EXHIBIT E

Environmental Report

Scott's Mill Hydropower Project

FERC Project No. 14867

EXHIBIT E

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EXHIBIT E

ENVIRONMENTAL REPORT

1.0 SUMMARY

This Exhibit E analyzes and evaluates the effects associated with issuing an original license for the construction and operation of the Scott's Mill Hydroelectric Project (Federal Energy Regulatory Commission (FERC or Commission) Project 14867). Exhibit E updates the previously filed Exemption Application, includes the results of the studies conducted by Scott's Mill Hydro, LLC (Applicant), provides additional information developed in response to FERC additional information requests, presents an assessment of project impacts and Applicant's Protection, Mitigation and Enhancement Measures (PME), and updates documentation of Applicant's consultation. It follows the requirements of the Commission's regulations at 18 CFR § 4.61.

Applicant intends to operate the project in a run-of-river mode except in extreme electrical demand periods. Applicant proposes to maintain the approximate normal maximum surface elevation of the existing impoundment for flows less than the powerhouse capacity. For moderately higher flows, there will be an increase of up to 2.6 feet during flood flows. However, during large flood flows, the increase in water levels from existing conditions will be on the order of 1 ½ feet or less. Applicant analysis indicates that there would be no significant environmental impact from construction or operation of the project. In fact, Applicant is cooperating with resource agencies to expedite diadromous and resident fish restoration in the upper James River basin.

The Commission approved Applicant's use of the Traditional Licensing Process (TLP). To facilitate processing of this application and for the convenience of the FERC staff, this Exhibit E has been prepared in a format to facilitate the Commission's preparation of an Environmental Assessment.

This Exhibit E contains evaluations of two primary alternatives: a No-Action Alternative, and the Proposed Action. The No-Action Alternative is the continuation of project operation and maintenance without change (i.e., no hydropower). The Proposed Action is the inclusion of a 4.5 MW hydropower plant, a two-foot-high spillway cap to essentially maintain existing headpond water elevations during average flow conditions and provide additional energy, fish passage facilities, and additional mitigation and enhancement measures.

During the Joint meeting, the parties participating in the licensing process discussed an Action Alternative involving decommissioning the Project. The Applicant explained that the seven dams on this section of the James River are not likely to be decommissioned because two dams are used for water supply and a third is used for manufacturing paper products and is a significant employer in the area. The importance of these projects to the region suggests that there would be a significant threshold required for dam removal. Nonetheless, Applicant committed to preparing a brief decommissioning assessment as part of the study plan approval process in conjunction with American Rivers. Despite several requests to American Rivers to participate in the decommissioning assessment, American Rivers was unable to participate (see **Appendix A** Consultation Record). Accordingly, Applicant's decommissioning report was prepared solely by Applicant. American Rivers and other parties will have the opportunity to provide comments as part of the Commission's review of Applicant's License Application.

This Exhibit E analyzes the site-specific and cumulative effects associated with the construction and operation of the Project under the aforementioned Proposed Action and No-Action Alternative.

1.1 PROJECT OVERVIEW

Luminaire Technologies owns the Scott's Mill dam on the James River along the borders of Amherst and Bedford Counties, Virginia and has rights to flood up to three additional feet in the headpond for adding hydropower. Flows over the dam are currently uncontrolled. Headpond water levels at a median flow of 2,000 cfs are slightly greater than one foot over the spillway crest, which is at elevation 514.4 feet. During low flows, the tailwater elevation is approximately 499 feet, resulting in a potential gross head of about 15 feet. Applicant is proposing to add a two-foot high cap to the dam crest and nine 500 kW units for a total plant capacity of 4.5 MW. Applicant intends to start construction in summer 2023 (or within one year following license issuance) and anticipates construction will take two years to complete.

1.1.1 PROPOSED PROJECT OPERATION

Applicant proposes to operate the project in a run-of-river mode except during critical electrical demand periods. During such periods flows may be adjusted for a period of one to two hours to increase generation. Similar testing operations at Cushaw Dam has indicated no significant impacts. It is anticipated that less than 10 days of such deviations would occur annually.

After the hydro powerhouse is completed, Applicant plans to add a two-foot-high concrete cap on the existing spillway, raising the crest elevation to 516.4 feet. Applicant proposes to maintain a constant upstream water level at the dam up to 1 inch above the spillway crest elevation (i.e., veil of water) until inflows exceed the plant turbine capacity of 4,500 cfs, at which time flows over the spillway will be uncontrolled. If additional flows are needed for environmental purposes (e.g., water quality), Applicant will increase the veil over the dam and reduce powerhouse generation, even during high electrical demand periods.

With the addition of the concrete cap, during low flows the available gross head will be about 17 feet. Given that the tailwater rises more rapidly than the headwater as flows increase, the gross head decreases to about 14 feet at the hydraulic capacity of the project. At the upper end of project generation (i.e, about 25,000 cfs), the head continues to decrease to about 11 feet (see **Table A-3, Figures A-21 and A-22** for tailwater and headwater curves).

Monthly and annual flow duration curves were developed for Scott's Mill using data from the US Geological Survey (USGS) Holcomb Rock Gage (Gage No. 02025500), which is located about 11 miles upstream of Scott's Mill Dam (see **Figures A-8 through A-20**). The period of record is from 1927 to 2020 and represents 93 years of recorded flows. The drainage area for the Holcomb Rock Gage is about one percent less than the drainage area at the proposed hydro project. Thus, gage flow data was considered to be representative of site flow without adjustment.

Initial fish passage flows required for American Eel and Sea Lamprey passage are expected to be less than one cfs. When a vertical slot fishway (or nature-like fishway) is constructed at the site, fish passage flows are likely to be in the 25-50 cfs range. These latter flows would reduce generation by about one percent. However, the energy estimates were not reduced, because the larger drainage area at the dam offsets the flow reduction.

Generation potential was estimated based on gross head, the flow duration curve, and estimated overall plant efficiency. The flow duration curve shows the percentage of time that a specified flow is equaled or exceeded in a typical year. Theoretical annual generation potential is estimated at 20,700 MWh annually. This excludes unscheduled plant outages, which could result in slightly reduced generation.

During flood events with a return interval of 100 years or more, project operations would vary slightly from existing conditions. Detailed modeling indicates that there could be an increase of up to 2 feet over existing water levels.

1.2 MAJOR ISSUES ANALYZED

Evaluations of project effects have been made for water quality, aquatic resources (including fish passage), terrestrial resources, endangered species (i.e., mussels), cultural resources, recreational resources, land management and aesthetics. These issues were identified during the Joint meeting of licensing stakeholders held on December 2, 2015 (**Appendix A**, Consultation Record). No new issues were identified during the draft application comment period, during the second Joint meeting, or subsequent to that meeting.

The resource agencies have identified a long-term goal to restore American Eel, Sea Lamprey and American Shad to the upper James River and to permit resident fish species access to upstream and downstream habitat. Applicant has agreed to work cooperatively with resource agencies and other James River licensees to further these restoration goals. No endangered mussels were identified in the project boundary during a reconnaissance survey for mussels.

The City of Lynchburg also expressed concerns regarding the potential of a hydropower project at the Scott's Mill dam site to affect water rights and water supply for the Lynchburg area. Applicant's proposed operations will not affect the City's water supply or any associated water rights.

2.0 APPLICATION

2.1 THE APPLICANT PLANS TO FILE THE LICENSE APPLICATION IN MARCH 2022

2.2 APPLICANT'S NAME

Scott's Mill Hydro, LLC

2.3 TYPE OF LICENSE OR EXEMPTION

Scott's Mill Hydro LLC is applying for an original license for Major Water Project, 10 Megawatts or Less. Applicant is using the Traditional Licensing Process.

2.4 SIZE AND LOCATION OF PROJECT

The proposed 4.5 MW Scott's Mill Dam Hydroelectric Project is located on the upper James River at river-mile 258.5[1] in Lynchburg, Virginia, Amherst County and Bedford County. The Project is approximately a mile north-northeast of downtown Lynchburg. The GPS location is 37.424466 N, -79.140858 W.

2.5 ENERGY BENEFITS PRODUCED BY PROJECT

The Project has an estimated average annual generation of 20,700 megawatt-hours.

2.6 FEDERAL LANDS, IF ANY, THE PROJECT OCCUPIES

The Project includes no federal lands.

3.0 PURPOSE OF ACTION AND NEED FOR POWER

3.1 PURPOSE OF ACTION

In compliance with the National Environmental Policy Act (NEPA), the Proposed Action addresses the future construction, operation, and maintenance of the Scott's Mill Hydropower Project for electric power generation, including the implementation of terms and

[1] There are multiple river mile references as a distance upstream on the James River. FEMA's flood study states that the Scott's Mill or Lynchburg Dam is at river mile 252.1. Applicant uses the river mile reference adopted by Virginia Department of Wildlife Resources.

conditions proposed for inclusion in an original FERC hydroelectric license. The purpose of the Proposed Action is to determine whether to grant a license for the future operation of hydroelectric and related facilities in compliance with Federal Power Act (FPA) requirements and other laws. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the Project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

Applicant is seeking an original Federal license; therefore, the purpose of the Proposed Action is to generate electric power while continuing to meet existing commitments and comply with regulations pertaining to water supply, flood control, the environment, and recreational opportunities. The Proposed Action includes future hydropower operation and maintenance of the Project with additional resource mitigation and enhancement measures. FERC will use the results of these evaluations to prepare a NEPA document to support its decision-making under the FPA and other Federal laws. The purpose of this Exhibit E is to analyze the site-specific and cumulative effects associated with the future operation of the Project under the Proposed Action.

3.2 NEED FOR POWER

The Scott's Mill Project is projected to generate an average of about 20,700 megawatt-hours annually. Additionally, operation of the Project improves the operating flexibility of the overall power system to help offset the cost and air quality effects of fossil fuels.

Applicant intends to sell the power to U.S. Pipe or into the PJM grid. U.S. Pipe has an annual energy use that is greater than the output of the Scott's Mill Project and could reduce the cost of energy to U.S. Pipe. Excess energy may be available in months when the project output exceeds the U.S. Pipe demand. During such times, Applicant will sell the excess energy into the PJM grid. Since the project provides renewable energy and there is a demand for more renewable energy, the project energy will offset fossil fuel generation and reduce greenhouse gas emissions. Further, the Virginia legislature like many other states across the United States has implemented renewable energy standards. Scott's Mill output will assist the Commonwealth in meeting that goal.

4.0 PROPOSED ACTION AND ALTERNATIVES

This section describes the facilities and environmental measures proposed by Applicant in the application for an original license (referred to as the Proposed Action). An Action Alternative involving decommissioning the Project was discussed during the Joint meeting. Applicant agreed to conduct a decommissioning study, and to work with American Rivers in preparing the study report. Applicant had stated at the Joint meeting that decommissioning of the Scott's Mill dam, was not a likely alternative. Section 4.3 discusses the decommissioning option and Applicant's basis for eliminating decommissioning from further consideration. **Table E-4.1** provides a summary of the objectives of each alternative.

TABLE E-4-1

ALTERNATIVE OBJECTIVES

ALTERNATIVE	IMPLEMENTING OBJECTIVES
No-Action Alternative	1.) Provide existing environmental conditions as a basis for comparison.
Proposed Action	1.) Provide resource and social enhancements to meet public interest needs, specifically fish restoration, protection of water quality and aquatic habitat, protection of endangered species, wetlands mitigation, increased paddler recreation, and boating consistent with comprehensive land use plans. 2.) Provide power generation benefits.

4.1 EFFECTS OF CONTINUED OPERATION WITHOUT HYDROPOWER

The "existing conditions" is the baseline from which the Proposed Action and all alternatives are compared. Under existing conditions, the Scott's Mill Dam would continue to provide flows based on outflow from the upstream Reusens Project, with no environmental or recreation enhancements. Passage of diadromous fish would continue to be obstructed by the presence of Scott's Mill Dam and the six dams upstream of Scott's Mill.

4.1.1 PROJECT DESCRIPTION

4.1.1.1 PROJECT FACILITES AND OPERATION

This information in Section 4.1 reflects Project facilities and operations applicable to both the Proposed Action and the No-Action Alternative.

4.1.1.2 DAMS AND SPILLWAYS

The Scott's Mill Dam was constructed in the 1840s. The Dam consists of an 875-foot long and 15-foot high masonry dam extending across the James River, creating a 305[2]-acre reservoir. Pertinent Project data is summarized in **Exhibit A, Table A-1**.

4.1.1.3 RESERVOIRS

The reservoir behind Scott's Mill Dam extends over 305 acres at the normal pool elevation of 516.4 feet mean sea level (msl). The drainage area at the dam is approximately 3,300 square miles.

4.1.1.4 PROJECT LANDS WITHIN THE PROJECT BOUNDARY

Per direction from the Commission, Applicant has revised the project boundary to include lands around the shoreline and Daniel, Treasure, and Woodruff islands (see **Exhibit G** for a project boundary map). Applicant owns the lands on both sides of the river that are necessary for constructing the powerplant, fishway facilities and recreation enhancements at the dam. As part of the Settlement Agreement with the resource agencies, applicant is proposing to construct a boat ramp on the headpond adjacent to Harris Creek. While the Settlement Agreement will be filed with the Commission, Applicant is not proposing to include the boat ramp as part of the license application.

4.2 PROPOSED ACTION

Applicant proposes to construct, operate and maintain the Project as described above in Section 4.1 with the additional measures set forth below.

4.2.1 PROJECT FACILITIES

Applicant will construct a powerplant with dimensions approximately 168 feet wide by 20 feet long, consisting of nine 500 kW turbines for a total plant capacity of 4.5 MW. The powerplant will be designed to be oblique to the direction of flow, such that general flow direction in the headpond will be about 90 degrees from the flow direction of water drawn into each turbine intake. The powerplant will contain trashracks with 2-inch openings, a trash rake, a travelling gantry crane, and other appurtenant facilities. During detail design studies, applicant will conduct computational fluid dynamics (CFD) modeling of the intake.

Guide vanes will be added to the trash racks at a 135-degree angle away from the flow. While the vanes are on 3" centers at the upstream portion of the trash racks, because they are on a 45-degree diagonal, the actual spacing, measured perpendicular to

[2] Previous estimates of the reservoir surface area indicated it was 316 acres. New GIS measurements of the reservoir surface area within the project boundary and upstream to Reusens Dam indicate s slightly smaller reservoir area of 305 acres.

the vanes themselves, is effectively 2-1/8" on center, giving rise to 2" clear spacing between adjacent vane surfaces. That being said, the proposed Scott's Mill hydropower plant has been designed so that the hydraulic flows – rather than the bar spacing as such – serve as the primary means of exclusion. The flow direction will change to some degree as different turbines in the array are brought online and/or shut down, but the essential principle is that the fish swim parallel to the trash racks and do not turn to enter the trash racks. In order for a fish to enter behind the trash rack, it would have to execute a 135 degree turn and burst-swim at about 45 degrees from upstream. While not impossible, fish passage experts at Alden, opine that it is improbable, as there is no attraction flow or any other reason for passing fish to execute such a course change.

Bedrock will be excavated to a depth of approximately 7.6 feet both upstream and downstream of the hydropower plant, which will be located downstream of the existing arch section of the Scott's Mill spillway. The plant will be connected to an AEP substation on US Pipe property approximately 1,200 feet from the proposed hydroelectric facility. The transmission line will be an overhead line that will not affect U.S. Pipe operations or adversely affect environmental resources since the U.S. Pipe site is highly disturbed. The transmission line will extend from the powerplant to the fence line with the Chesapeake and Ohio Railway company (CSX). From there it will parallel the fence line. Near the substation the line will use an existing unused power pole and cross over to the substation.

During construction, a water filled bladder dam will be secured to the arch section of the spillway to serve as an upstream cofferdam. For the downstream cofferdam, Applicant proposes to use a Portadam. Because the powerplant will be of modular construction, installation of the turbines will be on the order of weeks and will be scheduled to take place during the low flow period (i.e., late summer and fall). Because of the rapid installation of the pre-fabricated modular units, the level of flood protection for the construction site can be reduced from the typical 50-year flood to a 2 or 3-year flood for both the upstream and downstream cofferdams, thereby reducing construction costs.

The project will be operated in a run-of-river mode. That is it will use inflows from Reusens and maintain a constant headpond water level. Therefore if flows fluctuate from Reusens, similar fluctuations will be propagated downstream. Applicant would like the option to make minor flow adjustments during critical electrical demand periods to maximize capacity benefits if power is sold into the PJM grid. Such deviations would occur for one to two hours per day on up to 10 days per year. Because of the short term flow changes, flows would attenuate downstream. Maximum flow changes would be worked out with resource agencies during a one-or-two year test period, as was done for the upstream Cushaw Project.

4.2.2 ENVIRONMENTAL MEASURES

Applicant proposes to operate the Scott's Mill Project in a run-of-river mode to minimize downstream environmental effects and to maintain existing headpond water levels during project operations. Impoundment levels may be modified for short periods pending agency approval. Applicant intends to request agencies to modify project operations for up to 2 hours per day for a maximum of 10 days per year during periods of maximum electoral energy demand or other emergency conditions.

Table A-3 and **Figure A-22** compare the existing headpond levels to the proposed operation levels from low flows through flood flows. Although much of the flow will be directed to the right side of the river, the powerplant will also discharge directly to the area behind the straight section of the dam. The tailwater levels on the left side are expected to change only slightly because of this added flow and because a sill downstream in Riveredge Park causes a backwater at the dam. Applicant has also discussed with the U.S. Fish and Wildlife Service (USFWS) and Virginia Department of Wildlife Resources (VDGIF) a rotation of the powerplant to discharge more water to the left (north) side of the river. Although more costly, this proposed design should improve downstream fish passage and water quality.

Applicant intends to dredge and enlarge an existing channel at the southern end of Daniel Island just upstream of the dam to allow flow from the main channel to the powerhouse. This will have the effect of increasing circulation and maintaining water quality upstream of the main section of the dam. Applicant intends to implement a soil erosion and control plan that would include dredging operations. Applicant intends to consider dredging dimensions during detailed design in conjunction with the specifics of turbine discharge, but the width of the channel is expected to be about 130 feet with a length of about 100 feet. If necessary, during low flow conditions, flow can also be released over the spillway to maintain water quality. Applicant also proposes the following environmental measures:

- Provide a 1-inch veil of water over the dam, to preserve downstream environmental water quality, in particular dissolved oxygen and water temperature. This would be achieved through a water level monitoring gauge upstream of the dam and using the Holcomb Rock gauge to estimate inflow and matching project output to release flows that are slightly below the inflow level. If the water level falls below one inch over the weir, the turbine flow will be adjusted (reduced) to enable the upstream water level to be maintained. It is likely that through this process, the water level in the headpond will result in a veil greater than 1 inch. If the water level exceeds one inch, a further adjustment can be made to increase the flow through the turbines. Applicant uses a similar strategy to maintain flows over the Cushaw dam. Such operation usually results in a more conservative operation and water levels that are greater than the 1-inch veil. Coordinated operations with the upstream Reusens could also facilitate maintaining the 1-inch veil. Conduct a downstream wetted perimeter study and adaptively manage veil with agencies.

- Develop a Streamflow and Water Level Monitoring Plan. Provide an annual record of stream flows.

- Monitor water quality (temperature and dissolved oxygen) upstream and downstream of Scott's Mill Dam.

- Provide immediate upstream passage for American Eel and Sea Lamprey. Operate facilities from March through November.

- Conduct a siting and passage effectiveness study for American Eels and Sea Lamprey under high, medium and low flow conditions for at least one month when the project is operational.

- Work with other upstream dam owners, resource agencies, and other licensing participants to restore anadromous fish to the upper James River Basin within 10 years of license issuance or earlier if directed by resource agencies. The facilities will be designed for multi-species passage to include diadromous and riverine species. (Applicant expects to sign the Settlement Agreement {SA] with state and Federal resources agencies in early spring 2022. The SA will be filed with the Commission once it is signed.)

- Conduct an upstream fish passage study of American Eel attempting to find and pass through the fishway.

- Provide downstream passage facilities for diadromous and riverine species with a passage survival effectiveness of 95 percent. Flows of up to 225 cfs (i.e., up to 5 percent of the hydraulic capacity of the turbines) will be provided to facilitate downstream passage in the intake area. If passage effectiveness is not achieved, Applicant will provide clear spacing of ¾ inch at the intake trashracks.

- Develop a Fish Passage Operations and Maintenance Plan. Provide annual reports.

- Direct approximately half the flow from the upstream turbines into the main channel of the James River to preserve habitat quality in the area immediately downstream of Scott's Mill Dam. This will be accomplished by orienting the upstream turbine flow discharge toward the main channel. As necessary, the area upstream of the island downstream of the dam will be excavated to achieve this goal. Because there is already a hydraulic connection between the main channel and the channel downstream of the horseshoe section of the dam, orientation of the turbine discharge may be sufficient.

- Avoid entrainment by orienting the powerhouse more in line with the direction of flow. Downstream migrating fish will tend to swim with the current rather than turning 90 degrees to enter the turbine intake.

- Minimize and mitigate any effects to wetlands both upstream and downstream of Scott's Mill dam.

- Develop an Invasive Species Management Plan in consultation with the USFWS and VDWR.

- Develop a Northern Long-Eared Bat Management Plan in consultation with the USFWS and VDWR.

- Implement Bald Eagle Management Plan as prescribed in the SA.

- Provide a canoe portage around Scott's Mill Dam on the left side of the James River. The portage will skirt the proposed American Eel and Sea Lamprey ladder on the left side of the river and will be designed in coordination with the American Eel/Sea Lamprey facility on the left side of the river.

- Work with Virginia Marine Resources Commission (VMRC), Virginia Department of Wildlife Resources (VDWR), and Amherst County to provide boat ramp facilities to the public in the headpond at Lot 154-A-52 near Harris Creek. This will be part of the Settlement Agreement, but Applicant is proposing the boat ramp be excluded from the license since it will be operated by either the State or Amherst County. (There are boat ramps on both sides of the river within a mile downstream of Scott's Mill Dam, so no additional boat ramps are needed downstream.)

- Provide a fishing pier on the left side of the river downstream of the dam.

- Prepare a Historic Properties Management Plan (HPMP) to protect cultural resources in the Area of Potential Effects (APE). The HPMP will include provision for signage to identify the various cultural resources in close proximity to the site (e.g., Scott's Mill Dam, Scott's Mill grist mill site, water works canal on the right bank).

- Applicant considered connector trails and public camping, but determined there is insufficient space along River Road to provide for these recreational opportunities. On the right side the existing railroad, U.S. Pipe Company facility and the steep bank preclude connector trails to nearby existing trails.

Table E 4-2 provides estimated capital and operational costs for the above described environmental measures.

4.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

American Rivers and the James River Association requested that Applicant consider the decommissioning and removal of Scott's Mill Dam as an alternative to the proposed Scott's Mill Hydropower Project. Since dams on other rivers have affected fish passage and free-flowing rivers, Applicant agreed to conduct an analysis of how dam removal would affect the regional economy and environment if Scott's Mill Dam were to be removed.

TABLE E-4-2

COST OF PROPOSED ENVIRONMENTAL MEASURES

Environmental Measure	Capital Cost	Operational Cost[3]
Run of river implementation	$100,000	$10,000
Soil Erosion and Control Plan	$5,000	
Provide one inch veil (see run of river implementation above)		
Streamflow and Water Level Monitoring Plan	$10,000	$5,000
Monitor water quality	$10,000	$15,000[4]
Upstream passage of American Eel and Sea Lamprey	$120,000	$20,000
Eel and Lamprey Effectiveness Study	$50,000	
Upstream fish passage	$1,500,000	$50,000[5]
Upstream eel and lamprey fish passage effectiveness study	$50,000	
Downstream fish passage	$500,000	100,000[6]
Fish Passage Operations and Maintenance Plan	$15,000	$10,000
Direct half of the turbine flow to area downstream of main spillway	In construction cost	
Orient power plant at oblique angle	In construction cost	
Wetlands mitigation	$20,000	
Invasive Species Management Plan	$5,000	$2,000
Northern Long-eared bat management plan	$5,000	
Bald Eagle Management Plan	$2,000	
Canoe portage	$40,000	$2,000
Boat ramp	$150,000	$10,000
Fishing pier	$40,000	$2,000
Historic Property Management Plan	$15,000	

The decommissioning and removal of Scott's Mill Dam would restore approximately 3.6 miles of mainstem habitat, plus an undetermined amount of tributary habitat to pre-dam conditions. However, without the removal of six additional dams which lie upstream of Scott's Mill (i.e., Resuens, Holcomb Rock, Coleman Falls, Big Island. Bedford and Cushaw),

[3] Annual cost
[4] Monitoring for an initial three years
[5] Required within 10 years from license or as directed by agencies
[6] Lost energy based on 225 cfs, 15 feet head, and $50 per MWh

or major changes to operational modes, downstream flows would be similar to current operations and fish passage would be restricted from Reusens Dam upstream.

The removal of Scott's Mill Dam would allow for the passage of anadromous and catadromous species that traditionally migrated upstream of Scott's Mill Dam (e.g., American Shad, American Eel and Lamprey). However, only 3.6 additional miles of the James River would become available for spawning and rearing habitat if the dam were removed. The six additional dams discussed earlier also impede the passage of these species. Therefore, the removal of the dam would have minimal effect on the total restoration of these species and their ability to migrate the James River.

