United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 Westgate Center Drive
Hadley, MA 01035-9589

SEP 11 2018

Ms. Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, D.C. 20426

Attn: David Swearingen, Branch Chief

Re: Atlantic Coast Pipeline, LLC, Atlantic Coast Pipeline; Dominion Energy Transmission, Inc., Supply Header Project; Docket Numbers CP15-554-000, CP15-554-001, CP15-555-000; Project #05E2VA00-2016-F-1219, #05E2WV00-2014-F-0832, #05E2PA00-2016-TA-0960, #04EN2000-2017-I-0738

Dear Ms. Bose:

This document transmits the U.S. Fish and Wildlife Service's (Service) revised biological opinion (Opinion) with a new Incidental Take Statement (ITS) based on our review of the referenced project and its effects on the federally listed species in Table 1 in accordance with Section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA).

Table 1. Species considered in this Opinion.

Species Common Name	Species Scientific Name	ESA Status	State	FERC Action
Small whorled pogonia (SWP)	*Isotria medeoloides*	threatened	VA, WV	Atlantic Coast Pipeline (ACP)
Running Buffalo clover (RBC)	*Trifolium stoloniferum*	endangered	WV	ACP
Roanoke logperch (RLP)	*Percina rex*	endangered	VA	ACP
Clubshell	*Pleurobema clava*	endangered	WV	ACP
Rusty patched bumble bee (RPBB)	*Bombus affinis*	endangered	VA	ACP
Madison Cave isopod (MCI)	*Antrolana lira*	threatened	VA	ACP
Indiana bat (Ibat)	*Myotis sodalis*	endangered	VA, WV	ACP (VA, WV); Supply Header Project (SHP) (WV)
Northern long-eared bat (NLEB)	*Myotis septentrionalis*	threatened	WV	ACP

Your August 23, 2018 request to reinitiate formal consultation was received on August 23, 2018. We have drafted a new ITS to address the U.S. Court of Appeals for the Fourth Circuit's August 6, 2018 opinion. Much of the Service's October 16, 2017 Opinion remains unaffected by the Court's opinion. Other portions of this Opinion are modified to either: 1) directly address the Court's opinion with respect to the ITS, or 2) update the Opinion to ensure that we continue using the best available scientific and commercial information. This revised Opinion replaces the Service's 2017 version of the Opinion.

This Opinion is based on information provided in the July 2017 Final Environmental Impact Statement (FEIS) (Federal Energy Regulatory Commission [FERC] 2017); information provided to the Service from FERC, the project proponent, or interested parties (e.g., State agencies, federal land management agencies) including information provided since issuance of the October 16, 2017 Opinion; telephone conversations; field surveys/investigations; and other sources of information. The consultation history is located in Appendix A. Because the project traverses 4 states under the geographic jurisdiction of the 4 Service Field Offices in Raleigh, North Carolina (NC), State College, Pennsylvania (PA), Gloucester, Virginia (VA), and Elkins, West Virginia (WV), each maintain their geographic portion of the administrative record in their respective Field Office.

FERC, under Section 7 of the Natural Gas Act, is required to consider, as part of its decision to authorize interstate gas facilities, all factors bearing on the public convenience and necessity. This includes any "nonjurisdictional" facilities that do not come under the jurisdiction of FERC but may be integral to the project objective. Nonjurisdictional facilities that lie outside the footprint of jurisdictional facilities were not included in the analysis of impacts to federally listed species provided to the Service by FERC. Therefore, any effects to and take of listed species associated with nonjurisdictional facilities may not be covered in this Opinion. The nonjurisdictional facilities associated with this project are summarized in Table 2.8-1 of the FEIS and further discussed in Section 4.13 (FERC 2017).

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

As defined in the ESA Section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas." The "action area" is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action."

Atlantic Coast Pipeline, LLC (Atlantic) and Dominion Energy Transmission, Inc. (DETI) have requested the FERC authorize the construction and operation of a total of 642.0 miles of natural gas transmission pipeline and associated facilities in PA, WV, VA, and NC (Figure 1).

The following is a summary of the proposed action and a detailed description can be found in FERC's ACP and Supply Header Project (SHP) Final Environmental Impact Statement, July 2017 (collectively FEIS) (FERC 2017).

Proposed Facilities – ACP will be located in WV, VA, and NC (Figure 2). As proposed, this project includes 2 mainline pipeline facilities and 3 pipeline laterals consisting of 519.7 miles of new 42- and 36-inch (in) diameter natural gas pipeline and 84.8 miles of 20- and 16-in diameter natural gas pipeline. Additional components include 3 new compressor stations, 9 metering and regulation (M&R) stations, 41 valves, and 8 sets of pig launchers/receivers. ACP will deliver up to 1.5 billion cubic feet per day (Bcf/d) to customers in WV, VA, and NC.

SHP will be located in PA and WV (Figure 3). As proposed, this project includes 37.5 miles of new 30-in diameter natural gas pipeline, modifications to 4 existing compressor stations, 1 M&R station, 6 valves, and 2 sets of pig launchers/receivers. DETI also proposes to abandon 2 existing gathering compressor units and build 2 new ones at an existing compression station. SHP will deliver up to 1.5 Bcf/d to various customers including Atlantic.

A brief description of the 6 types of above-ground facilities proposed to be installed is included below. Additional details describing the facilities are included in Section 2.1.2 of the FEIS (FERC 2017).

- Compressor stations – utilize engines to maintain pressure within the pipeline to deliver the contracted volumes of natural gas to specific points at specific pressures. Designed to attenuate noise and allow for operation and maintenance (O&M) activities.
- M&R stations – measure the volume of gas removed from or added to a pipeline system at receipt and delivery interconnects. These consist of a small graveled area with a small building(s) that encloses the measurement equipment.
- Valves – consist of a small system of aboveground and underground piping and valves that control the flow of gas within the pipeline and can also be used to vacate, or blow-off, the gas within a pipeline segment, if necessary.
- Pig launchers and receivers – facilities where internal pipeline cleaning and inspection tools, referred to as "pigs", can be inserted or retrieved from the pipeline. These generally consist of a segment of aboveground piping, 20-30 feet (ft) in length, which ties into the mainline pipeline facilities below the ground surface.
- Cathodic protection systems – systems that help prevent corrosion of underground pipeline facilities. These typically include a small, aboveground transformer-rectifier unit and an associated anode ground bed located underground.
- Communication towers and antennas – provide wireless communications necessary to operate monitoring and control systems.

Figure 1. ACP and SHP project overview.

Figure 2. ACP project overview.

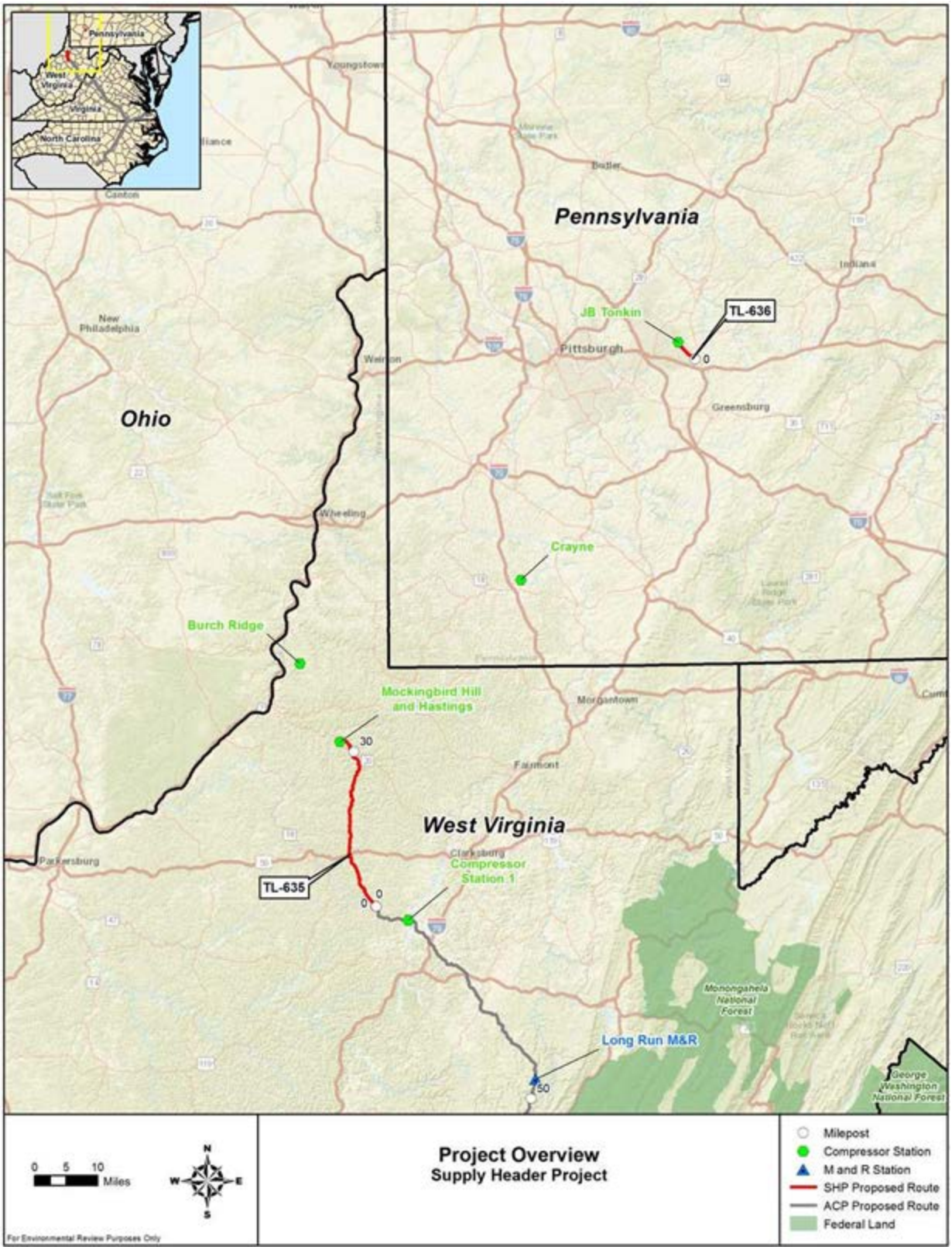

Figure 3. SHP project overview.

Land Requirements – Collectively, construction of ACP and SHP will disturb 11,775.9 acres of land. Following construction, 4,929.6 acres will be maintained for O&M of the project facilities. The remaining 6,846.3 acres of land disturbed by ACP and SHP will be restored and allowed to revert to former use. A brief description of the 4 types of land requirements is included below. Additional details describing the land requirements are included in Section 2.2 of the FEIS (FERC 2017).

- Pipeline right-of-way (ROW) – Atlantic and DETI will use a variety of ROW configurations to construct and operate the pipeline facilities. Section 2.2.1 and Table 2.1.1-1 of the FEIS provide specific details (FERC 2017). The construction ROW consists of 2 portions, the temporary construction ROW and the permanent ROW. Temporary construction ROW will be restored or will revert to former use while the permanent ROW will be maintained and utilized for O&M purposes.
- Additional temporary workspace (ATWS) – additional space required in particular areas necessary to complete construction of the pipeline. Examples include, but are not limited to, certain pipe bend locations, truck turnarounds or equipment passing lanes, and construction constraint areas that require special construction techniques such as horizontal directional drill (HDD) entry and exit locations.
- Pipe/contractor yards (CY) and staging areas – used for equipment, pipe sections, and construction material and supply storage, as well as temporary field offices, parking, and pipe preparation and preassembly staging areas.
- Access roads – necessary to gain access to the construction ROW and aboveground facilities. Many of the proposed access roads are existing roads that can accommodate construction traffic without modification.

Construction Procedures – Atlantic and DETI will design, construct, operate, and maintain their respective pipelines and facilities in accordance with U.S. Department of Transportation (DOT) regulations under 49 CFR 192 and other applicable federal and state/commonwealth requirements. Atlantic and DETI will comply with siting and maintenance requirements under 18 CFR 380.15 and implement various forms of mitigations as defined in 40 CFR 1508.20. They will adopt FERC's general construction, restoration, and operational mitigation measures as outlined in FERC's Upland Erosion Control Revegetation and Maintenance Plan (FERC 2013a) and Wetland and Waterbody Construction and Mitigation Procedures (FERC 2013b). Specific mitigation plans for National Forest lands have been determined in consultation with the U.S. Forest Service (USFS). Construction plans for both projects include some modifications to FERC's procedures and more details can be found in FEIS section 2.3.1.1 (FERC 2017).

A brief description of the 9 types of typical construction procedures associated with the project is included below. Additional details describing the typical construction procedures are included in Section 2.3.2 of the FEIS (FERC 2017). Construction at any single point along the pipelines could last from 6 to 12 weeks or longer. The complete proposed construction schedule can be found in FEIS section 2.4 and FEIS Table 2.4-1 (FERC 2017).

- Surveying and staking – marking of the limits of construction ROW, centerline, ATWS, other approved work areas, and environmentally sensitive areas using temporary flagging or tape.

- Clearing and grading – removal of trees, shrubs, brush, roots, and large rocks from the construction work area and leveling of the construction ROW to allow for operation of construction equipment.
- Trenching – digging of pipeline trench by removal of soil and rock by rotary trenching machine, track-mounted excavator, or similar equipment. Tractor-mounted mechanical rippers, hydraulic hoe rams, rock trenchers, or blasting may be used to fracture rock prior to removal.
- Rock removal and blasting – where bedrock cannot be fractured by mechanical equipment, blasting will be required following a project-specific *Blasting Plan* (*http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14395436*). Typical blasting methods include mass rock blasting, production blasting, and trench blasting.
- Pipe stringing, bending, welding, and coating – transportation of pipe segments to CY or work areas and bending of pipes to fit contours of the trench. Pipeline segments will be aligned and welded together, and the welds will be inspected and coated with epoxy or other protective coating.
- Lowering-in and backfilling – lowering of pipe using side-boom tractors and backfill of trench with suitable excavated material. In rocky areas, protective materials may be placed in trench to protect pipe. Trench breakers (stacked sandbags or polyurethane foam) will be placed in trench prior to backfilling to prevent subsurface water movement along pipeline.
- Internal pipe cleaning and hydrostatic testing – cleaning of pipe to remove dirt, water, or other debris and hydrostatic testing to ensure that the system is capable of withstanding the operating pressure for which is it designed.
- Commissioning – verifying that equipment has been properly installed and working, verifying that controls and communication systems are functioning, and confirming that the pipeline is ready for service. As a final step, the pipeline will be purged of air and loaded with natural gas.
- Cleanup and restoration – grading and restoration of all work areas to pre-construction contours and natural drainage patterns as closely as possible.

Specialized construction methods for crossing under sensitive resources such as agricultural lands, roads, foreign utilities, residential areas, waterbodies, wetlands, and other sensitive environmental resources will be employed. A brief description of the specialized construction methods is included below. Additional details describing the specialized construction methods are included in Section 2.3.3 of the FEIS (FERC 2017).

- Waterbody crossings –
    - Wet open-cut construction method – trench excavation, pipeline installation, and backfilling in a waterbody without controlling or diverting streamflow.
    - Flume construction method – diversion of streamflow through flume pipes and placement of dam structures to exclude water flow from trench area.
    - Dam and pump construction method – diversion of stream flow using pumps and hoses and placement of dam structures to exclude water flow from trench area.
    - Cofferdam method – installation of a temporary diversion structure from 1 bank of the waterbody to the approximate midpoint of the waterbody crossing to isolate

that section of the stream from the rest of the waterbody, creating discrete dry sections around which water flows unimpeded.

- Trenchless methods –
    - Conventional bore method – bore pits are excavated on both sides of the sensitive resource, boring machines are used to excavate a tunnel between the bore pits, and a pre-fabricated pipe is pushed through the borehole without affecting the surface of the resource.
    - HDD construction method – drilling of a hole under a sensitive resource and installation of a pre-fabricated pipe segment through the hole. A pilot hole is first drilled and then enlarged using several passes of successively larger reaming tools. Drilling mud composed of 65 percent water and 30 percent bentonite clay is required to lubricate the drills.
    - Direct pipe method – excavation and hole boring is performed with a navigable microtunneling machine and a cutterhead while simultaneously installing the pipe using a pipe thruster.
- Wetland crossings – construction ROW through wetlands are typically 75 ft wide with ATWS located in upland areas a minimum of 50 ft from wetland edge, unless granted site-specific approval for a reduced setback. Sediment barriers such as silt fence and staked straw bales will be utilized during clearing and construction. The push-pull technique, conventional bore, and HDD methods may be used to install pipes.
- Karst sensitive areas – crossing of karst sensitive areas will follow the project-specific construction, restoration, and mitigation methods outlined in the *Karst Mitigation Plan* included in Appendix I of the FEIS (FERC 2017).
- Steep slopes – temporary and permanent controls measures such as trench breakers, trench plugs, silt fencing, erosion control matting, and hydro-mulching will be put in place to minimize erosion and sedimentation. In steepest area, techniques such as "winching" and two-tone construction methods may be employed.
- Residential construction – implement measures to minimize construction-related impacts on all residences and other structures located within 50 ft of the construction ROW following site-specific *Residential Construction Plans* included in Appendix J1 of the FEIS (FERC 2017).
- Agricultural areas – a maximum 12-in of topsoil in actively cultivated and rotated croplands, pastures, and hayfields and in other areas at the specific request of the landowners or land management agency will be segregated during construction and replaced to the upper soil layer during backfill. Any disrupted irrigation and drainage systems will be permanently repaired.
- Road, railroad, and trail crossings – railroads and roads where traffic cannot be detoured will generally be crossed by boring beneath the road or railroad. Most gravel and dirt roads, driveways, and roads in areas with a high water table, as well as most USFS system trails, will be crossed by open-cut method, which will require temporary closure of the road or trail and establishment of detours.
- Foreign utilities – buried utilities will be identified and flagged using One-Call systems prior to ground-disturbing activities.
- Winter construction – specialized construction methods or procedures will be utilized to

protect resources during the winter season as described in the *Winter Construction Plan* (*http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14475037*).

Environmental Inspection, Compliance Monitoring, and Post-Approval Variances – Atlantic and DETI have developed procedures for environmental inspection, compliance monitoring, and post-approval variances. A brief description of the procedures is included below. Additional details describing the procedures are included in Section 2.3.3 of the FEIS (FERC 2017).

- Coordination and Training – copies of all applicable environmental permits, construction drawings, and specifications will be provided to construction contractors. Contractors will attend an environmental training program tailored to the proposed projects and their construction requirements.
- Environmental Inspection – trained environmental inspectors (EIs) will be employed to ensure that construction complies with construction and mitigation procedures imposed by FERC and other regulatory agencies. EIs will have the authority to stop activities that violate conditions of the FERC certificate, other permits, or landowner requirements, and have authority to order the appropriate corrective actions.
- FERC Compliance Monitoring – in additions to EIs, a third-party compliance monitoring program will be funded to provide daily environmental monitoring services during construction. Other federal, state/commonwealth, and local agencies may also monitor the project to the extent determined necessary by the agency.
- USFS Compliance Monitoring – USFS will monitor implementation of ACP to assure that the terms and conditions of the Special Use Permit are carried out during and after construction.
- Post-Approval Variance Process – a "variance request" will be submitted to FERC in the event that minor route realignment or other workspace refinements are required subsequent to project approval. FERC will take the lead on evaluating the request and coordinating with any appropriate land-managing agencies for approval or denial.
- Post-Construction Monitoring – follow-up inspections of all disturbed uplands areas will be conducted, at a minimum after the first and second growing seasons to determine the success of restoration, and inspections will continue monitoring areas until revegetation thresholds are met, temporary erosion control devices are removed, and restoration deemed complete.

Operation and Maintenance – ACP and SHP pipelines and aboveground facilities will be operated and maintained in accordance with U.S. DOT regulations in 49 CFR 192, FERC's guidance at 18 CFR 380.15, the USFS Special Use Permit, and the maintenance provisions of the FERC Plan (*https://www.ferc.gov/industries/gas/enviro/plan.pdf*) and Procedures (*https://www.ferc.gov/industries/gas/enviro/procedures.pdf*). A brief description of the O&M details is included below. Additional details describing O&M are included in Section 2.6 of the FEIS (FERC 2017).

- Pipeline Facility O&M – an O&M plan and an emergency plan will be established that includes procedures to minimize the hazards in a natural gas pipeline emergency. Regular patrols, inspection, and repair of the pipeline will be conducted.
- Aboveground Facility O&M – new and modified compressor stations will be operated

and maintained in accordance with Pipeline and Hazardous Materials Safety Administration requirements and standard procedures. Standard operations at compressor stations include such activities as the calibration, maintenance, and inspection of equipment, as well as periodic checking of safety and emergency equipment and cathodic protection systems.

Future Plans and Abandonment – ACP Foundation Shippers have a right to request an increase in contracted capacity by participation in an Optional Expansion or Second Expansion. Any future increase in capacity or expansion would require additional environmental review and FERC authorization. If at some point in the future, any of the approved project facilities are proposed to be abandoned, Atlantic and/or DETI would have to seek specific authorization from FERC for that action and the public will have the opportunity to comment on the applicant's abandonment proposal.

Conservation Measures – Conservation measures proposed as part of the action (measures that will avoid, minimize, and mitigate effects of the proposed action on the species and/or benefit the species as a whole) are referred to as avoidance and minimization measures (AMMs) in this Opinion. AMMs are provided in the FEIS (FERC 2017) and discussed, as applicable, in Appendix B of that document.

Project Status and Variances - In their August 23, 2018 letter to the Service, FERC stated that "The Project has been in various stages of construction since January 2018. However, we have reviewed the current status of the Project and have confirmed that the Description of the Proposed Action contained in the BO is still accurate. The FERC has approved requests for a number of minor variances (generally, minor route realignments, workspace modifications, and new access routes) during construction of the Project. The FERC variance program requires that each requested project change result in either no impacts to federally listed species, or that impacts are not likely to adversely affect listed species, for which the FWS provided concurrence as a part of the variance review. Thus, the approval of the variances has not resulted in any additional impacts to listed species. All such variances have been documented in the FERC record."

Action Area

The action area is defined (50 CFR 402.02) as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The Service has determined that the action area for this project is all lands in PA, WV, VA, and NC affected directly or indirectly by the project's components described in Description of Proposed Action.

STATUS OF THE SPECIES

Per the ESA Section 7 regulations (50 CFR 402.14(g)(2)), it is the Service's responsibility to "evaluate the current status of the listed species or critical habitat."

To assess the current status of the species, it is helpful to understand the species' conservation needs which are generally described in terms of reproduction, numbers, and distribution (RND). The Service frequently characterizes RND for a given species via the conservation principles of resiliency (ability of species/populations to withstand stochastic events – numbers, growth rates), redundancy (ability of a species to withstand catastrophic events – number of populations and their distribution), and representation (variation/ability of a species to adapt to changing conditions) (collectively known as the three Rs).

Small whorled pogonia (SWP) – As described by the Service (2008), the SWP conservation needs include "resolving data gaps and assessing the conservation potential for populations on private lands." Currently, as a whole, the rangewide status of the species is stable (Service 2008). From 1985 - 2007, the populations in VA had been improving and population numbers in WV remained low but stable (Service 2008). The primary factors influencing the status include risks posed by land development; however these activities are diffuse across the species' range and do not constitute an acute threat to SWP survival and recovery (Service 2008). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=Q1XL.

Running Buffalo clover (RBC) – As described by the Service (2011), the RBC conservation needs include assessing "direct and indirect human impacts that lead to habitat loss, alteration, significant degradation such as development, and the introduction of non-native invasive species." Currently, the rangewide status of the species is stable or improving. In WV, 12 populations are improving (Service 2011). The primary factors influencing the status include risks posed by "habitat destruction, habitat succession, and invasive plant competition" (Service 2011). In WV, "invasive species such as multiflora rose (*Rosa multiflora*) and Japanese stiltgrass (*Microstegium vimineum*), a lack of protection from heavy trail use, and shading are severe threats to populations." Small population size and climate change continue to be threats as well (Service 2011). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: *https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=Q2RE*.

Roanoke logperch (RLP) – As described by the Service (2007), the RLP conservation needs include solving data gaps that limit an accurate assessment of population abundance, maintaining the health and vigor of present populations by addressing sediment loading at the watershed level and preserving ecological processes, increasing connectivity of populations by identifying and eliminating barriers, and preventing and reducing the risk of catastrophic extirpation from toxic spills. Currently, the rangewide status of the species is improving, although the geographic range remains small. The populations in VA seem to be stable or increasing (Service 2007). The primary factors influencing the status include risks posed by large dams and reservoirs, small dams and barriers, watershed urbanization, agricultural and silvicultural activities, channelization, roads, toxic spills, riparian/woody debris loss, and water withdrawals (Service 2007). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: *https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E01G*.

Clubshell – As described by the Service (2008), the clubshell conservation needs include assessing habitat loss, susceptibility to land use changes, and reproductive success. Currently, as a whole, the rangewide status of the species is declining. In the Kanawha River system of WV the species appears to be stable (successfully reproducing). However, in the Monongahela River system of WV, the species is in "severe decline" (Service 2008). The primary factors influencing the status include risks posed by water quality degradation and alterations, instream activities, exploration and extraction of coal, oil, and natural gas, even at a distance from clubshell populations, and development near streams and adjacent uplands (Service 2008). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: *https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=F01D*.

Rusty patched bumble bee (RPBB) – As described in Service (2016), the RPBB conservation needs include assessing resiliency to environmental variation, perturbations affecting habitat size and quality, and population size. Currently, the rangewide status of the species is declining (82 FR 3186-3209). The primary factors influencing the status include risks posed by "pathogens, pesticides, habitat loss and degradation, small population dynamics, and climate change" (82 FR 3186-3209). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: *https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=I0WI*.

Madison Cave isopod (MCI) – As described by the Service (2011), the MCI conservation needs include assessing "thermal and chemical pollution from urban development and agricultural runoff, physical pollution, and human disturbance (cave vandalism and visitation)." Currently, the rangewide status of the species appears to be stable (Service 2011). The primary factors influencing the status include risks posed by habitat degradation from altering streams, isolation of populations from physical barriers, shifts in subterranean sediment associated with development, and groundwater contamination (Service 2011). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: *https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=K008*.

Indiana bat (Ibat) – As described by the Service (2016), the Ibat conservation needs include assessing and offsetting adverse impacts to the species and promoting recovery. Currently, the rangewide status of the species is declining (Service 2016) and the degree of threat to the continued existence of the species is high (Service 2009). The primary factors influencing the status of the species include risks posed by White-nose syndrome (WNS), habitat loss and degradation, forest fragmentation, winter disturbance, environmental contaminants, climate change, and collisions with human-made objects (Service 2009, 2016). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: *https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A000*.

Northern long-eared bat (NLEB) – The NLEB conservation needs include protecting and reducing disturbance of hibernacula, summer roosts, and the buffer zone known as "WNS zone" (81 FR 1900-1922). Currently, the rangewide status of the species is declining (81 FR 1900-

1922). The primary factors influencing the status include risks posed by WNS, tree removal, disturbance around roosts during the summer months, and disturbance at the entrance and interior of hibernacula. "This includes the physical or other alteration of the hibernaculum's entrance or environment when bats are not present if the result of the activity will impair essential behavioral patterns" (81 FR 1900-1922). For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to: *https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A0JE*.

STATUS OF CRITICAL HABITAT

No critical habitat has been designated for SWP, RBC, RLP, clubshell, RPBB, MCI, or NLEB.

Critical habitat for Ibat has been designated at Hellhole Cave, Pendleton County, WV; however, this action does not affect that area.

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated or ongoing impacts of all proposed federal projects in the action area that have undergone Section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Status of the Species within the Action Area

Small whorled pogonia – Two new SWP colonies were found within the action area during 2016 plant surveys (Allstar Ecology 2016a, 2016b; Vanasse Hangen Brustlin, Inc. [VHB] 2016a, 2016b, 2017; Environmental Resource Management [ERM] 2017). One colony is located in the Seneca State Forest, WV (Seneca colony) and 1 colony is located in the Monongahela National Forest (MNF), WV (MNF colony).

The Service received new information from June 29 to August 23, 2018 from ERM about additional SWP stems adjacent to the Seneca and MNF colonies, as well as adjacent to 2 previously documented SWP colonies in the MNF (MNF-2 colony) and the George Washington National Forest (GWNF), VA (GWNF colony). The latter 2 colonies were not included in the October 16, 2017 Opinion because the proposed action was not likely to adversely affect these SWP colonies, based on the percentage of upslope drainage area within the construction ROW, distance of the colony from the construction ROW and access road, and AMMs proposed in the revised SWP Conservation Plan (S. Trichell, Dominion Energy, emails to T. Andersen, Service, September 6 and 8, 2017; VHB 2017; T. Andersen, Service, to K. Bowman, FERC, October 11, 2017). Based on new information that stems are closer to the construction ROW, MNF-2 and GWNF colonies are now considered likely to be adversely affected by the proposed action and are included in this Opinion.

The Seneca colony in Pocahontas County, WV, was originally located 70 ft downslope from the construction ROW in 2016 (Allstar Ecology 2016a, 2016b; ERM 2017; VHB 2017). Ten stems were observed above an alluvial bench on a hillside in an oak-pine forest. Three of the stems were flowering. This colony is characterized by a relatively dense understory, larger light gaps, and a higher frequency of coarse woody debris compared to the MNF colony. During a 2017 pre-construction survey, 24 stems were observed (VHB 2017). On June 28, July 17, and July 18, 2018, approximately 38 stems were observed and 1 of the new stems was located approximately 11 ft downslope from the construction ROW (S. Throndson, ERM, emails to J. Stanhope, Service, August 8 and 23, 2018). This colony has the potential to meet the definition of a self-sustaining, viable population (i.e., geometric mean of 20 emergent stems, of which at least 25 percent are flowering stems, over a 10-year period) (Service 1992). The colony is approximately 550 ft from the nearest trail and 1,000 ft from the nearest road. No invasive plants are present near this colony, thus no invasive species control plan has been established by the WV Division of Natural Resources (WVDNR) (C. Brown, WVDNR, email to J. Stanhope, Service, September 15, 2017).

The MNF colony in Pocahontas County, WV, was originally located approximately 221 ft downslope of the construction ROW in 2016 and 2017 (Allstar Ecology 2016a, 2016b; ERM 2017; VHB 2017). Three stems were observed mid-slope on a south-facing hillside dominated by an oak-hickory-heath community, characterized by presence of dappled sunlight, low-density understory, and some coarse woody debris. On July 11, 12, and 30, 2018, approximately 7 stems were observed and 3 of the new stems were located approximately 45 ft downslope of the construction ROW (S. Throndson, ERM, emails to J. Stanhope, Service, August 8 and 23, 2018). The colony is on a MNF parcel “landlocked” by private landowners and thus inaccessible by the general public (K. Karriker, USFS, email to E. Stout, Service, August 11, 2017). The USFS is not conducting invasive species control in this area, because, until recently, they did not have invasive plant inventory data for that parcel (K. Karriker, USFS, email to J. Stanhope, Service, September 26, 2017). Plant surveys identified invasive Japanese stiltgrass and Japanese barberry (*Berberis thunbergii*) in the general vicinity.

