQ, FEMA, and VDWR. Copies of these letters are enclosed, except that of VDWR's because it was filed with the Commission.[31] Reusens Hydro also distributed to stakeholders a DSP meeting summary by e-mail dated May 14, 2020. Reusens Hydro then received a DSP comment letter from the FWS.[32] Reusens Hydro then prepared a Final Study Plan, and distributed it to stakeholders via e-mail on July 21, 2020. The Final Study Plan is

[23] See FERC Accession No. 20190228-5222
[24] See FERC Accession No. 20190313-5055
[25] See FERC Accession No. 20190329-5139
[26] See FERC Accession No. 20190416-3045
[27] See FERC Accession No. 20190416-3038
[28] See FERC Accession No. 20190503-5031
[29] See FERC Accession No. 20190627-5055
[30] See FERC Accession Nos. 20190718-5021 (VDWR), Accession No. 20190719-5006 (FWS)
[31] See FERC Accession No. 20200514-5182
[32] See FERC Accession No. 20200707-5149

included as Attachment 2 to this application. Reusens Hydro then received a letter from the Monacan Tribe that requested hard copies of licensing documents. Reusens Hydro subsequently responded to the Monacan Tribe by letter dated September 1, 2020. No other comments were received.

Stage 2 Requirements

[*to be completed for the Final License Application*]

Stage 3 Requirements

[*to be completed for the Final License Application*]