Removal of the Scott's Mill Dam would also allow for increased boating and watersport activities access for the 3.6 river miles upstream of the dam. However, due to the small length of river reach, this would likely have little positive impact on the local economy.

It is beyond the scope of this analysis to look at the benefits to the regional economy that would accrue from removal of all dams on the James River upstream of Lynchburg. However, there would be benefits from restoration of habitat for the diadromous fish species and for recreational boating. There also could be effects to the existing boating that occurs upstream of Scott's Mill Dam, but downstream of Cushaw Dam. Use of this reach of river is primarily for fishing. Turning the reaches between Scott's Mill and Cushaw from lentic to lotic waters could affect the species caught, the quantity of fish caught, and boater safety.

Removal of Scott's Mill Dam would also have adverse effects. The reservoir created by the Scott's Mill Dam also serves as a back-up emergency water supply for the town of Lynchburg, Virginia. The City has pump stations on the James River both upstream of Reusens Dam and downstream of Scott's Mill Dam in downtown Lynchburg. The pumphouse intake is located approximately 3,000 feet downstream of Scott's Mill Dam near the 5th Avenue bridge . The capacity of the pump station is 10 mgd (approximately 15.5 cfs). The City has expressed concern about changes to the dam and existing water levels. The City has stated that it utilizes the river for raw water withdrawal (letter from Timothy Mitchell, Director Water Resources, City of Lynchburg, January 11, 2016 – see **Appendix A**). Removal of the dam would adversely affect the City's back up emergency water supply.

Removal of the 6 dams upstream of Scott's Mill would have significant adverse effects. The Big Island Dam (located above Scott's Mill) is critical for operations of Georgia Pacific's Big Island paper products manufacturing plant. Loss of this facility would adversely affect local employment, and local tax revenues, not to mention the significant investment that Georgia Pacific has made in upgrading the plant. Reusens Dam serves as a back up to Lynchburg's primary water supply source on the Pedlar River. Loss of the Reusens water supply source would likely be unacceptable to Lynchburg. The Snowden hydropower plant provides about 5 MW of power to the Town of Bedford's electric utility customers. Loss of the energy from Snowden would adversely affect Bedford rate payers. Cushaw, Holcomb Rock and Coleman Falls are privately owned projects. Removal of these dams would adversely affect the private ownership and could impact the cost of power to the power purchasers.

Finally, the removal of Scott's Mill Dam and the 6 dams located upstream would cause an increase in carbon emissions since the power generated would have to be replaced though alternative sources, fossil fuels being the most likely. For the above reasons, dam removal is not considered a reasonable alternative and is eliminated from further consideration.

5.0 CONSULTATION AND COMPLIANCE

5.1 AGENCY CONSULTATION

The FERC regulations (18 Code of Federal Regulations [CFR] § 4.38) require an applicant to consult with appropriate resource agencies, Tribes and members of the public before filing an application for license. The consultation constitutes an initial step in compliance with the Fish and Wildlife Coordination Act, Endangered Species Act (ESA), National Historic Preservation Act (NHPA) and other Federal statutes.

In the first stage of the licensing process, FERC regulations require an applicant to engage the appropriate Federal, State and local resource agencies, Native American Tribes and interested parties to determine which studies should be conducted to support the licensing process. The Applicant held a public/agency meeting on December 2, 2015. The Pre-Application Document (PAD) described the Scott's Mill Project and environmental resources potentially affected by project construction and operations. It also contained a list of proposed studies the Licensee would conduct during the licensing process.

5.1.1 JOINT MEETINGS AND APPLICATION PROCESS

Applicant held a Joint meeting on December 2, 2015 with members of resource agencies, interested parties and the public to discuss the licensing process, and to identify resources issues and alternatives. Numerous additional meetings and conference calls were held over the past several years. Meeting minutes and records of conversation are provided in **Appendix A**. (Meeting and telephone participants were all afforded the opportunity to edit the notes of the meetings/conference calls.)

DATE	ATTENDEES	PURPOSE
Dec. 2, 2015	Lynn Crump, Virginia Department of Conservation and Recreation	Public Scoping / Joint Meeting
	Jody Callihan, Federal Energy Regulatory Commission	
	Larry Jackson, APCO	
	Brian McGurk, Virginia Department of Environmental Quality	

	Justin Stauder, City of Lynchburg	
	Greg Poff, City of Lynchburg	
	Clay Simmons, City of Lynchburg	
	George Palmer, Virginia Department of Game and Inland Fisheries, now VDWR	
	Scott Smith, Virginia Department of Wildlife Resources	
	Scott Lyng, Lyng and Son Lumber	
	Rob Campbell, James River Association	
	Pat Calvert, James River Association	
	Ben Leatherland, Hurt & Proffitt	
	Randy Lichtenberger, Hurt & Proffitt	
	Mark Fendig, Luminaire Technologies	
	Kim Stein, Consultant for Liberty University	
	Eric Thompson, Natel Energy	
	Luke Graham, Consultant	
	Wayne Dyok, Facilitator	

Applicant distributed copies of the draft study plans on February 10, 2016. Licensing participants provided comments on the study plan in March and April. Applicant continued to coordinate with licensing participants and finalized the study plans in late May with filing and distribution of the final study plans on June 16, 2016. Applicant implemented the study plans beginning in April 2016. Most studies were completed in 2016, but fish passage efforts continued through November 14, 2017. Applicant continued consultation with licensing participants during the review period for the draft license application, and afterwards to the extent necessary.

5.1.1.1 COMMENTS ON DRAFT APPLICATION

On December 5, 2017 Applicant distributed copies of its draft application. Comments were due 90 days from that date. Responses to comments are included in **Appendix B**. As appropriate, this application has been revised to incorporate the comments.

5.1.1.2 JOINT MEETING ON DRAFT LICENSE APPLICATION

On May 8, 2018, Applicant held a second Joint Meeting with resource agencies and the public to discuss comments on the draft application. Notes of the meeting are provided in **Appendix A**, Consultation Record. Key discussion items included fish passage for catadromous and resident fish, recreation, protection of existing cultural resources, and preservation of water quality.

5.1.1.3 LICENSE EXEMPTION APPLICATION

In June 2020, Applicant filed a license exemption for the project because it has ownership of all lands necessary for construction and operation. However, because Applicant is proposing to increase the dam crest height by 2 feet, in November 2021, the Commission determined that the project does not qualify for an exemption and required Applicant to file a license application.

5.1.1.4 SETTLEMENT AGREEMENT

After the draft application Joint Meeting, Applicant continued to negotiate a Settlement Agreement on fish passage. An Agreement in Principle (AIP) was reached in February 2020. The signed AIP is included in **Appendix A**. Applicant has continued to work with the resource agencies and expects that the final Settlement Agreement will be signed and filed with the Commission in early spring 2022.

5.2 COMPLIANCE

5.2.1 WATER QUALITY CERTIFICATION UNDER SECTION 401 OF THE CELAN WATER ACT

The Virginia Department of Environmental Quality (VDEQ) is the agency responsible for issuing the Water Quality Certification for the Project. Applicant has consulted with the VDEQ in developing the license application and submitted a 401 Water Quality Certification application on June 10, 2020 (Tracking No. #20-1005). However, given that the exemption application was rejected and a new license application is required, applicant intends to resubmit the 401 Water Quality Certification application after filing the final license application once the Settlement Agreement has been signed. This will provide a fully consistent 401 application with the Settlement Agreement since VDEQ will be a signatory to the Settlement Agreement.

5.2.2 SECTION 18 FISHWAY PRESCRIPTIONS

Section 18 of the FPA states that the Commission must require a licensee to construct, operate and maintain such fishways as may be prescribed by the Secretary of the Interior and the Secretary of Commerce (16 U.S.C. § 811). The USFWS has a goal to restore

American Eel and American Shad in the upper James River, above Scott's Mill dam. Some American Eel have been observed in the vicinity of and upstream of Scott's Mill Dam. However, American Shad restoration has not achieved the restoration goals after more than two decades of stocking and other restoration efforts. Consequently, Virginia has elected to halt the stocking program (Karl Blankenship, Bay Journal, September 17, 2017).

Agencies have stated that American Shad passage is not as critical as for other species, but could become critical in the future (see **Appendix A**, August 25, 2017 notes of resource agency conference call). Nonetheless, there is an immediate need for passage of American Eel and Sea Lamprey. Accordingly, Applicant has developed conceptual plans for upstream passage of American Eel and Sea Lamprey. The AIP describes the initial steps the Applicant will take to provide fish passage for American Eel and Sea Lamprey. The AIP also includes a longer-term plan for passage of anadromous and resident fish species. The Settlement Agreement will update the AIP. The license application has been revised to incorporate elements of the most recent draft of the Settlement Agreement. However, there may be additional changes to the Settlement Agreement after the license application has been filed. These changes will be highlighted when the Settlement Agreement is filed.

5.2.3 COASTAL ZONE MANAGEMENT ACT

The Scott's Mill Project is located upstream of the coastal zone. Amherst and Bedford Counties are not included in Virginia's Coastal Program Resource Management Area (see January 2, 2019 Record of Conversation with VDEQ in **Appendix A**).[7] This was confirmed in an email from Bettina Rayfield of VDEQ on January 3, 2019. Therefore, the Coastal Zone Management Act does not apply to the Scott's Mill Project.

5.2.4 SECTION 4(e) FEDERAL LAND MANAGEMENT CONDITIONS

Section 4(e) of the FPA provides that if a project is located within a Federal reservation, the Department with management responsibility for the reservation, (including national forests and parks) may require such conditions necessary for the adequate protection and utilization of the reservation (16 U.S.C. § 797(e)). However, there are no federal lands within the Scott's Mill Project boundaries.

5.2.5 ENDANGERED SPECIES ACT

Section 7 of the Endangered Species Act (ESA) requires consultation with relevant resource agencies to ensure that FERC's issuance of a license does not jeopardize the continued existence of listed species or adversely modify designated critical habitat. (16 U.S.C. § 1536). Applicant has consulted with the USFWS pursuant to the ESA. Prior to

[7] Virginia Department of Environmental Quality. *Virginia Coastal Resources Management Area*. www.deq.state.va.us.

conducting licensing studies, Applicant requested a list of threatened and endangered species from the USFWS. The James spiny-mussel (federally endangered) was listed as potentially occurring in the project area. With the exception of the James spiny-mussel, no other ESA studies were requested for aquatic species. Applicant conducted a survey for freshwater mussels at seven specific sites in the pool located between Scott's Mill Dam and Reusens Dam. Additionally, the survey also included the tailrace below Scott's Mill Dam downstream to the confluence of Blackwater Creek.

No live target species of freshwater mussels were found. Project effects on the endangered James spiny-mussel are discussed in the environmental assessment. Applicant anticipates that the USFWS will issue its biological determination after FERC has issued its draft environmental assessment and biological assessment.

Applicant had intended to conduct a bat study, but after the Terrestrial Habitat Assessment and Applicant's decision to essentially maintain existing water levels, Applicant determined that no bat habitat would be affected by the project and abandoned plans for the bat study.

5.2.6 SECTION 10(j) FISH AND WILDLIFE COORDINATION ACT RECOMMENDATIONS

Applicant's responses to resource agency comments on the draft application that pertain to recommendations relating to the Fish and Wildlife Coordination Act in the final application are provided in **Appendix B**. The application has been modified, as appropriate to address agency comments, as well as follow on discussions. The USFWS and VDWR will provide their recommendations in response to the Commission's request for formal recommendations.

6.0 ENVIRONMENTAL ANALYSIS

The Project effects discussed in Section 6.0 are based on a comparison to the existing environment (i.e., No-Action Alternative). They include all protection, mitigation and enhancement measures.

6.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The James River originates in the Allegheny Mountains at the junction of the Jackson and Cowpasture Rivers near Clifton Forge, Virginia (**Figure A-1**). The river flows generally southeast, traversing the Blue Ridge Mountains, the Piedmont Plateau and finally the Coastal Plain/Tidewater where it discharges into Chesapeake Bay (approximately 340 miles [544 kilometers] from its origin). The total drainage area of the basin is an estimated 10,060 square miles (approximately 25% of the state).

There are approximately 45 dams and associated hydroelectric facilities in the basin, half of which are in the lower third of the basin and half in the upper third of the basin, with approximately 80 miles of river in between (Dominion 2006). The dams cumulatively affect anadromous fisheries of the James River as well as canoeing and kayaking. A series of seven low-head dams over a 22-mile stretch of river begins as the river enters the Piedmont Plateau province (**Appendix C, Photographs**). The first of the seven dams (Cushaw Dam) is located a few miles below Balcony Falls (near Glasgow, Virginia), which is where the James River leaves the Blue Ridge Mountains and enters the Piedmont. The Scott's Mill Dam is the lowermost dam and is located approximately 258.5 river miles (416 km) upstream of Chesapeake Bay.

Topography of the basin is characterized by mountainous areas in the western portion, gradually changing to low, rounded hills and level areas of unconsolidated soils in the eastern portion. In the Project vicinity, the topography is characterized by hilly terrain.

Virginia's climate is classified as humid sub-tropical, but temperature and precipitation vary widely with topography. On average, approximately 43 to 45 inches of precipitation, mostly rain, fall annually in the vicinity of the Scott's Mill Hydropower Project. Precipitation varies markedly, however, with elevation and location within the gorge that cuts through the Blue Ridge Mountains. Exceptionally heavy rains can occur at the Project when Atlantic storms move inland and encounter the sharply rising mountain range (Woodward and Hoffman 1991).

Forests cover more than 75 percent of the land in the upper and middle James River watersheds, and agricultural uses constitute much of the rest. Amherst County comprises 475 square miles, with a population of around 32,000; Bedford County is 764 square miles with a population around 61,000. The 1990 population in the upper James River watershed was less than 37 people/square mile, and in the middle watershed between 37 and 67 people/square mile (Jones, et al. 1997).

The immediate area of the project site is industrial/urban with railroad tracks on the west side and River Road on the east side of the river at Scott's Mill Dam. The area in the vicinity of the Project is characterized as forested hills. Outside the floodplain area, there are steep slopes on both sides of the river.

Water withdrawals from the James River throughout its 340 miles are used by municipalities and industry for industrial uses (73 percent), public water supply (17 percent) and agriculture (ten percent).

6.2 CUMULATIVE EFFECTS

According to the Council on Environmental Quality's regulations implementing the NEPA (40 CFR 1508.7), an action may cause cumulative effects of the environment if its effects overlap in space and/or time with effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities. At this time, Applicant has identified fisheries and recreation as potentially cumulatively affected resources. The analysis of cumulative effects to these resources is found in the corresponding resources section.

6.2.1 GEOGRAPHIC SCOPE OF CUMULATIVE ANALYSIS

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect the resources differently, the geographic scope for each resource may vary. However, in this instance the geographic scope for all identified resources is the same and would extend from downstream of Scott's Mill Dam near the City of Lynchburg, to upstream of the Cushaw Project.

The Scott's Mill Dam is the downstream most dam in a series of seven dams from Cushaw to Lynchburg. The seven dams inhibit fish passage and recreational boating. Resource agencies have a goal to restore American Eel, Sea Lamprey and American Shad to their historic spawning grounds.

6.2.2 TEMPORAL SCOPE OF ANALYSIS

The temporal scope of the cumulative effects analysis includes past, present, and future actions and their possible cumulative effects on each resource. Based on a license term, the temporal scope looks 30 to 50 years in the future, concentrating on the effects of the resources from reasonably foreseeable future actions. The historical discussion, by necessity, is limited to the amount of available information for each resource.

6.3 PROPOSED ACTION AND ALTERNATIVES

6.3.1 GEOLOGICAL RESOURCES

6.3.1.1 AFFECTED ENVIRONMENT

The Scott's Mill Dam is located on a reach of the upper James River downstream of the Blue Ridge Physiographic Province. Typically, seven to ten miles in width (but wider south of Roanoke Gap), the Blue Ridge Mountain range extends from Georgia to Pennsylvania and represents the eastern most ridge of the Appalachian Highlands (Hunt, 1974). Relatively rapid erosion has formed a terrain of high relief comprising resistant granites, greenstones and quartzites. In the general vicinity of the Project, the nearby hills rise from a river elevation of approximately 500 feet above msl to heights of almost 800 feet.

Although the area adjacent to the river is heavily wooded, landslides can occur, introducing large amounts of sediments and woody material into the James River. This can cause debris flows and flooding. Erosion along the reservoir shoreline is typically limited to localized sites where boaters and anglers have accessed the water and worn paths.

6.3.1.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

Applicant would implement best management practices to prevent soil erosion, particularly during the construction of the powerhouse. Applicant also proposes to prepare an erosion and sediment control plan. Excavation work for the powerhouse and the tailrace channel would be conducted in the dry within upstream and downstream cofferdams. Pumping of water from this area would be into secondary stilling basins to remove sediments. Additionally, standard erosion control fences would be erected around any earth moving areas.

When excavation of the sediments upstream of the horseshoe dam and at the southern tip of Daniel Island is undertaken, the area will be isolated to prevent disturbed sediments from escaping the dredged area. Similarly, the top section of the existing arch dam will be removed after the powerhouse has been constructed. This area also will be isolated and the headpond filled with water to facilitate removal of the top section of the arch dam.

Applicant acknowledges that any fill or excavation below the ordinary high-water mark in surface waters, or in wetlands, for any aspect of the Project, is required to be reported in the Joint Permit Application for Section 401 Certification by VDEQ's Virginia Water Protection Permit Program. Applicant would avoid to the extent possible, minimize, and mitigate any impacts to wetlands.

6.3.2 WATER RESOURCES

6.3.2.1 AFFECTED ENVIRONMENT

The nearest USGS gage is at Holcomb Rock (USGS gage no. 0202550), about 11.2 miles upstream of the Scott's Mill Dam. The total drainage area at the Holcomb Rock gage is 3,259 square miles, representing about one third of the drainage of the James River Basin. Drainage area at the Scott's Mill Dam site is approximately 3,300 square miles. The average daily flow for the period of record from July 9, 1927 to December 31, 2020 is 3,692 cfs. During this period, the highest instantaneous discharge recorded at Holcomb Rock was 207,000 cfs on November 5, 1985, and the lowest discharge was 223 cfs on July 28, 1930. The highest daily flows most frequently occur in March and, less frequently, in January, February and April. The lowest daily flows occur most frequently in September and, less frequently, in July, August, October and November (**Table E-6-1**).

6.3.2.1.1 STORAGE AND RELEASE OF PROJECT INFLOW

The Scott's Mill Dam currently operates as a run-of-river project based on inflow from the Reusen's Dam. Under steady state flows, the headpond elevation is governed by the weir equation: $Q=CLH^{1.5}$, where Q is the James River flow in cfs, C is a coefficient, L is the spillway length in feet, and H is the head over the spillway crest in feet (see Study Report Assessment of Pre- and Post-Project Water Levels Upstream and Downstream of Scott's Mill Dam in Appendix J for additional information). The spillway length is 735 feet for the straight section of spillway and 140 feet for the arch section. Applicant measured the headpond level for various flow levels up to 25,000 cfs. Headpond levels as a function of discharge are presented in **Figure A-22**. These measurements verified that a coefficient of 3.5 provided accurate estimates of upstream water levels for specific flow levels. For example, in Applicant's final study plan Applicant estimated that a 4-foot head would equate to a flow of 23,800 cfs. Measurements at 25,000 cfs indicated a head of 4.1 feet over the dam crest, equivalent to an upstream water level of 518.5 feet (see **Table A-3, Figure A-22**). Given the excellent agreement of headpond water levels and discharges with the weir equation, applicant was able to extrapolate upstream water levels for flows above 25,000 cfs. However, for flood flows above 75,000 Applicant used the Federal Emergency Management Agency (FEMA) flood studies to estimate upstream and downstream water levels during flood events. Applicant cross checked these water levels with weir equation estimates.

For low flows of around 1,000 cfs, the weir coefficient was estimated to be 1.55. Applicant conducted a storm analysis and determined that the weir coefficient increases as flows increase and reaches a maximum of 3.5 at a head of 4 feet. Above 4 feet the coefficient remains constant at 3.5 feet.

During flood events, downstream backwater levels increase much faster than upstream water levels. At flows over 50,000 cfs the tailwater level reaches the dam crest and begins to affect flow. At flows above 60,000 the tailwater is above the spillway crest and the spillway acts as a submerged weir. Applicant calculated the submergence effects based on the FEMA analysis and compared the results to published values of measured discharge to theoretical discharge based on the ratio of the tailwater head over the spillway to the headpond head over the spillway (Vennard 1961). Excellent results were obtained and used in the storm analysis.

TABLE E-6-1

FLOW DURATION VALUES (CFS) FOR THE JAMES RIVER AT HOLCOMB ROCK

JULY 9, 1927 – DECEMBER 31, 2020

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average	4770	5643	7060	5966	4577	2861	1662	1836	1659	2131	2552	3689
Maximum	93,900	63,600	110,000	96,700	55,600	118,000	26,800	98,800	62,200	52,100	180,000	62,900
Minimum	431	579	882	966	685	424	223	244	280	266	400	452
5	13,900	15,500	20,800	15,900	11,800	7,520	4,280	5,270	5,130	7,860	8,040	11,300
10	9,900	11,300	14,300	11,800	8,130	5,020	2,930	2,960	2,980	4,080	5,020	7,430
15	7,800	9,010	11,700	9,360	6,630	3,800	2,240	2,120	2,100	2,750	3,850	5,700
20	6,190	7,450	9,540	7,860	5,730	3,160	1,910	1,750	1,590	2,220	3,100	4,550
25	5,280	6,410	8,240	6,780	4,990	2,750	1,720	1,530	1,330	1,850	2,600	3,970
30	4,590	5,700	7,200	5,920	4,420	2,440	1,570	1,360	1,180	1,540	2,180	3,450
35	4,020	5,200	6,410	5,220	3,970	2,160	1,450	1,240	1,060	1,320	1,880	3,040
40	3,660	4,720	5,760	4,660	3,640	1,990	1,340	1,150	996	1,160	1,680	2,720
45	3,300	4,230	5,210	4,260	3,340	1,840	1,250	1,080	934	1,060	1,510	2,460
50	3,020	3,750	4,790	3,860	3,090	1,730	1,170	1,020	883	976	1,350	2,240
55	2,800	3,220	4,370	3,570	2,840	1,590	1,100	958	837	901	1,210	2,020
60	2,550	3,100	4,080	3,280	2,650	1,500	1,060	905	793	842	1,090	1,800
65	2,320	2,840	3,770	3,030	2,450	1,420	1.010	861	754	801	970	1,620
70	2,120	2,620	3,480	2,800	2,270	1,340	956	814	711	764	896	1,450
75	1,860	2,380	3,210	2,600	2,070	1,260	900	769	678	722	834	1,300
80	1,600	2,140	2,940	2,440	1,910	1,180	841	716	641	672	787	1,140
85	1,370	1,850	2,620	2,270	1,730	1,080	781	660	586	636	732	954
90	1,120	1,550	2,150	2,040	1,520	970	708	580	530	580	660	794
95	843	1,170	1,710	1780	1,280	854	598	508	452	491	576	663

Source: USGS Surface Water Monthly Statistics for Virginia (http://waterdata.usgs.gov/va)

For the most part, the backwater levels drive the upstream water levels at floods greater than the 100-year flood. Scott's Mill Dam has little effect on upstream water levels. FEMA estimated that the presence of Scott's Mill Dam increased water levels by less than two feet.

Applicant also measured tailwater levels at flows from 700 cfs to 25,100 cfs, as illustrated in **Table A-3 and Figure A-21**. Downstream water level gauges installed by Applicant were washed downstream during a flood event. Consequently, Applicant surveyed downstream water levels at various James River flow levels to develop the tailwater rating curve below 25,000 cfs. (Applicant's first survey conducted by a registered land surveyor indicated that the actual crest elevation of the main spillway is 514.4 feet (NAVD88) and the crest elevation of the arch section is at elevation 514.8 feet. Applicant determined that the 511-foot crest elevation shown on USGS maps is approximate and has used the corrected crest elevation in all current studies. Applicant's surveyed data corresponds with the FEMA elevation data.) Above 25,000 cfs, Applicant used the FEMA study to estimate downstream water levels.

Downstream water levels increase from 499 feet (NAVD88) to about 507.8 feet over this range. This has the effect of reducing gross head for power generation as flows increase. The downstream water levels are controlled by a sill located at Riveredge Park (see **Appendix C, Photographs**).

As flows in the James River increase, the water level increases until a new equilibrium is established per the headwater rating curve. Similarly, as flows decrease, water levels fall until a new equilibrium is established. Because the river has steep banks, the increase in surface area per foot increase in water levels is small and there is limited storage capacity in the headpond. Consequently, discharge equilibrium over the dam is reached in a short period of time at higher flows.

During project operations, the project will be operated in a run-of-river mode. Flows equal to the headpond inflow will be maintained through the turbines and as necessary, over the dam to maintain a constant headpond elevation when flows are less than the hydraulic capacity of the turbines. Consequently, inflow and outflow from the Project will essentially be equal. The operators of the Scott's Mill powerhouse will monitor the flow and headpond levels, and when the river flow increases to a point that can support the addition of another unit without dropping the water level below the dam crest, a unit will be started. Conversely, units will be shut down when flow decreases to a point at which flow cannot be maintained just above the crest level.