The MNF-2 colony in Pocahontas County, WV, is located approximately 0.3 miles southeast of the MNF colony and was originally 308 ft downslope of the construction ROW in 2016 and 2017 (Allstar Ecology 2016a, 2016b; ERM 2017; VHB 2017). Four and 3 stems were observed in 2016 and 2017, respectively, near the toe of an east-facing hillside dominated by an oak-pine-heath community, with similar characteristics as MNF colony. On July 9, 2018, approximately 22 stems were observed and 6 stems are located approximately 103 ft downslope of the construction ROW. An unnamed, private two-track MNF access road is located approximately 385 ft downslope of MNF-2 colony; ACP does not propose to use this road so it will remain in its current condition throughout the project.

The GWNF colony in Highland County, VA, was originally located 382 ft downslope of the construction ROW in 2016 and 2017 (VHB 2016a, 2016b; S. Trichell, Dominion Energy, email to T. Andersen, Service, September 8, 2017). A total of 19 and 13 stems were observed in 2016

and 2017, respectively within the 0.34-acre colony boundary (VHB 2016a, 2016b; VHB 2017). From June 25 to 27, 2018, 5 new stems were observed outside of the colony boundary and 2 of them were located approximately 115 ft downslope of the construction ROW (S. Throndson, ERM, emails to J. Stanhope, Service, August 8 and 23, 2018). SWP within the original colony boundary was not resurveyed; taking the average of the 2016 and 2017 stems in this original area (16 stems), we estimate approximately 21 stems total in this colony. This colony has the potential of meeting the definition of a self-sustaining, viable population (e.g., geometric mean of 20 emergent stems, of which at least 25 percent are flowering stems, over a 10-yr period) (Service 1992). The habitat within and surrounding this colony included mixed oak hardwood forests with generally open understory conditions, minimal aggressive ground-level species, moderately sloping land within shallow upland draws, scattered ground-level sunlight, and mesic, acidic soils. The western portion of the colony was located in a habitat transition zone between mature mixed oak and regenerative forest types. There is an existing GWNF access road, not currently used or maintained by USFS, east and south (downslope) of the colony, approximately 187 ft and 270 ft away, respectively; ACP is proposing to improve and maintain this road as a permanent access road.

For the Seneca colony, maintenance of existing roads by the WV Department of Transportation and maintenance of trails and adjacent areas by WVDNR likely reduces suitability of SWP habitat due to vegetation management, soil compaction, vehicle operation, foot traffic, and chemical contamination. The close proximity of trails and roads to the Seneca colony provides for easy public access to the colony and resulting foot traffic. Collection by orchid enthusiasts and vandalism continues to be a threat for all SWP colonies. SWP plants were illegally removed from MNF in Randolph County, WV in 2016. Herbivory by white-tailed deer (*Odocoileus virginianus*) or other mammals and invertebrates occurs throughout the range of SWP (Service 1992). In 2017, 1 plant from the MNF colony appeared to have been browsed and only the stem was observed (VHB 2017). Herbivory of SWP or an obvious white-tailed deer browse line in the forest area has not been observed near the Seneca colony (C. Brown, WVDNR, email to J. Stanhope, Service, September 19, 2017).

Running buffalo clover – Survey efforts completed in 2015, 2016, and 2017 (AllStar Ecology 2015, 2016, 2017) documented 27 RBC occurrences (Table 2) on private land in Randolph and Pocahontas Counties, WV, within the action area. Most occurrences were documented in areas with intermittent soil disturbance, such as former logging roads and off-road vehicle (ORV) trails under primarily closed-canopy mixed-hardwood forest with filtered sunlight. All occurrences were within, or in close proximity to, limestone geology of the Mississippian age.

Delineating RBC populations from occurrences is difficult and involves distinguishing and mapping discrete occurrences. For the purposes of our analysis, the 27 occurrences were delineated as 6 populations (Table 2). The populations were delineated based on distance of the occurrences from one another and habitat connectivity between the occurrences.

Table 2. RBC populations and occurrences within action area. Population number 3 and 4 are not included because they are not affected by the proposed action. Data on rooted crowns in the limits of disturbance obtained from ERM (2017).

Population Number	County	Size of Occurrence (acres)	Total Rooted Crowns	Number of Rooted Crowns in Limits of Disturbance
1	Randolph	0.0354	159	108
2	Randolph	0.7143	4,722	3,055
2	Randolph	0.0014	15	15
2	Randolph	0.0051	31	31
5	Pocahontas	0.0015	6	6
5	Pocahontas	0.0020	34	34
5	Pocahontas	0.1104	447	167
5	Pocahontas	0.0022	26	26
5	Pocahontas	0.0006	39	39
6	Pocahontas	0.0140	118	118
6	Pocahontas	0.0589	24	17
6	Pocahontas	0.0004	10	10
6	Pocahontas	0.0144	60	60
7	Pocahontas	0.0007	7	7
7	Pocahontas	0.0004	7	7
7	Pocahontas	0.0124	85	85
7	Pocahontas	0.0009	30	30
7	Pocahontas	0.0013	17	17
7	Pocahontas	0.0069	108	108
7	Pocahontas	0.020	291	3
7	Pocahontas	0.0161	610	220
7	Pocahontas	0.0014	47	47
7	Pocahontas	0.0021	53	53
7	Pocahontas	0.0005	26	26
7	Pocahontas	0.3484	3,313	1,233
8	Pocahontas	0.0012	220	220

8	Pocahontas	0.0024	10	10

All RBC occurrences are on private land and we are not aware of specific activities that have occurred that benefit or adversely affect the species. However, because most occurrences of RBC are located on or near old logging roads or trails, they have likely received some type of occasional disturbance. For example, beneficial effects may have occurred at some RBC occurrences as a result of occasional foot traffic or ORV use by landowners. Conversely, adverse effects may have occurred from higher frequencies of ORV travel during a shortened time period or heavy equipment use of old logging roads during land management or timbering operations.

Roanoke logperch – Presence/absence surveys for RLP were not conducted for the proposed action. RLP presence is assumed where suitable habitat was identified within potential habitat and in areas known to support RLP. Genetic analysis (Roberts et al. 2013) of RLP indicated a dispersal extent of up to 80 river kilometers (km) and the authors recommended monitoring and recovery efforts should target entire catchment areas. The following waterbody crossings were categorized as suitable habitat identified by desktop analysis or in-situ assessment: Butterwood Creek (milepost [(MP]) 253.7) and Sturgeon Creek (MP 272). The following waterbody crossings were categorized as known to support RLP-presence assumed: Nottoway River 1 (MP 260.7) and Waqua Creek (MP 267.4).

On June 1, 2018, the Service received "Revised Habitat Assessments Conducted for Roanoke Logperch (*Percina rex*) Along the Proposed Atlantic Coast Pipeline in Virginia, Revised," dated December 1, 2017 (Environmental Solutions & Innovations, Inc. [ESI] 2018), from FERC. A habitat assessment was conducted at the Butterwood Creek crossing (MP 253.7) and no portion of the assessed stream reach contained habitat suitable to support RLP. The habitat assessment indicates no RLP habitat, therefore RLP presence is no longer assumed at this crossing.

Sturgeon Creek crossing, Brunswick County, VA, is a tributary to the Nottoway River and contains suitable RLP habitat based on the in-situ assessment (ESI 2017). Sturgeon Creek is a perennial, low gradient stream at the crossing. The substrate is composed of 20 percent gravel, 10 percent clay, 10 percent cobble, and 60 percent sand. The stream morphology is characterized as 50 percent run, 20 percent riffle, and 30 percent pool habitats. Average and maximum depths measured 0.4 m and 1.3 m, respectively (ESI 2016, 2017). The construction ROW is 38 m wide at this crossing, the wetted width is 8 m. The Anderson (2016) model identifies this crossing as potential RLP habitat. RLP occurrences are documented 9.7-10.5 km downstream of the crossing (VA Fish and Wildlife Information Service 2017). We expect numbers in this tributary are comparable to RLP numbers reported in other tributaries of the Nottoway River. Waqua Creek is the only tributary crossed for this project that has applicable RLP survey information, details of which are discussed below.

Nottoway River 1 crossing, Dinwiddie and Brunswick Counties, VA, is known to support RLP. Therefore, RLP presence is assumed and habitat suitability was not assessed. The construction ROW is 38 m wide at this crossing, the wetted width is 22 m. The Anderson (2016) model identifies this crossing as potential RLP habitat. Documented RLP occurrences are 0.8 km

downstream of the crossing (VA Fish and Wildlife Information Service 2017). During 2016 and 2017 mussel surveys, RLP were found in the area of direct impact from the proposed pipeline crossing and downstream of the proposed pipeline crossing (ESI 2017). Twelve RLP were observed during the July 2017 mussel survey of this crossing (S. Trichell, Dominion Energy Services, email to T. Andersen and S. Hoskin, Service, August 25, 2017). Mussel surveys were conducted 200 m upstream and 800 m downstream of the proposed crossing, the same distance instream sedimentation is expected to travel. We used this survey information to estimate the total number of RLP present at this crossing. We added a correction factor since mark-recapture data indicates that only about 10 percent of RLP are actually detected during surveys (P. Angermeier, U.S. Geological Survey VA Cooperative Fish and Wildlife Research Unit, email to Service, February 2, 2012). To incorporate the detectability correction factor we multiplied the 12 RLP found in the action area by 10 and estimate that approximately 120 RLP occur within the Nottoway River at this crossing.

Waqua Creek crossing, Brunswick, VA, is a tributary to the Nottoway River and known to support RLP. Therefore, RLP presence is assumed and habitat suitability was not assessed. The construction ROW is 27.4 m wide at this crossing, the wetted width is 8 m. Waqua Creek is a low gradient stream and substrates are composed of 15 percent gravel, 5 percent silt, and 80 percent sand. Stream morphology is characterized as 70 percent run and 30 percent pool habitats. Average and maximum depths measure 0.49 and 2.0 m, respectively (ESI 2016, 2017). The Anderson (2016) model identifies this crossing as potential RLP habitat. One RLP was documented on July 12, 2012, 3.7 km downstream of the crossing (Roberts and Angermeier 2012). To incorporate the detectability correction factor we multiplied the 1 RLP found in a reach of similar length to the action area by 10 and estimate that approximately 10 RLP occur within Waqua Creek at this crossing.

As stated earlier, we expect Sturgeon Creek supports the same density of RLP as Waqua Creek. Ten RLP are estimated to occur at the Waqua Creek crossing; therefore an estimated 10 RLP are expected to occur at the Sturgeon Creek crossing. An estimated 120 RLP are expected to occur at Nottoway River 1. A total of 140 RLP are expected to occur in the action area.

In the Anderson (2016) model, RLP potential habitat covers approximately 2,552 km in VA and NC, of which 497.753 km are in the Nottoway River basin. The proposed project crosses 3 waterbodies (Sturgeon Creek, Nottoway River 1, and Waqua Creek) known or with potential to support RLP. The proposed action has the potential to impact 1,000 m (200 m above and 800 m below a crossing) plus the construction ROW at each crossing or a total of 3,104 m in VA. The action area represents approximately 0.62 percent of the total RLP potential habitat in the Nottoway River basin and 0.12 percent of the total RLP potential habitat in NC and VA.

RLP decline in the action area is primarily the result of destruction and modification of habitat and fragmentation of the species range. Primary causes of RLP habitat degradation include chemical spills, non-point runoff, channelization, impoundments, impediments, and siltation; and the Nottoway River and tributaries were added to VA’s impaired waters list in 2014.

Clubshell – Hackers Creek is known to support the clubshell; however, the population in this stream has been declining for approximately 25 years. In 1995, 168 clubshell were documented at a site downstream of the I-79 Bridge over Hackers Creek in Lewis County, WV. In 2004, WVDNR visited this location to establish a long-term clubshell monitoring location and found 18 live clubshell. During this visit, a "hazmat" boom was found along the bank of Hackers Creek under the I-79 Bridge indicating a spill had occurred (WVDNR 2004). Additionally, a spring that appeared to be high in iron was located between the proposed monitoring site and the I-79 Bridge. As a result, the long-term monitoring site was relocated further upstream in Hackers Creek at the Life's Run Bridge (County Route 14) in Lewis County, WV, where 38 clubshell were located. The 18 clubshell from the downstream area were relocated to this upstream site because it was determined to be safer for the species (WVDNR 2004).

Data from the long-term monitoring site (the Hackers Creek population) has been collected every 5 years. The 2009 and 2014 monitoring events documented a continued decline and no recruitment (29 individuals in 2009; 19 individuals in 2014) (WVDNR 2009, 2014). In 2009, there was high mortality of all freshwater mussels in the long-term monitoring site in Hackers Creek, with a total of 415 found dead and only 70 live (Service 2010). The Hackers Creek population is the only extant clubshell population in the Monongahela River drainage (WVDNR 2004). Continued declines in the number of individuals have raised concerns that the population may be in peril (WVDNR 2014). Surveys for clubshell were conducted in Hackers Creek in Lewis County, WV, in 2015 (ESI 2016), approximately 3.2 miles upstream of the long-term monitoring site. This survey effort did not document clubshell. Based on the continuing decline of this population and the lack of recruitment, the Service and WVDNR began meeting in early 2017 to discuss recovery actions needed for this area. As a result of these discussions, the Service issued a 10(a)1 recovery permit to White Sulphur Springs National Fish Hatchery (WSSNFH) to collect, hold, and propagate clubshell from Hackers Creek in order to address ongoing declines in the population and prevent loss of the population's genetic material.

Threats leading to the decline of the Hackers Creek population include a high sediment load suspected to result from mining, gas well construction, highway runoff, and agricultural practices (WVDNR 2014), and the removal of all riparian vegetation within a 2-mile stretch immediately upstream of the long-term monitoring site as a result of expanding agricultural business (Service 2010). The action area is currently affected by agricultural practices, traditional oil and gas drilling activities**,** and newer oil and gas activities that involve water withdrawals and horizontally fracked Marcellus shale wells. Water withdrawals have been suspected of affecting aquatic life during low flow conditions by causing more fluctuation in water levels which sometimes leads to the dewatering of mussel beds. Additionally, sedimentation and erosion from the supporting infrastructure for Marcellus shale gas developments are impacting streams in this area. Bank instability, often a result of land use practices, has resulted in excessive sedimentation that may reduce suitable habitat for the clubshell and can smother individuals, causing death. Excessive suspended sediments can impair feeding processes, leading to acute short-term or chronic long-term stress. Both excessive sedimentation and excessive suspended sediments can lead to reduced mussel populations (Ellis 1931, 1936; Houp 1993; Box and Mossa 1999; Anderson and Kreeger 2010).

Approximately 6.4 miles of construction ROW and 11.9 miles of access roads from MP 14.7 to MP 21.1 are proposed in the upstream drainage area of the Hackers Creek 12-digit hydrologic unit code (HUC-12) watershed. The construction ROW and access roads in this area total approximately 142.8 acres, of which 100.5 acres are forested; these acreages have been updated due to project variances. Six tributaries of Hackers Creek are proposed to be crossed within this HUC-12; the closest is 1.23 miles upstream from the Hackers Creek clubshell population and the furthest is 6.25 miles upstream from the Hackers Creek clubshell population. The extent of these effects to the Hackers Creek watershed accelerated the need to move forward with any salvage efforts in Hackers Creek so that they occurred in advance of construction of ACP.

On April 20, 2018, the Service (WV Field Office [WVFO] and WSSNFH), Atlantic, and the WVDNR participated in a conference call to discuss clubshell salvage and relocation efforts per the October 16, 2017, Opinion's (pages 55-56) Term and Condition 1 for the clubshell. A relocation plan was prepared and submitted by ESI on behalf of Atlantic to the WVFO and WVDNR on May 2, 2018. The relocation plan was approved by the WVFO on May 2, 2018. In accordance with this plan (ESI 2018a), up to 3 independent salvage efforts would be conducted within the 585m reach of Hackers Creek identified in the October 16, 2017 Opinion (pages 55-56). This 585 m reach of Hackers Creek was determined based on the estimated distribution of clubshell in Hackers Creek based on previous mussel survey data from the WVDNR. The salvage area was terminated at the upstream extent because the WVDNR had previously done a survey and found no endangered mussels upstream of that point. All clubshell collected during these efforts would be transported to WSSNFH where they will be held and propagated for 2 years. After propagation, the clubshell will be reintroduced into the Monongahela River basin.

The first relocation effort was conducted on May 3, 2018. A total of 56 live clubshell and one dead shell were identified and collected. The mussels were measured, aged, gender-verified, marked with tags provided by the WVDNR, and transported to WSSNFH. All of the clubshell collected were adults, and no individuals were gravid (Hern, T., WSSNFH, personal comm.). Additional salvage efforts were delayed due to unfavorable weather conditions. However, the second salvage pass was able to be completed under the supervision of WSSNFH under their 10(a)1 recovery permit. The second salvage pass was completed on July 20, 2018, and recovered 12 live individuals and 24 dead individuals (shells); no juveniles were collected. The total number of live clubshell recovered during the first two salvage efforts was 68 individuals and there were 25 dead shells. It should be noted that because the level of effort and survey area for the salvage effort differs from that of the long-term monitoring efforts, the results are not comparable.

Per an interim report from ESI (2018b), the 585 m salvage area was split into 25 survey cells. The downstream extent, cells 1 through 7, of the salvage area exhibited a riffle, run, pool complex and 48 clubshell (70.6 percent) were found here. Another 19 clubshell (27.9 percent) were found in glide habitat that extended from cell 8 through 18, and the final clubshell individual (1.5 percent) was found in the most upstream extent of the survey area in cell 25. Cells 19 through 25 again showed riffle, run, and pool habitats. Cells 19 through 22 were

shallow, subjected to desiccation during drought, and "were markedly impacted via an abundance of attached algae which suggested signs of nutrient loading where cattle had open access to the stream" (ESI 2018b). A fence crosses the stream near cell 24 and correlates with a shift back to higher quality habitat in cell 25; this habitat continues upstream of cell 25. Erosion was present along both streambanks throughout the salvage area, and forested riparian vegetation was limited to the downstream 20 percent of the salvage area while the upstream area was characterized as agricultural/pasture with open stream access for cattle.

These data from the salvage effort provided an update to the WVDNR survey data upon which the 585 m reach was based and suggest that clubshell may be present up to 7.6 km upstream of the clubshell salvage area considered in the October 16, 2017, Opinion. Habitat improves upstream of the salvage area where a fence crosses the stream preventing livestock from degrading the natural condition of the habitat. Additionally, a clubshell was found in the final upstream salvage cell during the first salvage pass on May 3, 2018. Based on these data and conversations with the state malacologist about the limitations of past surveys completed in Hackers Creek (WVDNR 1994), we now believe clubshell may be present up to 7.6 km upstream of the previously delineated salvage area. We do not expect clubshell further upstream of this area because past survey data noted no mussels of any species above this point, and since those surveys the habitat in Hackers Creek has only declined due to increased development and agricultural practices in the watershed. Conversations with the WVDNR about existing upstream habitats and beds of non-listed mussels revealed that both the number of individuals and the number of species (species diversity) decreased further upstream; per the WV Mussel Survey Protocol, the presence of a diverse mussel bed indicates potential for clubshell, but review of survey data from 1993 noted that no mussels of any species were found in the upstream area (WVDNR 1994). Therefore, we anticipate that the project may affect 8.185 km (585 m salvage area + 7.6 km upstream of the salvage area) of clubshell habitat in Hackers Creek.

In addition to initiating mussel salvage efforts, turbidity monitoring, per the October 16, 2017, Opinion's (pages 58) Monitoring and Reporting requirement 5 for the clubshell, has also been initiated. The monitoring data was provided to the WVFO on April 10, April 30, June 1, July 2, and August 10, 2018, by Atlantic. Pipeline construction has not begun within the Hackers Creek watershed, so these data provide baseline information from which to monitor sediment effects during and post-construction.

Finally, the Service was notified on August 13, 2018, that ACP had cleared 28.9 acres of forest within the Hackers Creek HUC-12 upstream of the confluence with Life's Run prior to the May 15, 2018, court decision. This acreage was felled by hand and no clearing or grubbing has yet taken place. Because hand felling trees was not considered ground disturbance, no erosion and sedimentation best management practices were installed before or since this tree felling.

<u>Rusty patched bumble bee</u> – The proposed action is not within the historical range of RPBB in NC, but it is within the historic range of RPBB in WV and VA. Prior to the mid-1990s, RPBB was widespread and considered common throughout its historical range. There are historical records of RPBBs in Randolph, Lewis, Pocahontas, and Upshur Counties, WV. There are no

historical records for RPBB in Augusta, Bath, and Highland Counties, VA. However, there is a record of 1 RPBB collected from Nelson County in 1976.

An entomology survey documented a RPBB on June 6, 2017 (S. Throndson, ERM, email to S. Hoskin, Service, June 8, 2017) in Bath County, VA. A single worker bee foraging on a rhododendron (*Rhododendron catawbiense*) within the GWNF along Forest Road 124 (project access road 36-014.AR2) was captured for identification and then released. The capture site is located approximately 1.6 km from the construction ROW (MP 93.7). One hour of additional sampling in the area surrounding the capture location was completed and no additional RPBBs were found in 2017.

The Service received new information from July 19 to August 20, 2018 from the VA Department of Conservation and Recreation-Division of Natural Heritage (VDCR-DNH) about an additional 22 RPBB findings in Bath (9) and Highland Counties (13), VA. The 2018 RPBB locations in Bath County are closer to the construction ROW than the 2017 RPBB location and are near 3 project access roads (36-014.AR2, 36-012.AR2, and 36-012.AR1) (Table 3).

Table 3. Distance from 2018 RPBB capture locations to the proposed land requirements included in the FEIS (Section 2.2).

Land Requirements	Distance (km) from 2018 RPBB Capture Locations
Construction ROW	0.2 – 1.0
Access road 36-014.AR2	0.7 – 1.4
Access road 36-012.AR1	0.5 – 1.3
Access road 36-012.AR2	0.8 – 1.5

High Potential Zones (HPZ) are modeled by evaluating the likelihood of RPBB movement across the surrounding vegetation cover classes as predicted by species experts and literature of bumble bee movement through various habitat types. The model is based on the latest available National Land Cover Database and uses extant (i.e., sites where RPBB has been documented in 2007 or later) RPBB observations. The HPZ includes the areas within which the RPBBs would move from the point of observation to forage and where queens may be most likely to disperse and overwinter. This model allows us to predict where the species may be found based on empirical information and scientific inferences as opposed to using a buffer of an arbitrary radius. The HPZs generated by the model suggest areas with the highest potential for the species to be present based on the location of 1 or more RPBB records, typical foraging distances, and inferred habitat suitability (*https://www.fws.gov/midwest/endangered/insects/rpbb/pdf/HabitatConnectivityModelRPBB.pdf*).

The HPZs associated with the Highland County records are outside the project action area (Figure 4). We do not anticipate impacts from the proposed action to RPBBs in Highland County.

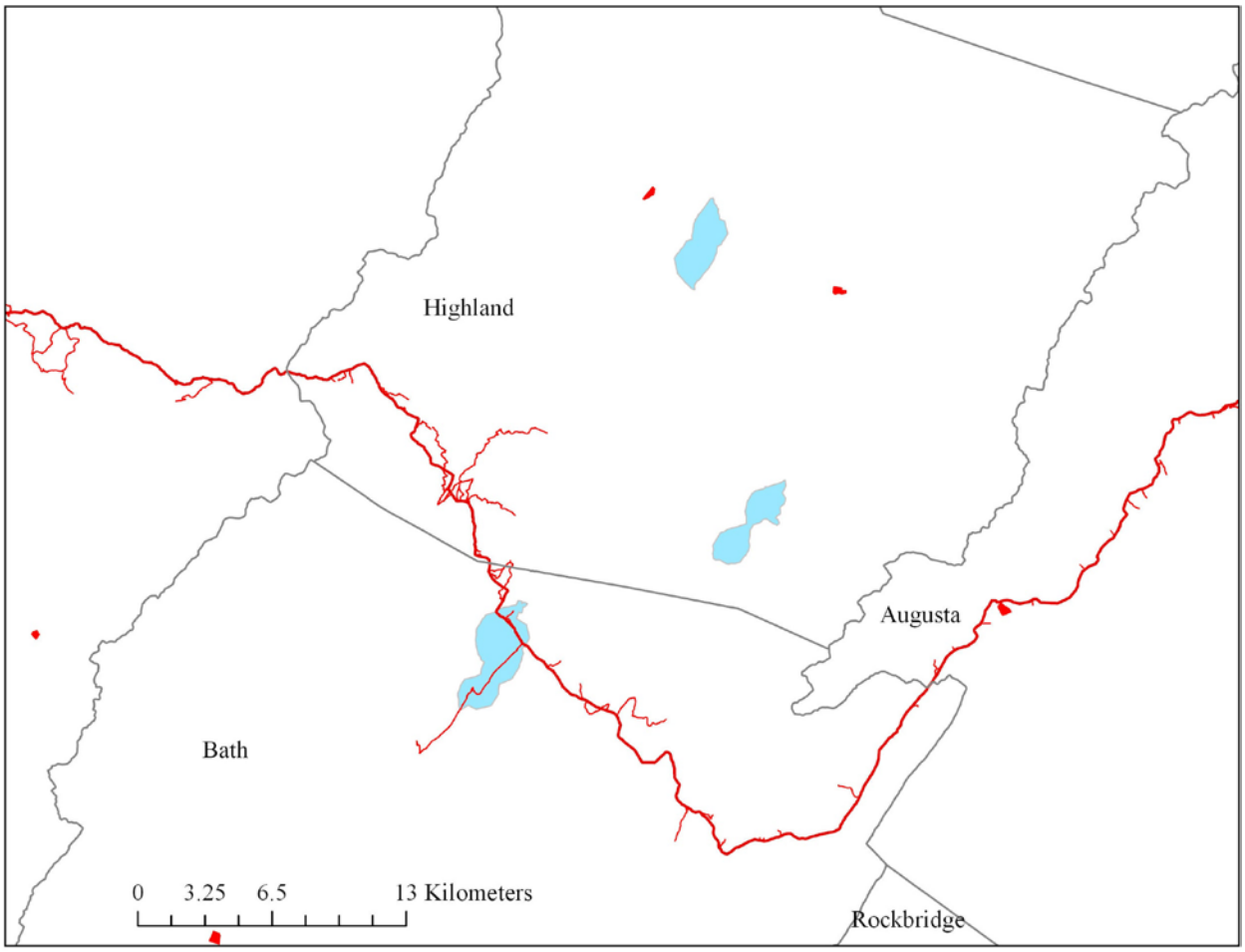

Figure 4. HPZs (blue polygons), the construction ROW (thick red line), and access roads (thin red lines).

The HPZ modeled in 2017 was 653 ha and is primarily forested, with a few openings that may be characterized as field or meadow. Forested areas are characterized by oak (*Quercus* spp.) dominated overstory, with understory coverage of 30-50 percent rhododendron (*Rhododendron* spp.), mountain laurel (*Kalmia latifolia*), blueberry (*Vaccinium* spp.), flowering forbs, and few non-native plants (ACP 2017, VDCR-DNH 2017). Small openings have been created throughout the forested area by gypsy moth (*Lymantria dispar dispar*) caterpillar and wind damage. These openings provide opportunities for sub-canopy flowering shrubs and forbs to develop, which provide foraging habitat for the RPBB. The 2018 updated HPZ overlaps with the 2017 HPZ and we assume the habitat characteristics as described above are similar for the updated HPZ. The updated HPZ is 316.6 ha larger than the HPZ modeled in 2017.

RPBB is most likely to occur in the 969.6-hectare (ha) HPZ in Bath County (Figure 5), which was modeled based on the 2017 and 2018 RPBB locations and the species' potential ability to disperse across the landscape (Service 2018a).

Due to the rarity of the species in VA and uncertainty associated with some RPBB life history

requirements, there is uncertainty regarding habitat use and distribution of the species during certain life stages and time periods. As a result, we make the following assumptions, based on the best available information, regarding RPBB distribution and habitat use:

- The amount of habitat in the 969.6-ha HPZ was estimated based on a desktop calculation of aerial imagery. A 30 m wide edge was added to each of the habitat categories because the 30 m wide edge can function as nesting and overwintering habitat and summer/fall foraging habitat (Service 2018b). The 969.6-ha HPZ consists of:
    - 900.7 ha of overwintering habitat (812.92 ha of forested habitat + 87.77 ha of forest edge habitat);
    - 156.3 ha of nesting/foraging habitat (68.57 ha of open grassland/shrubland habitat + 87.77 ha of forest edge habitat); and
    - 0.33 ha of unsuitable habitat. When summed, the total area of the habitat categories exceeds 969.6 ha because the habitat categories are not mutually exclusive. Specifically, the 30 m wide edges of forested habitat function as both nesting and overwintering habitat, and summer/fall foraging habitat also functions as nesting habitat.
- The 13.89 ha action area consists of:
    - 10.27 ha of overwintering habitat (7.61 ha of forested habitat + 2.66 ha of forest edge habitat); and
    - 6.29 ha of nesting/foraging habitat (3.64 ha of open grassland/shrubland habitat + 2.66 ha forest edge habitat). When summed, the total area of the habitat categories exceeds 13.89 ha because the habitat categories are not mutually exclusive. Specifically, the 30 m wide edges of forested habitat function as both nesting and overwintering habitat, and summer/fall foraging habitat also functions as nesting habitat.
- RPBB activity (foraging, nesting, overwintering queens) is concentrated in the 969.6-ha HPZ, based on the 2017 and 2018 Bath County RPBB records. Impacts to RPBB outside of the HPZ are not anticipated because the model incorporates the typical foraging and dispersal movements of RPBB, making it unlikely that project impacts will occur beyond the boundaries of the HPZ.
- Floral resources of sufficient quality for RPBB foraging are found throughout the HPZ and are concentrated in patches where canopy openings have been created, and these patches are evenly distributed throughout the HPZ.
- Average foraging distance for an individual RPBB is 0.8 km from a nest site. Worker foraging distances may extend 3 km from a nest in some species and circumstances (Lepais et al. 2010); however, foraging distances of less than 1 km from nests are typical (Knight et al. 2005, Wolf and Moritz 2008, Dramstad 1996, Osborne et al. 1999, Rao and Strange 2012).
- The RPBB observed in June 2017 and the RPBBs observed in 2018 represent at least 1 colony, which is part of at least 1 population (multiple, interacting colonies).
- Overwintering queens are likely to be in proximity to spring ephemerals and may be found near woodland edges or in wooded areas with canopy openings that provide light to the forest floor in the spring.
- Approximately 30 new foundress queens per colony are produced at the end of summer

(Service 2018b).