The operators at the Scott's Mill facility will have access to a live controllable video camera situated on the intake structure, which will allow them to visually monitor the headpond level and the entire crest of the dam. Additionally, a level probe will be situated on the right abutment of the dam which will provide headpond level relative to the crest of the dam. The level probe will provide operational input as to when it is possible to start a unit and when it is necessary to shut a unit down. The Scott's Mill facility will be operated remotely 24 hours-per-day, 7 days-per-week, and the standard operating procedure will be to review the video and probe level on an hourly basis. The level probe will be alarmed to alter operations if the pond level deviates significantly from the dam crest elevation.

The upstream and downstream USGS gauging stations, available on the internet, will also be monitored and utilized by the operators to anticipate flow changes that will be experienced at Scott's Mill over the next 24 to 48 hours. These changes can be from local/upstream precipitation, or as a result of changes of releases from the six dams upstream (Reusens being the first/closest).

6.3.2.1.2 BATHYMETRY STUDY

Applicant conducted a bathymetry study in April 2016 during near-constant flows of about 1800 cfs to better understand the hydraulic effects of the project on flows and aquatic habitat (See Bathymetric Study Report n Appendix J for additional information). **Figure E-6-1** shows bathymetric contours both upstream and downstream of Scott's Mill dam. Water levels downstream of the dam are about 1 foot above the water levels observed at a low flow of 700 cfs. **Figure E-6-2** orients the bathymetry map to Google Earth. (Note there is some distortion.) **Figure E-6-3** presents bathymetry data just upstream of the arch section of the dam.

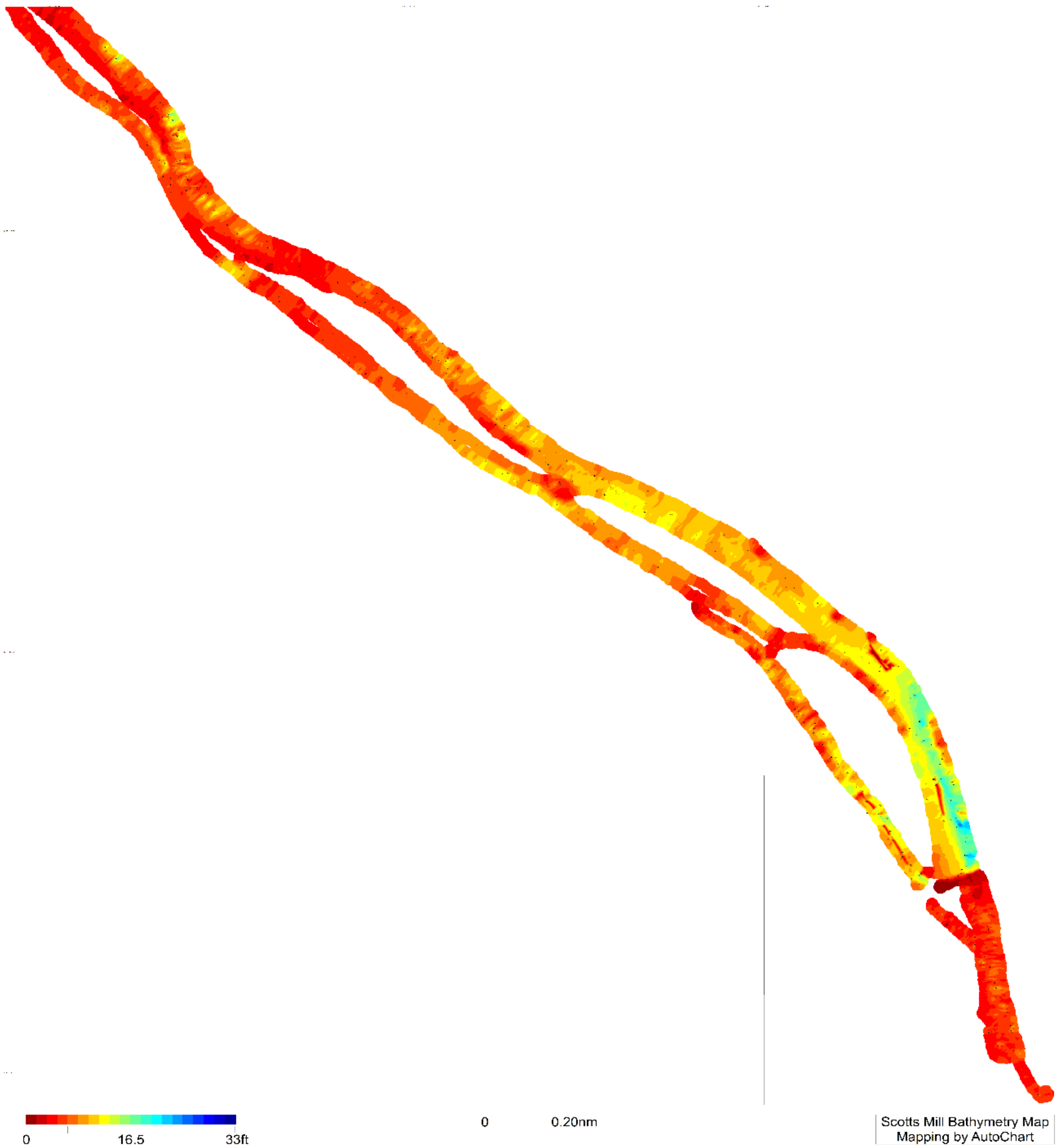


FIGURE E-6-1 Bathymetry of Scott's Mill Headpond and Downstream Area

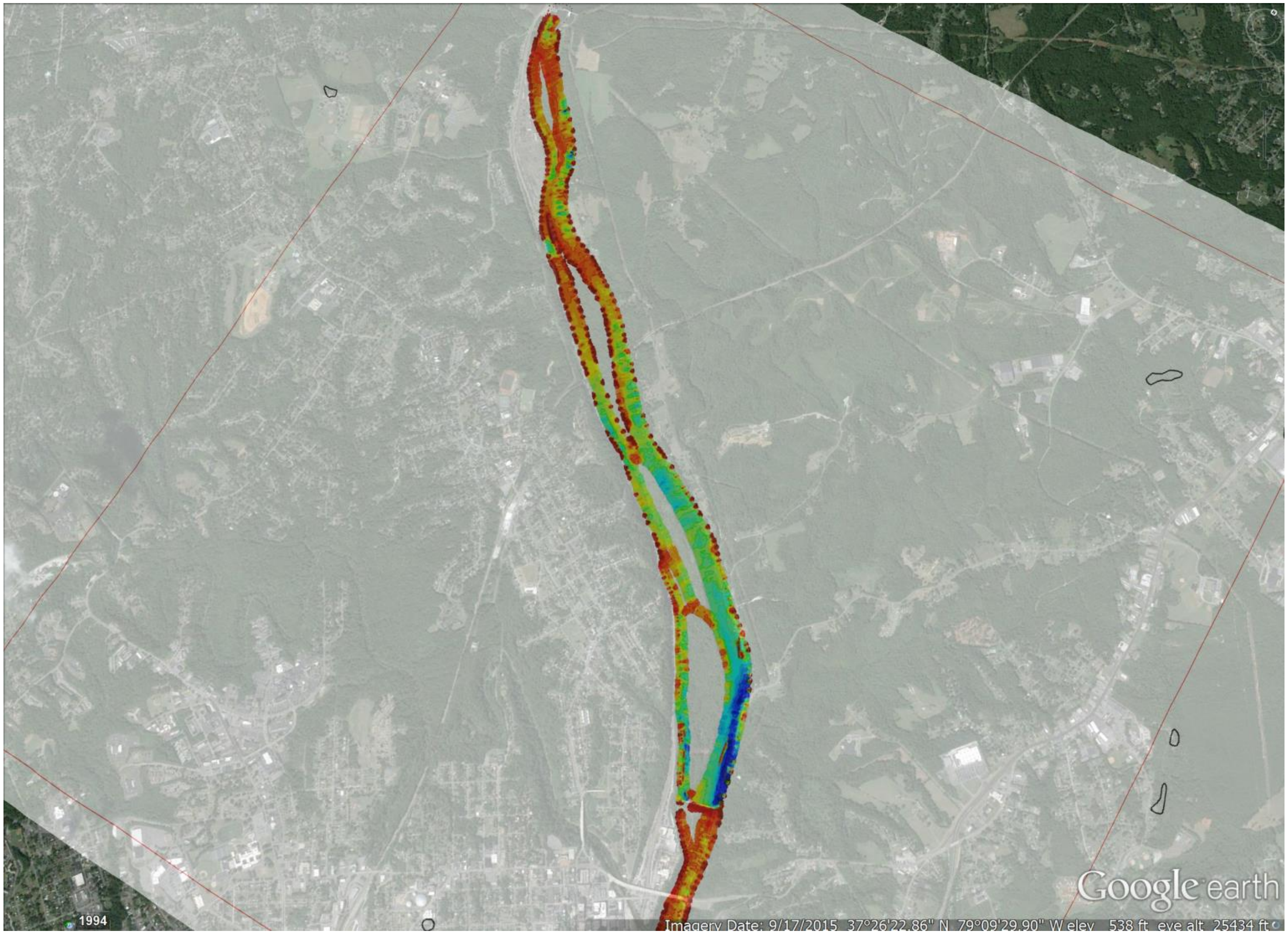


FIGURE E-6-2 Bathymetry of Scott's Mill With Reference to Google Earth

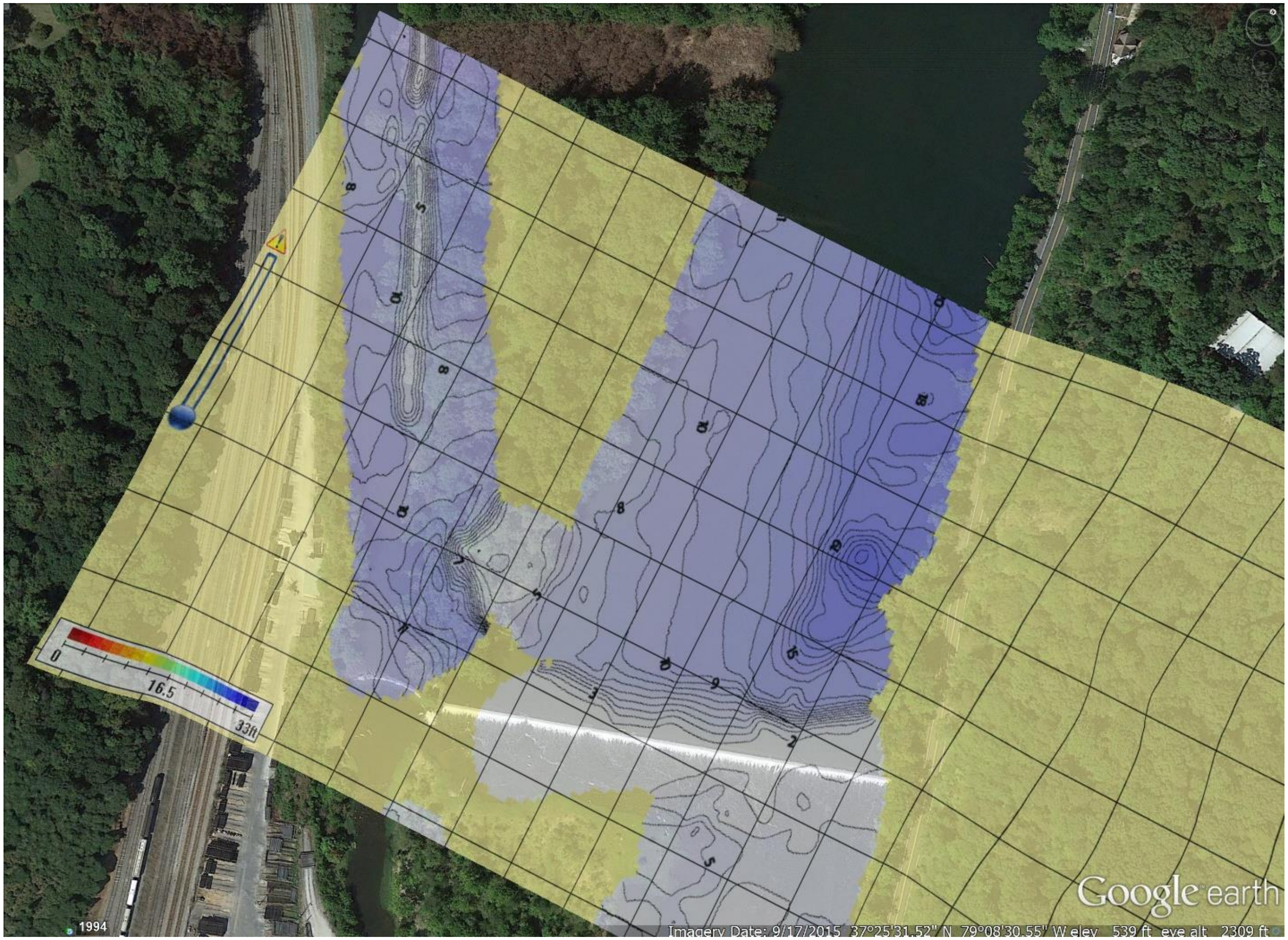


FIGURE E-6-3 Headpond Bathymetry Upstream of Scott's Mill Dam

6.3.2.1.3 EFFECTS OF FLOW RELEASES

Study plan 3 required Applicant to measure water velocities in the headpond during low flow conditions (see Appendix J – Study Plan 3). Specific locations included (1) at the buoys located several hundred feet upstream of the main section of the dam, (2) in the opening between the dam and the downstream end of Daniel Island, and (3) upstream of the arch section of the dam. Applicant measured velocities at 0.2 and 0.8 of the depth. Velocity measurements were at the lower end of the meter, measuring only a couple of tenths foot per second (fps). At the opening, just upstream of the old fish passage site to the left side of the arch section, velocities were below the meter detection limit. Velocities were not measured immediately upstream of the dam for safety reasons, but because of the depth, low flow conditions and the fact that the arch section is 0.4 feet higher than the main spillway section, average velocities were estimated to be less than 0.2 feet per second. Velocities measured at the buoys were on the order of 0.2 fps. This seems reasonable given the cross-sectional area is on the order of 7,000 ft^2 and the flow through this reach was about 1600 cfs.

Based on the bathymetry and a normal surface area of 305 acres, Applicant estimates a headpond volume of about 2,000 acre-feet. Based on a median flow of 2,000 cfs, the residence time in the headpond is about 12 hours. For a low flow of 700 cfs residence time would be about 1 ½ days.

Under maximum generation conditions of 4,500 cfs, flows in the channel upstream of the arch section would be about 3.5 fps based on a depth of 10 feet and channel width of 130 feet, assuming all flow passed through this channel. Further upstream in the channel to the right of Daniel Island, velocities could be on the order of 6 fps in some areas. However, by excavating the opening that is immediately upstream of the old fishway to the left of the arch dam, Applicant proposes to draw flow from the left side of the channel to the north of Daniel Island. Enlarging the opening to about 130 feet wide by 10 feet deep would approximately double the cross-sectional area from which the hydro project would draw water, resulting in an average flow of less than 2 feet per second during maximum operating conditions of 4,500 cfs. This would result in about half the flow coming from the left side of the channel and half coming from the right side. Under lower flow conditions, Applicant expects that each channel would continue to provide half the flow for the turbines. Average velocities in the main channel would continue to be very low except in the vicinity of the cut where they will range from ¼ fps to 2 fps over the range of turbine flows from minimum to maximum. Since the cut would be designed to provide about half the flow from the left side of the river, residence time would effectively double to about 3 days.

Applicant plans to excavate about 7 feet of rock to elevation 491 feet at the powerplant site and for about 10 feet downstream. It may also be necessary to excavate the riffle area downstream of the arch dam and an area immediately downstream of the old fishway to the left of the arch section. Applicant's goal is to provide about half the flow to the area downstream of the main spillway section. Flow from the arch section currently flows in this direction. This will maintain flows in the area downstream of the main spillway section. The proportion of flow to be discharged will depend upon the design of any required fishways. The goal will be to attract fish to the fishway entrance and to provide quiescent flows on the right bank to facilitate eel passage.

Applicant conducted a pre- and post-project storm analysis of three flood events. These are presented in **Appendix K**. At the hydraulic capacity of the powerhouse, headpond elevations are about 0.2 feet higher during project operations than during existing conditions. As flows increase to 25,000 cfs, the differential increases to about 2 ½ feet. This is primarily due to loss of the horseshoe portion of the spillway and the 2 foot increase in the main spillway crest elevation.

At about 50,000 cfs, the differential headpond level between existing and proposed project operations reaches a maximum of 2.6 feet. As flows increase to about 200,000 cfs (i.e., the 1985 peak flood flow), the differential decreases to about 1.5 feet. This is primarily due to the weir submergence effect and flows over the powerhouse that are initiated when headpond elevations exceed 521.5 feet. For the most part, water levels are governed by backwater conditions, but Scott's Mill Dam continues to have a minor impact.

6.3.2.1.4 FLOWS RELEASED FOR SPECIFIC PURPOSES

Water withdrawals from the James River throughout its 340 miles are used by municipalities and industry for industrial uses (73%), public water supply (17%) and agriculture (10%).

6.3.2.1.5 DESCRIPTION OF WATER RIGHTS, IF ANY

Under Virginia law, riparian water rights are real property rights appurtenant to the land in which the river or stream is located. The water rights required for the operation of the Project is included within the ownership in fee held by Applicant. (Virginia law recognizes that water rights can be severed and conveyed separately from the real property to which they are appurtenant.)

Virginia follows the “reasonable use” doctrine of riparian law. The owner of land adjoining a river or stream has the right to make a reasonable use of the waters flowing by his land, qualified by the right of other riparian owners “to have the stream substantially preserved in its size, flow, and purity, and to be protected against any material pollution of its waters.” Project use of the water is non-consumptive and non-polluting, and retention of water in the reservoir does not and will not exceed Applicant’s reasonable use rights.

6.3.2.1.6 WATER QUALITY IN PROJECT HEADPOND AND DOWNSTREAM

The Scott’s Mill dam is located in a reach of the James River that Virginia Department of Environmental Quality (VDEQ) identifies as Section 11j. This Section is Class III, Nontidal Waters, in which VDEQ numerical water quality criteria for minimum and daily dissolved oxygen (DO), pH and maximum temperature are as follows (AC 25-260-5 et seq. Water Quality Standards):

Minimum DO 4.0 mg/l
Daily average DO 5 mg/l
pH 6.0-9.0
Maximum temperature 32^{o}C

The City of Lynchburg has an emergency water withdrawal from the James River immediately downstream of Scott’s Mill dam and as such, water quality criteria for parameters other than DO, pH and temperature are identified under the category “Aquatic Life, Freshwater (Acute and Chronic)”, and “Human Health, All Other Surface Waters.” The numerical water quality criteria for specific parameters other than DO, pH and temperature are included in **Appendix D**.

VDEQ has classified this portion of the James River as a Class III surface water, with Category 5D impairment (bacteria and polychlorinated biphenyls [PCB's]). According to the VDEQ, this 4.2-mile section of the river (VAC-H03R JMS 04A02, from Reusens Dam to Highway 29) currently supports aquatic life uses, public water supply uses, and wildlife uses, but does not support recreational uses or fish consumption. Elevated *E. coli* bacteria concentrations in the water and high PCB levels in fish tissue have resulted in these impairment classifications.

The VDEQ identifies the James River at the vicinity of the Project as "Impaired Waters" (VDEQ 2002 303(D) Impaired Waters Fact Sheet). It is identified as impaired for 2012 and 2014. A river segment located about four miles downstream of the Project, however, was listed in 1998 as impaired due to seven out of 59 fecal coliform bacteria samples exceeding 1,000 n/100 ml. VDEQ identified a mix of agricultural and industrial nonpoint source runoff as the likely sources. The listing was removed in 2002 because less than ten percent of sampling events did not exceed criteria.

VDEQ currently measures water quality (at about 0.3 m depth) bi-monthly in the James River downstream of Scott's Mill dam at Percival Island (RM 258) and upstream near Coleman Falls Dam (RM 270) . These sampling locations are identified by VDEQ as Station 2-JMS258.54 and Station 2JMS270.84. A summary of the results for parameters measured for the period 2010 to 2019 are provided in **Table E-6-2**. The data support the information collected by Scott's Mill and show only minor differences between the upstream and downstream sampling sites. Water temperatures during the sampling events varied from 0.96 C to 30.0 C. Dissolved oxygen values ranged from 7.05 to 14.59 mg/l, while pH values ranged between 6.7 and 8.8. Turbidity was generally low and ranged from 1.27 to 228 NTU. Eight of the 60 samples contained fecal coliform at concentrations exceeding the 1,000 n/100 ml criterion. All parameters, dates and values are found in **Appendix L.**

All state waters, including wetlands, are designated for the following uses: 1) recreation uses (e.g., swimming and boating); 2) the propagation and growth of a balanced, indigenous population of aquatic life (including game fish) which might reasonably be expected to inhabit them; 3) wildlife; and 4) the production of edible and marketable natural resources (e.g., fish and shellfish). (Virginia Water Quality Standards; 9 VAC 25-260; January 2006.)

Applicant undertook a dissolved oxygen (DO) study during low flows and warm conditions in September 2016, pursuant to the Study Plan. The resource agencies concurred that because of the extensive data base that VDEQ has amassed, there was no need for collecting additional water quality data other than DO and water temperature. Applicant measured DO levels downstream from Reusens Dam to downstream of Scott's Mill Dam. Applicant then continuously recorded DO immediately

TABLE E-6-2 WATER QUALITY DATA IN VICINITY OF SCOTT'S MILL DAM

Parameter	Units	Station							
		2-JMS270.84 - Upstream				2-JMS258.54 - Downstream			
		Count	Max	Min	Mean	Count	Max	Min	Mean
Depth	Meters	60			0.3	60			0.3
Temperature, Degrees Celsius	°C	60	28.8	2.2	15.84	60	30.0	0.96	16
Field pH	Std Units	60	8.7	6.7	7.8	60	8.8	7.1	7.8
Nitrogen, Kjeldal, Total, as N	mg/l	60	3.4	0.1	0.45	60	1.6	0.1	0.36
Nitrogen, Total, as N	mg/l	59	0.5	4.38	0.58	57	1.21	0.27	0.59
TSS Residue, Total Nonfilterable	mg/l	60	322	20.5	1	60	359	1	18.1
Turbidity	NTU	60	228	1.43	14.5	60	222	1.27	15.9
TS Residue, Total Solids	mg/l	60	411	212.5	115	60	313	47	183
E. Coli - MTEC - MF	NO/100ml	60	5794	10	225.8	60	2755	10	235
Fecal Coliform, Membrane Filter	CFU/100ml	60	2000	25	190.6	60	2000	25	285
Phosphorus, Total, as P	mg/l	58	0.56	0.01	0.07	60	0.47	0.01	0.47
Calcium	mg/l	2	21	17.4	19.2	2	15.4	4	9.7
Magnesium	mg/l	2	4.1	3.1	3.6	2	4	2.8	3.4
Dissolved Oxygen	mg/l	60	13.9	7.05	10.1	60	14.59	7.7	10.52
Specific Conductance	µmhos/cm	60	502	72	284	60	469	70	254
PCB, Total Concentration	pg/ml	3	600	457	388	3	3216	222	1351

upstream of the arch section of Scott's Mill dam to better understand diurnal DO patterns in the headpond. Applicant subsequently measured cross sectional and vertical DO profiles upstream of Scott's Mill Dam upstream of the warning buoys located upstream of Scott's Mill Dam. The data are presented in **Appendix E** and summarized in the Water Quality Report in **Appendix J**.

Applicant collected the DO and temperature data from September 9 through 12, 2016 with day-time air temperatures in the range of 70-90 ^{0}F and no rain for the previous 4 to 5 days. Flow during this period varied between about 700 and 800 cfs. Data were collected using a YSI Pro ODO meter, which was calibrated to barometric pressure on September 9th according to YSI instructions. The September 9th river bank data and longer-term data (September 9 and 10) were from depths less than 0.5 meters. Applicant had intended to monitor DO to develop a longer continuous record, but battery life limited the data to 21 hours of continuous data collection.

Over the 24-hour period that DO was continuously measured immediately upstream of the arch section of Scott's Mill Dam, DO varied from a low of 6.6 mg/l at 3 am to a high of 9.0 mg/l at 9 am with an average of 7.6 mg/l over the period (**Table E-6-3**). Aquatic vegetation and algae may be partly responsible for the higher daytime DO levels.

From upstream to downstream in the Scott's Mill headpond, DO was relatively constant at about 7.5 mg/l. Similarly, water temperatures varied between 28 and 30 ^{0}C. Downstream of Scott's Mill Dam, DO increased by about 0.5 mg/l to about 8 mg/l. This is likely due to the aeration from flow over Scott's Mill Dam and in the reach downstream.

The September 12, 2016 cross-section data (vertical depth data) were collected by trailing the meter cable/probe behind a canoe using 10 second logging intervals. Due to the forward movement of the canoe, the actual depths are slightly less than the noted cable lengths. This data was collected from the left bank to Daniel Island. The deepest measurements are generally within the first half of the data for each cross-section.

These data indicate that DO and water temperature were relatively constant across the river at each depth measured. DO near the surface was approximately 8.2 mg/l and water temperature was about 28 ^{0}C. DO and temperature were slightly lower on the left bank.

TABLE E-6-3 WATER QUALITY AND TEMPERATURE DATA UPSTREAM OF SCOTT'S MILL DAM

50m u/s of Scott's Mill Dam arch section, 9/9/16-9/10/16, site 012, beginning at 16:24pm							
Meter time	**Actual time**	**DO (%)**	**DO (mg/L)**	**Temp (ºC)**	**Pressure (mm Hg)**	**Depth (m)**	**Notes**
0:37	17:01	100.9	7.9	27.9	753.1	0.3	
1:37	18:01	99.6	7.8	27.9	752.9	0.3	6pm, 9/9/16
2:37	19:01	99.0	7.8	27.9	752.9	0.3	
3:37	20:01	96.5	7.6	27.8	752.8	0.3	8pm
4:37	21:01	95.1	7.5	27.8	753.2	0.3	
5:37	22:01	94.1	7.4	27.7	753.2	0.3	10pm
6:37	23:01	92.0	7.2	27.7	753.9	0.3	
7:37	0:01	89.8	7.1	27.6	754.3	0.3	12 midnight, 9/9/16
8:37	1:01	88.7	7.0	27.6	754.9	0.3	
9:37	2:01	86.0	6.8	27.6	755.5	0.3	2am, 9/10/16
10:37	3:01	**83.9**	**6.6**	27.5	755.9	0.3	
11:37	4:01	89.8	7.1	27.6	756.2	0.3	4am
12:37	5:01	91.8	7.2	27.8	756.1	0.3	
13:37	6:01	95.8	7.5	27.9	755.8	0.3	6am
14:37	7:01	97.5	7.6	28.0	755.6	0.3	
15:37	8:01	108.0	8.4	28.2	755.4	0.3	8am
16:37	9:01	114.9	9.0	28.2	755.0	0.3	
17:37	10:01	**113.2**	**8.8**	28.3	754.9	0.3	10am
18:37	11:01	109.2	8.5	28.1	755.2	0.3	
19:37	12:01	102.2	8.0	28.0	755.9	0.3	12 noon, 9/10/16
20:37	13:01	98.8	7.8	27.9	756.8	0.3	
21:37	14:01	95.3	7.5	27.8	757.3	0.3	2pm

Four vertical profiles were measured, all in the main channel upstream of the straight section of Scott's Mill Dam. Profiles 1-2 were in the main channel, within 100 meters of the left river bank. Vertical Profile 3 was the deepest of the three. Vertical profile 4 was within 100 meters of Daniel Island.

The vertical profiles indicate a gradual decrease in temperature and DO with depth. The temperature range was generally between 1.2-2.0 C^0. The data indicate that there was little thermal stratification through the water column. This can be attributed to the short residence time of water in the headpond (i.e., less than one day). There was a general decrease in DO with depth, with the surface being about 8.5 mg/l and the bottom being about 6.8 mg/l.

In comparing Reusens reservoir and Scott's Mill headpond surface water temperature and DO, the water temperatures and DO in Reusens reservoir measured by Eagle Creek Renewable Energy for their license application were higher than measurements in Scott's Mill headpond and downstream. This is possibly because water from Reusens is released from below the surface, resulting in slightly cooler water and lower DO in Scott's Mill.

Applicant collected and analyzed sediment data for the presence of low-level poly chlorinated biphenyls (PCBs) on November 16, 2016 on Daniel Island 250 feet upstream of the dam and in the James River 160 feet upstream of the dam. (Details of the data collection effort are described in Study Plan 4 and **Appendix F**.) The sediment analysis indicated that PCB concentrations varied between 9 and 422 pg/g (parts per trillion) on Daniel Island and 9-75 pg/g in the James River. These PCB levels are not a source of concern.

6.3.2.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.2.2.1 EXISTING STATE WATER QUALITY STANDARDS AND THE PROJECT'S EFFECTS ON WATER QUALITY.

The water quality in the Project area would likely remain within the State water quality criteria under the proposed operation and continue to follow a similar diurnal and seasonal trend as existing conditions. The proposed operations may have a small effect on DO and temperature.

During existing conditions with a flow of about 800 cfs, almost all flow passes over the main (straight section) of the spillway. During the September 2016 DO measurements, Applicant estimated that no more than 10 cfs flowed over the arch section of the spillway, whereas almost 800 cfs flowed over the main spillway. Using the weir equation, Applicant estimated that 7 cfs flowed over the arch section on September 12th given that the arch section crest is 0.4 feet higher than the main spillway section. Therefore, most of the flow passed downstream in the main section of the James River.

During future project operations, Applicant estimates that about half the flow will pass downstream in the main section of the James River, approximately doubling the residence time from 1½ days to 3 days in this section of the James River. This could have the effect of slightly decreasing DO in this section of the James River. However, Applicant's measurements 50 meters upstream of the arch section of the dam where very little flow was coming from upstream showed DO levels varying from 6.63 mg/l to 8.96 mg/l, which were very similar to DO levels in the main portion of the river. Therefore, Applicant expects that DO (and water temperature) should not differ significantly from existing conditions during project operations.

Applicant proposes to monitor DO and water temperatures in the headpond upstream of the main spillway during low flow conditions during the first three years of operations and if DO falls below State water quality standards, Applicant will take steps to increase flow in the main channel area upstream of the Scott's Mill Dam by passing flow over the spillway as needed to meet water quality standards during low flow conditions.

Downstream of the main section of the spillway, DO could decrease by about 0.5 mg/l because of the reduced flows over the dam and associated reduction in reaeration. However, by directing flow from the powerhouse to the reach downstream of the main spillway section, Applicant intends to ensure state water quality standards are met downstream of the spillway. This should also preserve water quality for aquatic resources.

Construction of the powerhouse will require dredging of sediment upstream of Scott's Mill dam and excavation of rock downstream of the dam. Based on the results of the chemical analysis of sediment upstream of the dam, the sediments are not likely to be a source of elevated PCBs. Excavation of the powerhouse and tailrace will be undertaken within cofferdams. To minimize dredging effects on turbidity and resuspension of sediments, Applicant will use best management practices. Accordingly, project effects on water quality should be localized and minor. Since Applicant intends to use modular (off-site) construction for the project to the extent possible to minimize costs, this should also result in minimizing the potential for water quality effects from spills.

Requirements of Section 401 Water Quality Certification. Section 401 of the Clean Water Act (CWA) provides that FERC may not issue an original license for a project unless the State certifies that the Project will comply with CWA Sections 301, 302, 303, 306 and 307. These sections include State water quality standards approved by the U.S. Environmental Protection Agency (USEPA). Section 401 requires that any applicant for a Federal permit or license that may result in a discharge to waters of the United States must first obtain certification from the state. In Virginia, the agency authorized to issue Section 401 certifications is VDEQ. Applicant intends to refile its 401 Virginia Water Permit Application (Water Quality Certification application) in March 2022 after the Settlement Agreement is signed.

Flow gaging and plans for monitoring water quality. Due to the run-of-river nature of the Project, the current flow gages are sufficient for operational purposes. Applicant proposes to monitor headpond levels through use of video cameras at the Scott's Mill Project. Because the VDEQ monitors water quality immediately downstream of the project, there is no need for Applicant to conduct additional water quality monitoring other than for the first three years after project completion in order to monitor temperature and DO.

Applicant will continue to utilize the USGS Holcomb Rock gauging station (USGS No. 02025500).

6.3.3 AQUATIC RESOURCES

6.3.3.1 AFFECTED ENVIRONMENT

6.3.3.1.1 CHARACTERIZATION OF FISH HABITAT IN THE JAMES RIVER BASIN

The James River is the largest river located entirely within Virginia, and the third largest tributary to the Chesapeake Bay. The James River originates in the Allegheny Mountains at the junction of the Jackson and Cowpasture Rivers near Clifton Forge, Virginia (**Figure A-1**). The river flows generally southeast, traversing the Blue Ridge Mountains, the Piedmont Plateau and finally the Coastal Plain where it discharges into Chesapeake Bay approximately 340 miles from its origin. The upper section is characterized by cool water with mainly swift boulder-filled rapids and pool/run complexes with gravel/cobble substrates (VDGIF 2015b). Within the project area, there is an array of habitat types, with areas of slow to moderate current and mixed substrate.

The Middle River, from Lynchburg downstream to Bosher Dam in Henrico, flows through the Piedmont Plateau. This section is the flattest portion of the non-tidal James, and is composed of mild to moderate rapids and long sandy runs (VDGIF 2015b). A fish passage facility has been in operation at Bosher Dam since 1999. Below the Middle River, the character of the river changes dramatically. The 9-mile stretch of the James River that flows through Richmond (known locally as the fall-line section) 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 2015b).

There are 45 dams used for hydroelectric generation in the James River basin, about half of which occur in the lower portion of the river, while the other half are located in the upper 70-mile-long section. There are approximately 80 miles separating the lower dams from the upper river dams. Anadromous fish are currently able to pass upstream only to Scott's Mill Dam (the first in a series of 7 dams between Lynchburg and Cushaw). None of the seven dams between Lynchburg and Cushaw Dam currently provide fish passage. **Table E-6-4** identifies characteristics of the seven dams. Photos of the structures from Lynchburg to Cushaw are included in **Appendix C.**

6.3.3.1.2 JAMES RIVER RESIDENT AQUATIC SPECIES

The James River supports a variety of warmwater game and non-game fish and currently provides an excellent smallmouth bass fishery, with additional angling opportunities for muskellunge and catfish. Smallmouth bass are the dominant game species, but spotted and largemouth bass can also be caught. Other plentiful species in the James River include Channel Catfish, Flathead Catfish, and various sunfish species (redbreast, bluegill, and rock bass) and Muskellunge. The James River also supports many nongame species including telescope shiner, spottail shiner, rosyface shiner and stripeback darter (endemic to the James River). Invertebrates potentially inhabiting the project area include the James spiny-mussel (described in the Threatened and Endangered Species section). A list of aquatic species confirmed by VDGIF to occur in the James River upstream of Scott's Mill (Snowden Pool) and downstream (Middle River) is presented in **Table E-6-5**.

Below Scott's Mill Dam, the Middle River is characterized by higher ictalurid (catfish) abundance, migratory species (American Eel and Gizzard Shad), and centrachids more common to low gradient habitats (Largemouth and Spotted Bass). Flathead and Channel Catfish abundance peaks in the Middle River section while Blue Catfish abundance is greatest in the Lower River.

TABLE E-6-4 STRUCTURAL COMPONENTS OF THE DAMS BETWEEN SCOTT'S MILL AND CUSHAW

	Scott's Mill	Reusens	Holcomb Rock	Coleman Falls	Big Island	Bedford	Cushaw
Approximate River Mile[1]	258.5	262	270	272	276	279	280
Approximate Height (ft)	16	24	21	10-15	15	17	28
Length (ft)	875	416	644		657	1617	1550
Spillway Length (ft)	735	125.5	644		427	1617	1500
Approximate Angle of Face (degrees)	90	90	90	80	90	70-80	70-80
Construction Material	Sone masonry	Concrete with Flashboards[2]	Stone masonry / concrete	Concrete	Masonry and timber crib structure	Concrete	Concrete
Use	Drinking Water	Hydro	Hydro	Hydro	Hydro, water supply for mill	Hydro	Hydro
Average Eel CPUE[3]	D/S[4] 6.68 U/S[4] 7.02	U/S 0.25	Not a sample location	U/S 0.10	Not a sample location	Not a sample location	U/S 0.00

1) River mile is estimated based on the Cushaw location at RM 280 and Scott's Mill at 258.5.
2) Reusens Dam does not always have flow over the structure.
3) All CPUE's are calculated based on boat electrofishing conducted by VDGIF.
4) D/S = Downstream of dam; U/S = Upstream of dam.

Source: Dominion Virginia Power

TABLE E-6-5: LIST OF FISH SPECIES DOCUMENTED IN JAMES RIVER BASIN

Common Name	Scientific Name	Snowden Pool[a]	Middle River[b]
Bass, Largemouth	Micropterus salmoides	X	X
Bass, Rock	Ambloplites rupestris	X	X
Bass, Smallmouth	Micropterus dolomieu	X	X
Bass, Spotted	Micropterus punctulatus	X	X
Bluegill	Lepomis macrochirus	X	
Bullhead, Brown	Ameiurus nebulosus	X	
Bullhead, Yellow	Ameiurus natalis	X	
Common Carp	Cyprinus carpio	X	X
Catfish, Blue	Ictalurus furcatus		X
Catfish, Channel	Ictalurus punctatus	X	X
Catfish, Flathead	Pylodictis olivaris	X	X
Catfish, White	Ameiurus catus		
Chub, Bluehead	Nocomis leptocephalus	X	
Chub, Bull	Nocomis raneyi	X	X
Chub, Creek	Semotilus atromaculatus		
Chub, River	Nocomis micropogon		
Chubsucker, Creek	Erimyzon oblongus	X	
Crappie, Black	Pomoxis nigromaculatus	X	X
Dace, Blacknose	Rhinichthys atratulus		
Dace, Longnose	Rhinichthys cataractae		
Dace, Mountain Redbelly	Phoxinus oreas		
Dace, Rosyside	Clinostomus funduloides		
Darter, fantail	Etheostoma flabellare		
Darter, glassy	Etheostoma vitreum		
Darter, johnny	Etheostoma nigrum		

Darter, longfin	Etheostoma longimanum		
Darter, Roanoke	Percina roanoka	X	
Darter, Shield	Percina peltate		X
Darter, Stripeback	Percina notogramma	X	
Darter, tessellated	Etheostoma olmstedi		
Eel, American	Anguilla rostrate		X
Fallfish	Semotilus corporalis	X	
Gar, Longnose	Lepisosteus osseus		X
Goldfish	Carassius auratus		X
Hogsucker, Northern	Hypentelium nigricans	X	X
Jumprock, Black	Moxostoma cervinum	X	X
Lamprey, Sea	Petromyzon marinus		
Madtom, margined	Noturus insignis		
Minnow, Bluntnose	Pimephales notatus	X	
Minnow, Cutlips	Exoglossum maxillingua		
Muskellunge	Esox masquinongy	X	
Perch, Pirate	Aphredoderus sayanus sayanus		
Pumpkinseed	Lepomis gibbosus	X	
Quillback	Carpiodes cyprinus		X
Redhorse, Golden	Moxostoma erythrurum	X	
Redhorse, Shorthead	Moxostoma macrolepidotum	X	X
Sculpin, Mottled	Cottus bairdi		
Shad, American	Alosa sapidissima		
Shad, Gizzard	Dorosoma cepedianum		X
Shiner, Comely	Notropis amoenus	X	
Shiner, Common	Luxilus cornutus	X	
Shiner, Crescent	Luxilus cerasinus	X	
Shiner, Golden	Notemigonus crysoleucas	X	

Shiner, Mimic	Notropis volucellus	X	
Shiner, Rosefin	Lythrurus umbratilis	X	
Shiner, Rosyface	Notropis rubellus	X	
Shiner, Roughhead	Notropis semperasper	X	
Shiner, Satinfin	Cyprinella analostana	X	
Shiner, Spottail	Notropis hudsonius	X	
Shiner, Swallowtail	Notropis procne	X	
Shiner, Telescope	Notropis telescopus	X	
Stoneroller, Central	Campostoma anomalum	X	
Sucker, Torrent	Moxostoma rhothoecum		
Sucker, White	Catostomus commersonii	X	X
Sunfish, Green	Lepomis cyanellus	X	X
Sunfish, Hybrid	Lepomis sp	X	
Sunfish, Redbreast	Lepomis auritus	X	X
Sunfish, Redear	Lepomis microlophus	X	X
Trout, Brook	Salvelinus fontinalis		
Trout, Rainbow	Onchorhynchus mykiss		
Warmouth	Lepomis gulosus		

Source:

a: Snowden Pool sampling from 1991 through 2001, no sampling occurred in 1996 (Dominion 2003)

b: Middle James River between Columbia and Watkins Landing, October 2011 (VDGIF 2012)

The following paragraphs describe the key resident fish species found near Scott's Mill.

Muskellunge: Muskellunge (*Esox masquinongy*) are not native to Virginia Rivers. They were first introduced in the 1960's, and were stocked regularly until 2010 when VDWR determined the species to be self-supporting. Muskellunges are considered as a high value sport fish. Density of populations is dependent upon prey abundance, as well as stocking abundance. Muskellunges are voracious feeders, eating microcrustaceans and insect larvae as fry, switching to small fish as juveniles, and eating nearly anything as adults, including fish, amphibians, crustaceans, and even mammals and birds. If prey of suitable size is not available to adults, the population will be affected, even if the small fish are abundant (Cook and Solomon 1987, Jenkins and Burkhead 1993).

Muskellunge typically live 6-8 years (females typically outlive the males), but can live much longer. Sexual maturity is reached around 3-5 years, with males reaching sexual maturity before females. Spawning takes place in the spring, typically from April to June. Water temperatures near 13º C are optimal, but spawning will take place at temperatures between 9.5 and 15.5º C. A decrease in water temperature or an increase in flows can disrupt spawning and reduce reproductive success. Muskellunge spawn in shallow water, usually over detritus or living vegetation. Spawning takes place both during the day and night. They are broadcast spawners, and the eggs settle down to the substrate, and hatching takes place in 7 to 14 days (Cook and Solomon 1987, Jenkins and Burkhead 1993, Butler 2004).

Muskellunges are solitary fish, growing to very large sizes (up to 1,000 mm), and establish a home range in summer and winter. During the spawning season, however, the home range breaks down. Their preferred habitat is clear waters with temperatures between 17 and 25º C, streams with aquatic vegetation and submerged structures (Cook and Solomon 1987).

Smallmouth Bass: Smallmouth bass (*Micropterus dolomieu*) were introduced into the James River in the early 1800's, and have become a valuable sport fish in the watershed. They live in both cool and warm water environments, generally in large creeks or rivers greater than 10.5 m wide with clear water, gravelly or rocky substrates, and plenty of shade and cover. They also prefer systems with a frequent succession of riffles, runs and pools, though they mostly inhabit runs and pools. They are often the dominant species when occupying reservoirs and impounded streams. During winter, smallmouth bass occupy deep pool habitat (Edwards et al. 1983; Jenkins and Burkhead 1993).

Smallmouth bass exhibit strong cover-seeking behavior, preferring protection from sunlight during all life stages. They will use deep water, boulders, submerged woody debris, rootwads and crevices, without preference for any specific cover type. They can tolerate periodic bursts of increased turbidity, but will show a reduction in survival in areas with prolonged turbidity (Edwards et al. 1983; Jenkins and Burkhead 1993).

Smallmouth bass at all life stages are carnivorous, feeding on microcrustaceans, insects and small fish while fingerlings, and moving up to crayfish and larger fishes as adults.

Smallmouth bass typically live up to 7 years, and reach sexual maturity in 3-4 years. Spawning takes place in late April through May when water temperatures are between 16 and 22º C. Nests are defended by the males until several days following hatching (Edwards et al. 1983; Jenkins and Burkhead 1993).

Rock bass: Rock bass (*Ambloplites rupestris*) are found in streams with permanent flow, low turbidity, abundant cover and silt-free bottoms. They may occupy pools and backwaters. The rock bass is considered to be a sedentary and secretive fish spending much of its time passively hiding near underwater structures (http://www.rook.org/earl/bwca/nature/fish/ambloplites.html). They can change color very quickly to match their surroundings. Feeding occurs mainly at night with aquatic insects making up the bulk of the diet but they will also eat fish and crayfish (Jenkins and Burkhead 1993, http://dnr.state.il.us/lands/education/fish/sunfish.htm).

Sexual maturity is reached by age 3, and most do not live past 6 years. Spawning typically occurs between April to July when water temperatures are between 15.6 and 22º C. Eggs are released into a saucer-shaped nest fanned out by the male in coarse sand or fine gravel. The rock bass nests individually, and the male remains with the nest until the fry have dispersed. After hatching, the young fish are found only in quiet water areas protected from waves and strong currents (Jenkins and Burkhead 1993, http://dnr.state.il.us/lands/education/fish/sunfish.htm; http://www.rook.org/earl/bwca/nature/fish/ambloplites.html).

Redbreast sunfish: Redbreast sunfish (*Lepomis auritus*) are native to Virginia and the James River watershed and are a popular sportfish. The redbreast sunfish lives in small creeks to big rivers and reservoirs. They can tolerate silted, turbid water, but prefer warm, clear water. They prefer the same habitat as smallmouth bass and rock bass, and are often found in the larger rivers with them, but they also frequent the shallower water. They can be found in waters as warm as 39º C (Aho et al. 1986, Jenkins and Burkhead 1993; http://sites.state.pa.us/PA_Exec/Fish_Boat/pafish/fishhtms/chap22.htm).

Redbreast sunfish are generalists, feeding on aquatic and terrestrial insects, crayfish and other arthropods, mollusks, and sometimes fishes. Although widespread, redbreast sunfish are not as locally abundant as other sunfishes, and they are normally solitary when the water is warm. When the water cools, redbreasts form schools (Aho et al. 1986; Jenkins and Burkhead 1993, http://sites.state.pa.us/PA_Exec/Fish_Boat/pafish/fishhtms/chap22.htm).

Sexual maturity is reached by 2 years, and the life span is typically 4-5 years, though they can live up to 8 years. Spawning takes place in May through July with water temperatures between 16-28º C. Male redbreast sunfish construct a shallow nest in fine gravel or sand. They construct a single nest, but the nests may be grouped in closely packed colonies, when appropriate bottom material is in short supply. They guard the eggs and protect the young for a short while after the eggs hatch (Aho et al. 1986; Jenkins and Burkhead 1993; http://sites.state.pa.us/PA_Exec/Fish_Boat/pafish/fishhtms/chap22.htm).

Bluegill: Bluegill (*Lepomis macrochirus*) are native fish in the James River drainage, and are also considered a valuable sport fish in the system. Bluegill occupy areas of low velocity, including pools, backwater areas, lakes, reservoirs and ponds. They can be found in both clear and turbid waters, systems with hard or silted substrates, and in areas with submerged cover structures, such as boulders, woody debris or brush. Bluegill will use deep pools in the winter and summer. Optimal water temperatures for growth of adults, hatching, fry rearing, and juvenile rearing occurs at 27º C, 22-34º C, 25-32º C, and 22-34º C respectively (Stuber et al. 1982; Jenkins and Burkhead 1993).

Opportunistic feeders, bluegill will alter their diet based on available food. Fry feed on zooplankton and small insects. Adults and juveniles feed also on zooplankton and larger insects and on plant material (Stuber et al. 1982; Jenkins and Burkhead 1993).

Bluegill reach sexual maturity in 1-2 years, with most individuals living 4-6 years, but as long as 11 years. Spawning takes place from May to August or even September. Males construct nests in shallow water on sand or smaller gravel and will guard the nests. Hatching takes place 1-5 days following spawning (Stuber et al. 1982; Jenkins and Burkhead 1993).

Spottail shiner: The spottail shiner (*Notropis hudsonius*) is native to the James River. They inhabit creeks and small to large rivers. They live in rocky systems with clear water or turbid waters with sand and silt bottoms. They occupy pools, backwaters, runs and sometimes riffles. Spottail shiner feed mostly on microcrustaceans, terrestrial and aquatic invertebrates, fish eggs and plant material. They, like many in the minnow family, provide a primary food source for larger predatory fish (Jenkins and Burkhead 1993; http://lanier.sam.usace.army.mil/fishing/Spottail_Shiner.htm).

They reach sexual maturity by age 1 or 2, and live up to 5 years. Spawning depends upon water temperature, but typically occurs during mid-April to mid-June. Spottail shiner spawn in groups, either few individuals to large aggregates. Following spawning, eggs have been found attached to sand and gravel in shallow riffles (Jenkins and Burkhead 1993).

Stripeback darter: Stripeback darter (*Percina notogramma*) is endemic to the Atlantic slope from the Patuxent drainage in Maryland to the James River drainage of Virginia and West Virginia. There are two subspecies of stripeback darters; P. n. montuosa is endemic to the upper and middle James River drainage. They occupy warm, moderate-gradient streams and rivers with mostly clear water.

Their preferred habitats are riffles, pools near riffles and sometimes weedbeds. They are often found among gravel, cobble and boulder substrates that were clean, silted or cloaked with detritus. Stripeback darter feeds on insects and other invertebrates (Jenkins and Burkhead 1993).

The life span of the stripeback darter is approximately 3 years. Females and males grow at similar rates. Sexual maturity is reached by year 2, and spawning occurs March to mid-May in water 7-16° C. Spawning probably occurs over gravel riffles. Fecundity is unknown. Stripeback darter naturally hybridize with the shield darter (P. peltata).
(http://www.cnr.vt.edu/efish/families/stripeback.html; Jenkins and Burkhead 1993).

6.3.3.1.3 DIADROMOUS FISH SPECIES

Several diadromous fish species including American Shad, Alewife, Blueback Herring, Striped Bass, Sea Lamprey and American Eel occur in the James River. They are discussed below.

American Shad: American Shad are anadromous fish that spend the majority of their life at sea and only enter freshwater to spawn. Shad are river-specific; each major river along the Atlantic coast appears to have a discrete spawning stock. Mixed stocks of American Shad enter the lower Chesapeake Bay in late winter-early spring and segregate into river-specific populations (ASMFC 2007). Most adults spawn once and die, repeat spawning does occur, the incidence of which increases with increasing latitude (NMFS 1999).

American Shad spawn in freshwater portions of the rivers, usually beginning in March and ending in June with peaks in April, by broadcasting a large quantity of eggs into the water column. The annual spawning run consists of virgin fish 3 to 7 years in age (based on analysis of scales) plus repeat spawners (age-4 through age-12). American Shad age-9 and older are rare; maximum age recorded is 12 years.