- Status of colonies and the population in the HPZ are unknown at this time. The presence of worker bees signifies the existence of at least 1 colony. Existing survey methods do not include a measure of confidence levels for species detectability and cannot be used to calculate the number of individuals in the colony, distinguish whether or not individuals are a part of the same colony, or estimate population size (i.e., the approximate total number of individuals in a population), population health or status. The objectives of the Service's 2018 Survey Protocols for the RPBB are only to: (1) find and document new RPBB locations; (2) determine if RPBB are still extant at previously documented locations; (3) monitor bumble bee populations to determine long-term population trends (i.e., rate of change), relative abundance and species richness; and (4) provide protocol recommendations for areas we believe are unoccupied by RPBB (*https://www.fws.gov/midwest/endangered/insects/rpbb/pdf/SurveyProtocolsRPBB28Feb2018.pdf*). The Service can use records, obtained with the use of its survey protocols (Service 2018a), of live individual RPBB to help understand long-term population trends at landscape, regional, or continental scales, but not at a project-level because the quantity of bumble bees changes throughout the warm months as worker populations increase or decrease and bumble bee habitat suitability changes over time as floral landscapes change composition. Because suitable habitat may change locations from one year to the next and bumble bee numbers fluctuate throughout the season, quantifying populations can be difficult. As a result, using surveys to predict the precise number of individuals that will be taken by the project is not practical, and likely not possible.
- There are no studies that estimate RPBB nest density. Therefore, we reviewed 11 studies of nest density for 7 bumble bee species. Nest density estimates varied among species and among landscapes that ranged widely in their relative amounts of foraging habitat. In general, nest density estimates were higher in landscapes that contained relatively extensive and high quality foraging habitat. Methods of analysis were generally similar. Density of RPBB colonies in nesting habitat is estimated to be approximately 0.14 nests/ha for the following reasons:
    - For the buff-tailed bumblebee (*Bombus terrestris*), a close relative of the RPBB, nest density estimates varied from 0.04 nests/ha to 0.88 nests/ha, with a mean of 0.34 nests/ha (n=10) (Chapman et al. 2003 [as cited in Charman et al. 2010], Darvill et al. 2004, Knight et al. 2005, Kraus et al. 2009, Wolf et al. 2012, Dreier et al. 2014, Wood et al. 2015). The large range of nest densities was observed due to the variety of landscape settings. The 0.14 nests/ha is a reasonable estimate for the RPBB because densities of 0.04 to 0.15 nests/ha for the buff-tailed bumblebee represented 40 percent of the estimates in these studies and the buff-tailed bumblebee is common and abundant compared to the relatively rare RPBB. Applying the mean nest density would likely be an overestimate of the density of RPBB nests;
    - Estimates of nest density are typically available only for relatively common species of bumble bees. The estimated nest density for the RPBB (0.14 nests/ha) is similar, however, to the nest density (0.19 nests/ha) found for the great yellow bumblebee *(B. distinguendus*) in coastal grasslands in the United Kingdom (UK).

Like the RPBB, the great yellow bumblebee has undergone a precipitous decline; it is listed as Nationally Scarce in the UK (Charman et al. 2010). In addition to both species being relatively rare, the great yellow bumblebee like the RPBB relies "on the continued presence of flower-rich, unimproved grassland that provides floral resources throughout the colony cycle (June to September) and contains, or is close to, suitable sites for nesting, mating and hibernation" (Charman et al. 2010). Moreover, Charman et al. (2010) conducted their study in relatively natural landscapes comprised of coastal grassland, not in urban or agricultural landscapes where habitat suitable for nesting is more likely to be patchily distributed.

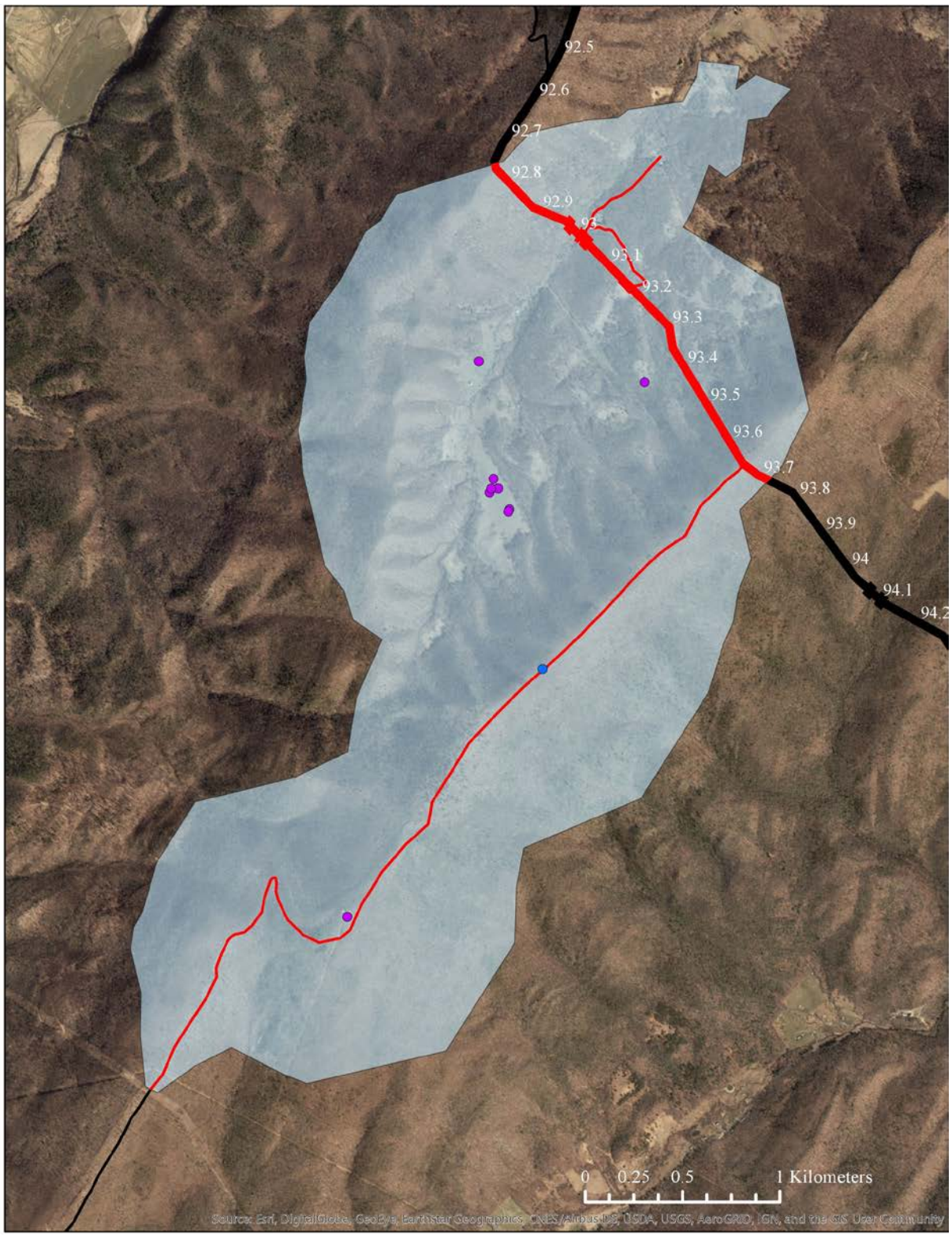

Figure 5. The construction ROW (thick red line) and access roads (thin red lines) within the HPZ (light blue polygon), the 2017 RPBB location (blue dot), and the 2018 RPBB locations (purple dots), in Bath County.

RPBB in the HPZ are affected by existing actions associated with forest management at GWNF. Current activities in the HPZ are use of the access roads by pedestrians and occasional vehicle use by 1 private landowner who rarely uses the road to access his property. No timber sales have occurred in the HPZ in recent years.

Madison Cave isopod – The presence or abundance of MCI in the action area cannot be accurately determined due to lack of effective survey protocols (i.e., more effective survey protocols do not exist at present), access to subterranean habitat (i.e., access to this habitat is not possible), and knowledge of subsurface connectivity. However, the best available scientific data leads us to conclude the species may occur throughout phreatic karst waters based on the MCI potential habitat model (Orndorff and Hobson 2007), which is based on the geologic layer in which MCI have been found. MCI potential habitat covers approximately 266,822 surface acres in Augusta County, VA. Within the MCI potential habitat in Augusta County, the construction ROW, access roads, and ATWS cross approximately 25 linear miles (approximately 1,974 surface acres) (Figure 6).

Within the 1,974 surface acres, the construction ROW and ATWS cross Cochran's Cave (MP 139.8 -140.4). Surveys of Cochran's Cave have not documented MCI; however MCI presence is assumed based on the site's location and a phreatic upwelling stream at the site (W. Orndorff, VDCR-DNH, email to S. Hoskin, Service, August 11, 2017), which will bring MCI closer to the surface. The construction ROW and ATWS cross Cochran's Cave (Figure 7, MP 139.8 - MP 140.4) over a total of 11.2 surface acres (Table 6).

Previous pipeline project analysis in the region indicate that materials released into surface or subsurface karst features may reach MCI up to 0.5 mile away (Service 2013). Therefore, we estimate that the project will impact 11.2 surface acres of MCI habitat (where the construction ROW and ATWS cross Cochran's Cave) where materials will be released (the construction ROW centerline and ATWS) as well as 885.5 surface acres, which includes the area up to 0.5 mile away.

We do not anticipate impacts to MCI in the remainder of the 1,974 surface acres (beyond the 11.2 and 885.5 surface acres) due to the AMMs (Appendix B Table 6) and the depth of the phreatic water (at least 20 ft below ground surface) they inhabit. The depth to groundwater level in Augusta County is approximately 20 ft below ground the surface (*https://waterdata.usgs.gov/va/nwis/uv/?site_no=382523078535501&PARAmeter_cd=72019,72020)*. The limit of project disturbance is 6-8 ft below ground surface and therefore not expected to pose a significant risk to groundwater (FERC 2017).

Cochran's Cave is a privately owned site identified as a VDCR-DNH Conservation Site (GeoConcepts Engineering, Inc. 2017b). VDCR-DNH Conservation Site designation is their tool for representing key areas of the landscape worthy of protection and stewardship action. Cochran's Cave Conservation Site is surrounded by agricultural fields interspersed with some forested land and it is likely some pesticides and sediments have entered the phreatic water in

runoff from the agricultural fields. The introduction of pesticides and sediments likely contribute to degradation of MCI habitat in this area.

On August 1, 2018, the Service received clarification from ERM (M. Voth, ERM, email to S. Hoskin, Service, August 1, 2018) that a 40.8 acre CY in Rockbridge County, VA, is in MCI potential habitat. This CY was previously cleared and no other project activities (i.e., storage of equipment and materials, temporary field offices, parking, pipe preparation and preassembly staging areas) at the CY will alter subsurface features or water quality and/or quantity. Therefore, the Service believes the CY will not affect the MCI.

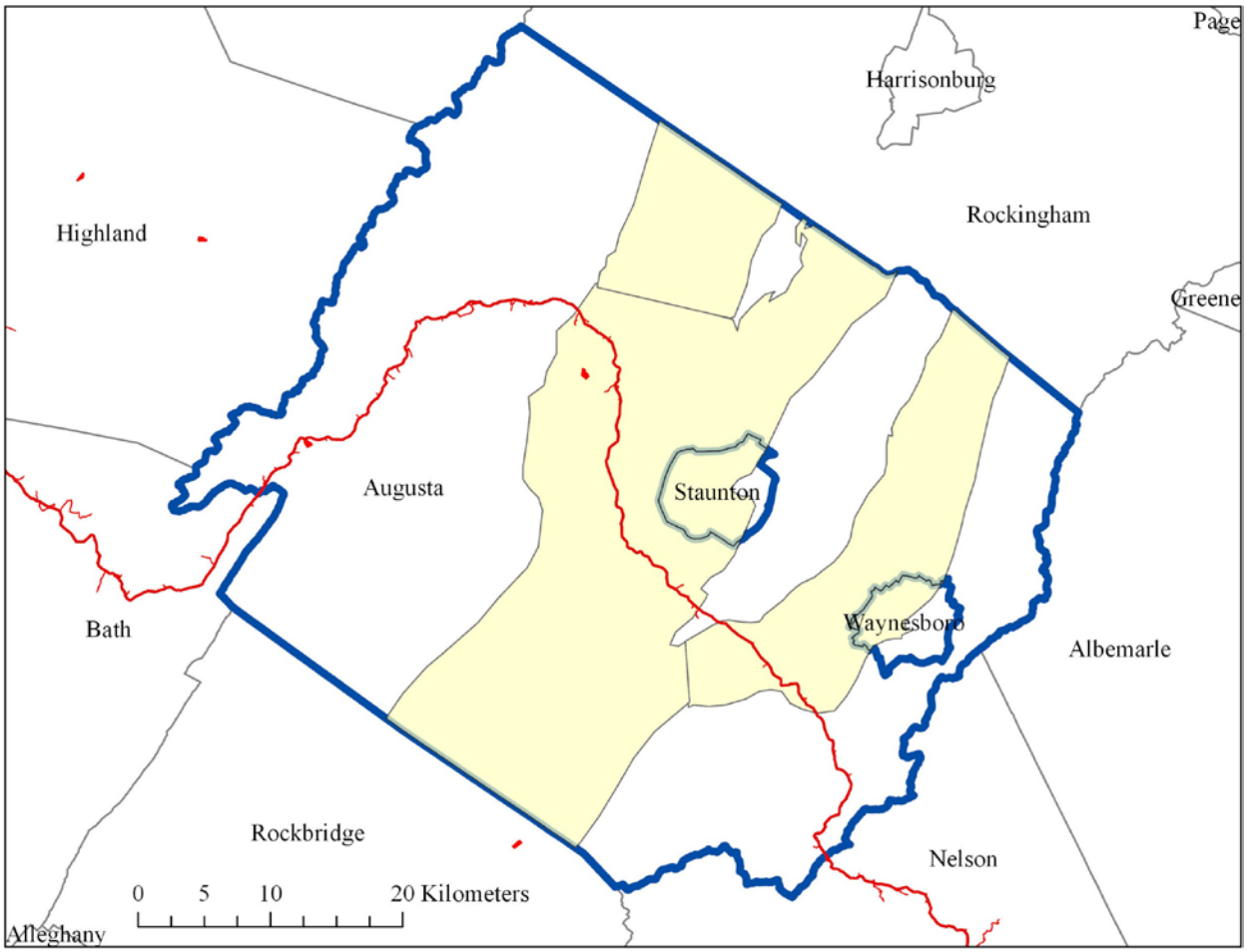

Figure 6. MCI potential habitat (266,822 surface acres; yellow polygon) in Augusta County, VA bisected by the construction ROW, access roads, and ATWS (1,974 surface acres; red lines/polygons).

Indiana bat – The Ibat Appalachian Mountain Recovery Unit (RU) (Service 2007) covers 8,762,586 acres in VA and 15,506,210 acres in WV. The action area crosses 2,015.992 acres (0.023 percent) of the RU in VA and 2,431.99 acres (0.016 percent) of the RU in WV. The Service (2017a) estimates the 2017 Ibat population is 425 in VA and 1,076 in WV; these numbers indicate an 8.4 percent decline in VA and a 54.7 percent decline in WV since the 2015 census. The action area crosses 4 categories of Ibat habitat: suitable unoccupied summer habitat

in VA and WV; known use summer habitat in WV; unknown use spring staging/fall swarming habitat within WV, and known use spring staging/fall swarming habitat in VA and WV.

Suitable unoccupied summer habitat is defined as forested/wooded habitats in an Ibat RU in which survey results per the level of effort outlined in the Range-wide Indiana bat Summer Survey Guidelines (Service 2017b) suggest probable absence during the summer months. As of the date of this Opinion, Ibats have been acoustically detected at 17 sites along the proposed pipeline route, 13 in VA and 4 in WV. Follow up mist-net surveys per the level of effort outlined in Phase 2/Step 4 of the Range-wide Indiana bat Summer Survey Guidelines did not capture Ibats (ERM 2017a, 2017b, 2017c). Presence/absence surveys are complete project-wide (M. Voth, ERM, email to S. Hoskin, Service, August 16, 2018). The Ibat surveys for the proposed action achieve a 90 percent confidence in negative results (Niver et al. 2013). Approximately 1,589.992 acres in VA and 1,685.39 acres in WV (83.6 miles in total) proposed for clearing are classified as suitable unoccupied summer habitat.

Removing large areas of trees when Ibat surveys were negative, i.e., in unoccupied summer habitat, is presumed not to result in indirect effects to Ibats because survey results indicate they are not currently occupying the area (R. Niver, Service, email to S. Hoskin, Service, October 31, 2017). Without survey results, we cannot make that same presumption in unsurveyed areas, which are referred to as “unknown use” habitat. Additionally, negative survey results are considered probable absence for Ibats and the correct determination for project effects in these instances is “not likely to adversely affect” the Ibat regardless of the amount of acres being cleared. This interpretation of Ibat negative survey results is used by other field offices and regions of the Service. The negative survey results, in combination with the impact WNS has had on species abundance, make it unlikely the Ibat occurs in unoccupied summer habitat identified for clearing. For these reasons, project effects to Ibats from habitat clearing in the suitable unoccupied summer habitat category are “not likely to adversely affect” and are not addressed further in this Opinion.

In the October 16, 2017 Opinion, a multiplier of 0.5 was used for the suitable unoccupied summer habitat category because, based on the negative survey results, the Service believed Ibats were not currently using the area. Loss of that habitat was included in the ITS with a multiplier to account for the loss of habitat available for future Ibats and those that might travel through the area. The revised ITS does not use a multiplier for project effects to Ibats from habitat clearing in the suitable unoccupied summer habitat category because, as explained above, we believe these sites are not likely to be used by Ibats. Therefore, we have determined that these effects are “not likely to adversely affect” and are not addressed further in this Opinion.

In the October 16, 2017 Opinion, a multiplier of 0.5 was also used for unknown use spring staging/fall swarming habitat (178.1 acres) per the Revised Conservation Strategy for Forest-Dwelling Bats (Service 2016), which recommends a mitigation multiplier of 0.5 for tree removal during November 15 - March 31 for habitat where bat use has not been documented, but where it may be possible. A multiplier was used to represent the value of the habitat to Ibats; if the value of the habitat is lower, we expect the amount of take would be lower. The revised ITS does not

use a multiplier for unknown use spring staging/fall swarming habitat because we are not expressing take in terms of expected value to the Ibat, rather, we are expressing take numerically and using acres of habitat cleared to assist in monitoring that take.

Known use summer habitat is defined as areas within: a 5-mile radius (home range) of a pregnant female or juvenile capture or within 2.5 miles of a known roost tree. None occurs in VA (Table 4). Approximately 8.54 miles of construction ROW and 6.38 miles of access roads, a total of 137.5 acres, will be cleared within known use summer habitat in WV (Table 4). Potential roost tree surveys in known use summer habitat in WV documented 2,888 potential roost trees, of which 329 were potential primary trees and 2,595 were potential secondary trees (ERM 2017d). Primary roost trees are more likely to support a maternity colony of Ibats than secondary trees.

Unknown use spring staging/fall swarming habitat is defined as areas within a 5-mile radius of a potentially suitable hibernaculum that has not been surveyed. Potential hibernaculum surveys are complete in VA and Phase 1 and 2 potential surveys per the Service Guidance (Service 2015) did not document new Ibat hibernacula in VA (ERM 2017e) (Table 4). Phase 2 surveys have not been completed for 2 sites in WV. Approximately 178.1 acres proposed for clearing remain to be surveyed for potential hibernacula in WV (Table 4).

On July 23, 2018, the Service (VAFO) received (M. Voth, ERM, email to S. Hoskin, Service, July 23, 2018) updated information on the amount of tree felling that has occurred and has yet to occur in each Ibat habitat category where Ibats are likely to be adversely affected (Table 4).

Table 4. Ibat habitat (in acres) proposed to be cleared.

Habitat Category	VA			WV			Total
	To be Felled	Felled[a]	VA Total	To be Felled	Felled[a]	WV Total	
Known use summer habitat	0	0	0	137.5	0	137.5	137.5
Unknown use spring staging/fall swarming habitat	0	0	0	178.1	0	178.1	178.1
Known use spring staging/fall swarming habitat	252.7	30.3	283.0	248.1	171.9	420.0	703.0
Appalachian Mountain RU	252.7	30.3	283.0	563.7	171.9	735.6	1,018.6
Appalachian Mountain RU Total	283.0			735.6			1,018.6

[a]Tree felling occurred in compliance with the Ibat winter tree clearing time-of-year restriction (TOYR).

Known use spring staging/fall swarming habitat: Work in Missouri (Romme et al. 2002) and Kentucky (Kiser and Elliott 1996) has found that Ibats range up to 5 miles from hibernacula during autumn and spring swarming activity periods. Therefore, we defined known use spring staging/fall swarming habitat as areas within: a 5-mile radius of priority 3 and 4 hibernacula. The action area is within 5 miles of 12 known Ibat hibernacula, 5 in VA and 7 in WV (Table 5). Population estimates for the 12 Ibat hibernacula from the 2016/2017 winter surveys range from 0-73 bats (Service 2017a). The most recent Ibat counts in each hibernaculum (A. King, Service, email to S. Hoskin, Service, August 30, 2017 and C. Stihler, WVDNR, email to S. Hoskin, Service, September 6, 2017) are in Table 5. Some hibernacula have not had a documented occurrence since the 1990s. Of the known hibernacula within 5 miles of the action area, Ibats were documented in 3 (Breathing, Clarks, and Starr Chapel Caves) during the 2017 winter counts. The proposed action will clear known use spring staging/fall swarming habitat, 283 acres in VA and 420 acres in WV (Table 4).

Table 5. Known Ibat hibernacula within 5 miles of the action area[a].

County, State	Hibernaculum Name	Approximate Distance (miles) to ATWS	Hibernaculum Priority Number [c]	WNS Status (date)	Ibat Population Estimate (date)
Randolph, WV	Gooseberry Cave	1.6 (CY[b])	4	Suspect (2014)	15 max (1990-1999)
Randolph, WV	Fortlick Cave	2.5 (CY)	3	Confirmed (2012)	16 (2016)
Randolph, WV	Stewart Run Cave	4.9 (CY)	3	Suspect (2014)	55 (2009)
Pocahontas, WV	Dreen Cave	0.7 (AR[b])	4	Suspect (2013)	1 (2015)
Randolph, WV	Falling Spring Cave	<0.1 (AR)	4	Confirmed (2011)	44 (2009)
Randolph, WV	Simmons-Mingo Cave	0.3	4	Suspect (2014)	17 max (1990-1999)
Pocahontas, WV	Cass Cave	4.4	4	Suspect (2014)	2 max (1980-1989)
Bath, VA	Starr Chapel Cave	2.0 (AR)	3	Suspect (2010)	46 (2017)
Bath, VA	Mountain Grove Cave	3.4 (CY)	4	Suspect (2014)	2 (2000)
Bath, VA	Breathing Cave	2.3 (AR)	3	Confirmed (2009)	20 (2017)

Bath, VA	Clarks' Cave	3.1 (AR)	3	Suspect (2011)	73 (2017)
Bath, VA	Witheros Cave	4.7	4	Suspect (2011)	5 (2015)

[a]There are no known Ibat hibernacula within 5 miles of SHP.
[b]CY – contractor yard, AR – access road.
[c]Priority 1 is highest priority and most essential to recovery of the species. Priority 4 is least important to recovery (Service 2007).

The abundance of Ibats rangewide has declined approximately 20 percent due to the effects of WNS since its onset in 2006 (*https://www.fws.gov/midwest/endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf*). WNS was first detected in VA and WV during the 2008/2009 winter hibernacula surveys (Stihler 2012, Powers et al. 2015). VA and WV hibernacula surveys indicate Ibat populations have decreased at least 95 percent since the discovery of WNS (*https://www.fws.gov/midwest/endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf*).

On August 16, 2018, the Service (VAFO) received (M. Voth, ERM, email to S. Hoskin, Service, August 16, 2018) updated information on the status of the Ibat surveys. Presence/absence surveys for summer habitat are complete project-wide. No new Ibat occurrences have been reported.

Northern long-eared bat – This Opinion is for effects to the NLEB not addressed by the January 5, 2016 programmatic biological opinion implementing the final 4(d) rule (*https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/BOnlebFinal4d.pdf*).

There are 4 known hibernacula in the action area: Simmons-Mingo Cave, PH-S018, PH-S007/PH-S008, and PH-S019. In 2016, these sites were sampled for bats either through harp trapping, which allows for physical capture of bats, or acoustic survey methods, which passively sample bats by detecting and recording their vocalizations. Thirty-one NLEBs were captured through harp trapping at Simmons-Mingo Cave, Randolph County, WV, and NLEBs were detected with acoustic surveys at PH-S018 in Randolph County, WV, and at PH-S007/PH-S008 and PH-S019 in Pocahontas County, WV (FERC 2017). PH-S018, PH-S007/PH-S008, and PH-S019 were sampled acoustically because their entrances could not be safely or effectively trapped or netted (ERM 2016).

WNS was first detected in WV in 2009 in Trout Cave, Pendleton County. Since that time, WNS has been confirmed in all areas of WV where NLEB hibernacula are known to occur (Stihler 2012).

On June 12, 2018, the Service was notified that the approximate acreage to be cleared within the ¼-mile radius around the PH-S018 hibernacula increased from 0.4 acres to 0.52 acres since the October 16, 2017, Opinion. This is the result of route changes filed on April 18, 2018.

EFFECTS OF THE ACTION

Direct effects are the direct or immediate effects of the project on the species, its habitat, or designated/proposed critical habitat. Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. Direct and indirect effects of the proposed action along with the effects of interrelated/interdependent activities are all considered together as the "effects of the action."

To standardize the effects analysis, the proposed action was divided into discrete actions described as subactivities. Defining subactivities allows for easier interpretation and consideration of complex activities. The project subactivities are defined in the species effects tables (Appendix B Tables 1-8).

Small whorled pogonia – The potential effects of the proposed action are described in Appendix B Table 1. The project subactivities unlikely to result in any impacts to SWP are described in Appendix B Table 1; no effect (NE) subactivities. For those subactivities of the proposed action that are determined to result in NE to SWP, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are not likely to adversely affect (NLAA), the SWP are described in Appendix B Table 1; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA SWP, there will be no further discussion in this Opinion.

There are other subactivities of the project that are likely to adversely affect (LAA) SWP (Appendix B Table 1; LAA subactivities). For some components of the proposed action that may affect SWP, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 1. These subactivities are LAA SWP by altering and degrading its habitat or physically impacting individual plants. The new information based on 2018 surveys indicated that new stems in the MNF-2 and GWNF colonies are closer to the construction ROW than stems previously observed in 2016 and 2017, which causes these subactivities to also LAA these colonies, in addition to the Seneca and MNF colonies previously discussed in the October 16, 2017 Opinion.

These subactivities in the construction ROW will affect 22.5, 27.4, 2.4, and 3.6 percent, respectively, of the Seneca, MNF, MNF-2, and GWNF colonies' upslope drainage areas, based on the locations of new stems observed in 2018. The subactivities during O&M will occur in 22.5, 8.4, and 1.0 percent, respectively, of the Seneca, MNF, and GWNF colonies' upslope drainage areas, based on the locations of the new stems observed in 2018. The ground disturbing and vegetation clearing/management subactivities proposed in the upslope drainage areas of these SWP colonies will result in soil compaction and vegetation removal in the construction ROW, which will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration

rates and soil moisture downslope of the construction ROW near the colonies. Some of these subactivities will also redistribute and loosen soils in the construction ROW, which will cause sedimentation downslope towards the colonies. These stressors will affect both the mycorrhizal fungi relied on by SWP and individual SWP, decreasing SWP fitness and reproductive success and possibly killing individual plants. Depending on the degree of surface water runoff and sedimentation, SWP habitat may be degraded and individual stems may be buried. Blasting will also loosen large rocks, which could fall and crush SWP.

During construction and restoration, methods described in the Upland Erosion Control Plan and Restoration and Rehabilitation Plan and onsite AMMs (e.g., temporary diversion channels and berms in the SWP Conservation Plan) are expected to minimize effects through surface water erosion control and restoration of graded areas; however diversion of surface water flow away from the colonies will alter hydrology in the watershed and soil moisture, causing decreased fitness and reproductive success and possibly death of individual stems.

The vegetation clearing, management, and trimming subactivities in the construction ROW that remove and thin mid- and over-story canopy trees will alter SWP habitat by increasing direct and ambient light. ERM (2017) conducted qualitative analyses of the potential changes to light regime near each colony as a result of tree removal in the construction ROW using 3D computer modeling. For the Seneca colony (distance of 70 ft from construction ROW based on stems observed in 2016 and 2017), the simulations indicated significant increases in ambient and direct light on the ground and surrounding area during summer, spring, and fall days, although not quantified. For the MNF colony, the simulations indicated changes in ambient light on the ground and surrounding area during early morning on summer and fall days, based on a distance of 113 ft from the construction ROW. With the new stems observed in 2018 at Seneca and MNF colonies closer to the construction ROW, respectively 11 and 45 ft, we anticipate greater changes in direct and ambient light in these 2 colonies. Due to the close proximity of the 2018 SWP stems in MNF-2 and GWNF colonies to the construction ROW identified (approximately 103 and 115 ft, respectively), we also anticipate changes in light at these 2 colonies.

Increased light availability may increase SWP flowering and population size (Dibble et al. 1997; Dibble 2000a, 2000b; Brumback et al. 2011; McCormick et al. 2015). However, increased light availability above an unknown threshold is anticipated to degrade SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, which will cause decreased fitness and reproductive success and possibly death of individual stems. Increased light levels will also facilitate germination and development of other herbaceous and/or woody species, including invasive species, which could compete with SWP. Significant changes to the sunlight regime and potential competition due to increased vegetation are likely to cause decreased fitness and reproductive success and possibly death of SWP individuals.

Methods described in the Non-Native Invasive Plant Species Management Plan (FERC 2017) will minimize effects due to invasive species in the construction ROW and access roads, but will not address herbaceous and invasive vegetation growing outside of the construction ROW and near the SWP colonies due to increased light. The SWP Conservation Plan includes temporary

AMMs to monitor the population status of the SWP colonies annually for 10 years post-construction and to minimize effects from invasive species outside of the construction ROW and near the SWP colonies for 3 years (e.g., before, during, and 1 year after construction) (VHB 2017). The SWP Conservation Plan also includes planting native tree seedlings for 200 ft along the construction ROW edge to the west of the pipeline (e.g., farther away from the colony) to ameliorate for changes in sunlight regime and monitoring light levels in the colony for 3 years (e.g., before, during, and 1 year after construction) (VHB 2017). Approximately 20-30 years after planting, canopy trees (e.g., white oak [*Quercus alba*] and eastern white pine [*Pinus strobus*] found at the Seneca colony) are expected to provide some mid-story shade (Burns et al. 1990), which would contribute to partially restoring the SWP habitat.

Running Buffalo clover – The potential effects of the proposed action are described in Appendix B Table 2. The project subactivities unlikely to result in any impacts to RBC are described in Appendix B Table 2; NE subactivities. For those subactivities of the proposed action that are determined to result in NE to RBC, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are NLAA, the RBC are described in Appendix B Table 2; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA RBC, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA RBC (Appendix B Table 2; LAA subactivities). For some components of the proposed action that may affect RBC, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 2. These subactivities are LAA RBC by physically impacting individual plants and/or altering or degrading its habitat. There are approximately 5.1 acres of RBC within 150 ft of the construction ROW centerline and 0.8 acres of RBC will be affected and killed (FERC 2017).

Ground disturbance subactivities related to grading, grubbing, increased foot and vehicle traffic, vegetation clearing and disposal, and trenching (Appendix B Table 2) for access roads and the construction ROW will kill RBC plants and seeds from some occurrences in 5 populations and all occurrences in 1 population (Table 2). Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction. The placement of fill and gravel will cause permanent habitat loss in all permanently maintained areas, preventing populations from re-establishing post-construction.

Burning for vegetation disposal (Appendix B Table 2) is expected to kill RBC because much of the plant structure is above ground and plants exposed to fire are likely to be killed. Additionally, topsoil containing RBC plant material and seed source is likely to be submerged in ash piles, restricting further plant growth and recolonization. We expect RBC plants and seeds within occurrences in 5 populations and all occurrences in 1 population exposed to fire and/or submerged in ash piles to be killed within the footprint of burns conducted for vegetation disposal.

Tree clearing and tree trimming subactivities (Appendix B Table 2) will remove all canopy cover over the construction ROW and significantly reduce canopy cover over access roads. While RBC is a disturbance dependent species and some level of tree removal may be beneficial (Madarish and Schuler 2002), the proposed clearing will create too much sunlight for RBC, which prefers partial to filtered sunlight. Burkhart et al. (2013) found that plots which received direct sun for most of the day did not allow RBC to persist. Increased sunlight from openings in the canopy may also increase competition from other native and invasive plant species. Invasive species are one of the primary factors influencing the status of RBC. Seed from invasive species may outcompete RBC, limiting the ability of RBC to germinate, thrive, and produce seeds.

Cleared construction ROW and improved access roads will facilitate ORV traffic and increase white-tailed deer herbivory. AMMs (installation of barriers) will minimize ORV traffic along the ROW; however, ORV traffic on access roads will not be prohibited. ORV traffic on improved access roads and the construction ROW will exceed disturbance frequencies tolerated by RBC and prevent re-establishment of RBC in some of these disturbed areas. New travel corridors are expected to increase ease of access to RBC populations by white-tailed deer, and the resulting herbivory will kill some RBC and lower reproductive output of other RBC.

Roanoke logperch – The potential effects of the proposed action are described in Appendix B Table 3. The project subactivities unlikely to result in any impacts to RLP are described in Appendix B Table 3; NE subactivities. For those subactivities of the proposed action that are determined to result in NE to RLP, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are NLAA, the RLP are described in Appendix B Table 3; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA RLP, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA RLP (Appendix B Table 3; LAA subactivities). For some components of the proposed action that are anticipated to affect RLP, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 3. These subactivities are anticipated to stun, entrain, or crush RLP, or result in habitat degradation and loss due to dewatering and placement of cofferdams, placement of temporary work bridges with a center support, and/or altering water quality.

Installation and dewatering of cofferdams is anticipated to injure or kill some RLP by crushing individuals during placement of cofferdams and through stranding or entrainment as cofferdams are dewatered. Installation of the bridge center supports is likely to injure or kill a small number of RLP by crushing individuals during placement. Installation of the bridge center support is expected to disrupt breeding activities of the RLP in the work zone because supports will be installed during the RLP breeding season. We expect a range of impacts, from delaying breeding until a suitable location is found to inhibiting breeding because all suitable breeding grounds in the area have been disturbed. As a result, we anticipate that a few subsequent offspring will be smaller than their counterparts and therefore more vulnerable to predation resulting in injury or death. Inhibited breeding is expected to result in the loss of genetic contribution from those

adults for the breeding season.

Temporary loss of instream habitat will occur at stream crossings that use dam and pump, cofferdams and bridge center supports. Additionally cofferdam placement/removal, installation of bridge center supports, and other instream activities will temporarily re-suspend sediments and increase turbidity. We expect the RLP in the work zone will avoid these areas until the instream structures are removed and turbidity returns to baseline levels. If instream work occurs during spawning, RLP will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely.

Adjacent upland ground-disturbing activities, such as tree clearing, grading constructing/improving access roads, and pipe stringing, are likely to introduce sediment into RLP habitat. Moderately silted and high turbidity areas will be unusable to most RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is anticipated to result in a loss of prey items. If instream work occurs during spawning, a reasonable worst case scenario is a majority of RLP in the work zone will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely.

If blasting is needed for any crossings, a small number of RLP in the immediate blast area are likely to be killed and the RLP in the vicinity will be temporarily stunned and/or permanently injured; some of the RLP will recover, while some RLP will have internal injuries and die.

While implementation of AMMs (VA Fish Relocation Plan, Appendix K, and Restoration and Rehabilitation Plan, Appendix F, of the FEIS [FERC 2017]) should significantly reduce the likelihood of mortality or injury from stream crossings, which include placement of cofferdams, these effects are still anticipated. Additionally, streambank vegetation removal is likely to alter a small portion of RLP habitat. Loss of streambank vegetation is expected to result in increased water temperatures, which can lower dissolved oxygen levels, and changes in light regime in small areas. Changes in water temperature and light regime are anticipated to shift the RLP prey base to species that are more tolerant to light and lower dissolved oxygen and make the habitat less suitable for the RLP themselves. For work along existing ROW, riparian vegetation will be replanted. New alignments will result in permanent removal of riparian vegetation. These changes are anticipated to decreased fitness of a small portion of RLP individuals by shifting their diet and potentially decreasing the dissolved oxygen levels in small patches of the waterbodies.

Clubshell – The potential effects of the proposed action are described in Appendix B Table 4. The project subactivities unlikely to result in any impacts to clubshell are described in Appendix B Table 4; NE subactivities. For those subactivities of the proposed action that are determined to result in NE to clubshell, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are NLAA, the clubshell are described in Appendix B Table 4; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA clubshell, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA clubshell (Appendix B Table 4; LAA subactivities). For some components of the proposed action that may affect clubshell, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 4.

Subactivities that are LAA clubshell result from increased sediment loads to Hackers Creek upstream of the Hackers Creek clubshell population. Approximately 6.4 miles of construction ROW and 11.9 miles of access roads from MP 14.7 to MP 21.1 are proposed in the upstream drainage area of the Hackers Creek HUC-12 watershed. The construction ROW and access roads in this area total approximately 142.8 acres, of which 100.5 acres are forested; these acreages have been updated due to project variances. Six tributaries of Hackers Creek are proposed to be crossed within this HUC-12; the closest is 1.23 miles upstream from the Hackers Creek clubshell population and the furthest is 6.25 miles upstream from the Hackers Creek clubshell population. Based on this, sedimentation from the proposed action will affect the entire length of Hackers Creek. Sedimentation will affect clubshell that were not recovered during salvage efforts and degrade/alter clubshell habitat.

Mussels close their valves during periods of heavy siltation to avoid irritation and clogging of feeding structures (Loar et al. 1980). Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. The stream crossings and access roads are expected to result in sedimentation and increased turbidity causing impaired feeding, resulting in reduced physiological function; depressed rates of growth, reproduction, and recruitment. We expect this will result in the death of some individual clubshell.

Sedimentation may permanently alter and degrade habitat through siltation such that conditions are no longer favorable for clubshell. These effects will persist until high flows flush settled sediment downstream. Excessive siltation also degrades water and substrate quality. High levels of suspended sediments will reduce dissolved oxygen levels in the water, while heavy sediment deposition will fill interstitial spaces in the substrates, both of which can suffocate mussels particularly if sufficient accumulation occurs (Ellis 1936, Marking and Bills 1980).

Large releases of sediment may occur during storm events. Much of the sediment released from disturbed areas during storm events is expected to be transported downstream, temporarily elevating suspended solids, with those solids not washed out of the action area settling in pools. It is difficult to determine what level of excess sedimentation will be generated by the project, how far downstream sedimentation will occur, or how long these effects will persist. Factors such as storm intensity, stream channel morphology, flow rates during and post construction, and effectiveness of sediment and erosion control measures, can affect the duration and severity of instream sedimentation.

We anticipate these changes in habitat will further impair feeding, resulting in sublethal effects on growth and reproduction or starvation with long-term exposure. As a result of decreased

water quality, and degraded and altered habitat we anticipate that most of the clubshell will experience impaired feeding. While high flows may flush some sediment downstream, we expect that overtime the habitat will return to pre-construction conditions. Sediment flushing downstream will allow remaining mussels to feed in an unimpaired manner, but the quality of the habitat will have decreased due to sediment remaining within interstitial spaces in the substrate.

The implementation of AMMs (e.g., erosion and sedimentation control measures along workspace edges, and temporary equipment crossings) may ameliorate some of the sedimentation effects. However, due to the magnitude of anticipated disturbance, not all sediment will be prevented from entering waterways. As a result, we expect habitat degradation and loss will occur and individual clubshell will experience impaired feeding while others may suffocate and die.

Rusty patched bumble bee – The potential effects of the proposed action are described in Appendix B Table 5. Access road 36-012.AR2 is a public road to which gravel will be added, but no widening or culvert replacement/expansion is anticipated. There is no evidence that vehicle operation at low speeds on established roads will impact individual RPBB and floral resources will not be removed along this road. Therefore, we do not anticipate impacts to RPBB from use of access road 36-012.AR2 and it will not be considered further in this Opinion. The project subactivities unlikely to result in any impacts to RPBB are described in Appendix B Table 5; NE subactivities. For those subactivities of the proposed action that are determined to result in NE to RPBB, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are NLAA, the RPBB are described in Appendix B Table 5; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA RPBB, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA RPBB (Appendix B Table 5; LAA subactivities). For some components of the proposed action that may affect RPBB, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 5. Within the HPZ, these subactivities may crush RPBBs, expose RPBBs to noise/vibration, and render habitat temporarily and permanently unsuitable.

In the HPZ (969.6 ha) the proposed action (13.89 ha) is expected to include permanent (access road widening and permanent ROW) and temporary (temporary construction ROW and ATWS) habitat loss. Ground disturbance (vegetation removal, trenching, etc.) associated with the construction ROW is proposed to occur during the active foraging season for the RPBB. RPBB nests are expected to be crushed by machinery during vegetation removal and construction. We expect RPBB workers foraging in the area would fly away or avoid the area during vegetation removal. Displaced workers will have to travel further to forage, which will affect the ability of the workers to provide sufficient resources to a colony, resulting in reduced health of some individual workers, reduced reproductive capacity of the queen, and reduced production of foundress queens and males. Machinery is also expected to crush any colonies present in suitable nesting/foraging habitat (6.29 ha) within the action area.

Floral resources will be removed from the entire 13.89 ha, with permanent loss within the expanded road surface and temporary loss within the construction ROW and ATWS. These floral resources include concentrations of spring ephemerals (ACP 2017, VDCR-DNH 2017) potentially used by queens after overwintering. Loss of these resources will result in reduced survival and reproduction of some queens. To minimize impacts to foraging RPBBs, vegetation clearing along access roads will not occur during the flowering period; therefore we do not anticipate impacts to foraging bees along the access roads. However, road widening and culvert replacement will crush any nests or queens overwintering along the access roads.

Herbaceous floral resources will re-establish within 1 growing season adjacent to the access roads (36-014.AR2 and 36-012.AR1). Flowering shrubs are likely to take 8-10 years to re-establish. As floral resources are re-established post-construction, introduction and spread of invasive plant species and use of fertilizer are expected to reduce the diversity of native floral resources, limiting the suitability of restored habitat for RPBB throughout the entire active (growing) season. Per the AMMs, invasive species control measures and planting native species will take place on adjacent GWNF lands. However, the action area also includes RPBB habitat not adjacent to GWNF lands.

Soil compaction during road construction may affect the ability of queens to excavate an overwintering chamber and may reduce the ability of rodents to excavate burrows, which reduces the ability of colonies to find appropriate nest locations, resulting in reduced reproduction.

Construction ROW activities and restoration and maintenance activities on the access roads and construction ROW may expose RPBBs to noise/vibration, causing individuals to expend additional energy to seek out alternate foraging and nesting areas, which may reduce survival and reproduction.

Madison Cave isopod – The potential effects of the proposed action are described in Appendix B Table 6. Based on aerial imagery, the 40.8 acre CY in Rockbridge County was previously cleared and no other project activities (i.e., storage of equipment and materials, temporary field offices, parking, pipe preparation and preassembly staging areas) at the CY will alter subsurface features or water quality and/or quantity. Therefore the CY will not affect the MCI. The project subactivities unlikely to result in any impacts to MCI are described in Appendix B Table 6; NE subactivities. For those subactivities of the proposed action that are determined to result in NE to MCI, there will be no further discussion in this Opinion.

The project subactivities that may affect, but are NLAA, the MCI are described in Appendix B Table 6; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA MCI, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA MCI (Appendix B Table 6; LAA subactivities). For some components of the proposed action that are anticipated to affect MCI, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix

B Table 6. Details of the AMMs are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I and page 4-300 of the FEIS (FERC 2017). These subactivities are expected to crush or introduce sediment that smothers MCI, or collapse or fill subsurface features and/or alter subsurface water quality and/or quantity resulting in habitat degradation, fragmentation, and loss.

The proposed action is expected to result in ground disturbing activities, such as digging, trenching, blasting, grading, constructing/improving access roads, culvert installation, and wetland crossings, throughout the 11.2 surface acres where the construction ROW and ATWS cross the Cochran's Cave site.

Grading redistributes and loosens soil making it more prone to erosion. Depending on the amount and speed of the erosion event, MCI will either avoid a particular area until the sediment is settled or be smothered. Any MCI present in the zones of impact will likely be crushed or smothered. Trenching or blasting is likely to loosen subsurface rocks, which could fall and crush MCI. Loosened subsurface rocks from trenching or blasting are expected to disrupt the subsurface water flow and alter MCI travel corridors. The fractured nature of the geology in the area generally provides numerous travel corridors, which reduces the likelihood that a blocked corridor will completely isolate an individual; however, MCI will need to expend additional energy to find an alternate route. Additionally, trenching or blasting is anticipated to intercept a subsurface void, creating a direct conduit for soil and sediment to enter into the subsurface habitat. Depending on the degree of sedimentation, habitat will be degraded or lost. These changes will render habitat temporarily or permanently unsuitable for use by the MCI and are likely to prevent movements among or between populations.

The proposed action incorporates AMMs to minimize the amount of sediment introduced into the subsurface area, but introduction of sediment will not be entirely prevented. We expect sediment to enter the phreatic waters in 2 ways near the Cochrans Cave site: 1) sediments from ground disturbance may enter through the upwelling at the Cochrans Cave site, which provides a window for surface sediments to enter the phreatic system, and 2) sediment created when subsurface karst crumbles or is loosened from trenching or blasting. Therefore we anticipate ground disturbing activities (e.g., digging, trenching, blasting, grading, constructing/improving access roads, culvert installation, and wetland crossings) that occur in the 11.2 surface acres will introduce sediment into MCI potential habitat up to 0.5 mile from the construction ROW and ATWS that bisect the Cochran's Cave site (Figure 7). Previous pipeline project analysis in the region indicated materials released into surface or subsurface of similar karst features may reach known and potential occurrences of MCI up to 0.5 mile away (Service 2013). There are approximately 885.5 surface acres within 0.5 mile of the construction ROW and ATWS that bisect the Cochran's Cave site (Table 6). As previously stated, depending on the degree of sedimentation, habitat will be degraded or lost. These changes will render habitat temporarily or permanently unsuitable for use by the MCI and are likely to prevent movements among or between populations. The effects of the proposed action are expected to be primarily temporary impacts and MCI are expected to continue to occupy the phreatic water in the area.

Table 6. MCI potential habitat and MCI impacts, Augusta County, VA.

Total MCI potential habitat in Augusta County	266,822 surface acres
Total MCI potential habitat in construction ROW, access roads, and ATWS in Augusta County	1,974 surface acres
Area of ground disturbance impacts to MCI (where the construction ROW and ATWS cross Cochran's Cave site)	11.2 surface acres
Area of sedimentation impacts to MCI (area within 0.5 mile of where the construction ROW and ATWS cross Cochran's Cave site)	885.5 surface acres

Figure 7. Construction ROW (red line) in Augusta County, VA. Area of ground disturbing activities (blue polygon, 11.2 surface acres, MP 139.8 - MP 140.4) where construction ROW and ATWS bisect the Cochran's Cave site. Area within 0.5 mile (yellow polygon, 885.5 surface acres) of the construction ROW and ATWS that bisects the Cochran's Cave site.

Indiana bat – The potential effects of the proposed action are described in Appendix B Table 7. We did not reach a NE determination for Ibat for any of the subactivities.

The project subactivities that may affect, but are NLAA, the Ibat are described in Appendix B Table 7; NLAA subactivities. For those subactivities of the proposed action that are determined NLAA Ibat, there will be no further discussion in this Opinion.

There are other subactivities of the project that are LAA Ibat (Appendix B Table 7; LAA subactivities). These subactivities will temporarily or permanently remove a total of 1,018.6 acres of known use summer habitat, unknown use spring staging/fall swarming habitat, and known use spring staging/fall swarming habitat in the Ibat Appalachian Mountain RU (Table 4). For some components of the proposed action that are likely to affect Ibats, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 7. AMMs for tree clearing are outlined in Table 7.

Table 7. TOYR for tree clearing by Ibat habitat category.

Habitat Category	Dates when Tree Clearing will be Conducted in VA[a]	Dates when Tree Clearing will be Conducted in WV[a]
Known use summer habitat	NA	November 15 – March 31
Unknown use spring staging/fall swarming habitat	NA	November 15 – March 31
Known use spring staging/fall swarming habitat	November 15 – March 31	November 15 – March 31

[a]Tree clearing more than 5 miles from a known hibernacula will be conducted September 16 – April 14 in VA and November 15 – March 31 in WV; see Table 4.7.1-6 of the FEIS (FERC 2017).

Tree removal in known use summer habitat is likely to limit roosting options or necessitate roost tree switching when Ibats return the following season. Because maternity roost trees are ephemeral, Ibats have evolved to relocate roosts at the beginning of the season if needed. Because trees will be removed outside of the active season when the roost trees are not in use, the stress on an Ibat is decreased. Ibats have primary and secondary roosts and will shift between sites during a season (Humphrey et al. 1977, Gardner et al. 1991, Callahan 1993, Kurta et al. 1993, Romme et al. 1995). Therefore, in the rare instance a primary roost tree is cut, as long as alternate roosts remain in the vicinity, effects associated with loss of individual roost trees are likely to be short-term. There is a substantial amount of roosting habitat in the action area and we expect Ibats will relocate roosting areas with minimal effects to individuals.

Tree removal in unknown use spring staging/fall swarming habitat will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., spring emergence or fall swarming). Bats use the area around hibernacula to build fat reserves prior to hibernation and to socialize and mate in the fall. In the spring, bats spend a few hours or days around hibernacula or migrate immediately to summer habitat. Clearing trees around hibernacula will permanently decrease foraging and roosting habitat, requiring bats to spend more time

searching for food, which could result in bats entering hibernation with less fat reserves resulting in decreased overwinter survival or poorer spring body condition or result in less time on social interactions, which could result in decreased breeding success. We expect the same effects on Ibats from tree removal in known use spring staging/fall swarming habitat as those described for unknown use spring staging/fall swarming habitat.

We do not anticipate Ibats will be present during tree removal activities. A TOYR (trees will be removed between November 15 and March 31, when Ibats will not be present) will be implemented around known hibernacula in WV and VA and no impacts are anticipated to Ibats hibernacula or hibernating bats. However, as discussed above tree clearing will render the habitat temporarily or permanently unsuitable for use by Ibats. Vegetation will grow back in the temporary construction ROW. We expect pine (*Pinus* spp.) and sweet gum (*Liquidambar styraciflua*) will colonize the temporary construction ROW in VA and beech (*Fagus* spp.) and maple (*Acer* spp.) will colonize the temporary construction ROW in WV, which will not create Ibat habitat. Trees that create suitable Ibat habitat will be planted along the construction ROW edge only in the limited native tree planting near 1 SWP colony (VHB 2017).

Northern long-eared bat – The potential effects of the proposed action are described in Appendix B Table 8. We did not reach a NE determination for NLEB for any of the subactivities.

There are several project subactivities that may affect (MA) the NLEB. Some of these have effects that have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule (*https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/BOnlebFinal4d.pdf*) and are described in Appendix B Table 8; MA subactivities. For those subactivities, no detailed effects analysis discussion is required. For some components of the proposed action that MA NLEB, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 8.

There are other subactivities of the project that have not been addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule (Appendix B Table 8; LAA subactivities). Each of these subactivities involves tree clearing within 0.25 mile of hibernaculum PH-S018. Similar to the subactivities mentioned above, AMMs have been incorporated to ameliorate those effects and those are also noted in Appendix B Table 8. For context, 203 acres of tree removal is proposed within 5 miles (anticipated spring staging/fall swarming range [Lowe 2012]) of hibernaculum PH-S018; this acreage has been updated following receipt of a more accurate estimate from ERM. This activity will impact foraging and roosting areas for a concentrated number of bats in an abbreviated season (spring emergence or fall swarming). Bats use the area around hibernacula to build fat reserves prior to hibernation, to socialize and mate in the fall. In the spring, bats may spend a few hours or days around hibernacula or migrate immediately to summer habitat. Clearing trees around hibernacula will permanently decrease foraging and roosting habitat, which will require bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves resulting in decreased overwinter survival or poorer spring body condition or result in less time on social

interactions, which could result in decreased breeding success.

In addition, NLEB may have summer maternity colonies around hibernaculum PH-S018. Individual NLEB home ranges have been minimally estimated at 148.8–173.7 acres (Owen et al. 2003, Lacki et al. 2009). The proposed clearing of 203 acres could represent a complete loss of of an individual home range. However, the proposed action is linear and therefore tree clearing is not anticipated to remove an entire potential home range rather, sections of potential home ranges. Depending on the resulting level of habitat fragmentation, tree clearing will make the remaining forest less suitable for future roosting or foraging. We expect NLEB will avoid the permanently cleared areas and start exploring undisturbed areas for future roost sites. This will cause NLEBs to expend more energy searching for alternative roosting or foraging sites, which will delay their ability to gain post-hibernation weight resulting in decreased growth.

We do not anticipate NLEBs will be present during tree removal activities, a TOYR (trees will be removed between November 15 and March 31, when NLEBs will not be present) will be implemented around known hibernacula in WV and no impacts are anticipated to NLEB hibernacula or hibernating bats. Tree clearing will render the habitat permanently unsuitable for use by NLEBs. However, because this clearing will occur when bats are in hibernation, it will avoid killing NLEB. We anticipate impacts will occur during the first spring, summer, and fall after tree clearing occurred and as bats emerge from hibernation. Most impacts will occur during the season after tree clearing. All impacts are expected to be limited and short-term in nature, and NLEBs are expected to acclimate to this change and shift to alternative habitat.

The majority of effects described above have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule and any incidental take that may occur further than 0.25 mile from a hibernacula is not prohibited under the final 4(d) rule (50 CFR §17.40(o)). However, there are 0.52 acres within 0.25 mile of a hibernaculum that are not covered under the programmatic biological opinion on the 4(d) rule that require separate incidental take authorization in this biological opinion (Figure 8).

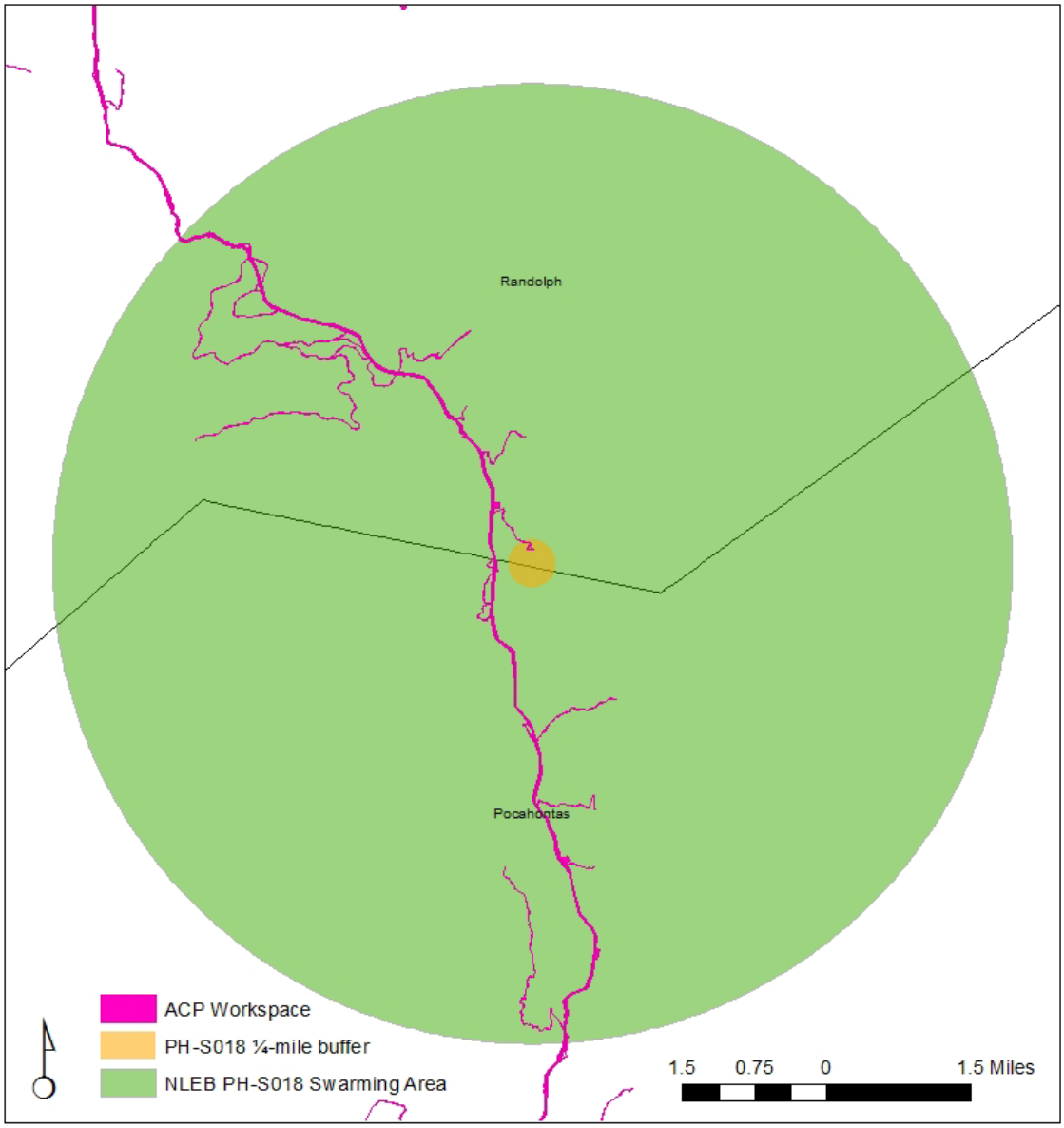

Figure 8. ACP limits-of-disturbance as it relates to NLEB swarming zones and PH-S018.

CUMULATIVE EFFECTS

Cumulative effects are those "effects of future State or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area" considered in this Opinion (50 CFR 402.02).

Small whorled pogonia – While the Service is not aware of any specific proposed projects scheduled to occur immediately within the action area, SWP is currently being affected by a variety of actions and activities in Seneca State Forest, such as trail maintenance, as described in the Environmental Baseline section above. WVDNR is considering options to reroute the

existing trail (currently 550 ft away) further from the Seneca SWP colony to reduce potential foot traffic, which may crush SWP and spread invasive plants. This action would be beneficial to SWP.

Running Buffalo clover – While the Service is not aware of any specific proposed projects scheduled to occur immediately within the action area, RBC is likely currently being affected by a variety of actions and activities such as disturbance from foot traffic or ORV use on private lands as described in the Environmental Baseline section above. All RBC occurrences are on private land and most are located on or near old logging roads or trails; therefore, they will likely received some type of occasional disturbance, some of which may be beneficial and some of which may cause adverse effects.

Roanoke logperch – While the Service is not aware of any specific proposed projects scheduled to occur immediately within the action area, RLP is likely currently being affected by a variety of actions and activities such as alteration of habitat, as described in the Environmental Baseline section above. RLP habitat destruction, modification, and fragmentation from chemical spills, non-point runoff, channelization, impoundments, impediments, and siltation is expected to continue to occur, resulting in declines in RLP abundance.

Clubshell – While the Service is not aware of any specific proposed projects scheduled to occur immediately within the action area, clubshell is currently being affected by a variety of actions and activities such as agricultural practices and oil and gas development and associated water withdrawals as described in the Environmental Baseline section above. Multiple oil and gas wells, pipelines, and water impoundments are under construction within the watershed. These activities often result in increased sedimentation and erosion to waterways due to a large quantity of earth disturbing activities. Additionally, private landowner practices within riparian areas of Hackers Creek (e.g., clearing all riparian vegetation and application of herbicides within the riparian zone) have adversely affected habitat conditions which place added stress to the already declining clubshell population.

Rusty patched bumble bee – The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Madison Cave isopod – While the Service is not aware of any specific proposed projects scheduled to occur immediately within the action area, MCI is likely currently being affected by a variety of actions and activities such as agriculture and forest management, as described in the Environmental Baseline section above. These areas provide for sediments and contaminants to MCI habitat and we expect they contribute to degradation of MCI habitat in this area.

Indiana bat – The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

Northern long-eared bat – The Service is not aware of any future state, tribal, local, or private actions that are reasonably certain to occur within the action area at this time; therefore, no cumulative effects are anticipated.

JEOPARDY ANALYSIS

Section 7(a)(2) of the ESA requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

Jeopardy Analysis Framework

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The following analysis relies on 4 components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Analysis for Jeopardy

Small whorled pogonia

Impacts to Individuals – The proposed action includes herbaceous vegetation and ground cover clearing, tree and shrubs clearing, tree side trimming, grading, trenching, blasting, regrading/stabilization, vegetation management, and permanent ROW repair/regrading. As discussed in the Effects of the Action, potential effects of the action include effects to SWP present within the action area year-around during construction and O&M. Effects include decreased fitness and reproductive success or death of individual SWP due to degradation and loss of SWP habitat caused by altered hydrology, changes in soil moisture, downslope erosion, sedimentation, changes to sunlight regime, and competition. Individual SWP may be crushed by rocks from blasting and experience injury and death. The AMMs (e.g., SWP Conservation Plan, Upland Erosion Control Plan, Restoration and Rehabilitation Plan, and Non-Native Invasive Plant Species Management Plan) will minimize the potential effects from surface water runoff during construction and restoration and competition from invasive plants. In summary, there will be impacts to individual SWP in their annual reproduction and survival rates.

Impacts to Populations – As we have concluded that individual SWP are likely to be killed or experience some reductions in their annual or lifetime reproductive success, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the population to which these individuals belong.