Fertilized eggs are carried by river currents and hatch within 2-17 days depending on water temperatures (NMFS 1999). Larvae drift with the current until they mature into juveniles. Juveniles remain in nursery areas, feeding on copepods, other crustaceans, zooplankton, chironomid larvae, and aquatic and terrestrial insects (NMFS 1999). By late fall, most juvenile shad migrate to nearshore coastal wintering areas. Immature shad will remain in the ocean for three to six years before returning to spawn. Little information is available on the life history of subadult and adult American Shad after they emigrate to the sea. American Shad is a highly migratory, schooling species. After spawning, iteroparous adult American Shad return to the sea and migrate northward to their summer feeding grounds in the Gulf of Maine/Bay of Fundy where they primarily feed on zooplankton and small fishes. Overwintering (winter habitat) occurs along the mid-Atlantic coast, particularly from Maryland to North Carolina (NMFS 1999). American Shad follow fairly specific temperature windows of 3 to 15º C during their migration at sea (ASMFC 2007).

As an anadromous fish, American Shad are negatively impacted by obstructions to migration from marine and estuarine habitats to the upstream freshwater spawning and rearing habitats. Habitat degradation, water withdrawals and pollution, overfishing and dams that block migration to spawning grounds have contributed to the decline of the American Shad (Hilton et al. 2014).

In response to the declining populations, members of the ASMFC recommended the preparation of a cooperative Interstate Fishery Management Plan (FMP) for American Shad and River Herring, which was adopted in 1985. The FMP recommended management measures, focused primarily on regulating exploitation and enhancing stock restoration efforts. The FMP was amended and approved in 1999. The goal of Amendment 1 is to protect, enhance, and restore East Coast migratory spawning stock of American Shad, hickory shad, and river herring (Alewife and Blueback Herring collectively) in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass. In the James River, the sampling program was to address: annual spawning stock survey and representative sampling for biological data; calculation of mortality and/or survival estimates; juvenile abundance surveys; hatchery evaluation; and monitoring of recreational landings, catch and effort every 5 years. In 2010, the Shad and River Herring Management Board approved Amendment 3, addressing American Shad management (ASMFC 2010). As a requirement of Amendment 3, biologists from Virginia Institute of Marine Science, Virginia Marine Resources Commission (VMRC), and VDWR collaboratively developed the American Shad Habitat Plan for the Commonwealth of Virginia (Hilton et al. 2014).

Shad have historically ascended farther upriver than at present within tributaries that are obstructed. Construction of the Bosher Dam fishway, functional beginning in 1999, was intended to restore migration to these historic habitats. The goal for the Upper James River is to restore 500,000 shad passing Bosher Dam annually and 34.66 catch-per-unit-effort in the Lower River (Chesapeake Bay Program 2014). The Lower James River target is based on shad abundance levels during the 1950s and the Upper James River target is based on the number of shad that can be supported by the 137 miles (or 11,930 acres) of habitat available above the Bosher Dam fishway.

Between 2000 and 2014, abundance of American Shad in the James River has hovered around 10 percent of the target, with peaks of 14 percent in 2003 and 2011 and a low of 2 percent in 2006 (Chesapeake Bay Program 2014). Abundance estimates for the James are a weighted combination of data collected in the upper and lower portions of the river. In the Upper[8] James, abundance has remained minimal at less than 1 percent of the target. The range of shad passing Bosher Dam over this period was 24-669 annually, with an average of 217 fish. In the Lower James, abundance has fluctuated between 4 and 27 percent of the target. Between 2013 and 2014, abundance rose from 7 to 12 percent of the target. In the Upper James, abundance remained minimal at less than 1 percent of the target (from 192 to 24 shad passing Bosher Dam). In the Lower James, abundance rose from 13 to 21 percent of the target (4.5 to 7.4 CPUE) (Chesapeake Bay Program 2014).

The Virginia Marine Resources Commission imposed a moratorium on the taking of American Shad in Virginia Rivers and the Chesapeake Bay in 1994 in response to sharp declines in commercial landings (Hilton et al. 2013). The ocean-intercept fishery in Virginia coastal waters was closed in December 2004 (ASMFC 2007). Drift-net fishing by two Native American tribal governments and the taking of brood stock by the Virginia Department of Wildlife Resources on the spawning grounds of the York River system for stock restoration in the James River are permitted. An active catch and release recreational fishery exists on the James River.

In spring 1994, the VDWR and the USFWS began hatchery-restocking efforts in the James and Pamunkey rivers. Adult shad from the Pamunkey River are used as brood stock for the James River releases. The success of the restoration program in the James River was evidenced by increasing adult catch rates by monitoring gear in 1998 through 2002 as large numbers of mature hatchery fish returned to the spawning grounds.

In the James River, juvenile abundance indices (JAI) show a period of relatively high values in early 1980s, a low period from the mid-1980s to the mid-1990s, and then occasional high values until 2005 when all Lower Chesapeake Bay River indices declined (ASMFC 2007). The James River JAI time series displays no measurable recruitment in most years with only 5 non-zero years since 1980. There has been a significant increase in staked gill net CPUE on the James River since the 1980s while there has been no trend in fishery-independent electrofishing or gill-net survey indices on the James River over the same time (ASMFC 2007).

A comparison of the historical and current catch indices indicates that the James River stock has not recovered from the severe declines in the 1980s and early 1990s. Although densities of larval shad are often high on the spawning grounds, there is little evidence of recruitment success on the James River, and the stock is

[8] In this context the Upper James River is above Bosher's dam.

dependent on hatchery inputs (ASMFC 2007). In 2012, 34% of the James River returns were composed of hatchery fish (Hilton et al. 2014).

The American Shad habitat plan (Hilton et al. 2014) identifies the need for further study of freshwater habitat use by American Shad in Virginia, specifically, quantification and analysis of specific reaches of riverine habitats used during residency (adults during the spawning run, larvae, and juveniles) to better manage and address habitat concerns of the species.

In 2017, the Commonwealth of Virginia announced that it was halting the shad stocking program in the James River, because there were only limited signs of recovery (Karl Blankenship, Bay Journal, September 17, 2017), and the amount of money spent on shad fry stocking was not justified. It was originally thought that opening up the James River and placing a fishing moratorium on American Shad would trigger a restoration, but unfortunately the long-term average was only about 200 returning adults annually through the fall zone up to and through the fishway.

In a September 29, 2017 conference call with VDWR and the USFWS, those agencies noted that passage of American Shad at Scott's Mill may not be required for some time. However, the agency staff also said that restoration of American Shad in the James River is a matter of time.

The Bay Journal article stated that the Virginia Institute of Marine Science (VIMS) catch index, which is downriver of Richmond, has also been well below targets. There is no total American Shad annual population estimate for the James River, only indices of abundance from the fishway count and the VIMS catch index. There is spawning habitat on the James in the fall zone below Bosher's fishway and in several tidal miles downstream of Richmond. The total number returning to the James River annually is a much higher number than at the Bosher fishway. The Bosher count is only providing information on the numbers of Shad moving into the middle James beyond Richmond, not the number of Shad in the entire James River. While there is spawning habitat available downstream of Bosher Dam, access to all historical spawning and rearing habitat is considered to be a necessary part of **fully** restoring the James River American Shad population.

River Herring: The anadromous river herring (Alewife and Blueback Herring) spawn in the spring in rivers from Florida through Maine and up into Canada. The newly spawned fish migrate out of the rivers into the ocean in the fall, where they spend the next three to five years of their life (ASMFC 2012b). When they are sexually mature, they return to the river where they were born to spawn. Unlike salmon, river herring do not all die after spawning and may return to spawn several times over the course of their lives. The oldest observed ages for river herring are 14 years for Alewife and 11 for Blueback Herring, but the oldest fish seen in rivers today are six to eight years old (ASMFC 2012b).

The Fishery Management Plan (FMP) for Shad and River Herring was developed by the ASMFC in 1985. In 1994, the Shad and River Herring Management Board determined that the FMP was no longer adequate for protecting or restoring the remaining shad and river herring stocks (ASMFC 2012b). Amendment 1 recommended fishery-dependent and independent monitoring programs in order to improve stock assessment capabilities (ASMFC 2012b). In 2009, the Shad and River Herring Management Board approved Amendment 2, which strengthened river herring management by prohibiting state waters commercial and recreational fisheries beginning January 1, 2012, unless a state or jurisdiction has a sustainable management plan reviewed by the Technical Committee and approved by the Management Board (ASMFC 2012b). Amendment 2 required states to implement fisheries-dependent and independent monitoring programs, and contains recommendations to member states and jurisdictions to conserve, restore, and protect critical river herring habitat. As of January 1, 2012, the Shad and River Herring Management Board approved sustainable fishery management plans for Maine, New Hampshire, New York, North Carolina and South Carolina.

In 2011, the Natural Resources Defense Council petitioned NOAA Fisheries to list river herring on the endangered species list throughout all or part of the species range; NOAA Fisheries conducted a status review and found that the listing was not warranted in 2013. In May 2015, the Commission and NOAA Fisheries released the River Herring Conservation Plan (http://www.greateratlantic.fisheries.noaa.gov/protected/riverherring/conserv/index.html), with the goals of increasing public awareness about river herring (Alewife and Blueback Herring), and fostering cooperative research and conservation efforts to restore river herring along the Atlantic coast.

ASMFC completed a benchmark stock assessment of river herring in 2012. For many rivers, data were inadequate to conduct a model-based stock assessment. Estimates of abundance and fishing mortality could not be developed because of the lack of adequate data (ASMFC 2012b). Trend analysis was used to identify patterns in the available fishery-dependent and -independent data sets. James River data was inadequate to develop a stock status. However, of the 52 stocks of Alewife and Blueback Herring for which data were available, 23 were depleted relative to historic levels, one stock was increasing, and the status of 28 stocks could not be determined because the time-series of available data was too short (ASMFC 2012b).

Since the mid-1990s, commercial CPUE indices for alewives showed declining trends in the James River. The juvenile-adult indices from fisheries-independent seine, gillnet and electrofishing surveys showed a stable or increasing trend for Alewife and Blueback Herring in the James River. VDWR has conducted annual electrofishing surveys; between 2002 and 2010, compared to alewives (<0.2 fish per minute), Blueback Herring (0.4-2 fish per minute) have dominated the catch

(ASMFC 2012b). There are no obvious trends in the JAI time series for either of the species, and variability about the annual estimates has been fairly high.

American Eel: The American Eel (*Anguilla rostrata*) historically migrated throughout the James River watershed. However, the introductions of dams and passage barriers have reduced their use of the James River. The current stock status of the American Eel is classified as *depleted* (ASMFC 2012a). Resource agencies have a goal to restore American Eel to their historic habitat.

The American Eel is a catadromous species, which means it spawns in the ocean, but spends most of its time rearing in the estuarine or fresh waters. Typically, those individuals that occupy more northern habitats tend to migrate later, grow larger and older, and therefore, females from the northern regions of their range, typically have a higher fecundity.

After spawning, adults die, and eggs and leptocephali (larvae) are transported by the prevailing currents along coastal areas. Glass eels (metamorphosed leptocephali) are transparent eel ranging in size from 5 – 10 cm. They actively migrate towards land where they begin their ascension into estuaries and rivers during the winter and spring. Migration typically occurs at night and is related to reaching a minimum threshold temperature in rivers (usually 10 to 12 degrees Celsius), and the occurrence of a full or new moon and freshets (ASMFC 2012a).

Once the glass eel has entered brackish or freshwater, they transform again, become pigmented, and are then called elvers. Elvers are active at night but burrow in the substrate during daylight. Upstream migration of elvers occurs over a broad space of time, between May and October. It is assumed that they move upstream resulting from a change in water chemistry and water current velocities. Growth is slow and highly variable.

The last juvenile stage of the American eel is known as the yellow eel. These juveniles resemble adults, but are typically yellow or green in color. Sizes range up to 28 cm for males and 46 cm for females, and are up to 2 years of age. Yellow eels live in bays, estuaries, rivers, streams, lakes and ponds, feeding mostly on invertebrates and small fish. Migration up into the watershed takes place from March through October, and may continue until sexual maturity is achieved. Maturation in the Chesapeake Bay Region is 8 to 24 years. Upstream migration typically occurs in the glass eel and elver stage, but yellow American Eels sometimes continue upstream migrations.

Downstream migration triggers transformation into the adult phase (silver eel), which includes several physiological changes, including 1) a color change from yellow/green to a metallic bronze-black sheen, 2) body fattening, 3) skin thickening, 4) enlargement of the eye and change in visual pigment, 5) increased length of capillaries in the rete of the swim bladder, and 6) digestive tract degeneration.

Silver eels can make long migrations in a short period of time (as much as 38 km in 40 hours), but show no behavioral change with diel or tidal cycles. During downstream river migration, silver eels typically move at night during the darker moon phases, high water flows, and decreasing water temperatures (ASMFC 2012a). There is little information about the ocean spawning migration or how they orient to the Sargasso Sea. There is no information on the spawning requirements behaviors, or even the exact location of spawning.

Eels were formerly extremely abundant in inland waters of eastern North America, colonizing lakes, rivers, streams, and estuaries. The current depletion of the American Eel is in part due to fishing that occurred in the 1970s into the 1980s as export demand rose. A suite of stressors including habitat loss from dams or urbanization, turbine mortality, the non-native swim bladder parasitic nematode *Anguillicolla crassus*, toxic pollutants, and climate change are all factors that act in concert with fishing mortality on American Eel (ASMFC 2012a).

A. crassus may be reducing American Eel survival during the yellow and silver eel life stages. The nematode prefers freshwater but can survive brackish or salt water. Chesapeake Bay infection rates were between 10% and 29% in the late 1990s and had increased to between 13% and 82% by 1998 to 1999 (ASMFC 2012a). In 2007, infection rate in James River eels was 17.8% (ASMFC 2012a).

With the implementation of the ASMFC Interstate Fishery Management Plan for American Eel in 2001 (ASMFC 2000), Virginia among other states implemented a six-inch minimum size limit for American Eels; currently, there is no silver eel fishery in Virginia. Catch rates were calculated for the James River commercial eel pot fishery from data associated with positive effort by dividing the amount of harvest of American Eels landed by the number of eel pots. Annual catch rates were variable between 1994 and 2009, ranging from approximately 1.2 to 4.5 pounds per number of pots; catch rates demonstrated a decline during the mid- to late 1990s with the peak catch rate occurring in 2002. While not a target of recreational fishing, data has indicated a significant decline in American Eel as bycatch in the mid-Atlantic region since the 1980s.

Under the FMP for American Eel, Virginia is required to conduct an annual young-of-year (YOY) abundance survey (ASMFC 2000). Accordingly, sampling for young-of-year has occurred at Wareham’s Pond on the lower James River since 2003 following the standard protocol approved by the ASMFC American Eel Technical Committee (ASMFC 2012a). However, annual recruitment indices have not been computed (ASMFC 2012a). VDWR and USFS have also conducted investigations of eel movement in the Tye River between 1999 and 2001 (Strickland 2002).

Sea Lamprey: Sea Lamprey (*Petromyzon marinus*) are among the 20 species of fish passed at Bosher Dam. Adults can reach up to 120 cm in length and weigh up to 5 pounds. Sea Lamprey migrate up rivers to spawn. After several years in freshwater habitats, the larvae undergo a metamorphosis that allows young lampreys to migrate to the ocean. Resource agencies have noted the need for passage of Sea Lamprey (see **Appendix A**, September 29, 2017 teleconference notes in consultation record).

6.3.3.1.4 VDWR ANNUAL FIELD SURVEYS

The VDWR conducts annual surveys of fish resources in the upper James River, primarily targeting smallmouth bass. Results of electrofishing surveys conducted above and below the Scott's Mill Dam are available from 1991 through 2020. Smallmouth bass, telescope shiner, bluntnose minnow, rock bass, bluegill and redbreast sunfish were caught in every year sampled and were generally among the most abundant species.

During boat electrofishing conducted in September and October of 2014, a total of 48 species were documented at 27 sample sites located between river kilometer (RKM) 168 and RKM 555[9] (VDWR 2015a). The five most numerous species collected were Smallmouth Bass, Rock Bass, American Eel, Redbreast Sunfish, and Bull Chub, comprising 25.5, 12.8, 11.0, 6.7, and 6.2 percent of the total catch, respectively (VDWR 2015a).

During the VDWR fall 2014 sampling in the Upper River, 905 smallmouth bass were collected ranging from 3 to 22 inches (VDWR 2015b). Approximately 51 percent of all smallmouth bass were juvenile smallmouth bass (less than 7 inches). Conversely, adult abundance was considerably low, likely still recovering from several years of poor recruitment. The majority of the adult smallmouth bass collected in the Upper River were between 7-14 inches and only 36 individuals greater than 14 inches were collected (VDWR 2015b). Results for the Middle River were similar.

In recent years, recruitment has been poor throughout the river due to low spring and summer flow conditions (VDWR 2012). However, 2014 flow conditions were ideal for young-of-year bass survival; the second highest CPUE of age zero fish since 1991 was documented during VDWR fall 2014 sampling (VDWR 2015a).

[9] This reach includes the Scott's Mill dam at approximately RKM 416.

Analysis of the 2014 data indicated no significant trend in diversity by RKM; all sites were essentially equal in diversity score with the exception of one site that is possibly influenced by the Tye River (VDWR 2015a). However, there was a significant difference in the fish assemblage between the Upper River (Eagle Rock to Lynchburg) and the middle and lower portion of the river. The difference in fish assemblages is most likely due to the seven dams between Buchanan and Lynchburg, impeding movement of migratory species, and a change in river morphology below Lynchburg associated with a change in physiographic province.

In October 2011, VDWR sampled the fish community in the Middle James River at six locations between Columbia and Watkins Landings (VDWR 2012). Twenty-three species were collected. American Eel was the most abundant species collected, followed by smallmouth bass, sunfish and Channel Catfish. Smallmouth bass were present at all six sampling sites. Redbreast Sunfish and Bluegill comprised the bulk (88%) of sunfish collected. Flathead Catfish were also found in the Middle River, but not nearly as abundant as Channel Catfish. Largemouth Bass were fairly uncommon throughout the Middle James River, and collected largemouth bass were generally small (<12 inches) (VDWR 2012).

The VDWR records include capture of small numbers of American Eel in the reach between Lynchburg and Cushaw Dam. The average electrofishing CPUE (catch per-unit-effort) obtained by VDWR for sample sites downstream of Reusens Dam was around 7 eels/hour, while the CPUE upstream of Reusens averaged less than 1 eel/hour (see **Table E-6-4**). VDWR captured only one individual upstream of Big Island (in the 2005 fall sample) (Scott Smith, personal communication).

For its Cushaw relicensing effort, Dominion Generation conducted a field effort in 2005 directed towards examining the presence of American eels in the vicinity of Cushaw Dam. The effort was developed in consultation with the USFWS, and the VDWR. A total of 31 eels were collected over 3,881.1 hours of eel pot fishing - 26 eels were collected at Lynchburg downstream of Scott's Mill Dam, five were collected at Bedford downstream of Cushaw Dam, and no eels were captured upstream of the Cushaw Dam (Cushaw Application for FERC License, Dominion 2006). All eels captured in the eel pots were examined in the laboratory for the swim bladder parasite *Anguillicola crassus*. Seven of the 26 eels collected at Lynchburg (27%) were infested with *A. crassus*, with a maximum of 7 nematodes found in one 435 mm eel. No *A. crassus* were found in the eels from the Bedford pool.

Commission staff requested American Eel data related to effort proximate to the Scotts Mill Dam. These data are provided in **Appendix M**. The RM 260 data was collected 1991 – 2000 and the RM 257 and 266 sites 2010 – 2019. The summary data indicate that the catch per unit effort was similar in the Scott's Mill headpond and downstream of Scott's Mill Dam. However, upstream of Scott's Mill the CPUE was considerably lower. This indicates that American eel are able to make it upstream of Scott's Mill, but have a much more difficult time passing upstream of Reusens because the Reusens Dam is considerably higher than Scott's Mill.

6.3.3.1.5 DISEASE

Chronic spring-time fish mortality and disease events have occurred in the Upper James River from 2007-2010 (VDWR 2014). These episodes have not been uniform in location or severity and have not occurred every year. These events have been less common since 2010. In 2014, mortality was low in the James River; angler reports of dead or diseased fish were almost non-existent. Adult smallmouth bass, redbreast sunfish and rock bass have been the primary fish affected, but several other species have also been inflicted. Affected fish typically exhibit open sores or lesions on the sides of their bodies while some dead and dying fish have no visible external abnormalities. Other external symptoms include: dark patches of skin, raised bumps, loss of scales, split or eroded fins, and discolored/eroded gills (VDWR 2010).

The cause of these mortality/disease events has not been determined (VDWR 2014). Scientists have and continue to conduct in-depth studies on fish health, pathogens, water quality, contaminant exposure and recently have begun looking at possible toxins released by bacteria. The fact that these events have occurred in multiple watersheds that differ in many ways has added to the complexity of understanding the primary cause.

6.3.3.1.6 RECREATIONAL FISHERY

The James River is an important regional recreational fishery. Angling pressure on the James River is exceptionally high. VDWR conducted an angler survey of the Upper James River in summer and early fall of 2000 (Dominion 2003). Approximately 78 percent of the anglers surveyed were targeting smallmouth bass, 16.5 percent expressed no species preference but were generally fishing for smallmouth bass, 4.0 percent were targeting muskellunge, and 1.0 percent flathead or Channel Catfish. Smallmouth bass constituted 82.3 percent of all fish caught, while rock bass accounted for 10.4 percent and sunfish 6.7 percent (Dominion 2003). All other species contributed less than 1 percent of the total estimated catch. Approximately ten percent of all smallmouth bass caught by anglers were greater than 14 inches in length, indicative of a high-quality fishery. The survey also indicated an overall catch rate of 2.17 fish/hour, which is considered high compared to angler surveys on other water bodies. Seventy-three percent of the anglers surveyed practiced catch and release. Fish densities for the upper James River have not been quantitatively determined, but qualitative electrofishing data suggest a smallmouth bass density in the range of 10-20 fish $\geq$ 14 inches length/mile (Dominion 2003).

6.3.3.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.3.2.1 MANAGEMENT OBJECTIVES

The resource agency management objectives for the fishery or fish habitat are as follows:

- restore stream health to historic habitat conditions and to benefit aquatic threatened and endangered species;
- assist private landowners with riparian habitats through partnership program in efforts to improve fish habitat;
- maintain high quality sport fishery; and
- ensure fish passage upstream.

6.3.3.2.2 PROJECT EFFECTS ON AQUATIC HABITAT

During project construction, a short section of the reach immediately downstream of the arch section of Scott's Mill Dam will be dewatered for the construction effort. This will cause a short-term temporary loss of habitat. Applicant will use best management practices to limit project impacts to aquatic habitat both upstream and downstream of the construction zone.

Licensing participants expressed concern that changes to flows both upstream and downstream of Scott's Mill Dam during project operations could affect aquatic habitat and recommended use of the PHABSIM model. In Study Plan 7, Applicant proposed evaluating the effects of flow, water level, water velocity, bathymetry and water quality on fish habitat and if appropriate, proposed that a PHABSIM model would be employed. However, after examining the changes in water levels, water velocities, and water quality, Applicant determined that PHABSIM would not be necessary to assess habitat changes.

Applicant is proposing to maintain essentially constant water levels up to the 4,500 cfs hydraulic capacity of the project. That is, during lower flows, the water levels would be slightly greater than existing conditions by up to 1 to 1 ½ feet. During average flows and above, project operation water levels with a two-foot high concrete cap would be slightly higher than under current conditions. Since Applicant intends to draw about half the flow from the left side of the river through the powerplant up to the capacity of the plant (i.e., 4,500 cfs), flows through the main channel could be reduced by about half. Given that water levels will essentially be the same as during existing conditions, velocities in the main channel could therefore be decreased to half during low and median flows. However, given the existing bathymetry, velocity measurements during flow conditions of about 1,800 cfs indicated that velocities were on the order of ¼ foot per second. Therefore, during project operations, velocities in the main channel could be on the order of 1/8 fps. Thus, during low and median flow conditions, the aquatic environment upstream would remain lentic and effects on fish habitat are expected to be very minor, especially since water quality upstream of the dam is also expected to be similar to existing conditions.

During high flow conditions, water will flow over the main section of the spillway similar to the way it does today. Headpond water levels would be up to 2.6 feet higher during project operations (see Section 6.3.2.1.4). Since the depths upstream typically vary from 10 to 20 feet, water quality, sediment transport and flow velocities are not expected to vary significantly from existing conditions, resulting in similar aquatic habitat.

Downstream of the main section of Scott's Mill Dam, Applicant is proposing to provide about 50 percent of the turbine flow during project operations into this reach. This should assist in circulating water in this downstream reach. However, there will be localized effects immediately downstream of the spillway where turbulent flow will give way to lower velocity water. These effects will be more pronounced for the 50 to 100 feet immediately downstream from the dam. Downstream of this, average flow velocities during median and low flow conditions may decrease from about 1/3 to 1 fps during existing conditions to 1/6 to ½ fps during project operations.