Four SWP colonies, Seneca, MNF, MNF-2, and GWNF containing approximately 38, 7, 22, and 21 individuals (i.e., stems), respectively, were found during surveys of the action area. Seneca and GWNF colonies represent individual populations. MNF and MNF-2 are approximately 0.3 mile part (Allstar Ecology 2016a, 2016b; ERM 2017; VHB 2017), and are considered part of the same population because the 2 are less than the 0.62 mile (1 km) minimum separation distance for an "element occurrence" or population, as defined by NatureServe (2002). Therefore, there are three populations total. We expect that multiple project subactivities (Appendix B Table 1) will permanently affect the Seneca population because of the permanent habitat alteration and degradation of the population's upslope drainage and long-term changes in sunlight regime. We anticipate that the long-term viability of the Seneca population will be reduced significantly due to decreased fitness, reproductive output, and death of individual SWP and the population will have a lower number of SWP individuals permanently, but will likely not be extirpated. Both the MNF and GWNF populations will be temporarily affected by the subactivities in the construction ROW (Appendix B Table 1). For these 2 populations, we anticipate a long-term reduction in fitness and reproductive success until the temporary construction ROW is restored and permanent vegetation, including shrubs and mid-story trees, is established.

As of 2007, 2 and 33 extant populations were documented in WV and VA, respectively (Service 2008). Since 2007, 7 additional populations have been found in WV, thus the total number of documented populations in WV is 9. For VA, 13 new populations have been documented and 1 population determined to be extirpated, thus there are 45 extant populations total (VDCR-DNH 2018). The affected populations represent 22 percent (2 of 9) and 2 percent (1 of 45) of all documented SWP populations in WV and VA, respectively.

Impacts to Species – As we have concluded that populations of SWP are likely to experience reductions in their fitness or mortality, we need to assess the aggregated consequences of the anticipated losses and reductions in fitness of the exposed populations on the species as a whole.

To understand the consequences of population-level effects at the species level, we need to understand the RND needs of the species. To meet the recovery objectives of SWP, the following must be met: 1) a minimum of 61 sites (or populations) (75 percent of number of sites known in 1992) must be permanently protected and distributed proportionately among the 3 geographic centers and the outliers; 2) these sites must represent at least 75 percent of the known self-sustaining, viable populations as determined at the time of reclassification, including a total of 20 sites having 80 stems or more (self-sustaining, viable population defined as showing a geometric mean of 20 emergent stems, over a 10-year period); 3) establishment of appropriate habitat management programs for occupied SWP habitat or protection of sufficient amount of unoccupied habitat adjacent to existing populations (Service 1992). The rangewide status of SWP is considered stable (Service 2008). As of 2007, 150 extant SWP populations were documented rangewide; however few SWP populations are monitored annually and some populations may only be visited once every 5 to 10 years, therefore it is difficult to fully assess population viability. With the 7 additional populations in WV and the net increase of 12 populations in VA observed since 2007, the total rangewide is approximately 169 SWP

populations.

The proposed action is anticipated to cause a long-term reduction in fitness of 2 populations and permanent reduction in fitness of 1 population, affecting 1.8 percent of SWP populations rangewide. Due to the presence of 169 populations throughout its range, the reduced fitness of 3 populations is not anticipated to change the status of the species rangewide.

Running Buffalo clover

Impacts to Individuals – The proposed action includes multiple subactivities (Appendix B Table 2) that will result in mortality of RBC individuals and will permanently alter and/or destroy RBC habitat. As discussed in the Effects of the Action, ground disturbance, tree clearing and trimming, and burning subactivities will kill individual plants. Additionally, these activities will permanently alter and degrade habitat such that conditions are no longer favorable for RBC re-establishment. Elimination of canopy cover which modifies the amount of sunlight reaching individual plants may reduce seed production and germination of some individuals and may lead to mortality of others. The increase in sunlight may also increase competition from invasive species which can outcompete RBC, prohibiting growth of individual plants. ORV traffic on improved access roads and the construction ROW will exceed disturbance frequencies tolerated by RBC and prevent re-establishment of RBC to some of the disturbed areas. Increased ease of access by white-tailed deer and the resulting herbivory will kill some RBC and lower reproductive output of other RBC. In summary, there will be impacts to individual RBC survival and fitness.

Impacts to Populations – As we have concluded that individual RBC are likely to experience mortality due to the proposed action, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the populations to which these individuals belong.

Six populations of RBC, each consisting of multiple occurrences, will be affected by the proposed action (Appendix B Table 2). The loss of individuals from these occurrences will cause a reduction in fitness to 5 of the 6 affected populations; the remaining population will experience mortality as all individuals and occurrences will be killed due to project subactivities. There are approximately 5.1 acres of RBC within 150 ft of the construction ROW centerline and 0.8 acres will be directly affected and killed as a result of the action (FERC 2017).

Impacts to Species – As we have concluded that RBC populations are likely to experience reductions in their fitness and mortality, we need to assess the aggregated consequences of the anticipated losses of the exposed populations on the species as a whole. To understand the consequences of population-level effects at the species level, we need to understand the RND needs of RBC. To meet the goal of recovery of RBC, at least 34 populations, in total, must be distributed as follows: 2 A-ranked, 6 B-ranked, 6 C-ranked, and 20 D-ranked populations across at least 2 of the 3 regions in which RBC occurs (Appalachian, Bluegrass, and Ozark) (Service 2017). The rangewide status of the species is considered stable/improving with 152 healthy populations across all 3 regions (16 A-ranked, 35 B-ranked, 42 C-ranked, and 59 D-ranked) and

15 percent of these occur on protected lands (Service 2017). With the addition of the populations found during surveys for the proposed action, there are 160 RBC populations rangewide.

This proposed action will cause a reduction in fitness of 5 populations due to mortality of some individuals from some occurrences that make up these populations and will result in the loss of 1 population. There are approximately 5.1 acres of RBC within 150 ft of the construction ROW centerline and 0.8 acres will be directly affected and killed (FERC 2017). The 6 affected populations represent 9.1 percent of RBC populations in WV and 3.75 percent of RBC populations rangewide. Due to the presence of 160 populations throughout its range, the reduced fitness of 5 populations and mortality of 1 population is not anticipated to change the status of the species.

As part of the proposed action, a 400-acre property containing part of an RBC population (approximately 50,000 rooted crowns) has been obtained and will be protected in perpetuity. This property will not be adversely affected by the proposed action. It will be enhanced for RBC by managing and treating invasive species, removing trees to provide more filtered sunlight, and providing periodic soil disturbance (e.g., disking, tractor tilling, and harrow rake digging) (AllStar Ecology 2017). Initial habitat enhancements will be monitored for a period of 5 years, which includes monitoring of existing populations. Protecting part of a RBC population is not anticipated to change the status of the species rangewide.

<u>Roanoke logperch</u>
Impacts to Individuals – The proposed action includes trenching, grading, constructing/improving access roads, and stream and wetland crossings. As discussed in the Effects of the Action, effects to individual RLP are expected to include injury or death from installation and dewatering of cofferdams, installation of the bridge center supports and blasting, if it occurs. Additionally, a temporary reduction in feeding or reproducing is expected as a result of either temporarily preventing access to a foraging or spawning area or altering habitat through the introduction of sediments, cofferdams, or bridge center supports such that the habitat is unsuitable for foraging or spawning. In response to sediment plumes, most RLP are anticipated to cease feeding or breeding activities and move to clearer water until sediment levels return to background levels. In particular, we expect spawning will be delayed or inhibited at Waqua and Sturgeon Creeks due to the installation of the bridge center supports during the RLP breeding period. Individuals will expend more energy to seek out different foraging and spawning areas. A TOYR (March 15 - June 30) to protect RLP during their spawning season will be implemented at Nottoway River 1, which will minimize the potential for effects from sedimentation. Permanent removal of riparian vegetation is expected to decrease fitness of RLP individuals. In summary, there will be impacts to individual RLPs in their annual reproduction and survival rates.

Impacts to Populations – As we have concluded that individual RLP are likely to be killed or experience some reduction in their annual reproductive success, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the population to which these individuals belong.

We expect that the population level impacts from injury, death, and spawning disruption to the RLP will be relatively small because the proposed action affects a small number of individuals in 0.62 percent of the RLP habitat within the Nottoway River drainage, which is a small portion (0.12 percent) of the entire range of the species. Following completion of each action that results in adverse effects to RLP, we expect that the RLP population, given no other major stressors, will recover within 1-3 years assuming that most RLP in the action area experience temporary impacts. Similarly, habitat impacts are minor compared to the overall amount of RLP habitat available. The effects of the proposed action are expected to be primarily temporary; in general, RLP habitat will recover to a suitable condition following temporary impacts; and RLP are expected to continue to occupy waterways within the action area. Therefore, we conclude that the effects from the proposed action do not pose a significant risk to the RLP and will not result in permanent population declines.

Impacts to Species – As we have concluded that populations of RLP are unlikely to experience reductions in their fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole.

<u>Clubshell</u>
Impacts to Individuals – The proposed action includes multiple subactivities (Appendix B Table 4) that are ground disturbing and will result in sediment entering tributaries to Hackers Creek. As discussed in the Effects of the Action, potential effects of the action include effects to all individuals in the Hackers Creek clubshell population. Effects from sedimentation will impair feeding of individual mussels and degrade and alter habitat. Impaired feeding is anticipated to result in reduced physiological function; depressed rates of growth, reproduction, and recruitment; and ultimately mortality of individual mussels.

Additionally, sedimentation may permanently alter and degrade habitat through siltation such that conditions are no longer favorable for clubshell. These effects will persist until high flows flush settled sediment downstream. We anticipate these changes in habitat will further impair feeding, resulting in sublethal effects on growth and reproduction or starvation with long-term exposure, affecting a majority of individual mussels. In summary, there will be impacts to individual clubshell survival and fitness as a result of impaired feeding and habitat degradation and alteration.

Impacts to Populations – As we have concluded that individual clubshell are likely to experience mortality due to the proposed action, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the populations to which these individuals belong.

There is 1 population of clubshell in Hackers Creek. As a result of sedimentation, decreased water quality, and degraded and altered habitat we anticipate the Hackers Creek clubshell population will experience impaired feeding. When high flows continue to flush sediment downstream, we expect that over time the habitat will begin to return to pre-construction conditions. At that time, the remaining mussels will be able to feed in an unimpaired manner.

However, the population will remain below pre-construction numbers.

Impacts to Species – As we have concluded that 1 population of clubshell is likely to experience reductions in its fitness and mortality, we need to assess the aggregated consequences of the anticipated loss of the exposed population on the species as a whole. To understand the consequences of population-level effects at the species level, we need to understand the RND needs of the species.

In brief, the clubshell recovery criteria (Service 1994) are:

1. Viable populations must be established in 10 separate drainages (Tippecanoe River, IN; East Fork West Branch St. Joseph River, MI/OH; Fish Creek, IN/OH; Green River; KY; Little Darby Creek, OH; Elk River, WV; French Creek, PA; Allegheny River, PA; plus two additional drainages).
2. Each of the 10 populations must be large enough to survive a single adverse ecological event.
3. The populations and their drainages must be permanently protected from all foreseeable and controllable threats, both natural and anthropogenic.

The rangewide status of the species is considered declining. Throughout its range, there are 13 populations of clubshell occupying 21 streams (Service 2008). This includes more than 1 million individuals (Villella 2007). However, only 7 of these populations show evidence of reproductive success, none of which occur in WV (Service 2008). Clubshell populations exist in 3 river systems in WV: the Monongahela, Kanawha, and Ohio Rivers. The Hackers Creek population is the only remaining population in the Monongahela River system.

The proposed project is anticipated to adversely impact the Hackers Creek population; however, this population is not in one of the specified drainages listed in Recovery Criteria 1 nor is it likely to be part of the 2 unspecified additional drainages because the population is not reproductive, as described above in the Baseline section. The reduction in fitness of the non-reproducing Hackers Creek population will not prevent meeting the Recovery Criteria. Therefore, we conclude that this project will not reduce the likelihood of survival and recovery of the clubshell.

<u>Rusty patched bumble bee</u>

Impacts to Individuals – As discussed in the Effects of the Action, anticipated effects of the action include effects to individual RPBBs present within the HPZ year-round. Effects will include reduced reproductive success of some queens as a result of removal of spring ephemerals and other floral resources, and injury or death of individual workers or queens during the active and overwintering season as a result of crushing by machinery during vegetation removal and construction in the construction ROW.

In response to removal of floral resources, the following season RPBB workers and early foraging queens will have less foraging habitat available to them and are likely to expend more energy to forage elsewhere within the foraging range of nests and may experience reduced health

as a result of the decrease in food availability. Consequently, there will be impacts to health of those individual RPBB workers that would have utilized previously available foraging habitat. Individual worker bees are responsible for supporting the reproductive success of the colony by providing food resources to the queen. The health of the colony is dependent on the number of workers foraging and providing resources and on the abundance of foraging habitat. Reduced health of RPBB workers will reduce the reproductive success of some queens (i.e., not as many males and foundress queens produced) as a result of loss of foraging resources provided by workers. Furthermore, the loss of reproductive individuals may reduce the success of future matings and the success of future colonies. When related individuals mate, there is a higher likelihood of colony collapse associated with haplodiploidy, when 50 percent of the workers are replaced by diploid males that do not contribute food resources to the colony (82 FR 3186-3209).

RPBB nests are typically in abandoned rodent nests or other similar cavities, 1-4 ft below ground (Plath 1922, Macfarlane et al. 1994). RPBB nests have also been occasionally observed above ground (Plath 1922). Nests are thought to be typically within 1 km (0.6 mi) of summer foraging areas. Nest locations are likely be in open areas or along the edges of forested habitat in areas that are not too wet (i.e., not marsh, shrub wetlands, or wetland forest). Vegetation along the access roads will not be cleared April - August to minimize impacts to foraging bees; however, vegetation clearing along the construction ROW spread that includes the HPZ is scheduled for 9 months, starting in April 2019 and finishing during the 4th quarter (December) of 2019. We expect RPBBs will be present along the construction ROW when clearing occurs. With an estimated 156.3 ha of nesting habitat in the HPZ, we estimate that there are 22 nests in the HPZ. Ground disturbance will impact approximately 6.29 ha of suitable nesting habitat within the HPZ. Based on a nest density of 0.14 nests/ha in the nesting habitat within the action area, we estimate that 1 nest may be impacted. The proposed action will affect up to 4.5 percent of nests estimated in the HPZ.

RPBB queens likely overwinter in chambers (i.e., a few centimeters deep in soft soil and leaf litter) that they form in forested portions of the HPZ. The surface of the access roads are not suitable overwintering habitat due to soil compaction; however, suitable overwintering habitat exists in the forested areas alongside the access roads. Widening and improvements will impact approximately 3 m, which is included in the 10.27 ha of suitable overwintering habitat on either side of the existing access road within the HPZ. Within the HPZ (969.6 ha), the proposed action will impact 10.27 ha of suitable overwintering habitat. We estimate that 30 overwintering queens are produced by each of the estimated 22 nests in the HPZ and that each of these queens remains in the HPZ to overwinter, resulting in an estimated 660 queens that overwinter in the HPZ at an approximate density of 0.7/ha. Based on the estimated amount of overwintering habitat in the HPZ, there would be approximately 8 overwintering queens in the construction ROW, access roads, and ATWS that might be displaced or crushed.

Impacts to Populations – As we have concluded that some individual RPBBs are likely to be killed or experience some reductions in health, and colonies may experience some reductions in their reproductive success, we need to assess the aggregated consequences of the anticipated losses and reductions in fitness (i.e., reproductive success and long-term viability) of the exposed

individuals and colonies on the population to which these belong. As explained above, while we cannot predict precise numbers of individuals affected, it is unreasonable to assume that there will be no impacts at all to any individual RPBBs. However, given the project description and overlap with habitat, the best available science indicates that loss of these resources is anticipated to have at least some negative impact on some individual RPBBs, as opposed to the assumption that the project will have a large impact on all of the bees or most of the bees. This relative quantification of impacts is essential to determining the magnitude of the importance of the take on the population and to the species.

Impacts to populations may result from loss of colonies or reduced colony formation when nests or overwintering foundress queens are crushed; when the health or survival of colony members is reduced; or when colonies produce fewer reproductive individuals due to reductions in foraging resources. A population of RPBB is represented by the number of successful nests or colonies in a given geographical area, rather than a number of individuals, because a colony is founded by a single queen and represents 1 reproductive unit (Chapman and Burke 2001, Zayed 2009, Service 2016). As a result of their genetic structure, a RPBB population can only persist on the landscape in a metapopulation structure (a group of spatially separated populations, which in this case are colonies, of the same species that interact at some level). A healthy population of bumble bees typically contains tens to hundreds of colonies (Macfarlane et al. 1994, 82 FR 3186-3209). Loss of a colony or overwintering queen could reduce the health of a metapopulation due to lost opportunities to interbreed. To date there are no studies that estimate the success rate of overwintering queens, but if we assume worst case scenario, all 8 overwintering queens in the action area are crushed. Therefore, up to 1.2 percent of overwintering queens (8 of 660 overwintering queens in HPZ) will be impacted. In addition, as population size decreases, population growth rate also tends to decrease and the risk of local extirpation increases.

Reduced foraging of workers may decrease the reproductive success of colonies as a result of loss of foraging resources provided by workers to the queen (i.e., not as many foundress queens produced to start new colonies). The proposed action will remove 6.29 ha (0.7 percent) of suitable foraging habitat within the HPZ. The remaining 99.3 percent of suitable foraging habitat in the HPZ will remain unaffected. Habitat removed as a result of widening and improving the access roads and the permanent ROW is likely to be permanently lost; however, the project activities will shift the canopy opening such that floral resources will develop along the new edge of the access roads and permanent ROW over time.

We estimate 22 nests within the HPZ; however, only a small number of foraging bees are expected to be impacted because a large amount of suitable foraging habitat in the HPZ will be unaffected. It is not possible to measure the impacts of reduced foraging to the health of individual worker bees. We can, however, assume that fewer floral resources may reduce colony (nest) fitness - in other words, fewer floral resources may result in less reproductive males and females produced; however we cannot quantify that loss. We assume that there is 1 nest in the 13.89 ha impacted by the project. Effects to 1 colony are expected from ground disturbance. We expect the lost foraging habitat will have an insignificant impact on the remaining 21 colonies in the HPZ. Due to the metapopulation dynamics of RPBB, limited indirect impacts to the ability of

queens associated with 1 colony to produce workers and foundress queens are not likely to negatively impact the fitness or survival of the population.

Impacts to Species – As we have concluded that populations of RPBB are unlikely to experience reductions in their fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole.

Madison Cave isopod

Impacts to Individuals – The proposed action includes trenching, blasting, grading, constructing/improving access roads, and wetland crossings. As discussed in the Effects of the Action, potential effects of the action include effects to MCI present within the action area during construction. Individuals will need to expend more energy to seek out different travel corridors, food sources, or mates. Effects include a temporary reduction in feeding or reproducing as a result of either a potentially blocked travel corridor or the need to shift from an area where MCI could be feeding or reproducing. Depending on the severity of the impact, some individuals are likely to die from crushing or smothering if they do not move from the area quickly. However, the AMMs (enhanced sediment and erosion control measures) will minimize the potential for direct and indirect effects from sedimentation. In summary, there will be impacts to individual MCIs in their annual survival rates.

Impacts to Populations – As we have concluded that individual MCIs are likely to be killed or experience some reduction in their annual reproductive success, we need to assess the aggregated consequences of the anticipated losses of the exposed individuals on the population to which these individuals belong.

No documented MCI localities occur in the proposed construction ROW centerline or ATWS; however, we consider Cochran's Cave site an undocumented MCI locality. Documented localities represent a sampling point where MCI were captured. For this analysis we are using localities as a surrogate for a population.

Limited information exists on the connectivity of MCI populations, preventing an understanding of how impacts at a given site may relate to populations. Sites that are be impacted could be rapidly recolonized if the site was part of a larger population, or they could be eliminated with little chance of subsequent recolonization if not part of a larger population.

We expect decreased fitness of the Cochran's Cave site MCI population. A total of 896.7 surface acres of MCI potential habitat is within 0.5 mile of the construction ROW centerline and ATWS that bisect Cochran's Cave site. Within that area, the construction ROW centerline and ATWS bisect the Cochran's Cave site, including the vertical entrance to the cave, totaling 11.2 surface acres of disturbance. While the AMMs provided in the FEIS (FERC 2017) will ameliorate much of the adverse effects, they will not be completely effective in preventing all sediment from entering the phreatic water. Additionally, the AMMs cannot completely prevent shifts in surface and sub-surface formations and hydrology from trenching, digging, or blasting. Sudden shifts in subterranean structures are likely to crush or trap MCIs, alter their travel corridors, or isolate

portions of the population. We anticipate a reduction in the fitness of this undocumented population.

Impacts to Species – As we have concluded that 1 undocumented population of the MCI is likely to experience a reduction in fitness, we need to assess the aggregated consequences of the anticipated reductions in fitness of the exposed population on the species as a whole.

To understand the consequences of population-level effects at the species level, we need to understand the RND needs of the species. In brief, the MCI recovery criteria (Service 1996) are:

1. Populations of MCI at Front Royal Caverns, Linville Quarry Cave No. 3, and Madison Saltpeter Cave/Steger's Fissure are shown to be stable over a 10-year monitoring period.
2. The recharge zone of the deep karst aquifer at each of the population sites identified in Criterion 1 is protected from all significant groundwater contamination sources.
3. Sufficient population sites are protected to maintain the genetic diversity of the species. Protection of newly discovered populations, if any, will be incorporated into this criterion insofar as they contribute to maintenance of overall genetic diversity.

The rangewide status of the species appears to be stable (Service 2011). The proposed project is anticipated to adversely impact 1 undocumented population; however, it is unlikely to adversely impact any of the populations listed in Recovery Criteria 1. The potential reduction in the fitness of 1 undocumented population will not measurably reduce the species ability to recover. Therefore, we conclude that this project will not reduce the likelihood of survival and recovery of the MCI.

<u>Indiana bat</u>

Impacts to Individuals – The proposed action includes removal of 1,018.6 acres of known use summer habitat, unknown use spring staging/fall swarming habitat, and known use spring staging/fall swarming habitat that is likely to cause pregnant females to expend energy when required to alter their travel corridors, and as a result give birth to smaller sized pups with a lower likelihood of survival. While a pup might die as a result of being born small, it is not expected given the low likelihood that maternity roost trees are in the action area. Tree removal may fragment the habitat such that individual Ibats traveling through the area will be more vulnerable to predation, resulting in injury or death. Tree clearing is likely to make the remaining forest less suitable for roosting or foraging, which will cause Ibats to expend more energy searching for alternative roosting or foraging sites resulting in impacts to individual Ibats in their annual survival rates.

We expect most effects from tree removal will occur during spring staging or fall swarming to individual Ibats that hibernate in Starr Chapel, Breathing, or Clark's Caves, which were known hibernacula with documented Ibats in the 2017 winter surveys. No direct effects are anticipated but individual Ibats may be temporarily affected (reduced overwinter survival or reproductive success) by loss of spring staging/fall swarming habitat. Bats travel between hibernacula during fall swarming to mate and likely assess the relative suitability of potential hibernation sites (Brack et al. 2005). Effects to individual Ibats could be minor such as a slight shift in

roosting/foraging areas or more significant such as delayed mating in the fall or fertilization in the spring. Bats born earlier in the year have a greater chance of surviving their first winter and breeding in their first year of life (Frick et al. 2010). Removing some of the roosting/foraging habitat is likely to delay the birth of a small number of Ibats, thereby decreasing their odds of surviving.

Impacts to Populations – As we have concluded that individual Ibats are likely to experience some reduction in their lifetime survival or reproductive success, we need to assess the aggregated consequences of the anticipated reductions in fitness of the exposed individuals on the population to which these individuals belong.

Individuals using the known use spring staging/fall swarming habitat at 3 hibernacula will be affected. The effects are not expected to measurably decrease the fitness of the hibernating populations. Any removal of trees within the known use spring staging/fall swarming habitat will occur during the winter when bats are hibernating, which will limit disrupting fall swarming or spring staging activities and will avoid directly killing Ibats. Further, not every Ibat from the 3 hibernacula will be exposed to stressors associated with tree clearing because effects are to a small portion of the known use spring staging/fall swarming habitat around each hibernaculum. Acres of trees removed around the 3 hibernacula are as follows: Star Chapel Cave 96 acres (0.2 percent of known spring staging/fall swarming habitat); Breathing Cave 189 acres (0.5 percent of known spring staging/fall swarming habitat), and Clarke's Cave 141 acres (0.3 percent of known spring staging/fall swarming habitat) (see Table 4.7.1-7, page 4-265 of the FEIS for details [FERC 2017]). We anticipate limited effects during the first spring after tree clearing as bats emerge from hibernation. We anticipate most effects will occur during the first fall swarm after tree clearing. Bats are expected to acclimate to this change and shift to alternative habitat within the known use spring staging/fall swarming habitat. All effects are expected to be limited and short-term in nature. We do not expect a long-term reduction in any hibernating populations because the Ibat is adapted to ephemeral environments and a significant portion of the known use spring staging/fall swarming habitat will remain. The effects from the proposed action will not result in permanent population declines.

Impacts to Species – As we have concluded that populations of Ibats are unlikely to experience reductions in their fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole. Additionally, as part of the proposed action, a 400-acre property containing 10 caves and 396 acres of forest that will not be affected by the action has been obtained and will be protected in perpetuity. The property will be improved and enhanced for bats through installation of watering/foraging pools, snag creation, and erection of artificial roost structures (bat boxes). Ibats have not been detected in any of these caves as of the date of this Opinion, but protection of this site may benefit Ibats in the future.

<u>Northern long-eared bat</u>
Impacts to Individuals – The majority of impacts to NLEB have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule. Some effects to NLEB associated with impacts to habitat within a ¼-mile radius surrounding

hibernaculum PH-S018 have not. The proposed action includes the permanent removal of 203 acres of forest around a NLEB known hibernaculum swarming zone, 0.52 acres of which are part of the larger 203 acres being cleared, but that are not addressed by the programmatic opinion. This area may be used as roosting/foraging habitat in the fall or spring or by maternity colonies. No direct effects are anticipated but individual NLEB may be temporarily affected by loss of fall swarming, spring staging, and summer habitat resulting in reduced overwinter survival or reproductive success.

Impacts to Populations – As we have concluded that individual NLEB are likely to experience some reduction in their lifetime survival or reproductive success, we need to assess the aggregated consequences of the anticipated reductions in fitness of the exposed individuals on the population to which these individuals belong.

Bats are expected to acclimate to this permanent habitat removal by shifting to alternative habitat. All impacts are expected to be limited and short-term in nature. We do not expect a long-term reduction in the PH-S018 population or potential maternity colony because the proposed project will only affect 0.4 percent of the area within the ¼ mile radius and a significant portion, approximately 78.8 percent, of the spring staging/fall swarming winter habitat or potential maternity colony habitat in this area will remain forested after project construction. Therefore, we conclude that the effects from the proposed action will not result in permanent population declines.

Impacts to Species – As we have concluded that populations of NLEB are unlikely to experience reductions in their fitness, there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole. Additionally, as part of the proposed action, a 400-acre property containing 10 caves and 396 acres of forest that will not be affected by the action will be protected in perpetuity. The property will be improved and enhanced for bats through installation of watering/foraging pools, snag creation, and erection of artificial roost structures (bat boxes). NLEBs have not been detected in any of these caves as of the date of this Opinion, but protection of this site may benefit NLEBs in the future.

CONCLUSION

Small whorled pogonia – We considered the current overall stable status of the SWP and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the SWP. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the SWP.

Running Buffalo clover – We considered the current overall stable/improving status of RBC and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action

area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of RBC. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of RBC.

Roanoke logperch – We considered the current overall improving status of the RLP and the stable condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals and populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the RLP. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the RLP.

Clubshell – We considered the current overall declining status of clubshell and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the species. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the species.

Rusty patched bumble bee – We considered the current overall declining status of the RPBB and the inferred condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, the affected population, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the RPBB. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the RPBB.

Madison Cave isopod – We considered the current overall stable status of the MCI and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the MCI. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the MCI.

Indiana bat – We considered the current overall declining status of the Ibat and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the Ibat. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the Ibat.

Northern long-eared bat – We considered the current overall declining status of the NLEB and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. As stated in the Jeopardy Analysis, we do not anticipate any reductions in the overall RND of the NLEB. It is the Service's Opinion that authorization to construct and operate the pipeline, as proposed, is not likely to jeopardize the continued existence of the NLEB.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering (50 CFR § 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the FERC so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in Section 7(o)(2) to apply. The FERC has a continuing duty to regulate the activity covered by this incidental take statement. If the FERC: (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of incidental take, the FERC must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

On January 14, 2016, the Service published a final species-specific rule pursuant to section 4(d) of the ESA for the NLEB (50 CFR §17.40(o)), which became effective February 16, 2016. The section 4(d) rule defines prohibited take of the NLEB, which is limited to certain circumstances and activities within the full suite of prohibitions otherwise applicable to threatened species under 50 CFR §17.31. The majority of incidental take of the NLEB that may occur from the proposed action is not considered prohibited take under the NLEB 4(d) rule. Therefore, that incidental take does not require exemption from the Service. However, incidental take associated with impacts to 0.52 acres of habitat removal within 0.25 miles of a hibernaculum is addressed below.

Sections 7(b)(4) and 7(o)(2) of the ESA generally do not apply to listed plants species. However,

limited protection of listed plants from take is provided to the extent that the ESA prohibits the removal and reduction to possession of federally listed endangered plants or the malicious damage of such plants on areas under federal jurisdiction, or the destruction of endangered plants on non-federal areas in violation of State law or regulation or in the course of any violation of a State criminal trespass law.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

50 CFR 402.14(i)(1)(i) states that surrogates may be used to express the amount or extent of anticipated take provided the Opinion or ITS: (1) describes the causal link between the surrogate and take of the listed species; (2) describes why it is not practical to express the amount of anticipated take or to monitor take-related impacts in terms of individuals of the listed species; and (3) sets a clear standard for determining when the amount or extent of the taking has been exceeded. Applying this regulation, this ITS uses habitat as a surrogate to express the amount or extent of anticipated, authorized take for 2 of the 6 covered species as explained below.

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Roanoke logperch – On June 1, 2018, the Service received "Revised Habitat Assessments Conducted for Roanoke Logperch (*Percina rex*) Along the Proposed Atlantic Coast Pipeline in Virginia, Revised" dated December 1, 2017 (ESI 2018), from FERC. A habitat assessment was conducted at the Butterwood Creek crossing (MP 253.7) and no portion of the assessed stream reach contained habitat suitable to support RLP. The habitat assessment indicates no RLP habitat and RLP presence is no longer assumed at this crossing. As such, Butterwood Creek is no longer included in the following incidental take calculations.

To estimate incidental take, we first calculated and added the area of RLP habitat at each crossing (i.e., wetted width of the waterbody by the total of the construction ROW width and the 1,000 m upstream/downstream impact length at each crossing) as follows: Sturgeon Creek (8 m)(38 m + 1,000 m) = 8,304 m^2; Nottoway River 1 (22 m)(38 m + 1,000 m) = 22,836 m^2; and Waqua Creek (8 m)(27.4 m + 1,000 m) = 8,219.2 m^2. Total = 39,356 m^2.