Downstream water levels are expected to remain about the same because they are controlled by a rock sill at Riveredge Park. Dissolved oxygen could decrease on the order of ½ mg/l since the reaeration over the dam will be reduced. Thus, for the majority of the reach downstream of the main spillway, habitat effects should be minor. However, for the first 100 or so feet immediately downstream of the dam during flows up to 4,500 cfs, it is difficult to predict exactly what effect the reduction in flows over the dam will be on fish habitat. Applicant believes that the turbulent flow in the short section provides additional cover that may not be present after project construction. (For safety reasons it was not safe to measure water velocities immediately downstream of dam.)

During project operations, the reach between the downstream island and U.S. Pipe Company will experience increased flows. Applicant expects similar water levels, but higher flow velocities in this reach. This reach may become more favorable for those fish species preferring higher water velocities.

6.3.3.2.3 FISH PASSAGE

Historically, a number of anadromous fish species including American Shad, Alewife, Blueback Herring, Sea Lamprey, and striped bass and the catadromous American Eel occurred in the James River. Numerous dams on the James River and its tributaries have historically blocked migration of fishes. Prior to damming, which began in the colonial period, shad and river herring (Alewife and Blueback Herring) were reported to reach the headwaters and far into the major tributaries of the James River. The annual input of marine-derived biomass from post-spawning carcasses of anadromous fish was an important source of energy and nutrients for the non-tidal portion of the James River (NMFS 1999).

It is a goal of resource agencies to restore American Eel, Sea Lamprey, American Shad and other anadromous fishes to their historic spawning grounds by initially establishing upstream passage facilities at James River dams. Efforts are underway to restore anadromous fish runs in the James River below Lynchburg. Between 1989 and 1993 three dams in the fall zone of the James River were breached or notched, extending available habitat to the base of Bosher Dam. Fish passage was installed in Bosher Dam (built in 1823) in 1999, reopening 221 km of the upper James River and 322 km of its tributaries to American Shad and other anadromous fishes, including Sea Lamprey (Hilton et al. 2014; Fisher 2007). Scott's Mill Dam is the next dam upstream on the mainstem. Currently there are no upstream or downstream fish passage facilities at the Scott's Mill Project. Upstream of Scott's Mill Dam, there are six dams spaced over a total of approximately 22 river miles.

The importance of migratory fish species was recognized in the 1987 Chesapeake Bay Agreement and re-affirmed in Chesapeake 2000. A commitment was endorsed to 'provide for fish passage at dams and remove stream blockages whenever necessary to restore natural passage for migratory and resident fish' (Hilton et al. 2014). The Fish Passage Work Group of the Bay Program's Living Resource Subcommittee developed strategies (1988) and implemented plans (1989) to fulfill this commitment. To date, the partners have reopened a grand total of 2,574.5 miles of Chesapeake Bay tributaries, which is 92% of the 2,807 mile goal (Hilton et al. 2014). The proposed new fish passage goal in the new Chesapeake Bay Agreement will be to reopen an additional 1,000 miles by 2025.

Few studies have looked at unassisted American Eel passage over structures such as dams. However, several experts have observed elvers and very small eels (mostly less than 100 mm in length) actually climbing over wetted surfaces of various sized structures at varying face angles (Haro 2001; Solomon and Beach 2004a and b; Haro personal communication). These experts have also noted that where a textured surface exists the climbing ability of eels is enhanced. There appears to be no consistency in what the fish will or will not pass. Size and age structure affect fish passage - if all eels are large and/or old, they will be less likely to pass a dam by climbing (they need to be small to adhere to extreme-angled substrate faces via surface tension). Eels are also known, during the wet season, to pass around the dam using small rivulets or even just wet ground close to the edge of the river (Scott Smith, VDGIF personal communication, Solomon and Beach 2004a). Applicant anticipates that with the reduced flow over the Scott's Mill Dam, more American Eels will be able to successfully climb over the dam.

As part of its relicensing for the Cushaw Project, Dominion conducted an evaluation of passage around the James River dams upstream of Cushaw (Cushaw FERC License Application, Dominion 2006). Dominion's preliminary evaluation of the flow regimes and the limited electrofishing data available for American Eel did not suggest a strong correlation between flow regimes and CPUE and was therefore inconclusive.

The number of eel captured by electrofishing was slightly lower immediately upstream of Scott's Mill Dam as it was immediately downstream, therefore, Scott's Mill Dam does not appear to be much of a barrier to eel passage, although it is likely that some fish will not, or cannot pass the structure for varying unknown reasons. CPUE drastically dropped upstream of Reusens Dam. This may be related to the lack of continuous flow over Reusens Dam. Reusens Dam appears to be a substantial (but not complete) barrier to eel passage, as a few individuals were captured above the structure.

The remaining structures, Holcomb Rock, Coleman Falls, Big Island, Bedford and Cushaw Dams, are relatively similar in structure to Scott's Mill Dam and would likely have similar effects on eel passage. Although eels are currently found upstream of the various structures between Scott's Mill and Cushaw Dams, the presence of eels does not necessarily imply adequate passability. Only a fraction of the eels attempting to pass a dam may in fact be successful. As well, structures downstream of Scott's Mill Dam may slow passage of upstream migrating eels enough to result in larger eels greater than 100 mm reaching the project area. The larger eels are not able to climb the face of the dam, and may move upstream only when suitable conditions are available.

Therefore, to facilitate restoration goals for American Eel, Applicant has closely coordinated with resource agencies to site and develop conceptual designs for upstream passage facilities for American Eel and Sea Lamprey at Scott's Mill Dam. To maximize the likelihood of success, resource agencies and Applicant agreed that there should be passage facilities on both banks of the James River at Scott's Mill Dam (see **Appendix A**, consultation record). Conceptual design drawings for American Eel and Sea Lamprey upstream passage are presented in **Exhibit F, Figures F-9, F-10 and F-11**.

Ramp type structures are anticipated for passage of American eel and Sea Lamprey. At this time, no decision has been made whether there would be a collection device, but this is likely to be the case. This will certainly be the case if a trap and haul program is developed in conjunction with upstream hydropower owners. Based on the Settlement Agreement that is currently in negotiation, a collection or counting device is likely to be required. Eel collection will be accomplished in consultation with the USFWS and VDWR. Because Scott's Mill Dam is 258.5 miles upstream from the mouth, American eels may move slightly later in the spring than at projects like Roanoke Rapids and Gaston on the Roanoke River which are closer to the mouth of the river and in a slightly warmer climate. At Roanoke Rapids, American eel move upstream during high flows when river water temperatures reach 60^0 F. At Roanoke Rapids American eel typically move upstream from mid-March through mid-May and from mid-September through mid-October. Per the Settlement Agreement, Applicant plans to operate the eel passage facilities from March through November.

Because winters are not severe in this location, Applicant anticipates that the passage facilities would be permanent structures like they are at Roanoke Rapids. However, during detail design, consideration will be given to the potential effects of large floods. Some components of the passage facility could be installed as seasonal structures.

Scott's Mill anticipates that there will be two primary ways for American eel to pass downstream: over the dam and through the debris passage module. It is difficult to determine how many American eels would pass over the dam versus through the fish passage/debris module. Most of the time, the flow over the straight portion of the dam will be small relative to the powerhouse flows. Accordingly, if eels migrate downstream when flows are less than about 4,500 cfs, it is expected that the majority of eels would migrate downstream passing the powerhouse entrance and then through the fish passage module. If American eels migrate downstream during higher flows (say 8,000 cfs or more), then most of the eels would be expected to stay in the main channel of the James River and pass over the dam.

Given the success of the Sullivan Dam downstream passage structure on the Willamette River in Oregon, Scott's Mill expects that the American eels that pass through the powerhouse intake channel, will go through the fish passage module. Eels that are 1.4 to 4 feet in length are not expected to turn 135 degrees, go around the guide vanes, and through the trash racks. Rather, they are more likely to proceed with the downstream current past the turbine intakes.

The debris and fish passage module will work much like an Eicher screen. As the American eels get closer to the module the flow will accelerate because cross sectional area is reduced. In essence the American eel will swim up an inclined ramp. As the eels move up the ramp, the flow will accelerate sufficiently so that the American eel are swept over the top of the inclined ramp into a downstream plunge pool.

Applicant plans to continue to consult with the resource agencies during the detail design phase for these passage facilities. Construction of the facilities would be undertaken in conjunction with the powerhouse construction. The upstream passage would extend the habitat upstream an additional 3.6 miles. Applicant anticipates that upstream dam owners would likewise add American Eel and Sea Lamprey passage facilities in the near future. Initially after operation of the Scott's Mill passage facilities, should the agencies elect to restore areas further upriver in anticipation of the future construction of upstream facilities, a trap and transport program also could be implemented.

Applicant proposes to monitor the success of the upstream passage facilities for a period of three years to ensure that the facilities are functional. Long-term monitoring would be undertaken in coordination with the resource agencies.

At this time, the resource agencies have not made a final decision on when upstream fish passage facilities would be required for American Shad, other anadromous fish and resident fish. Applicant proposes to design the powerhouse in anticipation that either a vertical slot fishway or a nature-like fishway will be constructed. Key considerations will be siting locations of the upstream passage facilities and attraction flows. Applicant proposes that when these upstream facilities are required all 6 dam owners upstream of Scott's Mill Dam work with the agencies and Applicant to install trapping facilities at either the vertical slot fishway or nature-like fishway and transport the captured fish upstream of Cushaw Dam.

For downstream fish passage, Applicant is proposing to allow the downstream migrants to pass over the main spillway section of the dam to the extent possible, particularly when flows exceed the hydraulic capacity of the turbines. Applicant intends to maximize survival of downstream migrants by orienting the power house parallel to the direction of flow in the headpond and drawing water at 90 degrees from the flow direction. At full hydraulic capacity of 4,500 cfs, Applicant anticipates that the downstream flows will be maintained at about 2 feet per second. Accordingly, downstream migrants should continue to swim downstream rather than turn 90 degrees and swim through the trashrack intakes. Downstream migrants will continue to swim downstream until they reach the end of the powerhouse, at which point they will be passed over a sluice into the tailrace. This is a similar approach to what was undertaken at the Willamette Falls hydropower project in Oregon, which has a downstream passage success rate of over 98 percent (Karchesky 2009). Further, Applicant proposes installing trashracks with a spacing of 2 inches and guide vanes to further avoid impingement and entrainment of larger fish. This will be confirmed with computational fluid dynamics modeling during detail design. Applicant plans to continue to consult with resource agencies on other low-cost measures for safe, timely, and effective downstream fish passage.

In February 2020, VDWR, USFWS and Applicant signed an Agreement in Principle (AIP). The AIP primarily addresses fish passage, but also covers minimum flows, water quality and recreational enhancements (see Appendix B). The AIP describes the actions to be taken to provide safe, timely and effective fish passage. The AIP is being converted to a Settlement Agreement. Applicant expects to file a signed Settlement Agreement in early spring 2022.

6.3.3.2.4 IMPINGEMENT AND ENTRAINMENT OF FISHES

Fish can become impinged on intake screens or trashrack bars if they are unable to overcome the approach velocity. Applicant intends to employ an avoidance strategy to prevent entrainment, by orienting the powerhouse in a direction that is primarily parallel to the direction of flow. Further guide vanes will be employed to reduce the effective opening to a 2-inch clear spacing between vanes. If this arrangement does not result in a 95 percent passage effectiveness, Applicant will be required to add 3/4–inch screening.

Water will be withdrawn from the Scott's Mill headpond at a direction of flow that is approximately at right angles to the headpond flow direction. With a flow rate of about 2 feet per second in the headpond at maximum turbine capacity, downstream migrants will continue to swim downstream rather than turn 90 degrees and enter the power house intakes. By narrowing the headpond as flow moves downstream, a constant velocity of about 2 feet per second is maintained and fish continue to swim with the current. This strategy was successfully employed on the Willamette Falls Project during its relicensing and has a better than 98 percent downstream passage survival rate (Karchesky 2009).

When the fish reach the debris and fish passage module at the end of the headpond, the fish are safely passed downstream. The fish passage/debris module has an inclined approach that allows fish and debris to safely pass over it into the tailrace (see **Exhibit F, Figure F-7**). To maintain a constant flow velocity in the headpond at the point of withdrawal, the units are operated from downstream to upstream. That is, as flows increase, the next upstream unit is added until all units are operating.

Even with this strategy, some fish could be impinged on the trashracks or entrained through the turbines under some circumstances. The following analysis provides an assessment of impingement and survival of fish that are entrained. An analysis conducted by APCO as part of the relicensing of the Reusens Project (FERC No. 2376) found that fish that encounter the intake screens were able to easily negotiate the currents (APCO 1991). Calculated velocities at the Reusens intake ranged from 1.4 to 2.6 feet per second. Similarly, water velocities calculated at the Cushaw Project (FERC No. 906-006) intake ranged from 1.4 to 2.6 feet per second. There has been no reported incidence of fish mortality at the Cushaw project intakes (FERC 2008). Based on the intake velocities at Cushaw and Reusen projects and the size of the trashrack bar spacing (3 inches) at Cushaw, it was concluded that most fish avoid impingement on the trashrack, but would be susceptible to entrainment through the project turbines (FERC 2008).

At Scott's Mill, the maximum intake velocity at the trashracks for each unit would be about 1.6 feet per second based on an intake cross sectional area of 19 feet high by 16 feet wide (i.e., 2 modules high by 2 modules wide for each intake) at the maxim hydraulic capacity of 500 cfs per turbine. At the maximum hydraulic capacity of the turbines (i.e., 4,500 cfs), the average velocity in the headpond would be about 2 feet per second based on a width of 140 feet and depth of 16 feet immediately downstream of the existing horseshoe dam, which will be partially removed. For a median flow of 2,000 cfs, the velocity in the headpond would approach 1 foot per second at the upstream end but would accelerate as the flow moves downstream because the headpond narrows with distance downstream. Consequently, headpond velocity will be about 2 feet per second in front of each operating intake. Since the intake velocities to the turbines will be similar to Reusens and Cushaw, fish should be able to avoid being impinged on the intake and continue swimming downstream.

The proposed turbines are similar to traditional Kaplan units. The principal difference is that instead of using adjustable-pitch runner blades as would be found in a traditional Kaplan, in the turbines contemplated for use at Scott's Mill, the runner blades are fixed and, rather, the inlet guide vanes are adjustable. This is a less costly way to accomplish essentially the same thing. The logic control for the turbine optimizes for efficiency given instantaneous head and flow, by (i) articulating the guide vanes and (ii) varying the operating speed of the turbine. The maximum design speed of each turbine is estimated to be 250 RPM. The operating speed will vary from 175-250 RPM based on operating flow and head. Fish passage, to the extent relevant, can be accurately assessed by treating each unit as a fixed-blade Kaplan with a 54" runner using the peak RPM; Scott's Mill is working with the turbine manufacturer to create meaningful through-turbine survival data. Since the units act like Kaplan units, Franke et al. should be applicable. It must be reemphasized, however, that the proposed plant is being designed to exclude fish from the turbines altogether. During detail design, Scott's Mill will include ¾-inch screens that can be added if passage survival does not achieve the agency goal of 95 percent passage.

At this time, the 54-inch LPS React turbines (previously named Rickly turbines) have a proposed operating speed of 250 rpm or less. Given that Cushaw turbines rotate at 150 rpm, Scott's Mill should have somewhat lower survival to estimates reported for the Cushaw project, which have similar fish species.

The potential for significant entrainment effects at the Reusens Project was found to be low; mortality of fishes that were entrained was estimated to be less than ten percent. Dominion calculated survival rates for fish of various lengths passing through the Cushaw Project using the Franke *et al.* (1997) model (**Table E-6-6**). Predicted fish survival ranged from 98.3 to 83.9 percent on average for fishes ranging in size from 2 to 18 inches, respectively (FERC 2008). In addition, a review of 16 projects with Kaplan or propeller-type turbines similar to those at the Cushaw Project corroborated, for the most part, the estimates from the Franke *et al.* analysis (**Table E-6-7**). For species common to the James River, centrarchids (sunfish and bass) and ictalurids (catfish), survival for fish less than 8 inches in total length ranged between 93 and 97.6 percent. For larger fish (up to 15 inches) of the same species, survival rates averaged 93 percent. Survival rates for American Eel were less at 73.5 percent. Therefore, Applicant estimates that survival at Scott's Mill should be about 90 percent for fish smaller than 10 inches and 80 percent for fish smaller than 18 inches. However, most fish are expected to avoid the turbine intakes, and Scott's Mill should have better survival than Cushaw and Reusens.

TABLE E-6-6

PREDICTED* SURVIVAL VALUES DERIVED FROM THE FRANKE ET AL. (1997) MODEL FOR FISH OF VARIOUS LENGTHS IN PASSAGE THROUGH THE CUSHAW PROJECT

Correction Factor	Predicted Survival (%) by Fish Length (inch)						
	2	4	6	8	10	12	18
0.1	98.9	97.6	96.5	95.2	94.1	92.8	89.3
0.2	97.6	95.2	92.5	90.0	88.0	85.6	78.5
Average	**98.3**	**96.4**	**94.5**	**92.6**	**91.1**	**89.2**	**83.9**

* Survival values are average of two entry points of fish into turbine at a head of 28 feet. Values are given separately for two correlation factors.

TABLE E-6-7

AVERAGE EMPIRICAL TURBINE PASSAGE SURVIVAL RATES REPORTED FROM VARIOUS POWER STATIONS WITH KAPLAN/PROPELLER TYPE TURBINES

	Fish Length (inch)		
	< 8	**8 – 15**	**> 15**
American Eel			73.5
Alewife	90.8		
American Shad	96.6		85.0
Blueback Herring	96.0		
Centrarchids	97.6	92.9	
Ictalurid	93.0	93.0	
Percid	93.0	96.2	
Cyprinids	97.5	85.1	
Salmonids	92.7	94.0	
AVERAGE	**95%**	**94%**	**82%**

At the direction of Commission staff, Applicant further investigated impingement and entrainment (i.e., desktop study) because fish avoidance of the powerhouse intakes cannot be verified until the CFD analysis is conducted during the design phase, or perhaps until the project is operational. There would be about a year that entrainment could occur before the ¾-inch screens are installed, even though they will be included in the project design, but not installed unless the effectiveness study demonstrates less than 95 percent effective passage.

Applicant reviewed entrainment studies conducted for both the upstream Bedford and Reusens project relicensings. (These study reports were filed in 2021 and 2022, respectively.) The Reusens entrainment study was more extensive and contained useful information to enable Applicant to conduct its investigation. However, the Reusens turbines are Francis-type and significantly different than those proposed for Scott's Mill. The Bedford turbines are Kaplan (propeller type), similar to Scott's Mill. Besides the physical characteristics of the turbines and intake design, operations and environmental factors are also important in determining entrainment and turbine mortality.

Applicant identified several target species for the analysis: smallmouth bass (predominant game species), muskellunge (important game species), blue gill (abundant in VDWR sampling between 1991 and 2020), bull club (plentiful species), channel catfish (game fish), American eel (important diadromous fish targeted for fish passage at Scott's Mill), and gizzard shad (migratory species). All these species were identified as target species in the Reusens relicensing entrainment study and therefore allow for comparison of entrainment and impingement between the two projects.

Applicant assumed that each target species could enter the headpond and become impinged or entrained in the turbines. The trashracks are designed with a three-inch opening, but with the guide vanes, there is an effective 2 1/8-inch spacing size at the intake. The body widths of most target species (i.e., smallmouth bass, blue gill, bull club, and gizzard shad) were less than the clear spacing and were generally considered too small to become impinged. The Reusens entrainment study indicated a similar finding. However, this could change if 3/4-inch screens are installed at the upstream end of the intakes because the passage effectiveness is shown to be less than 95 percent. Muskellunge and channel catfish do have body widths that could exceed the clear spacing and could be impinged, but muskellunge and channel catfish have swimming abilities that would permit them to avoid impingement because the intake velocity of 1.6 feet per second is less than the prolonged and burst speeds for muskellunge and channel catfish and less than the burst speed for American Eel (Eagle Creek Renewable Energy, Reusens License Application 2022).

Eagle Creek Renewable Energy examined overall entrainment potential at Reusens for 11 target species. The entrainment potential ranged from 'none' to 'high.' These were defined as follows:

• None—Species/lifestage does not prefer the habitat near the intake, and/or swim speed clearly exceeds intake velocity;

• Low—Species/lifestage does not prefer the habitat near the intake but could occur in the vicinity of the intake at times, and/or swim speed does not clearly exceed the intake velocity;

• Moderate—Species/lifestage seasonally prefers the habitat near the intake, can be characterized by downstream movements during at least one lifestage, and/or swim speed does not clearly exceed the intake velocity; and

• High—Species/life stage likely prefers the habitat near the intake year-round, can be characterized by large downstream movements during some life stages, and/or swim speed is less than intake velocity.

Silver phase American Eel (adult) was qualified as 'high' because of its downstream migration. Gizzard shad, bluegill, smallmouth bass, channel catfish and muskellunge all showed low potential at Powerhouse A. (Powerhouse A has a similar intake velocity with Scott's Mill of less than 2 feet per second at full turbine capacity.) Therefore, Applicant concludes that based on Eagle Creek's analysis and the intake velocity at Scott's Mill, the entrainment potential would be similar for these target species.

Using a blade strike model develop by Franke et al. (1997), Eagle Creek determined the probability of turbine passage survival at Reusens for different sized fish (i.e., 4, 8. 12. 16 and 30-inches) for strike mortality correlation factors of 0.1 and 0.2. Survival estimates for small fish (4 to 8 inches) under all scenarios ranged from approximately 86.5 to 96.9 percent, and for larger fish (12 to 16 inches) ranged from approximately 73.1 to 90.6 percent. For very large fish (30 inches) survival declined, and ranged from approximately 49.5 to 76.4 percent.

It must be recognized that Reusens Francis turbines are different than the Kaplan (propeller) turbines at Scott's Mill. Flow through each turbine is approximately twice that of Scott's Mill (i.e., 1,000 cfs at optimum efficiency versus 500 cfs at Scott's Mill). The number of blades or buckets at Reusens is 12 versus 4 for Scott's Mill and the runner diameter is 9 feet at Reusens versus 4.5 feet at Scott's Mill. Per Franke, the probability of a strike is directly proportional to the strike correlation factor, the number of blades (N) and the fish length and inversely proportional to the runner diameter (D). For a given fish length and strike correlation factor, the N/D factor would be 1.33 for Reusens and 0.89 for Scott's Mill, meaning that Scott's Mill would have better survival than Reusens. However, the strike probability is further modified by the discharge coefficient (Q_{wD}), which is equal to the turbine discharge divided by the rotational speed and the runner diameter cubed (Q/wD^3). The higher discharge and slower RPM at Reusens are offset by the larger runner diameter cubed, resulting in a factor of 0.008 for Reusens and 0.022 for Scott's Mill, making the trig portion of the Franke equation higher for Reusens and hence a higher mortality for a given fish size. Therefore, both components of the Franke equation are higher for Reusens than Scott's Mill and the probability of survival for a given sized fish at Scott's Mill is higher than for Reusens. Thus, for small fish, survival is better than 90 percent, and for larger fish of 8 to 16 inches likely in the 75 to 90 percent survival. For the very large fish (e.g., 30-inch-long eels, the survival is more dependent on the strike mortality correlation factor and survival probability is likely in the 50 to 80 percent survival. It should also be kept in mind that the pressure difference at Scott's Mill is 16 feet, whereas at Reusens it is twice that, making Reusens fish more likely to be affected as they pass through the turbines. The turbine survival results cited above are very consistent with both **Tables E-6-6 and E-6-7**.

Eagle Creek also presented the calculated survival estimates for each target species and life stage relative to a qualitative turbine passage survival category, adapted from Normandeau Associates (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. Scott's Mill results would be at least as good or better than the passage survival at Reusens. The Eagle Creek 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 muskie) having low overall survival ratings.

Although the blade strike model results in the Eagle Creek study suggest that turbine passage survival of American eel would be low, other research suggests that blade strike models may not be very applicable to predicting turbine passage survival of American eel. As noted in the Eagle Creek study, 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). 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 than estimated by the Franke blade strike model.

6.3.3.2.5 Cumulative Effects

The Scott's Mill Dam (the first in a series of seven dams with the six upstream dams lying between Cushaw and Lynchburg), water pollution, and overfishing have contributed to the decline of American Shad and American Eel in the

James River. Each of these factors cumulatively affects diadromous fish within the James River. The resource agencies have identified a resource goal to restore both American Shad and American Eel to their historic spawning areas in the James River. Applicant will cooperate with the agencies and other licensees on the James River to further the agency restoration goal. The USFWS and National Marine Fisheries Service (NMFS) have authority to prescribe fish passage under Section 18 of the FPA.

6.3.4 TERRESTRIAL RESOURCES

6.3.4.1 AFFECTED ENVIRONMENT

The area in the vicinity of the Scott's Mill Project is characterized by forested hills that rise 200 to 300 feet from both sides of the James River. The James River valley near the project site has been significantly affected by human activities during the past 200 years. These have included road construction, canal/railroad construction and operation, industrial land uses (along the western riverbank), downtown urban center growth (Lynchburg, less than 0.5 mile to the southwest), river impoundment, and residential development (on valley slopes and hills east and west of the site). As a result, the dominant wildlife species present nearby are generalists that typically survive well in close proximity to human land uses. These include a variety of omnivores and opportunistic species.