Then we calculated the subset of the total area of affected RLP habitat that will be utilized for cofferdam and bridge center support placement and removal (i.e., wetted width of the waterbody by the construction ROW width): Sturgeon Creek (8 m x 38 m) = 304 m^2; Nottoway River 1 (22 m x 38) = 836 m^2; and Waqua Creek (8 m x 27.4 m) = 219.2 m^2. Total = 1,359.2 m^2. Effects from cofferdam and bridge center support placement and removal thus comprise approximately

3.5 percent [(1,359.2 m^2/39,356 m^2)(100)] of the total area of RLP habitat affected by the project. The anticipated take is described in Table 8 below.

Table 8. RLP amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
RLP	5	Adults or juveniles	Injury or Kill	Crushing due to installation and removal of cofferdams and bridge center support (i.e., 3.5 percent of the action area x 140 RLP in action area).
RLP	135	Adults or juveniles	Harm[1]	Sedimentation and subsequent habitat alteration from cofferdam dewatering and upland construction activities.

Clubshell – In the October 16, 2017, Opinion, take of clubshell was expressed using a surrogate. In compliance with the Order, and as discussed below, the Service now sets a numeric take limit for clubshell.

To estimate incidental take, we used data gathered during the salvage efforts conducted in advance of project construction in the 585m salvage area delineated in the October 16, 2017, Opinion. Based on previous experiences with salvage efforts in West Virginia, it is estimated that single-pass (the initial May 3, 2018, salvage effort, in this case) relocations may find approximately 60 percent of the mussels in typical mussel habitat such as sand and gravel (EnviroScience Inc., 2013, 2004, 2002, 2001; Clayton, J. WVDNR, personal comm.). The first salvage pass found 56 live individuals. These 56 individuals are estimated to represent 60 percent of all clubshell individuals within the 585m reach. Therefore, up to 94 total individuals are estimated to be present within this area. The second salvage pass found 12 individuals, thus up to 26 additional individuals are estimated to be present within the 585m stream reach. These 94 individuals, which include the 68 individuals taken during the salvage passes required under the October 2017 ITS, are included in the estimated take.

As explained in the Environmental Baseline section, new data from the salvage efforts suggest clubshell may occur in 8.185 km (585 m salvage area + 7.6 km upstream of the salvage area) in

[1] The Service has determined that expected take impacts to the species addressed in this ITS properly fall within the definition of "harm" rather than "harass;" therefore, the term "harass" has been removed from the ITS. By regulation, "harass" does not include incidental take. Incidental take includes "harm," which is defined both as "an act which actually kills or injures wildlife" or "significant habitat modification or degradation where it actually kills or injures wildlife." 50 C.F.R. 17.3.

Hackers Creek. Based on reviews of aerial imagery and survey data (WVDNR 1994), we determined that the 7.6 km upstream reach is most similar to the most upstream riffle-run-pool complex observed from cells 19-25 of the salvage efforts within the 585m where only 1 individual was found (ESI 2018b). Because the success rate of the the first salvage pass is estimated at 60 percent and only 1 individual was found during that pass within cells 19-25, a distance of approximately 163.8 m, we can estimate that 1.67 clubshell occur per 163.8 m. This distance, 163.8 m, divides into 7.6 km 46.4 times; 46.4 multiplied by 1.67 is 77.49, which must be rounded to the next whole number because we cannot estimate take of a fraction of a mussel. Thus, up to 78 individual clubshell may be widely dispersed within 7.6 km upstream area; these 78 individuals are included in the estimated take. The anticipated low density of clubshell within the 7.6 km upstream area is supported by survey data of the best available habitat in these 7.6 km collected in 1993, which found no federally listed mussels present and observed few mussels of any species (WVDNR 1994). Since the time of these observations, the condition of Hackers Creek has only declined. Thus, we can expect that habitat throughout the upper 7.6 km extent is of lower quality and only has a few widely dispersed clubshell adults similar to the area between cells 19 and 25.

In total, up to 172 individuals may be taken by the project, 94 individuals from the 585 m salvage area previously delineated in the October 16, 2017, Opinion, and 78 individuals in the 7.6 km reach upstream of this area.

Table 9. Amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
Clubshell	172[2]	Adults	Direct mortality and harm	Suffocating or smothering due to sedimentation during construction; reduction in feeding and lower reproduction rates; handling and transport during salvage

Rusty patched bumble bee

Numeric Estimate of Anticipated Incidental Take/Monitoring of Take-Related Impacts – It is not practical to estimate or monitor the total number of workers and queen RPBBs that may be killed or harmed as a result of the proposed action. While well-informed worst cases scenarios (i.e., up to 8 overwintering queens potentially taken) are helpful in conducting jeopardy analysis (see above), no method exists to accurately determine the specific number of individual bees anticipated to be taken by this project. The Service (2018) has developed protocols and best

[2] Sixty-eight of these individuals were salvaged as a part of the Terms and Conditions in the October 16, 2017, Opinion and thus have already been taken.

practices for conducting RPBB surveys, which are not intended to provide a precise estimate of the number of RPBBs in a specific area. Instead, they are designed to: 1) find and document new RPBB locations; 2) determine if the species is still extant at previously documented locations; 3) monitor RPBB populations to determine long-term population trends, relative abundance (e.g., number observed per hour compared to other *Bombus* species), and bumble bee species richness…." The survey protocols provide information that can be used to infer the presence of a colony. The Service can use records, obtained with the use of its survey protocols (Service 2018a), of live individual RPBB to help understand long-term population trends at landscape, regional, or continental scales, but not at a project-level because the quantity of bumble bees changes throughout the warm months as worker populations increase or decrease and bumble bee habitat suitability changes over time as floral landscapes change composition. Because suitable habitat may change locations from one year to the next and bumble bee numbers fluctuate throughout the season, quantifying populations can be difficult. As a result, using surveys to predict the precise number of individuals that will be taken by the project is not practical, and likely not possible.

Additionally, it is not practical to monitor take-related impacts in terms of individual RPBBs for the following reasons: the RPBB has a small body size (queen 21-22 millimeters (mm) in length, worker 11-16 mm in length, male 13-17.5 mm in length; Michell 1960) making it difficult to locate, which makes encountering dead or injured individuals unlikely. In addition, RPBB losses may be masked by annual fluctuations in numbers. Moreover, the RPBB spends half its life cycle in habitat (i.e., underground) that makes detection difficult and take may occur offsite (e.g., a RPBB may die outside of the action area) and would not be detected. Some of the anticipated incidental take including non-lethal injury, reduced survival of workers, and reduced reproductive capacity of the queen is not directly observable and cannot be directly monitored. As stated above, while some individual live RPBB may be detected or counted during surveys, this does not mean that survey methods exist to adequately measure the RPBBs that would be taken by this project.

Causal Link Between Surrogate and Take of Species – This ITS uses acres of RPBB habitat as a surrogate to express the extent of authorized take for the RPBB because it is not practical to monitor take related impacts in terms of individuals of the species. Since it will be difficult to measure the effects of habitat loss on individuals, take will be expressed in terms of the area of habitat removed. Specifically, we anticipate that 13.89 acres of RPBB habitat will be removed as a result of the proposed action. The 13.89 acres encompasses the area where ground disturbance, including vegetation clearing, along the construction ROW and access roads 36-014.AR2 and 36-012.AR1 will occur. As described in the Opinion above, ground disturbance will directly and indirectly cause the anticipated incidental take within the bounds of the identified acres.

The 13.89 acres where RPBB habitat removal is anticipated to occur consists of:

- 8.78 acres along the construction ROW from MP 92.7 – MP 93.7 (Figure 5);
- 0.4636 acres along access road 36-012.AR1 from 38.1932177N, 79.6881090W to 38.1960645N, 79.6905913W (Figure 5); and
- 4.648 acres along access road 36-014.AR2 from 38.1849271N, 79.6817055W to

38.1564591N, 79.7169672W (Figure 5).

The anticipated take is described in Table 10 below.

Table 10. RPBB amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
RPBB	13.89 acres of habitat	Adult workers, males, or queen	Harm or Kill	Reduced reproduction associated with loss or alteration of foraging habitat. Crushing due to pipeline construction, vegetation removal, and operational vehicle traffic.

Clear Enforcement Standard – Therefore, because the 13.89 acres of RPBB habitat disturbance (Figure 5) can be readily identified and monitored, this surrogate serves as a practical means for detecting when the amount or extent of take may have been exceeded. The 13.89 acres of habitat disturbance sets a clear, enforceable standard and ground disturbance in RPBB habitat outside of that specific acreage would require FERC to reinitiate consultation.

Madison Cave isopod

Numeric Estimate of Anticipated Incidental Take/Monitoring of Take-Related Impacts – It is not practical to estimate or detect the number of MCI that are likely to be taken for the following reasons: small body size (males reach a length of 0.6 inches; females reach a length of 0.7 inches); species occurs in habitat (swimming freely underground through flooded caves formed in ancient limestone) that makes detection difficult; presence/absence surveys (typically capturing or detecting a single or small number of MCI) cannot be used to estimate abundance but rather simply provide a data point indicating MCI are present in a general area; most individual MCIs in a survey location are not encountered and documented even with the best available survey techniques; and finding a dead or impaired specimen is unlikely.

Additionally, it is not practical to monitor take-related impacts in terms of individual MCI for the following reasons: the MCI occurs in habitat (underground) that makes detection difficult, which makes encountering dead or injured individuals unlikely; it has a small body size; scavengers may consume the carcass; MCI losses may be masked by annual fluctuations in numbers; take may occur offsite (e.g., a MCI may die outside of the Action Area) and would not be detected; some of the anticipated indirect take including non-lethal injury, temporary reduction in feeding or reproducing of individual MCIs is not directly observable and cannot be directly monitored.

Causal Link Between Surrogate and Take of Species – This ITS uses 11.2 surface acres (where the construction ROW and ATWS cross Cochran's Cave, MP 139.8 - MP 140.4, Figure 7) as a surrogate to express the extent of authorized take for the MCI because, as the Service previously

found and the Fourth Circuit recognized in Sierra Club v. United States Dep't of the Interior, 899 F.3d 260, 278 (4th Cir. 2018), expressing take in terms of the number of affected individuals is not practical. Since it will be difficult to measure the subsurface impact, take will be expressed in terms of the area of surface acres disturbed from the construction ROW and ATWS. Specifically, 11.2 surface acres will serve as a surrogate for MCI subsurface habitat affected. As described in the Opinion above, ground disturbing activities will directly and indirectly cause the anticipated incidental take up to 0.5 miles from these 11.2 surface acres. However, the 11.2 acres of disturbed habitat will be used as the surrogate for expressing and monitoring take because that is the area that we can actually measure and monitor.

Table 11. MCI amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is Anticipated	Type of Take	Take is Anticipated as a Result of
MCI	11.2 acres direct ground disturbance	All	Harm or Kill	Crushing or smothering during trenching or blasting during construction. Reduced reproduction and feeding associated with loss or alteration of foraging habitat from sediment introduced into flooded voids during construction.

Clear Enforcement Standard – Therefore, because the 11.2 surface acres of ground disturbance (located between MP 139.8 and MP 140.4) can be readily identified and monitored, this surrogate serves as a practical means for detecting when the amount or extent of take may have been exceeded (Figure 7). The 11.2 surface acres of habitat disturbance sets a clear, enforceable standard, and ground disturbance outside of that specific acreage requires FERC to reinitiate consultation.

<u>Indiana bat</u>

Numeric Estimate of Anticipated Incidental Take/Monitoring of Take-Related Impacts – In the October 16, 2017 Opinion, take of Ibat was expressed using a surrogate because of the difficulties associated with monitoring take of individual bats. To comply with the August 6, 2018 opinion of the U.S. Court of Appeals for the Fourth Circuit in *Sierra Club v. U.S. Dept. of the Interior*, No. 18-1083, the Service has used available data to quantify and numerically express anticipated take of Ibat. This numerical estimate provides a clear limit on the incidental take anticipated and authorized in this Opinion. However, based on the difficulties associated with monitoring Ibat take in terms of affected individuals, and with determining the extent to which changes in broad scale population data are attributable to the project, the Service also provides acres of habitat as an additional, alternative means of monitoring take. The approach is most protective of bats in that reinitiation is triggered if the project results in the take of more than 2 bats, as measured by exceeding the take limit of 2 bats or exceeding the acres of habitat to be cleared.

Incidental take was calculated using a combination of Ibat population estimates from hibernacula data of the 3 known hibernacula within 5 miles of the action area where Ibats were documented during the 2017 winter counts (known use spring staging/fall swarming), 2 unsurveyed portals (unknown use spring staging/fall swarming), and general estimates of maternity roost sizes (known use summer habitat). To further refine the estimate, the amount of Ibat habitat proposed for clearing was compared to the total amount of habitat available.

Ibat population estimates indicate that there are an estimated 139 Ibats that utilize the known use spring staging/fall swarming habitat (Table 5 - Breathing Cave [20] + Clark's Cave [73] + Star Chapel Cave [46]). Hibernacula data for Fortlick Cave was used to estimate the Ibat population that utilizes the unknown use spring staging/fall swarming habitat. Approximately 32 Ibats are estimated to utilize the unknown use spring staging/fall swarming habitat (Table 5 - Fortlick Cave [16] x 2 unsurveyed portals). A total of 171 (139 + 32) Ibats may utilize the spring staging/fall swarming habitat. There are a total of approximately 251,200 acres of spring staging/fall swarming habitat in the action area (land area within a 5 mile radius of a potentially suitable hibernaculum that has not been surveyed or a known priority 3 or 4 hibernacula). Of this, 881 (178.1 + 703.0) acres are proposed to be cleared within known use and unknown use spring staging/fall swarming habitat (Table 4). To estimate incidental take, the total estimated number of Ibats was compared to the ratio of proposed tree clearing/total available habitat using the following equation: (171 Ibats)(881 acres spring staging/fall swarming habitat proposed for clearing/251,200 acres spring staging/fall swarming habitat available) = 0.6 Ibats taken. This is rounded up to 1 Ibat for known use spring staging/fall swarming habitat and unknown use spring staging/fall swarming habitat, combined.

Ibat maternity colony size can vary greatly, but typical colonies contain less than 100 adult females (Service 2007). Kurta (2005) summarized summer habitat information from 11 states and found most exit counts at primary roosts are at least 20-100 adults with a typical maximum of 60-70 adults in a primary roost at any given time. As stated in the above, VA and WV hibernacula surveys indicate Ibat populations have decreased at least 95 percent since the discovery of WNS. Given the ongoing negative effects of WNS to Ibat population levels across the landscape, we estimate a maternity colony size on the lower end of this range; 20 bats in the known use summer habitat. There are a total of approximately 12,560 acres of known use summer habitat in the action area (land area within within 2.5 miles of a known roost tree). Of this, 137.5 acres are proposed to be cleared (Table 4). To estimate incidental take, the total number of Ibats was compared to the ratio of proposed tree clearing/total available habitat using the following equation: (20 Ibats)(137.5 acres known use summer habitat proposed for clearing/12,560 acres known use summer habitat available) = 0.22 Ibats taken. This is rounded up to 1 Ibat for known use summer habitat. In total, up to 2 Ibats are anticipated to be taken by the project. This anticipated take is further described in Table 12 below.

Table 12. Ibat amount and type of anticipated incidental take.

Species	Amount of	Life Stage	Type	Take is Anticipated as a Result

	Take Anticipated	when Take is Anticipated	of Take	of
Ibat	2 bats	Adults or pups	Harm or Kill	Reduced pup viability associated with loss or alteration of spring staging and fall swarming habitat. Reduced overwinter survival associated with loss of fall swarming habitat. Temporary reduced reproduction associated with loss or alteration of spring staging/fall swarming habitat.

Additional Use of Surrogate for Monitoring Purposes – In situations where some data exists that may be used to calculate a numerical estimate of take for a species but there are challenges associated with measuring take in terms of individuals, the Service has used habitat as an additional means of monitoring take. In those instances, project effects outside of a specifically defined amount of affected habitat serve as a trigger indicating that the numerical take estimate may have been exceeded and reinitiation is required. The Service has previously applied this approach with respect to take of Ibats in other projects, including some on the Jefferson and GWNF and other pipeline projects. See, for example, Biological Opinion and Incidental Take Statement for the Indiana Bat (*Myotis sodalis*) and Northern Long-eared Bat (*Myotis septentrionalis*) for The East Ohio Gas Company's Western Access II Project in Harrison and Tuscarawas Counties, Ohio (July 31, 2015), p. 40 ("We anticipate that clearing during the active season will result in take in the form of death, harm, or harassment of no more than 2 IBATs on 77.2 acres where IBAT presence is assumed and 10 NLEBs on 10.8 acres where NLEB presence is confirmed and incidental take of NLEB is not exempted by the interim 4(d) rule. ... [T]he potential roosting and foraging habitat affected can be used as a surrogate to monitor the level of take. Therefore, the Corps must reinitiate consultation with the Service if more than 92 acres of forested habitat are removed during the project."); Biological Opinion on the 2003 Revision of the Jefferson National Forest Land and Resource Management Plan (January 13, 2004), pp. 33 (describing the difficulties in determining the amount of take of individual bats), 34 (numeric take estimate of 10 bats), 35 (Term and Condition 3 – "The amount of incidental take as measured indirectly by acreage (both total and categorical levels) must be monitored on an annual basis."), 36-37 (Term and Condition 6 – "The FWS believes that no more than 16,800 acres (15,000 acres prescribed burning and 1,800 all other disturbances) annually of potential Indiana bat habitat will be disturbed as a result of the proposed action. If, during the course of the action, this level of incidental take is exceeded, as measured by the total amount of habitat disturbance or the location of injured or dead Indiana bats, such incidental take represents new information requiring review of the reasonable and prudent measures."); 2013 Revised George Washington National Forest Land and Resource Management Plan Update, Virginia and West Virginia, Project # 2012-F-1762 (April 21, 2014), p. 2 ("The estimated total annual removal or disturbance of potential Indiana bat habitat was 25,288 acres, which consisted of disturbance

from oil and gas leasing, prescribed fire, timber harvest, salvage activities, wildlife habitat management, and special use activities. The removal of new oil and gas leasing disturbance from the LRMP leaves 23,513 acres of total disturbance (25,288 acres –1,775 acres), or 2.2 percent of the George Washington National Forest."); Biological Opinion on Enbridge Pipelines (FSP) LLC's Flanagan South Pipeline Project (July 24, 2013), p. ii ("The proposed action will likely modify 621 acres of Indiana bat habitat and potentially kill 19 non-reproductive or migratory individuals that may be roosting in felled trees during the active Indiana bat season."), 68 (Term and Condition 3 – "The Corps will ensure that Enbridge provides the Corps with an annual report detailing the area (acres) of forested habitat removed, number of active maternity roost trees and/or the 100 ft buffer removed, and the number of Indiana bats killed or injured during the construction of the FS Pipeline.").

Although some data from winter hibernacula surveys in the area is available for Ibat, which was used to calculate the above numerical estimate of anticipated take, certain challenges associated with documenting take in terms of individual bats remain. First, it may be difficult to monitor take-related impacts in terms of individual Ibats for the following reasons: the Ibat is nocturnal making it difficult to detect; it has a small body size (head and body length of 41-49 mm, Service 2007) making it difficult to locate even during daylight hours, which makes encountering dead or injured individuals unlikely; scavengers may consume or move the carcass; Ibat losses may be masked by annual fluctuations in numbers; the Ibat occurs in habitat (e.g., caves and forested areas) that makes detection difficult; take may occur offsite (e.g., a bat may die outside of the action area) and would not be detected; some of the anticipated indirect take including non-lethal injury, entering hibernation with reduced fat reserved, and reproductive failure of individual bats is not directly observable and cannot be directly monitored because survey protocols do not exist to monitor these forms of take on a project specific basis. While some individual live bats may be detected or counted during summer surveys or winter counts, this does not mean that survey methods exist to accurately document the bats taken by a specific project that will occur over 24 months or longer.

Summer surveys provide information about Ibat presence/absence in a specific project area, but they are sporadic and are not used to track general population trends over time. Unlike winter hibernacula surveys, summer surveys are not conducted on a systematic basis. Furthermore, changes in winter hibernacula survey counts cannot be used to provide an effective measure of when take has been exceeded. Winter hibernacula surveys which attempt to count individual, hibernating bats in a cave include a margin of error because individual Ibats can be overlooked during a winter hibernacula survey and a winter hibernacula consists of many summer populations, sometimes from different states. This information can be used to provide meaningful, general population trends and estimates (such as the estimated 2017 Ibat population of 425 in VA and 1,076 in WV), but has minimal value in actually documenting numbers of individuals taken in a specific area or as a result of a specific project. This is because winter bat counts use detections of individual live bats to extrapolate a population estimate or trend at a large, landscape level rather than at a project-level. Furthermore, because a winter count consists of many summer populations from different areas, including different states, it is not practical to rely on changes in winter survey counts to document take of individuals directly attributable to a

specific project. As a result, measuring the precise number of individuals that have been taken by a specific project based on winter counts is not practical, and likely not possible.

Moreover, per the Range-wide Ibat Summer Survey Guidelines (Service 2018) "The guidance are not intended to be rigorous enough to provide sufficient data to fully determine population size or structure." Presence/absence surveys that have been conducted (typically capturing or detecting a single or small number of bats) during the summer cannot be used to estimate abundance but rather simply provide a data point indicating Ibats are present in a general area (Service 2018 https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/2018RangewideIBatSurveyGuidelines.pdf). This information can be used only to determine whether Ibats are present or likely absent at a given site during the summer.

Accordingly, consistent with previous ITSs, the Service uses habitat impacts as an additional tool for determining whether take has been exceeded.

Causal Link Between Surrogate and Take of Species – While direct detection of 2 bats taken in the action area would provide evidence that the ITS limit has been reached, given the challenges associated with measuring the habitat loss impact on individuals, take may also be monitored in terms of the area of habitat removed by tree clearing. Specifically, 1,018.6 acres of Ibat habitat clearing may also serve as a surrogate for monitoring impacts to individual Ibats. These 1,018.6 acres encompass tree clearing in 3 Ibat habitat categories: known use summer habitat (137.5 acres); unknown use spring staging/fall swarming habitat (178.1 acres); and known use spring staging/fall swarming habitat (703.0 acres) (Table 4). As described in the Opinion above, clearing habitat (tree felling/clearing) will directly and indirectly cause the anticipated incidental take within the bounds of the identified surface acres. Accordingly, reinitiation is required if more than 2 Ibats are taken or more than 1,018.6 acres of habitat, or acreages for habitat categories as detailed below, are cleared.

The 1,018.6 acres where Ibat habitat clearing is anticipated to occur consists of:

- 137.5 acres of known use summer habitat in WV (Figure 9);
- 178.1 acres of unknown use spring staging/fall swarming habitat in WV (Figure 10); and
- 703.0 acres of known use spring staging/fall swarming habitat, which consists of 283 acres in VA and 420 acres in WV (Figures 10 and 11).

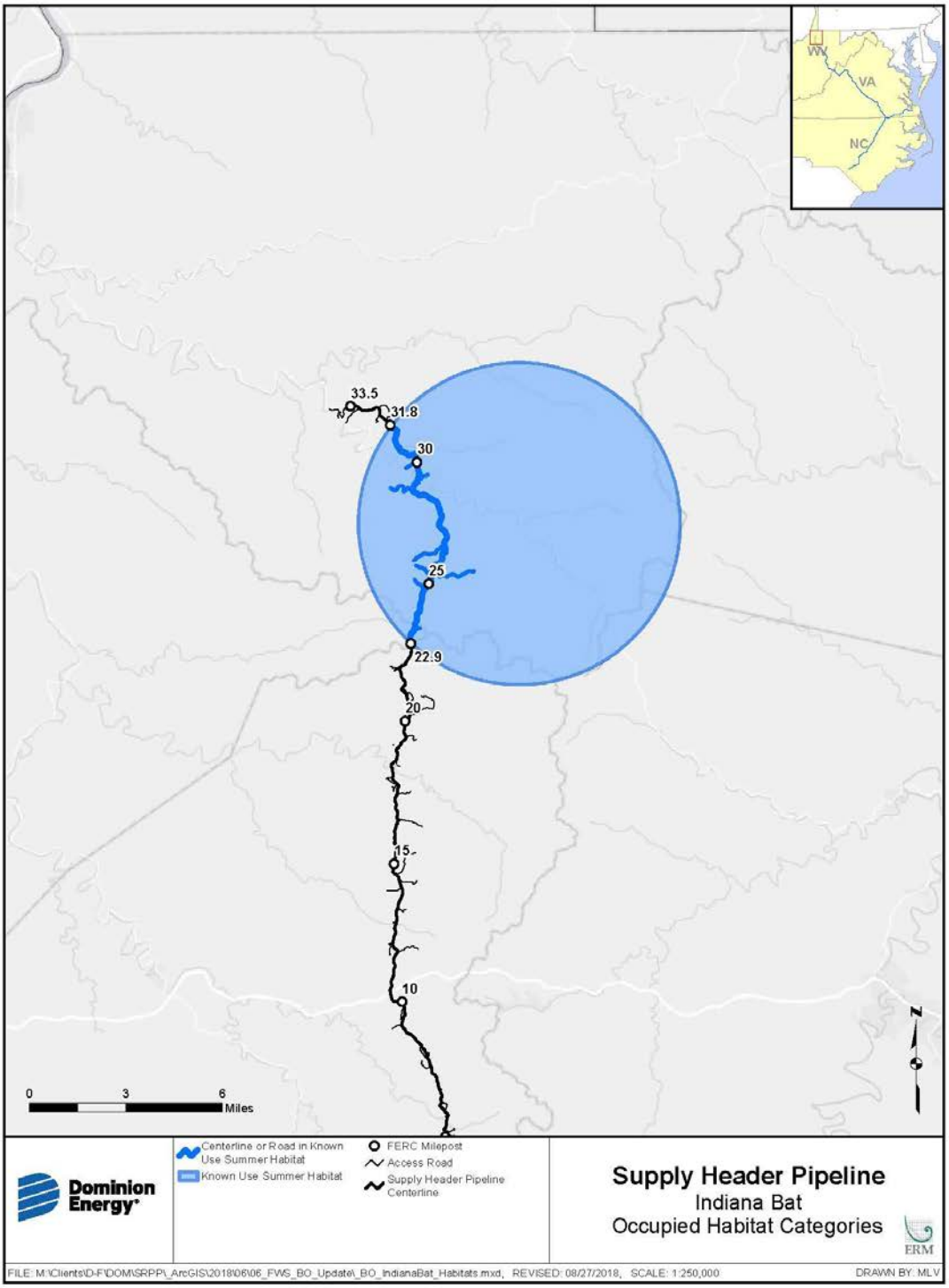

Figure 9. Ibat known use summer habitat buffer (137.5 acres of tree clearing) in WV.

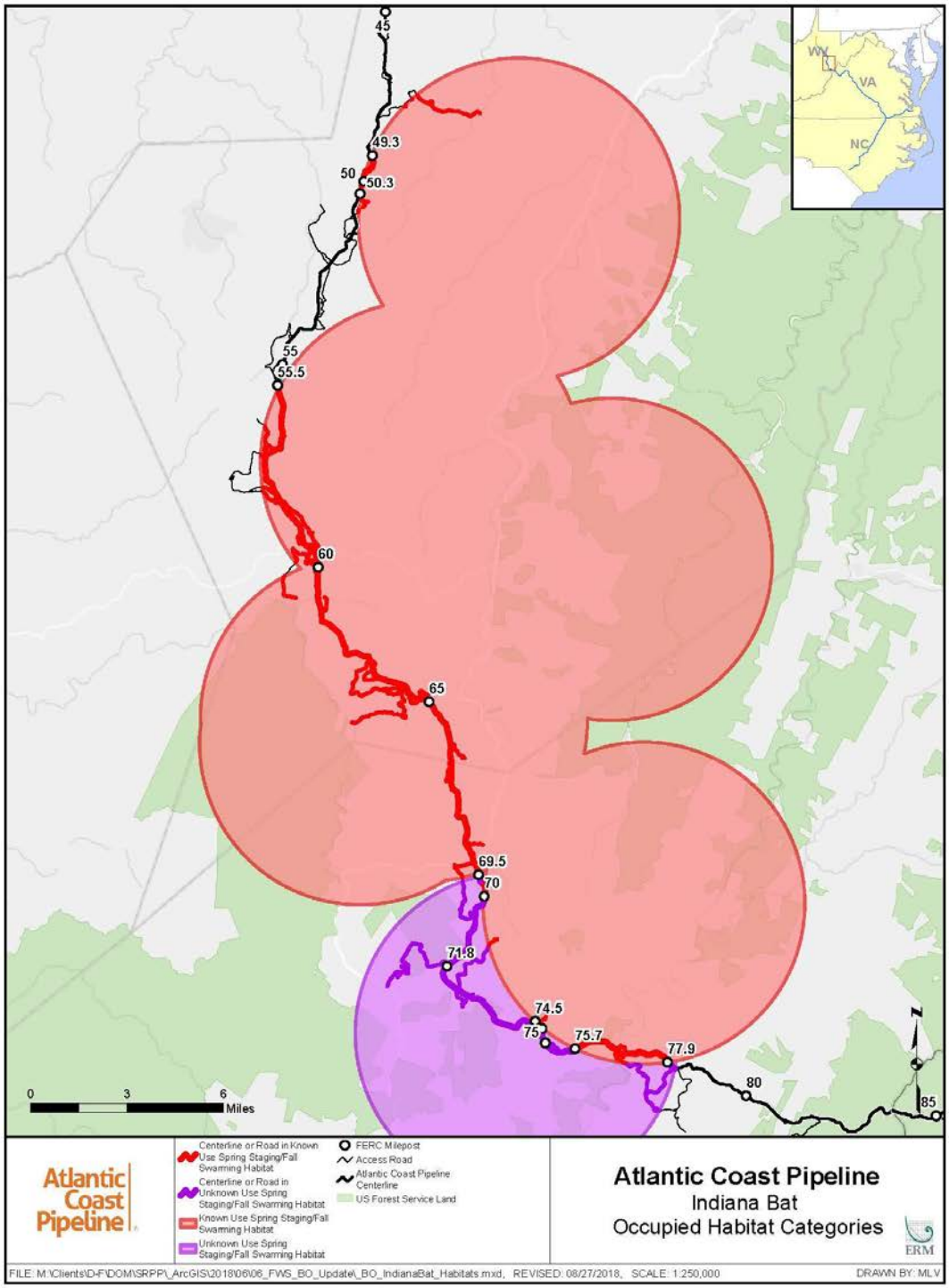

Figure 10. Ibat unknown use spring staging/fall swarming habitat (purple) (178.1 acres of tree clearing) and Ibat known use spring staging/fall swarming habitat (red) (420 acres of tree clearing) in WV.

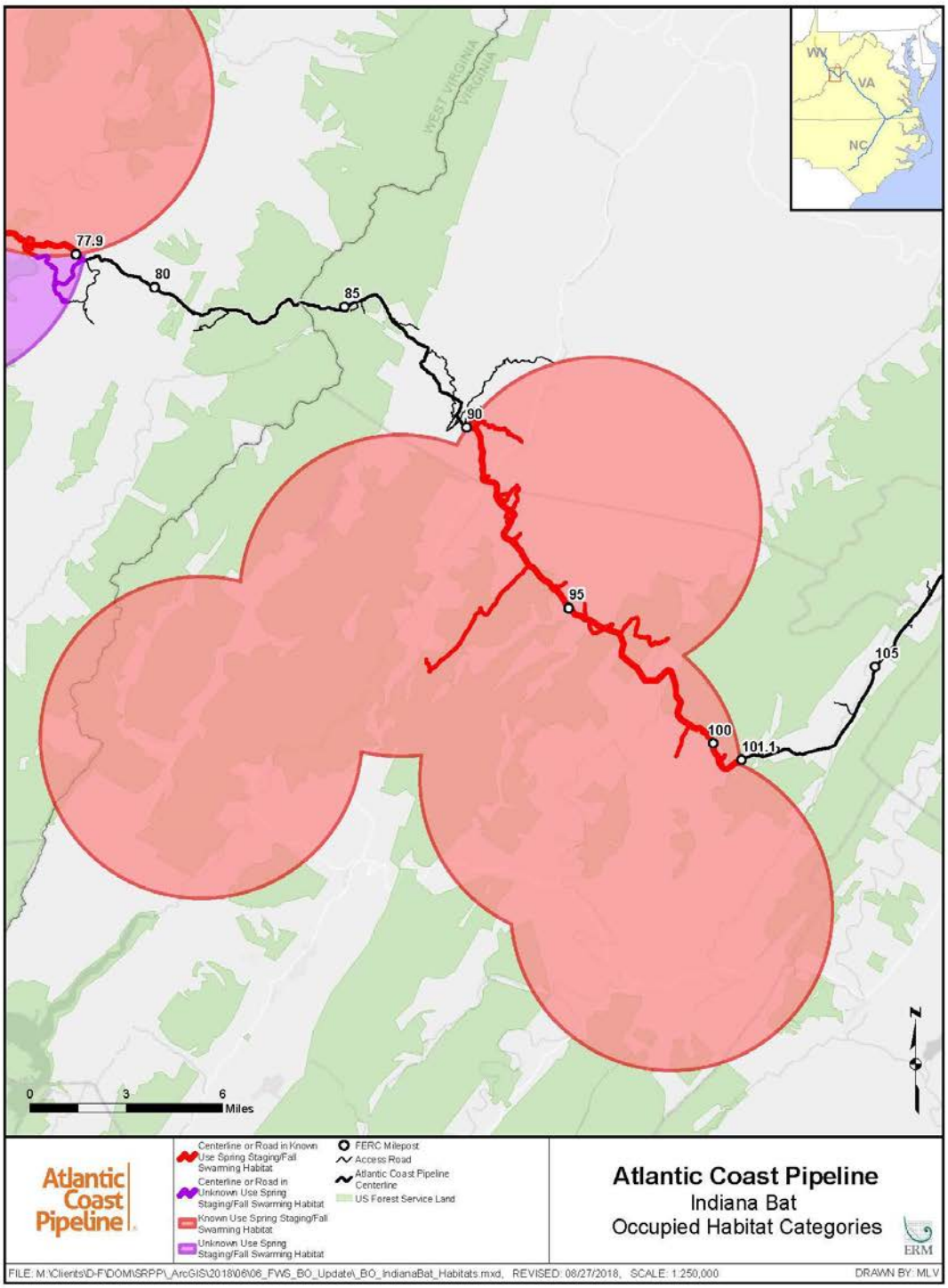

Figure 11. Ibat known use spring staging/fall swarming habitat (red) (283 acres of tree clearing) in VA.

Clear Enforcement Standard – As discussed, the numerical take limit is 2 Ibats. Consistent with previous ITSs, that limit is exceeded if more than 2 Ibats are taken. The 1,018.6 acres of habitat provides an additional clear standard indicating when reinitiation is required for the Service to determine if take has been exceeded. Because the 1,018.6 acres of Ibat habitat clearing (Figures 9-11) can be readily identified and monitored, this habitat serves as a practical means for detecting when the amount or extent of take may have been exceeded. That habitat acreage (and the acreages for specific habitat categories) thus sets a clear, enforceable standard because tree clearing outside of that specific acreage requires FERC to reinitiate consultation.

Northern long-eared bat – The majority of effects have been previously addressed in the Service's January 5, 2016 programmatic biological opinion implementing the final 4(d) rule and any incidental take further than 0.25 mile from hibernacula PH-S018 is not prohibited under the final 4(d) rule (50 CFR §17.40(o)).

Numeric Estimate of Anticipated Incidental Take/Monitoring of Take-Related Impacts – In the October 16, 2017 Opinion, take of NLEB was expressed using a surrogate because of the difficulties associated with monitoring take of individual bats. To comply with the August 6, 2018 opinion of the U.S. Court of Appeals for the Fourth Circuit in its August 6, 2018 opinion in *Sierra Club v. U.S. Dept. of the Interior*, No. 18-1083, the Service has used available data to quantify and numerically express anticipated take of NLEB. However, based on the difficulties associated with monitoring NLEB take in terms of affected individuals, the Service also provides acres of habitat as an alternative means of monitoring take. This approach is consistent with previous incidental take statements prepared for other Myotid bat species as described for the Indiana bat above.

Incidental take was calculated using a combination of local NLEB population counts derived from captures of NLEB at a nearby hibernacula 1.8 miles from PH-S018. To further refine this estimate, the amount of NLEB habitat proposed for clearing was compared to the total amount of available forested habitat within the 5-mile swarming zone of PH-S018. NLEB have been found to swarm within 5 miles of their hibernacula (Lowe 2012). Thirty-one NLEB were captured during a hibernacula emergence survey during fall swarming in 2016 at Simmons-Mingo Cave, 1.8 miles from PH-S018 (ERM 2016) and the nearest hibernacula for which data is available. There are a total of 46,122.3 acres of forested habitat within the 5-mile swarming zone of PH-S018. To estimate incidental take, the total estimated number of NLEB was compared to the ratio of impacted habitat to available habitat using the following equation: (31 NLEB)(0.52 acres of forested impact/46,122.3 acres of forested habitat within the swarming radius of PH-S018) = 0.0003 NLEB taken, which is rounded up to 1 NLEB that may be taken by the project.
The anticipated take is described in Table 13 below.

Table 13. NLEB amount and type of anticipated incidental take.

Species	Amount of Take Anticipated	Life Stage when Take is	Type of Take	Take is Anticipated as a Result of

		Anticipated		
NLEB	1 bat	Adults or pup	Harm or Kill	Reduced pup viability associated with loss or alteration of spring staging and fall swarming habitat. Reduced overwinter survival associated with loss of fall swarming habitat. Temporary reduced reproduction associated with loss or alteration of spring staging/fall swarming habitat.

Additional Use of Surrogate for Monitoring Purposes – Certain challenges associated with measuring take in terms of individual bats remain. First, it is not practical to monitor take-related impacts in terms of individual NLEBs for the following reasons: the NLEB is nocturnal making it difficult to detect; it has a small body size, 3-3.7 inches long and 0.2-0.3 ounces, making it difficult to locate even during daylight hours on a forested landscape as a dead individual is often difficult to distinguish in the leaf litter, which makes encountering dead or injured individuals unlikely; scavengers may consume or move the carcass; NLEB losses may be masked by annual fluctuations in numbers; the NLEB occurs in habitat (e.g., caves, heavily forested areas) that makes detection difficult; take may occur offsite (e.g., a bat may die outside of the Action Area) and would not be detected; some of the anticipated indirect take including non-lethal injury, starvation, and reproductive failure of individual bats is not directly observable and cannot be directly monitored.

Furthermore, changes in winter hibernacula survey counts cannot be used to provide an effective measure of when take has been exceeded. Although some data from winter hibernacula surveys in the area is available for NLEB, it has limited utility since very few individuals have been documented. Presence/absence surveys that have been conducted (typically capturing or detecting a single or small number of bats) cannot be used to estimate abundance but rather simply provide a data point indicating NLEB are present in a general area. Information about a captured individual can be utilized to make some science-based assumptions on NLEB use of an area (i.e., male, female, individual bat, maternity colony), probable location, and probable number of bats in the vicinity. Most individual bats are not encountered and documented even with the best available survey techniques as NLEB are typically found roosting in small crevices or cracks in cave or mine walls or ceilings, sometimes with only the nose and ears visible, and thus are easily overlooked during cave surveys (FR 80 63 17984). In WV, NLEB have never been seen in large numbers during winter cave counts, thus hibernacula survey data may not provide an accurate picture of the actual population trend (WVDNR 2016, 2017) much less document take of single or small numbers of individuals attributable to a specific project on the landscape.

Therefore, it is not possible to rely on changes in winter cave survey population estimates to measure take attributable to a specific project. NLEB presence at PH-S018 was detected acoustically during the fall swarming period. This method only provides presence/absence data and does not provide information about the number of individuals. There are 6 additional NLEB hibernacula swarming zones that overlap PH-S018. NLEB may travel and investigate several cave or mine openings during the transient portion of the swarming period, and some individuals may use these areas as temporary daytime roosts or may roost in forest habitat adjacent these sites (FR 80 63 17986). While some individual live bats may be detected or counted during summer surveys or winter counts, survey methods do not currently exist to accurately measure the bats expected to be taken by a specific project that will occur over a period of 24 months or longer.

Accordingly, consistent with other previous incidental take statements for other Myotid bat species, the Service uses habitat as an additional tool for determining when reinitiation is triggered for the Service to determine whether take has been exceeded.

Causal Link Between Surrogate and Take of Species – This ITS provides acres of habitat as an alternative to aid in monitoring the extent of authorized take for the covered species. Given the challenges associated with measuring the habitat loss impact on individuals, take may be monitored in terms of the area of habitat removed by tree clearing. Specifically, 0.52 acres of forest loss is used to monitor incidental take of NLEB because tree removal activity will indirectly cause the anticipated incidental take within the bounds of the identified acres of forest. As described in the Opinion above, we expect that impacts to this acreage will cause take of individual NLEB because they will expend more energy searching for alternative roosting or foraging sites, which will delay their ability to gain weight and result in decreased growth and reproduction. Take of NLEB is anticipated to be one individual. Reinitiation is required if more than 1 NLEB is taken or more than 0.52 acres of habitat is cleared.

Clear Enforcement Standard – We estimate incidental take at 1 NLEB. Taking more than 1 NLEB or clearing more than 0.52 acres of habitat provide clear standards indicating when reinitiation is required. The 0.52 acres of forest clearing where take is anticipated to occur is fall swarming, and summer roosting/foraging habitat within 0.25 miles of hibernacula PH-S018 in WV adjacent to an existing road that will be improved and used to access the pipeline during construction (located near MP 66.6) (Figure 8). Because the 0.52 acres of forest clearing can be readily identified and monitored, this habitat serves as a practical means for detecting when the amount or extent of take may have been exceeded. The 0.52 acres of forest clearing sets a clear, enforceable standard because clearing outside of that specific acreage requires FERC to reinitiate consultation.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

Roanoke logperch –

- Provide information to individuals involved in project construction on how to avoid and minimize potential effects to the RLP.
- Conduct construction in a manner that minimizes disturbance to RLP.

Clubshell –

- Provide information to individuals involved in project construction on how to avoid and minimize potential effects to the clubshell.
- Use best management practices to protect water quality inhabited by the clubshell.
- Minimize impacts to the clubshell through mussel salvage and relocation.

Rusty patched bumble bee –

- Minimize pre-construction vegetation clearing and ground disturbance.
- Use native species in restoration activities.
- Maintain suitable habitat within the permanent ROW.

Madison Cave isopod –

- Provide information to individuals involved in project construction on how to avoid and minimize potential effects to the MCI.

Indiana bat –

- Provide information to individuals involved in project construction on how to avoid and minimize potential effects to the Ibat.

Northern long-eared bat –

- The Service believes that all reasonable and prudent measures necessary and appropriate to minimize take of NLEB have been incorporated into the proposed action.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of Section 9 of the ESA, the FERC must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

Roanoke logperch –

1. Prior to initiation of on-site work, notify all prospective employees, operators, and contractors about the presence and biology of the RLP, special provisions necessary to protect the RLP, activities that may affect the RLP, and ways to avoid and minimize these effects. This information can be obtained by reading RLP-related information in this Opinion or a fact sheet containing this information can be created and provided by FERC or the applicant.
2. No riprap will be placed below ordinary high water at any of the 3 crossings (Waqua and

Sturgeon Creeks and Nottoway River 1) where RLP is present/assumed present.

3. Construct cofferdams (Waqua and Sturgeon Creeks and Nottoway River 1) using non-erodible materials. Remove cofferdams in their entirety upon project completion.
4. Fill any sandbags used in cofferdams with clean sand and no other materials. All sandbags must be new with no prior use and must be removed at the time of cofferdam removal.
5. Build cofferdams to a height, strength, and configuration to resist no less than normal peak daily flows. All construction must take place outside of the RLP TOYR.
6. Minimize instream (Waqua and Sturgeon Creeks and Nottoway River 1) foot traffic during construction.
7. Vehicles or construction equipment may not enter Waqua and Sturgeon Creeks and Nottoway River 1, except within cofferdams.
8. Inspect all vehicles for leaks immediately prior to instream or cofferdam work (Waqua and Sturgeon Creeks and Nottoway River 1). Repair any leaks and clean construction vehicles thoroughly to remove any residual dirt, mud, debris, grease, motor oil, hydraulic fluid, coolant, or other hazardous substances from construction vehicles. Inspections, repairs, cleaning, and/or servicing will be conducted either before the vehicle, equipment, or machinery is transported into the field or at the work site within the staging area. All wash-water runoff and/or harmful materials will be appropriately controlled to prevent entry into the waterbody, including the riparian zone.

Clubshell –

1. Prior to any ground-disturbing activities, complete the third and final salvage pass of the area 130 m downstream and 455 m upstream of Life's Run Bridge for freshwater mussels (ESI 2018a). The search will be conducted by a qualified surveyor(s) with a valid WVDNR State Collecting Permit for these activities. The permitted surveyor(s) will take all federally listed mussels found to a Service-approved holding facility. These individuals will be held and propagated at the approved facility for eventual reintroduction into the Monongahela River basin after project construction is completed.
2. Prior to any ground-disturbing activities, perform visual spot-check surveys for freshwater mussels in suitable habitat in 1 km segments from the upstream end of the 585 m salvage area to the bridge that crosses Hackers Creek on CR 13. If any freshwater mussels are observed during spot-check survey efforts of a 1 km segment, complete a mussel survey/salvage of those habitat reaches following the 2018 WV Mussel Survey Protocols. If no clubshell are found within a 1 km segment, no further surveys upstream of that segment shall occur. A survey plan shall be submitted to the WVFO for review and approval at least 30-days prior to performing the spot checks.
3. Prior to initiation of on-site work, notify all prospective employees, operators, and contractors about the presence and biology of clubshell, special provisions necessary to protect clubshell, activities that may affect clubshell, and ways to avoid and minimize these effects. This information can be obtained by reading clubshell-related information in this Opinion or a fact sheet containing this information can be created and provided by FERC or the applicant.
4. Notify the WVFO when work begins within the Hackers Creek HUC-12 between MP

14.7 and 21.1.

5. An environmental inspector shall be onsite during construction activities within the Hackers Creek HUC-12 between MP 14.7 and 21.1 and shall have stop work authority. If compliance issues are identified, the environmental inspector will resolve them and report on these activities to the WVFO.
6. Fuel and maintain vehicles or equipment and store all potentially toxic substances (fuels, paints, solvents, lubricants, etc.) within a containment site with adequate buffering (berms, vegetation, etc.) from any receiving waters of Hackers Creek.
7. Stabilize all disturbed sites and check that all erosion and sedimentation controls are properly installed and functioning within 24 hours of rain events along the construction ROW and access roads from MP 14.7 to 21.1. If erosion and sedimentation controls fail as a result of a precipitation event, the WVFO should be notified within 24 hours.

Rusty patched bumble bee –

1. Minimize pre-construction clearing, grading, and vegetation removal within the HPZ.
2. Re-seed all construction ROW areas (temporary and permanent) within the HPZ and the dispersal zone with pollinator friendly native seed mixes consistent with recommendations for plant restoration by GWNF. Include species preferred by RPBB, list available at: *https://www.fws.gov/midwest/Endangered/insects/rpbb/plants.html*
3. In the HPZ, plant disturbed areas adjacent to the improved access roads with established (not seeds) native flowering shrub varieties that will bloom within 3 years. Plant the same native flowering shrub varieties present within the HPZ.
4. Maintain suitable nesting and foraging habitat for RPBB within the permanent ROW by mowing once every 3 years between November 1 and March 1. A strip that is 10-feet wide centered on the pipeline may be mowed once annually between November 1 and March 1.

Madison Cave isopod –

1. Prior to initiation of on-site work, notify all prospective employees, operators, and contractors about the presence and biology of the MCI, special provisions necessary to protect the MCI, activities that may affect the MCI, and ways to avoid and minimize these effects. This information can be obtained by reading MCI-related information in this Opinion or a fact sheet containing this information can be created and provided by FERC or the applicant.

Indiana bat –

1. Prior to initiation of on-site work, notify all prospective employees, operators, and contractors about the presence and biology of the Ibat, special provisions necessary to protect the Ibat, activities that may affect the Ibat, and ways to avoid and minimize these effects. This information can be obtained by reading Ibat-related information in this Opinion or a fact sheet containing this information can be created and provided by FERC or the applicant.

Northern long-eared bat –

No terms and conditions provided.

MONITORING AND REPORTING REQUIREMENTS

Care must be taken in handling any dead specimens of proposed or listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead specimen, notify the Service's VA Law Enforcement Office at 804-771-2883 and the Service's VA Field Office (VAFO) at 804-824-2414.

Roanoke logperch –

1. FERC or applicant shall notify the Service regarding the projected and actual start dates, progress, and completion of the project and verify that the 1,359.2 m^2 of stream impact was not exceeded and all conservation measures were followed. Provide a report containing this information by December 31 of each year until construction is complete to the VAFO at sumalee_hoskin@fws.gov.
2. Any high water event that disturbs the construction site, including failure or overtopping of cofferdams, must be reported to the Service at 804-824-2414 or sumalee_hoskin@fws.gov within 24 hours.
3. Any spills of motor oil, hydraulic fluid, coolant, or similar fluids, not contained before entry into the action area, must be reported to the Service at 804-824-2414 or sumalee_hoskin@fws.gov and National Response Center (800-424-8802) immediately.
4. Conduct a RLP survey and habitat assessment at Waqua and Sturgeon Creeks and Nottoway River 1 crossings 6 months after project is complete to assess the status of the RLP. Survey/habitat assessment will be conducted 200 m upstream and 800 m downstream of each crossing site by a qualified surveyor(s) with a valid VDGIF Permit for these activities. Provide a report containing raw data and summarized information from the surveys and habitat assessments at each site to the VAFO at sumalee_hoskin@fws.gov within 30 days of completion of the survey/habitat assessment.

Clubshell –

1. Complete the third and final freshwater mussel salvage pass of the 585 m salvage reach defined in the October 16, 2017, Opinion and the May 2, 2018, study plan (ESI 2018). Provide a report documenting the salvage effort to the WVFO at elizabeth_stout@fws.gov within 30 days of completion of the salvage effort. Include the following in the report: surveyor names, protocols used for surveying, handling, and transporting mussels; total number of individuals of each mussel species collected; date collected; water and air temperatures; river stage; condition, size and approximate age of live snuffbox; data regarding non-endangered mussels; and maps or figures showing the salvage area relative to project features.

2. A survey plan shall be submitted to the WVFO for review and concurrence at least 30-days prior to performing the spot check survey/salvage efforts. These searches shall be conducted by a qualified surveyor(s) with a valid WVDNR State Collecting Permit for these activities. The permitted surveyor(s) will take all federally listed mussels found to a Service-approved holding facility. These individuals will be held and propagated at the approved facility for eventual reintroduction into the Monongahela River basin after project construction is completed.
3. If juvenile mussels are found during subsequent salvage/survey efforts, they should be reported to the WVFO immediately as this will constitute new information that the proposed action may affect the clubshell to an extent not considered in this Opinion.
4. Provide a report documenting the spot check and survey/salvage efforts in the 1 km segments from the end of the 585 m salvage area to the bridge that crosses Hackers Creek on CR 13 to the WVFO at elizabeth_stout@fws.gov within 30 days of completion of the survey/salvage effort. Include the following in the report: surveyor names, protocols used for surveying, handling, and transporting mussels; total number of individuals of each mussel species collected; date collected; water and air temperatures; river stage; condition, size and approximate age of live snuffbox; data regarding non-endangered mussels; and maps or figures showing the salvage area relative to project features.
5. To monitor sedimentation impacts on the clubshell, measure turbidity upstream and downstream of the salvage area and upstream and downstream of the mouth of 1 or more tributaries with crossings. Turbidity monitoring of the salvage area should take place approximately 150 m downstream of Life's Run Bridge (County Route 14), and 350 m above it. Turbidity upstream and downstream of the mouth of tributaries should take place approximately 5 m upstream and 5 m downstream of the mouth. To provide the most meaningful data, it is advisable to measure the turbidity continuously at least 1 month prior to construction, through the duration of construction activities, and 1 year post-construction or once vegetation has become fully established, whichever happens last. Every 30 days, provide the last 30 days of raw data, and any summarized data, to the WVFO at elizabeth_stout@fws.gov.
6. Immediately report any unpermitted discharge of any potentially toxic substance to the Service and WV Department of Environmental Protection upon discovery.

Rusty patched bumble bee –

1. FERC or applicant shall notify the Service regarding the projected and actual start dates, progress, and completion of the project and verify that the 13.89 ha of clearing was not exceeded and all conservation measures were followed. Provide a report containing this information by December 31 of each year until construction is complete to the VAFO at sumalee_hoskin@fws.gov.
2. Prior to initiation of vegetation clearing in the HPZ provide to the VAFO, at sumalee_hoskin@fws.gov, the limits of equipment and vehicle traffic and staging and the methods to be used to ensure that traffic and staging will not exceed these limits.

Madison Cave isopod –

1. FERC or applicant shall notify the Service regarding the projected and actual start dates,

progress, and completion of the project and verify that the 11.2 acres (between MP 139.8 and MP 140.4) of ground disturbance was not exceeded and all conservation measures were followed. Provide a report containing this information by December 31 of each year until construction is complete to the VAFO at sumalee_hoskin@fws.gov.

Indiana bat –

1. FERC or applicant shall notify the Service regarding the projected and actual start dates, progress, and completion of the project and verify that the 1,018.6 acres of clearing was not exceeded and all conservation measures were followed. Provide a report containing this information by December 31 of each year until construction is complete to the VAFO at sumalee_hoskin@fws.gov.
2. FERC or applicant shall notify the Service if a dead bat is found. Upon locating a dead bat in VA, notify the VAFO at 804-824-2414. Upon locating a dead bat in WV, notify the WVFO at 304-636-6586.
3. Monitor Ibat activity around Star Chapel, Breathing Cave, and Clark's Cave to determine effects to Ibats in the fall swarming/spring staging areas. Two weeks prior to the start of tree clearing place acoustic monitors outside the entrance of each cave. Monitors will remain in place until 2 hibernating seasons after construction. Provide a report including the raw acoustic data every year on January 30th to the VAFO at sumalee_hoskin@fws.gov.

Northern long-eared bat –

1. FERC or applicant shall notify the Service regarding the projected and actual start dates, progress, and completion of the project and verify that the 0.52 acres of clearing was not exceeded and all conservation measures were followed. Provide a report containing this information by December 31 of each year until construction is complete to the WVFO at elizabeth_stout@fws.gov.
2. The FERC or applicant shall notify the Service if a dead bat is found. Upon locating a dead bat in WV, notify the WVFO at 304-636-6586.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Small whorled pogonia –

- Conduct 10 years of post-construction monitoring annually (i.e., monitor each colony 1 time each year) during optimal survey timeframes for SWP to assess each colony's status and any potential threats to its continued success. Monitor all 4 SWP colonies (Seneca, MNF, MNF-2, and GWNF). Atlantic is working with WVDNR, USFS, and the Service to fund continuation of monitoring efforts beyond 1 year post-construction. We recommend

FERC verify that a monitoring plan is developed and funded.

- To determine the effectiveness of temporary diversion channels and temporary berms within the construction workspace located near the SWP colonies, install equipment to continuously monitor soil moisture and temperature prior to, during, and after construction (e.g., until the end of the first growing season after restoration activities are completed). Conduct this monitoring at all 4 SWP colonies and at a reference site to establish baseline conditions and take into account local weather/seasonal variation.
- Monitor ambient light levels prior to, during, and after construction (e.g., until the end of the first growing season after restoration activities are completed) at the MNF, MNF-2, and GWNF SWP colony.
- Conduct surveys of suitable SWP habitat in the surrounding area of all 4 SWP colonies to determine if additional colonies are present.

Running Buffalo clover –

- Monitor the 8 known RBC populations within and adjacent to the action area and conduct surveys to locate additional populations.
- Contribute towards seed storage efforts from selected locations, and develop management agreements that will remain in place if the species was delisted.

Roanoke logperch –

- Fund or conduct riparian and stream restoration throughout the RLP range, especially the Nottoway River drainage, to limit siltation and nutrient releases into receiving waterways.
- Fund or conduct projects to identify and remove man-made barriers to fish passage that will benefit RLP.

Clubshell –

- Provide funding to the WVDNR or other Service-approved facilities to support activities to determine captive husbandry techniques suitable for propagation and augmentation of clubshell populations within the Monongahela River system.

Rusty patched bumble bee –

- Improve pollinator habitat throughout the permanent ROW by using pollinator friendly native seed mixes. Include species preferred by RPBB, list available at: https://www.fws.gov/midwest/endangered/insects/rpbb/pdf/PlantListRPBBJune2017.pdf.

Madison Cave isopod –

- Fund VDCR-DNH or other qualified and permitted entity to conduct research to improve knowledge of MCI basic biology and connectivity between documented locations.

Indiana bat –

- Fund research on understanding/controlling and mitigating the effects of WNS.
- Fund research to improve knowledge of Ibat use of suitable habitat in WV and VA.
- Plant native trees with exfoliating bark in the temporary construction ROW to replace

those that were cleared. Contact VAFO (sumalee_hoskin@fws.gov) and WVFO (elizabeth_stout@fws.gov) for area-specific recommendations.

- Purchase or otherwise protect additional Ibat habitat, particularly known use summer habitat and known use spring staging/fall swarming habitat.

Northern long-eared bat –

- Fund research on understanding/controlling and mitigating the effects of WNS.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions regarding this Opinion or our shared responsibilities under the ESA, please contact me at 413-253-8698.

Sincerely,

Paul R. Phifer

Paul R. Phifer, Ph.D.
Assistant Regional Director
Ecological Services

Enclosures

cc: Corps, Norfolk, VA (Attn: William Walker)
DOI, Washington, DC (Attn: Erika Vaughan)
FERC, Washington, DC (Attn: Kevin Bowman)
Service, Elkins, WV (Attn: John Schmidt)
Service, Gloucester, VA (Attn: Cindy Schulz)

Service, Raleigh, NC (Attn: Tom Augspurger)
Service, State College, PA (Attn: Sonja Jahrsdoerfer)
USFS, Atlanta, GA (Attn: Timothy Abing)
USFS, Elkins, WV (Attn: Jennifer Adams)
USFS, Roanoke, VA (Attn: Connie Jankowiak)
NCWRC, Raleigh, NC (Attn: Shannon Deaton)
VDACS, Richmond, VA (Attn: Keith Tignor)
VDGIF, Richmond, VA (Attn: Amy Ewing)
VDCR-DNH, Richmond, VA (Attn: Rene' Hypes)
WVDNR, Elkins, WV (Attn: Cliff Brown)
ACP, Richmond, VA (Attn: Spencer Trichell)

LITERATURE CITED

Introduction

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554-001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

Description of Proposed Action

Federal Energy Regulatory Commission. 2013a. Upland erosion control, revegetation, and maintenance plan. Washington, DC.

Federal Energy Regulatory Commission. 2013b. Wetland and waterbody construction and mitigation procedures. Washington, DC.

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

Status of the Species

SWP

U.S. Fish and Wildlife Service. 2008. Small whorled pogonia (*Isotria medeoloides*) 5-year review: summary and evaluation. New England Field Office, Concord, NH.

RBC

U.S. Fish and Wildlife Service. 2011. Running buffalo clover (*Trifolium stoloniferum*) 5-year review: summary and evaluation. Ohio Field Office, Columbus, OH.

RLP

U.S. Fish and Wildlife Service. 2007. Roanoke logperch (*Percina rex*) 5-year review: summary and evaluation. Virginia Field Office, Gloucester, VA.

Clubshell

U.S. Fish and Wildlife Service. 2008. Clubshell (*Pleurobema clava*) 5-year review: summary and evaluation. Pennsylvania Field Office, State College, PA.

RPBB

U.S. Fish and Wildlife Service. 2016. Rusty patched bumble bee (*Bombus affinis*) species status assessment. Twin Cities Ecological Services Field Office, Bloomington, MN.

MCI

U.S. Fish and Wildlife Service. 2011. Biological opinion, Warren County Power Station low effect habitat conservation plan. Virginia Field Office, Gloucester, VA.

Ibat
U.S. Fish and Wildlife Service. 2009. Indiana bat (*Myotis sodalis*) 5-year review: summary and evaluation. Indiana Field Office, Bloomington, IN.

U.S. Fish and Wildlife Service. 2016. Revised programmatic biological opinion for transportation projects in the range of the Indiana bat and Northern long-eared bat. Midwest Regional Office, Bloomington, MN.

NLEB
N/A

Environmental Baseline

SWP
Allstar Ecology. 2016a. Atlantic Coast Pipeline, West Virginia interim botanical survey. Monongahela National Forest, Pocahontas County, WV. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Allstar Ecology. 2016b. Atlantic Coast Pipeline, West Virginia botanical survey report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Resource Management. 2017. Atlantic Coast Pipeline, evaluation of the small whorled pogonia in the Monongahela and George Washington National Forests and the Seneca State Forest. Report to U.S. Forest Service, Monongahela National Forest, Elkins, WV.

TRANSCON Environmental. 2018. June 25, 2018 Atlantic Coast Pipeline Project CIC Daily Inspection Report. Report to U.S. Forest Service, George Washington and Jefferson National Forest, Roanoke, VA.

U.S. Fish and Wildlife Service. 1992. Small whorled pogonia (*Isotria medeoloides*) recovery plan, first revision. Northeast Regional Office, Newton Corner, MA.

Vanasse Hangen Brustlin, Inc. 2016a. Atlantic Coast Pipeline, Virginia segment survey report for rare, threatened, and endangered plant species. 2016 Field Season. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; Virginia Department of Conservation and Recreation, Richmond, VA; and U.S. Forest Service, George Washington National Forests, Roanoke, VA.

Vanasse Hangen Brustlin, Inc. 2016b. Atlantic Coast Pipeline, Virginia segment survey report for rare, threatened, and endangered plant species. George Washington National Forest - 2016 Field Season. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA;

Virginia Department of Conservation and Recreation, Richmond, VA; and U.S. Forest Service, George Washington National Forest, Roanoke, VA.

Vanasse Hangen Brustlin, Inc. 2017. Atlantic Coast Pipeline, revised small whorled pogonia conservation plan. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Forest Service, Monongahela National Forest, Elkins, WV; U.S. Forest Service, George Washington and Jefferson National Forests, Roanoke, VA; and West Virginia Division of Natural Resources, Elkins, WV.