The riverbank west of the Scott's Mill dam is characterized by a narrow 15-25'wide woody riparian buffer between the railroad and water, steep riverbanks (6-10' high with slopes generally greater than 2:1), railroad/railyard tracks (up to seven parallel tracks), and pipe foundry operations. Approximately 60-70 percent of this riverbank has been stabilized with riprap. Within this industrial corridor, there is very little undisturbed vegetation, and those species present are typically hardy pioneer/early successional herbaceous plants.

The area east of the Scott's Mill dam has generally experienced less previous human alteration and disturbance, likely due to the presence of a steep rocky 200' high hill slope approximately 50' east of the river. The steep riverbank and adjacent hill slope are dominated by young-mature hardwood tree species. A public road (River Road/Route 685) is located within the narrow relic terrace/floodplain along the eastern riverbank. Further upriver, significant portions of the riparian area are currently in use as residential lawns. Multiple piers, boat docks, and floating wooden platforms are also present along this portion of the riverbank.

The greatest abundance and diversity of vegetative species is on the three islands located upstream of Scott's Mill Dam: Daniel Island, Treasure Island and Woodruff Island. The islands were previously used for agriculture, but pedestrian/vehicle access to the islands has been cut off since the flood of 1985. There are remnants of structures and athletic fields on the islands. The island shorelines have experienced significant erosion. The erosion is likely due to periodic floods and the alluvial soils of the islands. The eroded shorelines of some islands are generally as steep and high as the riverbanks, though gravel bars and low-gradient slopes are present in isolated areas of low velocity flow. A list of vegetative species on the islands and riverbanks can be found in **Appendix G**. The Appendix includes several photographs of the shorelines.

Dominant riparian vegetation upstream and downstream of Scott's Mill Dam is generally similar in terms of species composition, density, and diameter. However, tree and sapling diameters on the upstream (NW end) of Percival Island (also known as Anthony Island) appear to be 20-30% smaller than on islands between Scott's Mill Dam and Reusen's Dam upstream. This may be due to periodic flood flow scour here (as riverine substrate also appears to be larger diameter here than substrate within the Scott's Mill Dam impoundment upstream). The extent of riparian vegetation inundation downstream of Scott's Mill Dam will likely be comparable to periodic Q1-Q5 flood flow. However, the frequency of this inundation may be more frequent.

6.3.4.1.1 WETLANDS

Due to the steep riverbanks and previous land development activities over the past 200 years, there do not appear to be any jurisdictional wetlands along the riverbanks. Liberty University conducted a wetland delineation in 2013. The US Army Corps of Engineers (USACE) verified the presence of a jurisdictional wetland area on Daniel Island in the northern portion of the island (Jeanne Richardson, USACE, letter to Tim Reynolds, Liberty University dated January 22, 2014; included in **Appendix J**). Applicant is not aware of any changes on Daniel Island since that time that would have altered hydrology, soils, or vegetation. The James River itself is classified as a jurisdictional surface water, and any impacts to it would be classified as stream impacts.

Four other upstream islands (including Treasure Island, Woodruff Island) and one downstream island (Percival Island) are located within the study area. US Department of Agriculture (USDA) Web Soil Survey (WSS) records indicate that these other five islands are comprised of 9A soils (Combs loam, 0-3% slopes, frequently flooded, 1-33% hydric/wetland). In contrast, only the upstream (northwestern) end of Daniel Island is composed of 9A soils, with the remaining 90% of the Daniel Island being either CT soils (Chewacla-Toccoa complex, 33-65% hydric/wetland) or 31A soils (Sindion-Yogaville complex, 0-3% slopes, frequently flooded, 33-65% hydric/wetland). For the purpose of the wetland mapping effort, the entirety of the six primary islands (from upstream to downstream: un-named island, Woodruff Island, Treasure Island, un-named Island, Daniel Island, Percival Island) and a small area of 9A soil along the northeastern riverbank (at the NW end of Woodruff Island) are assumed to be potentially-jurisdictional wetlands (total area of approximately 160 acres). Due to steep 3-6' high slopes along the riverbanks and islands though, less than one acre of potentially-jurisdictional wetland area is likely to be affected by proposed project additional impoundment (and such effects will be similar to what these areas already experience in response to localized flooding). **Appendix N** contains a USDA WSS map excerpt indicating potential hydric soils within the project area.

A wetlands survey of the islands within the study boundary was conducted in March 2021. The survey indicated that the project would not affect wetlands. The consultant report is also provided in **Appendix N**.

6.3.4.1.2 WILDLIFE

Wildlife species likely to occur in the immediate vicinity of the Project include white-tailed deer, herons, raptors, wild turkey, dove, ducks, squirrel, rabbit, woodchuck, opossum, muskrat and raccoon. Numerous resident and neotropical migrant bird species likely occur and breed within or in the vicinity of project boundaries.

Songbirds that utilize early successional wooded habitats in the vicinity of the Project, include common flicker, yellow-breasted chat, prairie warbler and mourning warbler. A list of observed avian and mammalian species is presented in **Appendix G**.

6.3.4.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

During construction, Applicant will need to expand the current opening in Daniel Island just upstream of the dam to obtain the necessary flow balance down the two river channels. The current opening is about 20 feet wide, but may need to be widened to about 100 to 130 feet to provide about half the powerplant capacity from the main channel for water quality purposes. The length of the enlargement across the island would be about 130 feet. Applicant estimates that the area disturbed would be about one-quarter acre. The U.S. Army Corps of Engineers (USACE) has identified this area as a probable wetland. Applicant would mitigate any wetland impacts, as required by the USACE.

In Virginia, the USACE and VDEQ have developed a compensatory mitigation hierarchy, with purchase of commercial mitigation bank credits as the first (preferred) alternative, followed by purchase of credits from the Virginia Aquatic Resources Trust Fund (VARTF - second choice), and then applicant-proposed on-site or off-site mitigation (final options). Available mitigation credits are tracked using the USACE Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS), which currently indicates 0.14 ac of available wetland credits and 27,791 lf of available stream credits from a total of seven commercial mitigation banks within the Middle

James River Basin Service Area (HUC 2080203). In this river basin/service area, VARTF presently has 0.46 ac of wetland credits and 4,987 lf of stream credits available. If insufficient mitigation credits are available, the proposed project will discuss off-site mitigation options with USACE and VDEQ staff during the Clean Water Act (CWA) Section 404/401 permitting process.

Applicant proposes to place a 2-foot high concrete cap over the spillway and operate the project at a constant pool level of about 516.4 feet. This will have the effect of increasing water levels by 1.2 to 0.2 feet upstream during low flow conditions up to the maximum hydraulic capacity of the turbines (4500 cfs). These flows occur 77 percent of the time. During moderate flows between 4,500 cfs and 12,000 cfs, which occurs 18 percent of the time, water levels will be between 0.2 and 1.6 feet higher, respectively. During high flows on the order of 50,000 cfs the project could increase water levels up to 2.6 feet. During flood of 100,000 to 200,000 cfs such as occurred in 1985, water levels would increase from 2.3 to 1.4 feet (see **Table A-3 and Appendix K**). This increase will be dampened slightly with distance upstream because the lower velocities under project conditions for the same inflow will result in a lower hydraulic gradient in the upstream direction.

It is not likely that the higher water levels up to the 4,500 cfs hydraulic capacity of the turbines will affect the vegetation because of the steep slopes of the shorelines and islands and low current velocities. There is very little additional flooded area between elevations 514.4 and 516.4. For flows between 4,500 cfs and 12,000 cfs, average river flow velocities should be less than 2 feet per second and should not appreciably affect shoreline erosion, even though the water level will be 0.2 to 1.6 feet higher. At higher flows (e.g., between 25,000 cfs and 130,000) there could be an increase in shoreline erosion potential because of the higher water level. However, at the highest flood levels, the small difference in upstream water levels and virtually similar velocities suggest only a minor difference in erosion potential. Hence, project operations would likely have only a minor effect on upstream vegetation.

Since downstream of Scott's Mill Dam, the water level is controlled by a sill downstream of the dam and since Applicant intends to pass water into both channels downstream of the dam, downstream water level effects are expected to be very minor and hence, there should be little or no effect on riparian vegetation.

6.3.5 THREATENED AND ENDANGERED SPECIES

6.3.5.1 AFFECTED ENVIRONMENT

Protected species information from the USFWS, VDWR, and Virginia Department of Conservation and Recreation (VDCR) Natural Heritage has been reviewed for the project area. These records suggest the potential presence of the following species in proximity to the study area:

USFWS Protected Species (*per IPaC database*):

- James River spinymussel (*Pleurobema collina*) – Federal Endangered
- Northern long-eared bat (*Myotis septentrionalis*) – Federal Threatened,
  VDGIF Protected Species (*per VA Fish and Wildlife Information System*):
- James River spinymussel (*Pleurobema collina*) – Federal Endangered
- Peregrine falcon (*Falco peregrinus*) – State Threatened
- Loggerhead shrike (*Lanius ludovicianus*) – State Threatened
- Green floater (*Lasmigona subviridis*) – State Threatened
- Atlantic pigtoe (*Fusconaia masoni*) – State Threatened
- Migrant loggerhead shrike (*Lanius ludovicianus migrans*) – State Threatened
- Northern long-eared bat (*Myotis septentrionalis*) – Federal Threatened VDCR Natural Heritage Species (*for James River HUC 020802030305 watershed*):
- Green floater (*Lasmigona subviridis*) – State Threatened

Legal protection under the federal Endangered Species Act (ESA) normally exists for species listed as Endangered or Threatened (and Candidate/Pending). The proposed project should not eliminate avian nesting or loafing habitat, and should not significantly affect feeding/foraging habitat for the birds listed above. The project should not significantly reduce the extent of mature forest or alter natural hibernacula for bat species. Since the project could affect some aquatic habitat however, the most significant protected species review will likely be associated with aquatic species (specifically James spinymussel, green floater, and Atlantic pigtoe). These species have not been found during nearby upstream and downstream mussel surveys during the past 15 years.

James spiny-mussel. The James spiny-mussel (*Pleurobema collina*) is a small freshwater mussel, less than 3 inches in length. It was widely distributed in the James River drainage upstream of Richmond; however, it has exhibited a precipitous decline in population over the last 30+ years, and has been extirpated from approximately 90 percent of its historic range. It is now only documented in a few small headwater tributaries to the James and Roanoke rivers with clear, unpolluted waters. This makes the species highly vulnerable to water quality perturbations, disease, and displacement by introduced species. As a result, the USFWS listed the James spiny-mussel as a federally endangered species (53 FR 27689, July 22, 1988). A recovery plan was established by the USFWS in 1990. The Commonwealth of Virginia followed, also listing the James spiny-mussel as a State endangered species. Currently, the James spiny-mussel is known to inhabit Craig Creek and three of its tributaries (Johns, Dicks, and Patterson creeks); Jackson River drainage (South Fork Potts Creek, Potts Creek, Catawba Creek, and Pedlar River); Rivanna River (Mechums River, Moormans River and Rocky Run), Dan River and May River (USFWS 1990, http://216.109.117.135/search/cache?p=James+spinymussel&toggle=1&ei=UTF-8&u=www.insidewrc.org/divisionlinks/06_fish/habcon/Piedmont/W-

Piedmont/Stokes/Boxley%2520Final%2520Denial%2520%2523%25208509%2520adm.doc&w=james+spiny-mussel&d=38AE63A551&icp=1&.intl=us,

http://www.streamwatch.org/Watershed/index.php,
http://ecos.fws.gov/docs.life_histories/F025.html).

The shell of juveniles typically has 1 to 3 short but prominent spines on each valve; adults typically do not have spines. The foot and mantle of adults are orange, and the mantle is darkly pigmented in a narrow band around and within the edges of the branchial and anal openings (USFWS, 1990).

James spiny-mussel live in streams with widths varying from 10 to 75 ft and depths between 0.5 to 3 ft. Its immediate habitat requirements include slow to moderate water velocity and sand or cobble bottom riverbeds. It requires fish hosts to complete its life cycle. Of those host species, only 4 occur in the project vicinity – bluehead chub, rosefin shiner, satinfin shiner and stoneroller. During spawning season, the male releases sperm into the water column, which are taken in by the female during siphoning. The fertilized eggs are held in the gills, which also serve as brood pouches for the developing larvae (glochidia). Spawning takes place in the spring, and the release of the glochidia occurs in the spring and summer. Once the glochidia are released into the water, they must, within 3 or 4 days, attach to a host fish. After attachment, the glochidia metamorphose and drop as free-living juvenile mussels (USFWS 1990).

Because they are sessile organisms, and rely on siphoning water into their gills, siltation caused by silviculture, agriculture and road construction is highly detrimental to James spiny-mussel populations. Silt can clog and abrade the gills of the filter feeders, eventually suffocating them. Industrial and municipal waste also poses a threat to the survival of the James spiny-mussel (USFWS, 1990).

Introduction of the Asian clam (***Corbicula fuminea***) has resulted in increased competition, thus depleting the food supply for the James spiny-mussel. The Asian clam is very prolific, rapidly spreading throughout the introduced watershed (densities of 1,000/m2 have been identified in the James River) (USFWS, 1990).

Other factors affecting the abundance of the James spiny-mussel include impoundments on the rivers, including flood control dams. The alteration of habitat from a lentic to a lotic system results in increased depth, increased siltation and reduced water velocity, as well as affecting the fish communities present, thereby potentially eliminating a host species (USFWS, 1990).

Applicant conducted a freshwater mussel survey specific to the Scott’s Mill headpond and downstream area, with a specific focus on the Green Floater (*Lasmigona Subviridis*). The study was conducted in November 2016, consistent with Study Plan 9. No threatened or endangered mussels were found. The results of the study can be found in **Appendix H**.

Bats. Northern long-eared bat (NLEB) summer roosting habitat (mature trees larger than 2-4” in diameter, with loose bark) is present along much of the James River and throughout the surrounding region. For most land-development projects, potential bat impacts are minimized by ensuring that any required tree clearing occurs while bats are hibernating (no tree clearing within the April 15-September 15 time-of-year restriction [TOYR} period). Since the proposed Scott’s Mill project should not require tree clearing, should not affect winter hibernacula (caves or structures), and should not increase upstream or downstream riparian vegetation inundation outside the normal range experienced by the river (due to periodic flooding), the potential to impact bat habitat should be minimal. The USFWS Information and Planning Consultation (IPaC) system requires a standard conclusion of “May Affect, Not Likely to Adversely Affect” for most project sites within the typical NLEB habitat range (if no tree clearing or structure demolition is proposed).

Because the Scott’s Mill hydro project will have little effect on water levels and primarily affect steep shoreline areas, Applicant relied primarily on the terrestrial habitat assessment and determined that bats were unlikely to be affected by the project. Accordingly, Applicant elected not to conduct Study Plan 13, Bat Study.

6.3.5.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

Given the limited disturbance of the project in an already disturbed area, the minor effect that the project will have on water levels and the lack of observances of any threatened or endangered species, Applicant concludes that the project would not affect threatened or endangered species. Accordingly, no mitigation is proposed, except that Applicant will implement the Northern Long-Eared Bat Management Plan included as part of the Settlement Agreement.

6.3.6 RECREATIONAL RESOURCES

6.3.6.1 AFFECTED ENVIRONMENT

6.3.6.1.1 RECREATIONAL OPPORTUNITIES WITHIN 60 MILES OF THE PROJECT

The Scotts Mill Project is within 60 miles (approximately a one-hour drive) of numerous recreational opportunities including boating, fishing, hiking, camping and viewing nature. These opportunities, which are managed by Federal, State, local and non-governmental entities are listed below with distances from the project in miles:

Federal

- Appomattox Courthouse National Historic Park -22;
- Blue Ridge Parkway (managed by the National Park Service) - 22;
- Otter Lake Waterfalls – 22 Miles;
- George Washington National Forest; - 24;
- Jefferson National Forest – 24;
- Appalachian National Scenic Trail – 24;
- James River Face Wilderness Area – 24 and
- Shenandoah National Park – 59.

Virginia

- Appomattox-Buckingham State Forest – 32;
- Holiday Lake State Park – 34;
- Natural Bridge State Park – 36;
- Smith Mountain Lake State Park – 39;
- Lake Nelson (also managed by VDWR) – 40;
- Horsepen Lake WMA – 40;
- James River State WMA – 42;
- Mount Pleasant Special Management Area – 42;
- Lake Robertson State Recreation Area – 51;
- High Bridge State Park – 55;
- Staunton River Battlefield State Park – 57 and
- Bear Creek Lake State Park – 60.

Local

- The City of Lynchburg, Virginia, (operates and maintains 850 acres of parkland) – 0;
- City of Bedford (two natural area parks, 1 skate board park, two athletic field parks -26;
- The City of Lexington, Virginia, (operates and maintains 2600 acres of parkland) - 44 and
- City of Roanoke; (14,000 acres of public land) 56 Miles

Other

- Paradise Lake Family Campground – 14;
- Lynchburg RV Resort – 18;
- Lynchburg Blue Ridge Parkway KOA – 19;
- Yogi Bear’s Jellystone Park Camp-Resort (Natural Bridge Station) – 36;
- Lake Nelson Family Campground (Arrington) – 39;

- Smith Mountain Pumped Storage Hydroelectric Project (Smith Mountain Lake and Leesville Lake) – 40;
- Wintergreen Resort – 51;
- Misty Mountain Camp Resort (Greenwood) – 59;
- Shenandoah Acres Resort (Stuarts Draft) – 59;
- Charlottesville KOA – 60 and
- Goshen Scout Reservation – 60.

6.3.6.1.2 RECREATIONAL OPPORTUNITIES IN THE PROJECT VICINITY

The James River, Virginia's longest river, is an important recreational resource. It typically supports about 100,000 angling trips and about 50,000 boating trips annually (Stanovick et al., 1991), and is designated a State Scenic River in certain reaches including a reach that is upstream of the Cushaw Project.

VDWR calculated from their survey conducted in 2000 that anglers accounted for 1,926 angling hours/mile on the upper James River, a value that VDGIF considered "very high." Most anglers interviewed lived within a one-hour drive of the river, indicating a generally local fishery. About 82 percent of the interviewed anglers were fishing from a boat, while about eleven percent were fishing from the shore and four percent were wading. Eighteen percent indicated that boating access was a negative attribute of the upper James River fishery, while about 34 percent indicated there were no negative attributes (Scott Smith, VDWR).

James River Hydroelectric Projects. The following hydroelectric projects are located on the James River upstream from Scott's Mill Dam:

- Cushaw Hydroelectric project (FERC No. 906);
- Bedford Hydroelectric project (FERC No. 5596);
- Big Island Hydroelectric Project (FERC No. 2902);
- Coleman Falls (FERC No. 5456);
- Holcomb Rock Hydroelectric Project (FERC No. 2901); and,
- Reusens Hydroelectric Project (FERC No. 2376).

Various recreational facilities are associated with each of the projects.

The Cushaw Project has a boat ramp enabling anglers and recreational boaters to utilize the headpond. Canoeists and kayakers often paddle the free-flowing reach upstream of Cushaw Dam and typically take out their canoes and kayaks at the upper end of the headpond or further downstream.

The Bedford Hydroelectric Project at Snowden Dam is located on the James River approximately 1.2 miles downstream from the Cushaw Hydroelectric project. The upstream end of the 57-acre Bedford Reservoir overlaps the Cushaw Dam tailrace during high flows. Hunting for deer, bear and wild turkey is good throughout the project area. The public uses an old construction site along SR 130 for river access. This site has a concrete pier that is used for fishing by those in wheelchairs. A small ramp in this vicinity is used to place boats into the reservoir. Anglers reportedly use State Route 501 to access the right (west) bank of the Bedford headpond for fishing (FERC, 2001). FERC's 2001 Inspection Report noted that:

"Public recreational use at this small project is very limited. Because of the long, open spillway, boating use should not be encouraged. The site along the left (east) bank where the public is currently using lands for public access could be developed into a safe shoreline fishing area."

The Big Island Hydroelectric Project is located approximately 4 miles downstream from Bedford Dam. This small facility includes a 110-acre reservoir and boat ramp upstream of Big Island Dam, allowing boaters and anglers access from Big Island Dam upstream to the Bedford Project. A concrete boat ramp is located downstream of Big Island Dam, near the Georgia-Pacific mill entrance. This provides boating in the reach between Big Island Dam and Coleman Falls Dam. There is also a canoe portage around Big Island Dam.

Coleman Falls is an exempt FERC project and has no recreation facilities.

The Holcomb Rock Hydroelectric Project is located about seven miles downstream from Big Island. This facility includes a 127-acre reservoir, 2.5-mile canoe portage and boat ramp.

The Reusens Hydroelectric Project is located about eight miles downstream from Holcomb Rock and four miles upstream from the center of Lynchburg, Virginia. This facility includes a 500-acre reservoir and the following recreational facilities: two unimproved boat access areas, one improved boat launch, a nine-acre park, a playground and a picnic area.

The Scott's Mill impoundment offers little public opportunity for boating and fishing because of the limited access and lack of public boat ramps Within the headpond are a number of private boat docks on the east side of the river along River Road (**Figure E-6-4;** also see boat dock photographs in **Appendix G**). There is also one private boat ramp located a short distance upstream from Scott's Mill Dam. Limited angling takes place in the 305-acre headpond due to the lack of public access. Immediately downstream of Scott's Mill Dam on the east side (left bank) of the river, anglers fish the tailrace of the dam (**Figure E-6-5**). Although this area is posted as private property, this is a popular fishing area. There is informal parking along River Road adjacent to the dam. Approximately 10 vehicles can be accommodated along River Road.

There are two boat ramps located on either side of the river about one-half mile downstream from Scott's Mill Dam. The boat ramp in Riveredge Park accommodates motorized boats, whereas the ramp near the mouth of Blackwater Creek is for car top boats.

Anglers can often be seen fishing the reach downstream of Scott's Mill Dam. There are no portage facilities around Scott's Mill Dam. Access on the west side of the river is restricted due to the industrial activities at U.S. Pipe and the Chesapeake and Ohio railroad that parallels the river.

6.3.6.1.3 EXISTING AND POTENTIAL RECREATIONAL USE AND NEEDS

The 2013 Virginia Outdoors Plan (State Comprehensive Outdoors Recreation Plan or SCORP) through a survey conducted in 2011, identified the top 6 most needed recreational facilities as 1) hiking and walking trails (68%), 2) fishing,

Figure E-6-4. Scott's Mill Headpond Private Boat Ramps

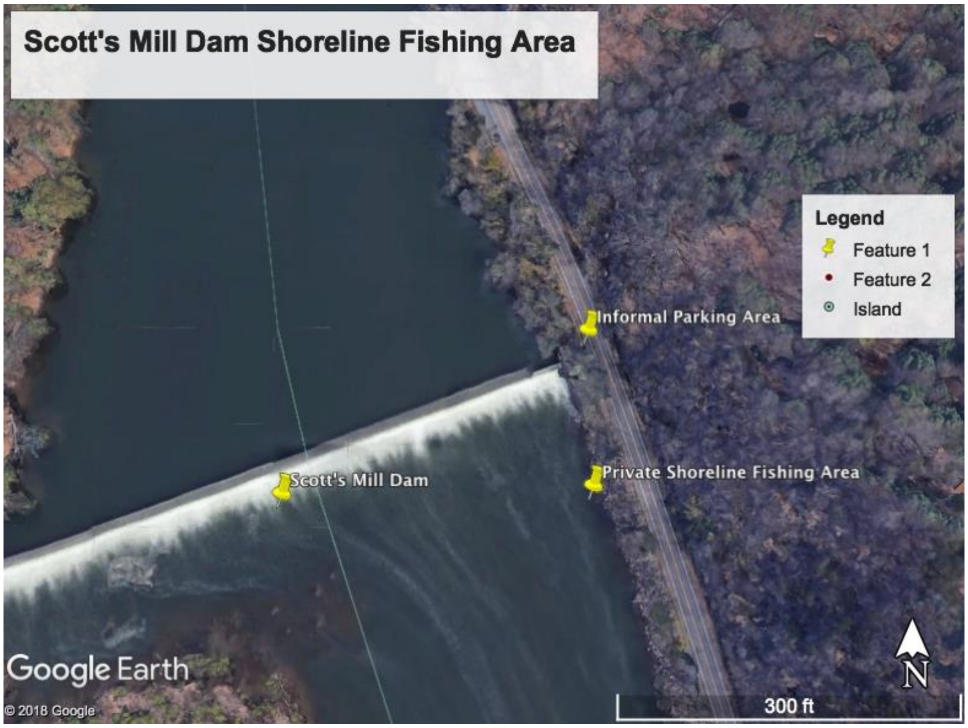


Figure 6-5. Scott's Mill Dam Fishing Area and Parking

swimming, and beaches (60%), 3) natural areas (55%), 4) bicycling trails (54%), 5) historic areas (51%), and 6) canoeing and kayaking (46%).

There are hiking and walking trails along Blackwater Creek and in downtown Lynchburg. Applicant surveyed these trails, but could not identify any locations that could link these trails to the project area because of the Chesapeake and Ohio railroad and the U.S. Pipe industrial facility. On the east side of the river, development of a hiking trail along River Road is constrained by the steep shoreline topography, the adjacent steep hillside and River Road itself. Therefore, hiking and walking trails, natural areas, and bicycling trails were eliminated from further consideration for recreational improvements. However, Applicant has further considered fishing, the historic area of the dam and Scott's Mill remnants, and canoeing and kayaking for potential recreation developments.

6.3.6.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.6.2.1 RECREATION IMPACTS

The fishery downstream of the Scott's Mill Dam is locally important. Applicant intends to protect this important aquatic habitat by discharging a portion of the flow from the turbines towards the area downstream of the straight section of the spillway. This should help to preserve this important fish habitat. Further, Applicant will maintain a veil of water flowing over the dam. The reduction in flow over the dam could reduce the value of the habitat for about 100 feet downstream of the dam, by reducing the turbulence and associated cover for fish. This could reduce the fish habitat along the 735-foot long dam for about 100 feet downstream. This may be somewhat mitigated by the turbulent conditions created immediately downstream of the turbines, which could provide additional cover.

The private boat docks along River Road would see approximately constant water levels 77 percent of the time. However, this water level would be about 0.2 to 1.6 feet above current average and low flow levels. Since most of the docks are built to handle these water levels, the near constant water levels may be considered a positive feature, since for most other hydropower projects, adjacent land owners prefer relatively constant water levels in project reservoirs. However, for flows above 25,000 cfs adjacent land owners could see up to a 2.6-foot increase relative to existing conditions, because of the reduced effective width of the spillway from construction of the powerhouse. These conditions would occur less than 5 percent of the time, but they could be considered an adverse impact. Because of the steep shorelines, this should not be a problem (see Photographs 13 through 18 in **Appendix G**, Terrestrial Habitat Assessment which depicts several boat docks located along the steep shorelines). Nonetheless, water velocities at the private boat docks would be slightly lower for a given flood flow, because of the greater cross-sectional area. This could help mitigate adverse effects on the docks. At the very high flood levels, there would be minor impact since the dam is no longer a control point, but there would still be a 1.4 to 2.3 foot water level increase. Accordingly, Applicant is not proposing any mitigation for the upstream water level effects during high flow conditions.

During construction, there would be minor effects to the informal recreation fishing at Scott's Mill Dam. During the construction of the fishway, portage and fishing platform, recreation use of this area would be precluded. This is expected to last for one year. On the south shore, due to the presence of the U.S. Pipe Company, no bank fishing is permitted. Accordingly, construction of the powerhouse and removal of a portion of the existing dam will not affect recreational use of these areas.

Project construction is not expected to affect fishing from boats. These boats typically put in at Riveredge Park and motor upstream. There would be additional flow over the dam because the cofferdam would divert water from the arch dam to the main portion of the dam.

6.3.6.2.2 RECREATION FACILITIES

As noted above, opportunities for improving shoreline and river access at the project are very limited, due to steep terrain extending to the river's edge, and the industrial development adjacent on the west side of the project. However, Applicant proposes to construct a canoe portage around the left abutment of Scott's Mill Dam. Applicant initially mapped out a portage route, but because the proposed upstream American Eel and Sea Lamprey fishway requires use of some of the same space that the portage would have used, Applicant curtailed design of the portage until detailed design details of the fishway are developed. Thus, Applicant proposes to design the portage in conjunction with the detailed design for the fishway, because of the limited space between River Road and the dam.

The portage take-out point will be located at least 100 feet upstream of the dam for safety reasons, even though there will be only a small flow over the dam 77 percent of the time. (During high flow periods canoeists and kayakers should not be using the river.) The downstream put-in location will be downstream of the entrance of the fishway. The fishway will be a secure site isolated from the portage. Applicant proposes to use metal construction (likely aluminum) for the take out and put in locations.

Applicant proposes to construct a fishing pier in the vicinity of the canoe put-in point downstream of the dam. Because of the significant variation in tailwater levels with river flow, the fishing pier will need to be designed to withstand high water levels. Applicant proposes to work with Amherst County to improve the informal parking areas adjacent to River Road to ensure the safety of both canoeists and kayakers using the portage and anglers using the fishing pier. Applicant also proposes to enter into an arrangement with VDWR and VMRC so that these facilities are managed by the state agencies. The portage and fishing pier facilities are presented in **Exhibit G, Sheet 2.**

Applicant also plans to add signage to illustrate the historic aspects of Scott's Mill, the Scott's Mill Dam and the water works canal on the west side of the river. This would be done in conjunction with the Virginia Department of Historic Resources (VDHR).

With respect to public boating access to the Scott's Mill headpond, Applicant proposes to purchase a lot currently owned by River Road, LLC near Harris Creek and add a public boat ramp. The boat ramp will be included in the Settlement Agreement with resource agencies, but not included in the FERC licensed project. The details have yet to be worked out, but the boat ramp would be similar to the boat ramp installed by Georgia-Pacific downstream of Big Island dam.

Adding a portage, a fishing pier, and public boat launch to Scott's Mill would add considerable recreational opportunities to the Project area. Additionally, restoration of American Eel and Sea Lamprey should help to improve angling opportunities. When a vertical slot fishway or nature-like fishway are constructed, this too will improve recreational opportunities in the James River.

6.3.6.2.3 CUMULATIVE EFFECTS

The seven dams on the James River from Cushaw Dam downstream to Lynchburg (Scott's Mill Dam) act as barriers to continuous boating along this reach of river. Few portages exist at the dams upstream of the Scott's Mill Project. As such the dams represent a cumulative impact to recreational boating. This will be partially mitigated at Scott's Mill through development of the portage facilities.

6.3.7 LAND MANAGEMENT AND AESTHETIC RESOURCES

6.3.7.1 AFFECTED ENVIRONMENT

6.3.7.1.1 USE OF PROJECT LANDS

The project area is primarily used by the public for fishing and recreational boating. The area in the vicinity of the Scott's Mill Dam and powerhouse will be off limits to the public for safety and security reasons, except for the proposed fishing pier and canoe portage.

The land included within the project boundary is minimal. It excludes the islands upstream except for a small portion of Daniel Island and the upstream portion of Anthony Island (also known as Percival Island) , which is located downstream, as well as the lands needed for project structures. Scott's Mill owner Luminaire Technologies possesses all lands necessary for project facilities and has a flowage easement to increase water levels in the headpond by three feet. In the area where the American Eel fish passage and recreation facilities will be located, the project lands extend from the shoreline to VDOT property on River Road. The width of this sliver of land is only about 50 feet wide for a total area of about 0.9 acres. This entire area has steep banks and is comprised of riparian and forested habitat.

On the south side of the river, approximately 0.3 acres of Daniel Island is included in the project area. Part of this area is needed to divert flow toward the powerhouse from the main channel of the James River. Daniel Island is primarily riparian habitat. Only about 0.2 acres will be needed to accommodate the channel connecting the main channel with the intake channel. About 3 acres of Anthony Island downstream of Scott's Mill Dam are included to ensure that a portion of the powerhouse flow can be diverted to the main channel to maintain water quality. This island is vegetated with riparian habitat. The remaining land needed for construction and operation of the powerhouse is industrial. It consists mainly of land leased to U.S. Pipe. There is a small amount of riparian vegetation along the riverbank, but the area is otherwise industrial. Approximately one acre of the industrial land will be needed to construct and operate the powerhouse. No lands upstream are necessary to operate and maintain the project.

6.3.7.1.2 WETLANDS AND FLOODPLAINS IN THE PROJECT VICINITY

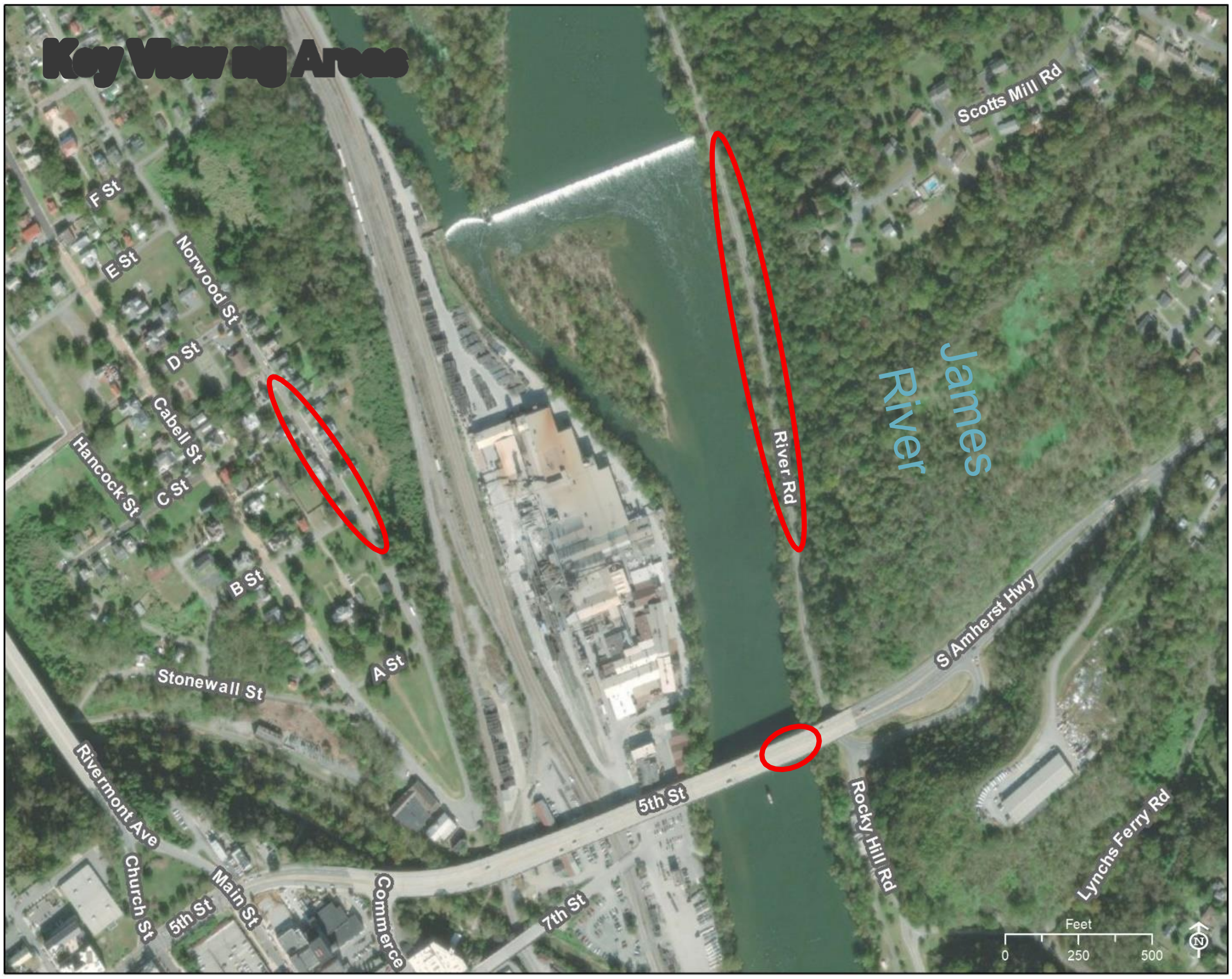
Wetlands: As described in Section 6.3.4 (Terrestrial Resources), the US Army Corps of Engineers (USACE) has verified the probable presence of a jurisdictional wetland area on Daniel Island (just upstream of Scott's Mill Dam). Additionally, some portions of the alluvial island downstream of Scott's Mill dam may be potentially jurisdictional wetlands (though much of the island is rocky).

The James River itself is classified as a jurisdictional surface water, and any impacts to it would be classified as stream impacts. As noted previously, there is little riparian habitat west of the dam. While there is some forested riparian habitat east of the dam, this area has been bisected by a public roadway for many years.

6.3.7.1.3 AESTHETIC RESOURCES ASSOCIATED WITH THE PROJECT

The setting for the Scott's Mill dam and reservoir is industrial/urban. **Photos 7 through 13** in **Appendix C** show the Scott's Mill dam at James River flow levels of 800, 1400, 1500, 1800, 3200 and 25,000 cfs. Flow over the dam becomes more spectacular with increasing James River flows. From an aesthetics perspective, flow over the Scott's Mill Dam is perhaps the most significant feature that could be affected by the project. A map of the KVAs (5th Street bridge, River Road and Norwood Street) is presented in **Figure E-6-6**.

Figure E-6-. Key Viewing Areas



The dam and headpond can be viewed primarily from River Road on the east side of the river. During the summer foliate season, the dam is well screened (**Appendix C, Photo 16 and 17**). Only very limited views of the dam are visible from River Road. Views of the dam are significantly improved during the defoliate season, although partial screening remains (**Photo 18**). Unobstructed views of the dam can be seen from the 5th Street bridge (**Photo 19**), but there are no convenient stopping locations on the bridge. The best view of the dam is from the top of the hill on the west side of the river along Norwood Street (**Photos 20 and 21**). There are seven homes on Norwood that appear to have an unobstructed view of the straight portion of the dam (**Photo 22**). These homes also overlook the U.S. Pipe industrial site. Along much of the route, vegetation partially blocks views of the arch section of the dam where the powerhouse would be located.

The James River and associated islands upstream and downstream (**Photo 22**) of the dam also contribute to the aesthetic character of the project area. In addition, the historic resources such as the Scott's Mill Dam itself, the Scott's Mill grist foundation (**Photo 23**), and the waterworks canal on the west side of the James River are part of the aesthetic setting. However, relative to the scenic area of the Blue Ridge Parkway upstream, the industrial setting diminishes the aesthetic value of the project area.

The three islands located within the impoundment: Daniel Island, Treasure Island, and Woodruff Island have no roadway access and can only be seen from the hilltop on the west side, from select areas along River Road, and by boat.

The annual natural water level fluctuation of the Scott's Mill dam impoundment is on the order of three feet between typical low and high flows, but can be considerably more during significant flood events. (In the 1985 flood it was over 20 feet.) Because of the steepness of the shoreline on each side of the river, there is relatively little exposed shoreline.

On the south side of the dam, there is considerable noise from U.S. Pipe and the railroad, but this is dampened on the north side where the noise primarily emanates from water flowing over the dam.

6.3.7.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

6.3.7.2.1 LAND MANAGEMENT

Applicant's management of Project lands is generally consistent with the surrounding industrial and rural uses. Applicant proposes to minimize impacts to the natural landscape.

6.3.7.2.2 AESTHETICS

The most significant aesthetic impact will be the reduction in flows over the dam. Applicant intends to provide a constant flow of water over the dam during post-project operations. For flows up to the hydraulic capacity of the project (i.e., 4,500 cfs), Applicant proposes a one-inch veil over the dam crest. This veil will be present about 77 percent of the time. It will not be visually significant.

Under existing conditions, flows at 800 cfs are not visually significant. Based on photographs taken at flows of 800 cfs, 1400 cfs, 1500 cfs and 1800 cfs, flows become more visually attractive but not spectacular. In general, it appears that at discharges below 1,000 cfs, flow could be considered not visually significant. Such flows occur about 25 percent of the time.

Flows at 3,000 and above were given a spectacular visual rating. Based on the visual character of flows between 1,800 cfs and 3,200 cfs, Applicant concluded that flows between 1,000 cfs and 3,000 could be considered visually attractive. Visually attractive flows between 1,000 cfs and 3,000 cfs occur about 40 percent of the time. Spectacular flows between 3,000 cfs and 4,500 cfs (the hydraulic capacity of the powerhouse) occur about 12 percent of the time.

The following table illustrates the percent of time that the aesthetic resources are "not visually significant", "visually appealing" or "spectacular category."

Table E-6-8 Waterfall Visual Resource Assessment

SM Flow (cfs)	Pct. of Time	Exist. Cond.	Dam Flow	Post Proj. Rating
<1,000	25	Not. Sig.	30	Not. Sig.
1,000-3,000	40	Appealing	30	Not. Sig.
3,000-4,500	12	Spectacular	30	Not. Sig.
4,500-5,500	6	Spectacular	30-1,000	Not Sig.
5,500-7,500	6	Spectacular	1,000-3,000	Appealing
>7,500	11	Spectacular	>3000	Spectacular

Because views of the flow of water over the dam are limited from River Road and the view from the 5th Street bridge is distant, the impacts from these key viewing areas (KVAs) are not as significant as they might otherwise be. The most significant effect will be to the seven homes on Norwood Street and from the passerby view on the street. However, a large part of their view is also toward the U.S. Pipe industrial site and the railroad. Because there are few observers with unobstructed views of the dam and because they will be able to observe the higher flows 11 percent of the time (i.e., about 40 days per year), Applicant does not propose any further mitigative measures to preserve the aesthetics of the water flowing over the dam, other than to provide a veil over the dam 77 percent of the of the time that the flow is less than the hydraulic capacity of the turbines.

The powerhouse should blend into the surrounding and generally will be shielded from most viewing locations (see **Photograph 22 in Appendix C**). This should not be a significant impact on the environment. Since the Applicant is not proposing significant changes to the headpond elevation, there should not be any impacts to the natural surrounding.

Construction noise should only be a minor nuisance because the U.S. Pipe facility and adjacent railroad contribute significantly to the ambient noise level and there are no close-by sensitive receptors. The north side is quieter, but during construction recreational use at the dam site will be precluded. Therefore, noise effects would impact only those fishing from boats and the intermittent noise generated from the one-year construction of the fishway and recreational facilities will be partially drowned out by the noise for water flowing over the dam."

6.3.8 CULTURAL RESOURCES

6.3.8.1 AFFECTED ENVIRONMENT

The Scott's Mill Hydropower Project has the potential to affect cultural resources that are eligible for or listed in the Virginia Landmarks Register (VLR) and the National Register of Historic Places (NRHP). The Area of Potential Effects (APE) for direct effects to cultural resources is the revised FERC project boundary as depicted in Exhibit G. The Virginia Department of Historic Resources affirmed the APE in an email dated March 30, 2021 (email from Timothy Roberts to James Thornton). The APE for indirect effects contains the area outside the direct effects APE that may experience visual or auditory effects and includes the pipe manufacturing yard on river right, Rocky Hill Road (Route 685) on river left, and the area downstream of the project to the John Lynch Memorial Bridge (Route 163). This section provides a local history to set the context for potential effects on historic properties.

6.3.8.1.1 HISTORY OF THE JAMES RIVER AND KANAWHA CANAL IN THE PROJECT VICINITY

James River and Kanawha Canal Sites in Lynchburg (VDHR No. 118-5497)

The James River and Kanawha Canal was one of the nation's major commercial and transportation arteries during the mid-19th century. Lynchburg was the terminus of the "First Grand Division," which extended 146.5 miles from the Richmond basin to a feeder dam just above Lynchburg [Scott's Mill dam]. This section was opened to traffic in December 1840, and was the only one of three divisions which was completed. During the 1850s, the canal enjoyed its greatest prosperity and assisted in Lynchburg's development as the major commercial and industrial center of the Piedmont. The canal suffered some damage late in the Civil War, and during the 1870s was severely harmed by two disastrous floods. In 1880, the newly organized Richmond and Alleghany Railway Company was authorized to take over the canal company's property. By 1881, tracks had been laid on the towpath and trains were running from Richmond through Lynchburg to Clifton Forge. Although the remains of the Lynchburg portions of the canal have been largely ignored in the 20th century, three important features still remain: The 9th Street Bridge and canal right-of-way, Blackwater Aqueduct, and the Scott's Mill dam. Considered as a thematic group, these sites provide important information on the development of engineering and transportation technology in the first three-quarters of the 19th century. In addition, they are key monuments to the commercial development of the state as well as tangible reminders of the water power necessary for industrial development in the 19th century.

Lynchburg was the terminus of the First Grand Division of the James River and Kanawha Canal. As the expected center of a great deal of commerce, and as the result of a number of natural and manmade features which had to be accommodated at the city's waterfront, Lynchburg was given a number of components of the work. Only in a few short stretches through the city did the canal resemble the tranquil waterway with attendant towpath that characterized its approximately hundred and fifty-mile course upstream from Richmond. When the first boats arrived in Lynchburg in 1841, the major portions of the canal in Lynchburg consisted of the Lynchburg Basin (later to be termed the Lower Basin), a stone bridge carrying Water (now Ninth) Street over the canal, a major aqueduct over the Blackwater Creek, and a dam [Scott's Mill dam] supplying water both to the canal and to the city's pump house for its own water supply. Only between the aqueduct and the dam did the waterway assume the traditional appearance of a canal.

Although the canal bed can still be traced and records and plats do exist to pinpoint the locations of its various original features, a Historic American Engineering Record survey of the Lower Basin conducted in the summer of 1977 revealed that only a few of the Lynchburg portions of the long-abandoned canal exist in anything resembling their original state. Both the Lower Basin and a later Upper Basin survive primarily in name only -- as the traditional designations of the two major centers of the city's industrial activity on the banks of the James River. Both basins have been filled in, paved over, or built upon. In addition to buildings, a number of railroad tracks crisscross the spaces once occupied by the basins. Only at its upstream end, where the Lower Basin approached the Ninth Street Bridge, is there a relatively undisturbed, though filled, remnant of this feature. Only these portions of the canal, that are in relatively original condition, form components of this thematic nomination. These portions are divided into three sections, corresponding to the three nominated sites:

A: Upper portion of Lower Basin and Ninth Street Bridge

B: Blackwater Aqueduct

C: Waterworks dam, James River dam and guard locks.

Source: VDHR V-CRIS database and NRHP Nomination Form data for VDHR architectural Site ID 118-0209 (1/1/1984 and 12/11/1984) and VDHR archaeological Site ID 44CP0069 (2/17/1983 and 6/8/2000), 2015

6.3.8.1.2 ARCHEOLOGICAL RESOURCES

An Architectural survey of the Water Works Dam and Canal (118-0209-0002), James River Dam (118-209-0003), and Scott's Mill Ruin (118-5497), was performed by Hurt and Proffitt, pursuant to Study Plan 15. The results and findings of this survey are included in Appendix I. A summary of the report follows.

The Water Works Dam and Canal and the James River Dam are all included within the National Register boundaries of the James River and Kanawha Canal Sites in Lynchburg, Virginia. The James River and Kanawha Canal Sites in Lynchburg was listed on the Virginia Landmarks Register (VLR) and the National Register of Historic Places (NRHP) in 1984 and has a period of significance of 1836-1882. The Water Works Dam and Canal and the James River Dam are identified with tertiary numbers because these properties are within the boundaries of the James River and Kanawha Canal Sites in Lynchburg. The Scott's Mill Ruin was issued a separate number and is not considered a contributing resource to the James River and Kanawha Canal Sites in Lynchburg, Virginia NRHP property.

The Area of Potential Effects (APE) for architecture is the project footprint as well as the vicinity to the project where alterations to feeling and setting may occur. It was determined that the Water Works Dam and Canal, the James River Dam, and the Scott's Mill Ruin all fall within the project APE for architecture.

Based on the results of the survey, the Water Works Dam and Canal (VDHR No.118-0209-0002) were recommended as eligible for the NRHP. The James River Dam (VDHR No.118-0209-0003) was included as a contributing resource to the James River and Kanawha Canal Sites in Lynchburg nomination; however, research indicates that the James River Dam is a separate resource from that property, post-dating its period of significance. The James River Dam is recommended eligible for the NRHP but it is not a contributing resource to the James River and Kanawha Canal Sites in Lynchburg, Virginia property. The Scott's Mill Ruin (VDHR No.118-5497) was not recommended as individually eligible for the NRHP nor is it a contributing resource to the James River and Kanawha Canal Sites in Lynchburg, Virginia property.

6.3.8.1.3 Archaeological Resources

A windshield site reconnaissance of archaeological resources was conducted in late 2017/early 2018. The study was conducted in accordance with Study Plan 15 and consists of the following (see **Appendix J)**. The ruins of Scott's Mill, located on river left, were identified as an archaeological site. The site's potential for listing in the VLR and NRHP was coordinated with the VDHR (see May 2, 2018 Record of Telephone Conversation in **Appendix A**). Archival research was used to determine the potential for underwater archaeological sites in the APE, and through discussions with VDHR, no underwater archeology investigations were needed at this time, since impacts were not deemed significant to the headpond (see May 2, 2018 Record of Telephone Conversation).

6.3.8.2 ENVIRONMENTAL IMPACTS AND RECOMMENDATIONS

Scott's Mill proposes to maintain the existing natural setting to the extent possible within the project boundary and APE. Applicant proposes to remove the top section of the arch section of Scott's Mill Dam and construct the powerhouse immediately downstream at an oblique angle. Initially the arch section will be used to construct the upstream cofferdam. Once the powerhouse is completed, the top portion of the arch section will be dismantled to allow flow to pass into the headpond and powerhouse. Applicant estimates that about 6.4 feet of the top of the arch dam will be removed. After the hydro powerhouse is completed, Applicant plans to add a two-foot high concrete cap on the spillway with a new crest elevation of 516.4 feet. Additional construction proposed would be a canoe portage near the old mill site and the American Eel and Sea Lamprey fishway which will utilize the east abutment and old mill site.

Based on the project scope and current findings the project is unlikely to have adverse effects on archaeological historic properties or historic properties in the indirect APE. The Applicant anticipates that modifications to the Water Works Dam and Canal (VDHR No.118-0209-0002) and James River Dam (VDHR No.118-0209-0003) may constitute an adverse effect on these historic properties. Applicant will continue to consult with the Commission, SHPO and Section 106 consulting parties to prepare a Historic Properties Management Plan and Programmatic Agreement to address effects to historic properties. The HPMP will include procedures to be followed for construction of the powerhouse and fishways. If a nature-like fishway is constructed using the water works canal on river right, Applicant will consult with the SHPO to determine the best approach for adaptive reuse of the historic canal.

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EXHIBIT E

APPENDICES

Scott’s Mill Hydropower Project

FERC Project No. 14867