RBC

AllStar Ecology. 2015. West Virginia Botanical Survey Report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

AllStar Ecology. 2016. West Virginia botanical survey report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

AllStar Ecology. 2017. West Virginia botanical survey report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Resources Management. 2017. Shapefile of botanical survey results in West Virginia. Unpublished shapefile to U.S. Fish and Wildlife Service, Elkins, WV.

RLP

Anderson, G.B. 2016. Development and application of a multiscale model of habitat suitability for Roanoke logperch. Final Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Environmental Solutions & Innovations, Inc. 2016. Habitat assessments conducted in 2016 for Roanoke logperch (*Percina rex*) along the proposed Atlantic Coast Pipeline in Virginia. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Environmental Solutions & Innovations, Inc. 2017. Habitat assessments conducted for Roanoke logperch (*Percina rex*) along the proposed Atlantic Coast Pipeline in Virginia. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Environmental Solutions & Innovations, Inc. 2018. Habitat assessments conducted for Roanoke logperch (*Percina rex*) along the proposed Atlantic Coast Pipeline in Virginia, revised. December 1, 2017. Report to Dominion Energy Services, Inc. Glen Allen, VA.

Lahey, A.M. and P.L. Angermeier. 2006. Survey for Roanoke logperch in the Roanoke and Meherrin river drainages, Virginia. Final Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA. 21 pp.

Lahey, A.M. and P.L. Angermeier. 2007. Range-wide assessment of habitat suitability for Roanoke logperch (*Percina rex*). Final Report to Virginia Transportation Research Council, Charlottesville, VA. 54 pp.

Roberts, J.H. and P.L. Angermeier. 2012. Monitoring of endangered Roanoke logperch (*Percina rex*) in Smith River upstream from the Philpott Reservoir on U.S. Army Corps of Engineers property near Martinsville, Virginia: U.S. Geological Survey Open-File Report 2012–1221, 11p.

Roberts, J.H., P.L. Angermeier, and E.M. Hallerman. 2013. Distance, dams and drift: what structures populations of an endangered, benthic stream fish? Freshwater Biology 58:1-15.

Virginia Department of Game and Inland Fisheries. 2005. Virginia's comprehensive wildlife conservation strategy. Virginia Department of Game and Inland Fisheries, Richmond, VA.

Virginia Fish and Wildlife Information Service. 2017. Species Information [Internet]. Richmond, VA [cited October 5, 2017]. Available from: h*ttp://vafwis.org/fwis*.

Clubshell

Anderson, R.M. and D.A. Kreeger. 2010. Potential for impairment of freshwater mussel populations in DRBC special protection waters as a consequence of natural gas exploratory well development. Unpublished Report to U.S. Fish and Wildlife Service, State College, PA; and the Partnership for the Delaware Estuary, Wilmington, DE.

Box, J.M. and J. Mossa. 1999. Sediment, land use, and freshwater mussels: prospects and problems. Journal of the North American Benthological Society 18:99-117.

Ellis, M.M. 1931. Some factors affecting the replacement of the commercial fresh-water mussels. U.S. Department of Commerce Bureau of Fisheries. Fishery Circular 7:1-10.

Ellis, M.M. 1936. Erosion silt as a factor in aquatic environments. Ecology 17:29-42.

Environmental Solutions & Innovations, Inc. 2016. Freshwater mussel (*Unionidae*) surveys for the proposed Atlantic Coast Pipeline in West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV, and West Virginia division of Natural Resources, Elkins, WV.

Houp, R.E. 1993. Observations on long-term effects of sedimentation on freshwater mussels (*Mollusca: Unionidae*) in the North Fork of Red River, Kentucky. Transactions of the Kentucky Academy of Science 54:93-97.

West Virginia Division of Natural Resources. 2004. Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 21 (1 October 2003 – 30 September 2004) Elkins, WV.

West Virginia Division of Natural Resources. 2009. Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 36 (1 October 2008 – 30 September 2009) Elkins, WV.

West Virginia Division of Natural Resources. 2014. Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 31 (1 October 2013 – 30 September 2014) Elkins, WV.

Environmental Solutions and Innovations, Inc. 2018a. Study Plan: Clubshell Mussel Relocation Efforts at Hackers Creek in Lewis County, West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; West Virginia Division of Natural Resources, Elkins, WV.

Environmental Solutions and Innovations, Inc. 2018b. Clubshell (*Pleurobema clava*) Salvage Efforts in Association with U.S. Fish and Wildlife Service Biological Opinion on Hackers Creek, Lewis County, West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV.

U.S. Fish and Wildlife Service. 2010. Draft Hackers Creek Watershed Inventory and Threat Assessment Habitat of the Clubshell Mussel (*Pleurobema clava).*

West Virginia Division of Natural Resources. 1994. Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 11 (1 July 1993 – 30 June 1994) Elkins, WV.

RPBB

Atlantic Coast Pipeline, LLC. 2017. Summary of the rusty patched bumble bee habitat assessment conducted on the George Washington National Forest. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Chapman, R.E., J. Wang, and A.F.G. Bourke. 2003. Genetic analysis of spatial foraging patterns and resource sharing in bumble bee pollinators. Molecular Ecology 12:2801-2808.

Charman, T.G., J. Sears, R.E. Green, and A.F.G. Bourke. 2010. Conservation genetics, foraging distance and nest density of the scarce Great Yellow Bumblebee (*Bombus distinguendus*). Molecular Ecology 19:2661-2674.

Darvill B., M.E. Knight, and D. Goulson. 2004. Use of genetic markers to quantify bumblebee foraging range and nest density. Oikos 107:471-478.

Dramstad, W.E. 1996. Do bumblebees (*Hymenoptera: Apidae*) really forage close to their nests? Journal of Insect Behavior 9(2):163-182.

Dreier, S., J.W. Redhead, I.A. Warren, A.F.G. Bourke, M.S. Heard, W.C. Jordan, S. Sumner, J. Wang, and C. Carvell. 2014. Fine-scale spatial genetic structure of common and declining bumble bees across an agricultural landscape. Molecular Ecology 23:3384- 3395.

Knight, M.E., A.P. Martin, S. Bishop, J.L. Osborne, R.J. Hale, A. Sanderson, and D. Goulson. 2005. An interspecific comparison of foraging range and nest density of four bumblebee (*Bombus*) species. Molecular Ecology 14:1811-1820.

Knight, M.E., J.L. Osbourne, R.A. Sanderson, R.K. Hale, A.P. Martin, and D. Goulson. 2009. Bumblebee nest density and the scale of available forage in arable landscapes. Insect Conservation and Diversity 2:116-124.

Kraus, F.B., S. Wolf, and R.F.A. Moritz. 2009. Male flight distance and population substructure in the bumblebee *Bombus terrestris*. Journal of Animal Ecology 78:247-252.

Lepais, O., B. Darvill, S. O'Connor, J.L. Osborne, R.A. Sanderson, J. Cussans, L. Goffe, and D. Goulson. 2010. Estimation of bumblebee queen dispersal distances using sibship reconstruction method. Molecular Ecology 19:819-831.

Osborne, J.L. S.J. Clark, R.J. Morris, I.H. Williams, J.R. Riley, A.D. Smith, D.R. Reynolds, and A.S. Edwards. 1999. A landscape-scale study of bumble bee foraging range and constancy, using harmonic radar. Journal of Applied Ecology 36:519-533.

Rao, S. and J.P. Strange. 2012. Bumble bee (*Hymenoptera: Apidae*) foraging distance and colony density associated with a late-season mass flowering crop. Environmental Entomology 41(4):905-915.

U.S. Fish and Wildlife Service. 2018a. Survey protocols for the rusty patched bumble bee (*Bombus affinis*). Version 2.1. Twin Cities Ecological Services Field Office, Bloomington, MN.

U.S. Fish and Wildlife Service. 2018b. Draft rusty patched bumble bee (*Bombus affinis*) Endangered Species Act Section 7(a)(2) voluntary implementation guidance. Version 2.0. Twin Cities Ecological Services Field Office, Bloomington, MN.

Virginia Department of Conservation and Recreation Division of Natural Heritage. 2017. Rusty patched bumble bee habitat assessment. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Wolf, S. and R.F.A. Moritz. 2008. Foraging distance in *Bombus terrestris* (Hymenoptera: Apidae). Apidologie 38:419-427.

Wolf, S., T. Toev, R.L.V. Moritz, and R.F.A. Moritz. 2012. Spatial and temporal dynamics of the male effective population size in bumblebees (Hymenoptera:Apidae). Population Ecology 54:115-124.

Wood, T.J., J.M. Holland, W.O.H. Hughes, and D. Goulson. 2015. Targeted agri-environment schemes significantly improve the population size of common farmland bumblebee species. Molecular Ecology 24:1668-1680.

MCI

GeoConcepts Engineering Inc. 2016. Karst Survey Report 8/1/2016. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; and Virginia Department of Conservation and Recreation Division of Natural Heritage, Richmond VA.

GeoConcepts Engineering Inc. 2017a. Karst Survey Report Revision 1 Atlantic Coast Pipeline Augusta, Bath and Highland Counties VA and Pocahontas and Randolph Counties, WV. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; and Virginia Department of Conservation and Recreation Division of Natural Heritage, Richmond VA.

GeoConcepts Engineering Inc. 2017b. Cochran's Cave Conservation Area (CCCA) and Moffett Lake investigation update. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; and Virginia Department of Conservation and Recreation Division of Natural Heritage, Richmond VA.

Orndorff, W.D. and C.S. Hobson. 2007. Status survey for the Madison Cave isopod (*Antrolana lira*) in Virginia, 2005-2007. Natural Heritage Technical Report 07-11. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 17pp.

Ibat

Environmental Resources Management. 2017a. Atlantic Coast Pipeline, Virginia segment protected bat species year 3 presence/ likely absence survey report. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Forest Service, George Washington National Forest, Roanoke, VA; and Virginia Department of Game and Inland Fisheries, Richmond, VA.

Environmental Resources Management. 2017b. Atlantic Coast Pipeline, West Virginia segment protected bat species year 3 presence/likely absence survey report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Resources Management. 2017c. Supply Header Project, West Virginia segment protected bat species year 3 presence/ likely absence survey report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Resources Management. 2017d. Atlantic Coast Pipeline, West Virginia segment protected bat species habitat assessment report spring 2017. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Resources Management. 2017e. Atlantic Coast Pipeline, Virginia segment protected bat species habitat assessment report. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Forest Service, George Washington National Forest, Roanoke, VA; and Virginia Department of Game and Inland Fisheries, Richmond, VA.

Kiser, J. D. and C. L. Elliot. 1996. Foraging habitat, food habits, and roost tree characteristics of the Indiana bat (Myotis sodalis) during autumn in Jackson County, Kentucky.

Niver, R.A., R.A. King, M.P. Armstrong, and W.M. Ford. 2014. Methods to evaluate and develop minimum recommended summer survey effort for Indiana Bats: White Paper. Available at: *https://www.fws.gov/midwest/endangered/mammals/inba/surveys/pdf/WhitePaperIBatSurveyEffort13Jan2014.pdf.*

Powers, K.E., R.J. Reynolds, W. Orndorff, W.M. Ford, and C.S. Hobson. 2015. Post-white –nose syndrome trends in Virginia's cave bats, 2008-2013. Journal of Ecology and the Natural Environment 7(4):113-123.

Romme', R. C., A. B. Henry, R. A. King, T. Glueck, and K. Tyrell. 2002. Home range near hibernacula in spring and autumn. Pp. 153-158 in The Indiana bat: biology and management of an endangered species (A. Kurta and J. Kennedy, Eds). Bat Conservation International, Austin Texas.

Stihler, C.W. 2012. White-nose syndrome a deadly enigma. West Virginia Wildlife Magazine. Fall/Winter edition. *http://www.wvdnr.gov/wildlife/magazine/Archive/12Winter/White-nose_Syndrome.pdf.*

U.S. Fish and Wildlife Service. 2007. Indiana bat (*Myotis sodalis*) draft recovery plan: first revision. Midwest Regional Office, Fort Snelling, MN. 258 pp.

U.S. Fish and Wildlife Service. 2015. Bat survey protocol for assessing use of potential hibernacula. *https://www.fws.gov/midwest/Endangered/mammals/inba/pdf/inba_srvyprtcl.pdf.*

U.S. Fish and Wildlife Service. 2017a. Ibat hibernacula data 3-6-2017. Unpublished data. Indiana Field Office, Bloomington, IN.

U.S. Fish and Wildlife Service. 2016. Revised Conservation Strategy for Forest-Dwelling Bats in the Commonwealth of Kentucky. Kentucky Field Office, Frankfort, KY.

U.S. Fish and Wildlife Service. 2017b. Rangewide Indiana bat summer survey guidelines. *https://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html*.

NLEB

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

Stihler, C.W. 2012. White-nose syndrome a deadly enigma. West Virginia Wildlife Magazine. Fall/Winter edition. *http://www.wvdnr.gov/wildlife/magazine/Archive/12Winter/White-nose_Syndrome.pdf*.

Environmental Resources Management. 2016. West Virginia Segment Protected Bat Species Habitat Assessment Addendum Report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Effects of the Action

SWP

Brumback, W.E., S. Cairns, M.B. Sperduto, and C.W. Fyler. 2011. Response of an *Isotria medeoloides* population to canopy thinning. Northeastern Naturalist 18(2):185-196.

Burns, R.M. and B.H. Honkala. 1990. Silvics of North America: 1. Conifers; 2. Hardwoods. Agriculture Handbook 654, Vol. 2. U.S. Department of Agriculture, U.S. Forest Service, Washington, D.C.

Dibble, A.C. 2000a. Demographic monitoring and habitat manipulation experiment for small whorled pogonia (*Isotria medeoloides*). Report to U.S. Fish and Wildlife Service, Northeast Regional Office, Hadley, MA.

Dibble, A.C. 2000b. Demographic monitoring and habitat manipulation of the small whorled pogonia, *Isotria medeoloides*, (Orchidaceae), in New England, U.S.A. Draft manuscript to Maine Department of Conservation, Maine Natural Areas Program, Augusta, ME.

Dibble, A.C., W.A. Wright, and C.S. Campbell. 1997. Small whorled pogonia (*Isotria medeoloides*): demographic monitoring and habitat manipulation experiment. Report to Maine

Department of Conservation, Maine Natural Areas Program, Augusta, ME and U.S. Fish and Wildlife Service, Northeast Regional Office, Newton Corner, MA.

Environmental Resource Management. 2017. Atlantic Coast Pipeline, evaluation of the small whorled pogonia in the Monongahela and George Washington National Forests and the Seneca State Forest. Report to U.S. Forest Service, Monongahela National Forest, Elkins, WV.

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

McCormick, M.K., D.F. Whigham, and J.P. O'Neill. 2015. Restore the federally threatened small whorled pogonia (*Isotria medeoloides*) in three National Park Service regions. Report to the U.S. National Park Service, Washington, DC.

Vanasse Hangen Brustlin, Inc. 2017. Atlantic Coast Pipeline, revised small whorled pogonia conservation plan. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Forest Service, Monongahela National Forest, Elkins, WV; U.S. Forest Service, George Washington and Jefferson National Forests, Roanoke, VA; and West Virginia Division of Natural Resources, Elkins, WV.

RBC

Burkhart, J.Q., J.S. Rentch, and T.M. Schuler. 2013. Effects of forest management on Running Buffalo clover (*Trifolium stoloniferum*, Muhl. ex A. Eaton) distribution and abundance in the Fernow Experimental Forest. Natural Areas Journal 33:156-162.

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

Madarish, D. and T.M. Schuler. 2002. Effects of forest management practices on the federally endangered Running Buffalo clover (*Trifolium stoloniferum* Muhl. ex A. Eaton). Natural Areas Journal 22:120-128.

RLP

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

Clubshell

Ellis, M.M. 1936. Erosion silt as a factor in aquatic environments. Ecology 17(1):29-42.

Loar, J.M., L.L. Dye, R.R. Turner, and S.G. Hildebrand. 1980. Analysis of environmental issues related to small-scale hydroelectric development. Dredging. ORNL, Environmental Science Division Publication No. 1565, Oak Ridge, TN.

Marking, L.L. and T.D. Bills. 1980. Acute effects of silt and sand sedimentation on freshwater mussels. Pages 204-211 in J.L. Rasmussen, ed. Proceedings of the symposium on Upper Mississippi River bivalve mollusks. Upper Mississippi River Conservation Committee, Rock Island, IL.

RPBB

Atlantic Coast Pipeline, LLC. 2017. Summary of the rusty patched bumble bee habitat assessment conducted on the George Washington National Forest. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

Virginia Department of Conservation and Recreation Division of Natural Heritage. 2017. Rusty patched bumble bee habitat assessment. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

MCI

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

GeoConcepts Engineering Inc. 2017c. Karst terrain assessment, construction, monitoring and mitigation plan, Atlantic Coast Pipeline, Randolph and Pocahontas Counties in West Virginia, and Highland, Augusta, and Nelson counties in Virginia. Report to Dominion Transmission, Inc. Clarksburg, WV.

U.S. Fish and Wildlife Service. 2015. Biological opinion, Incidental Take Statement, Informal Consultation, and related documents. U.S. Fish and Wildlife Service Regions 3, 4, and 5.

Ibat

Callahan, E.V. 1993. Indiana bat summer habitat requirements. M.S. Thesis, University of Missouri, Columbia, MO.

Frick, W.F., D.S. Reynolds, and T.H. Kunz. 2010. Influence of climate and reproductive timing on demography of little brown myotis *Myotis lucifugus*. Journal of Animal Ecology 79:128-136.

Gardner, J.E., J.D. Garner, and J.E. Hofmann. 1991. Summary of *Myotis sodalis* summer habitat studies in Illinois: with recommendations for impact assessment. Report to Indiana/Gray bat Recovery Team Meeting, Columbia, MO.

Humphrey, S.R., A.R. Richter, and J.B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammalogy 58:334-346.

Jachowski, D.S., J.B. Johnson, C.A. Dobony, J.W. Edwards, and W.M. Ford. 2014. Space use and resource selection by foraging Indiana bats at the northern edge of their distribution. Endangered Species Research 24(2):149.

Kniowski, A.B. and S.D. Gehrt. 2014. Home range and habitat selection of the Indiana bat in an agricultural landscape. Journal of Wildlife Management 78(3):503-512.

Kurta, A., J. Kath, E.L. Smith, R. Foster, M.W. Orick, and R. Ross. 1993. A maternity roost of the endangered Indiana bat (*Myotis sodalis*) in an unshaded, hollow, sycamore tree (*Platanus occidentalis*). American Midland Naturalist 130:405-407.

Menzel, J.M., W.M. Ford, M.A. Menzel, T.C. Carter, J.E. Gardner, J.D. Garner, and J.E. Hofmann. 2005. Summer habitat use and home-range analysis of the endangered Indiana bat. Journal of Wildlife Management 69(1):430-436.

Murray, S.W. and A. Kurta. 2004. Nocturnal activity of the endangered Indiana bat (*Myotis sodalis*). Journal of Zoology 262:197-206.

Romme, R.C., K. Tyrell, and V. Brack, Jr. 1995. Literature summary and habitat suitability index model: components of summer habitat for the Indiana bat, *Myotis sodalis*. Report to Indiana Department of Natural Resources, Division of Wildlife, Bloomington, Indiana by 3D/Environmental, Cincinnati, OH.

Sparks, D.W., C.M. Ritzi, J.E. Duchamp, and J.O. Whitaker, Jr. 2005. Foraging habitat of the Indiana bat, (*Myotis sodalis*) at an urban-rural interface. Journal of Mammalogy 86:713- 718.

Watrous, K.S., T.M. Donovan, R.M. Mickey, S.R. Darling, A.C. Hicks, and S.L. Von Oettingen. 2006. Predicting minimum habitat characteristics for the Indiana bat in the Champlain Valley. Journal of Wildlife Management 70(5):1228-1237.

Vanasse Hangen Brustlin, Inc. 2017. Atlantic Coast Pipeline, revised small whorled pogonia conservation plan. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Forest Service, Monongahela National Forest, Elkins, WV; U.S. Forest Service, George Washington and Jefferson National Forests, Roanoke, VA; and West Virginia Division of Natural Resources, Elkins, WV.

<u>NLEB</u>

Lacki, M.J., D.R. Cox, L.E. Dodd, and M.B. Dickinson. 2009. Response of northern bats (*Myotis septentrionalis*) to prescribed fires in eastern Kentucky forests. Journal of Mammalogy 90(5):1165-1175.

Owen, S.F., M.A. Menzel, W.M. Ford, B.R. Chapman, K.V. Miller, J.W. Edwards, and P.B. Wood. 2003. Home-range size and habitat used by the Northern Myotis (*Myotis septentrionalis*). American Midland Naturalist 150(2):352-359.

Analysis for Jeopardy

SWP

Allstar Ecology. 2016a. Atlantic Coast Pipeline, West Virginia interim botanical survey. Monongahela National Forest, Pocahontas County, WV. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Allstar Ecology. 2016b. Atlantic Coast Pipeline, West Virginia botanical survey report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Environmental Resource Management. 2017. Atlantic Coast Pipeline, evaluation of the small whorled pogonia in the Monongahela and George Washington National Forests and the Seneca State Forest. Report to U.S. Forest Service, Monongahela National Forest, Elkins, WV.

NatureServe. 2002. Element Occurrence Data Standard [Internet]. Arlington, VA [Created February 6, 2002; cited October 5, 2017] . Available from: *http://www.natureserve.org/conservation-tools/standards-methods/element-occurrence- data-standard*.

U.S. Fish and Wildlife Service. 1992. Small whorled pogonia (*Isotria medeoloides*) recovery plan, first revision. Northeast Regional Office, Newton Corner, MA.

U.S. Fish and Wildlife Service. 2008. Small whorled pogonia (*Isotria medeoloides*) 5-year review: summary and evaluation. New England Field Office, Concord, NH.

Vanasse Hangen Brustlin, Inc. 2017. Atlantic Coast Pipeline, revised small whorled pogonia conservation plan. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA; U.S. Forest Service, Monongahela National Forest, Elkins, WV; U.S. Forest Service, George Washington and Jefferson National Forests, Roanoke, VA; and West Virginia Division of Natural Resources, Elkins, WV.

Virginia Department of Conservation and Recreation-Division of Natural Heritage. 2018. Natural Heritage Data Explorer [Internet]. Richmond, VA [cited August 17, 2018]. Available from: *http://www.dcr.virginia.gov/natural-heritage/nhdeinfo*.

RBC

AllStar Ecology. 2017. West Virginia botanical survey report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

U.S. Fish and Wildlife Service. 2017. Draft Running Buffalo clover (*Trifolium stoloniferum*) 5-year review. Ohio Field Office, Columbus, OH.

RLP

N/A

Clubshell

U.S. Fish and Wildlife Service. 1994. Clubshell (*Pleurobema clava*) and northern riffleshell (*Epioblasma torulosa rangiana*) recovery plan. Hadley, MA.

U.S. Fish and Wildlife Service. 2008. Clubshell (*Pleurobema clava*) 5-year review: summary and evaluation. Pennsylvania Field Office, State College, PA.

Villella, R. 2007. A reassessment of freshwater mussels in the Allegheny River: some surprising results. (abs). Freshwater Conservation Society Symposium, 2007. Little Rock, Arkansas.

RPBB

Chapman, R.E. and A.F.G. Bourke. 2001. The influence of sociality on the conservation biology of social insects. Ecology Letters 4:650-662.

Macfarlane R.P., K.D. Patten, L.A. Royce, B.K.W. Wyatt, and D.F. Mayer. 1994. Management potential of sixteen North American bumble bee species. Melanderia 50:1-12.

Plath, O.E. 1922. Notes on the nesting habits of several North American bumble bees. Psyche 29(5-6):189-202.

U.S. Fish and Wildlife Service. 2016. Rusty patched bumble bee (*Bombus affinis*) species status assessment. Twin Cities Ecological Services Field Office, Bloomington, MN.

Zayed, A. 2009. Bee genetics and conservation. Apidologie 40(2):237-262.

MCI

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

U.S. Fish and Wildlife Service. 1996. Madison cave isopod (*Antrolana lira*) recovery plan. Northeast Regional Office, Hadley, MA. 36 pp.

U.S. Fish and Wildlife Service. 2011. Biological opinion, Warren County Power Station low effect habitat conservation plan. Virginia Field Office, Gloucester, VA.

Ibat
Brack, V.W. 2005. Field techniques for biological assessment: assessment of potential hibernacula and swarming/staging habitat. Pages 89-92 *in* K.C. Vories and A. Harrington, eds. The proceedings of the Indiana bat and coal mining: A technical interactive forum. U.S. Department of the Interior: Office of Surface Mining, Alton, IL.

Federal Energy Regulatory Commission. 2017. Atlantic Coast Pipeline and Supply Header Project Final Environmental Impact Statement. Docket Nos. CP15-554-000, CP15-554- 001, CP15-555-000, CP15-556-000. Office of Energy Projects, Washington, DC.

Frick, W.F., D.S. Reynolds, and T.H. Kunz. 2010. Influence of climate and reproductive timing on demography of little brown myotis *Myotis lucifugus*. Journal of Animal Ecology 79:128-136.

NLEB
N/A

Incidental Take Statement

Clubshell
Environmental Solutions and Innovations, Inc. 2018b. Clubshell (*Pleurobema clava*) Salvage Efforts in Association with U.S. Fish and Wildlife Service Biological Opinion on Hackers Creek, Lewis County, West Virginia. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV.

EnviroScience Inc. 2013. Biological Assessment and West Virginia Coordination Document for the Proposed 8-Inch Water Pipeline Crossing of the Kanawha River, Kanawha County, West Virginia. Report prepared for Hatch Mott MacDonald, Consulting Engineers and West Virginia American Water.

EnviroScience Inc. 2004. Mussel survey for a proposed barge loading facility at Ohio River mile 194 (Public Notice No. 200300661). Report prepared for D. Skinner, Belpre Sand & Gravel.

EnviroScience Inc. 2002. Kanawha River Mussel Survey Report River Mile 77.8 to 78.7. Report prepared for American Electric Power.

EnviroScience Inc. 2001. Braxton County State Route 4 Gassaway Bridge Replacement Project Freshwater Mussel Survey. Report prepared for West Virginia Department of Transportation.

West Virginia Division of Natural Resources. 1994. Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 11 (1 July 1993 – 30 June 1994) Elkins, WV.

RPBB
Mitchell, T.B. 1960. Bees of the eastern United States. I. Technical bulletin (North Carolina Agricultural Experiment Station) 141:1-538.

U.S. Fish and Wildlife Service. 2018. Survey protocols for the rusty patched bumble bee (*Bombus affinis*). Version 2.1. Twin Cities Ecological Services Field Office, Bloomington, MN.

Ibat
Kurta, A., 2005 Roosting ecology and behavior of Indiana bats (Myotis sodalis) in summer. Pp. 29-42 in K.C. Vories and A. Harrington (eds.), Proceeding of the Indiana bat and coal mining: a technical interactive form. Office of Surface Mining, U.S. Department of the Interior, Alton, IL. Available at http:www.mcrcc.osmre.gov/pdf.forums/bat percent20Indiana/TOC.pdf.

U.S. Fish and Wildlife Service. 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. U.S. Fish and Wildlife Service, Fort Snelling, MN. 258 pp.

U.S. Fish and Wildlife Service. 2018. Rangewide Indiana bat summer survey guidelines. https://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html.

NLEB
Environmental Resources Management. 2016. West Virginia Segment Protected Bat Species Habitat Assessment Addendum Report. Report to U.S. Fish and Wildlife Service, West Virginia Field Office, Elkins, WV; U.S. Forest Service, Monongahela National Forest, Elkins, WV; and West Virginia Division of Natural Resources, Elkins, WV.

Lowe, A.J. 2012. Swarming behaviour and fall roost-use of little brown (Myotis lucifugus), and Northern long-eared bats (Myotis septentrionalis) in Nova Scotia, Canada. M.S. Thesis. St. Mary's University, Halifax, Nova Scotia.

West Virginia Division of Natural Resources. 2017. Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 34 (1 October 2016 – 30 September 2017) Elkins, WV.

West Virginia Division of Natural Resources. 2016. Federal Assistance Performance Report: Endangered Species (Animals). Project E-1, Segment 33 (1 October 2015 – 30 September 2016) Elkins, WV.

Appendix A.

CONSULTATION HISTORY

09-04-14 The Service and Dominion Resources Services, Inc. (DRSI) met to discuss ACP in NC.

09-15-14 The Service received a letter from DRSI initiating early Section 7 coordination and requesting technical assistance for ACP in VA.

11-21-14 The Service received a letter from DRSI providing notification of pre-filing to FERC regarding ACP.

12-09-14 The Service submitted a letter to DRSI providing initial recommendations on ACP in WV.

01-23-15 The Service submitted a letter to DRSI providing initial recommendations on ACP in VA.

02-04-15 The Service participated in a site visit to see examples of existing gas pipeline crossings of waterbodies in NC.

03-25-15 The Service submitted a letter to DRSI providing initial recommendations on ACP in NC.

05-21-15 The Service, WVDNR, USFS, The Nature Conservancy, DRSI, and Natural Resource Group, LLC (NRG) met to discuss ACP alternatives analysis in WV.

07-07-15 The Service, WVDNR, USFS, DRSI, and NRG met to discuss the alternatives assessment and to participate in a helicopter flyover of proposed alternative routes for ACP in WV.

09-17-15 The Service received a letter from DRSI providing information about ACP and SHP and requesting a meeting.

10-02-15 The Service received a letter from Atlantic providing notification of certification application to FERC for ACP.

10-26-15 The Service and DRSI met to discuss ACP and SHP, FERC application, and development of a biological assessment (BA).

12-01-15 The Service and DRSI met to discuss bat survey results and current project status for ACP in NC.

12-17-15 The Service, DRSI, and NRG met to discuss 2015 survey results and project schedule in WV.

01-07-16 The Service submitted a letter to FERC providing further recommendations on ACP in WV.

01-28-16 The Service submitted a letter to DRSI accepting their bat survey results for SHP and made a NLAA determination for the Indiana and northern long-eared bats in PA.

02-22-16 The Service received a letter from DRSI requesting Section 7 review and technical assistance for the GWNF-6 alternative route of ACP in VA.

02-25-16 The Service and DRSI met to discuss freshwater mussels and other aquatic species survey study plan and current project status for ACP in NC.

03-02-16 The Service received a letter from DRSI submitting the draft BA for ACP and SHP.

05-02-16 The Service submitted a letter to FERC providing comments on the draft BA for ACP.

06-02-16 The Service submitted a letter to FERC providing clarification and recommendations regarding ACP and upcoming field season and bats, aquatic species, and migratory birds.

06-04-16 The Service and DRSI met to discuss sensitive waterbody crossings by ACP in NC.

08-16-16 The Service received a letter from DRSI providing a revised draft BA for ACP and SHP.

11-02-16 DRSI submitted the revised BA to the Service.

11-07-16 The Service and FERC met to discuss SHP, ACP, and development of the Draft Environmental Impact Statement (DEIS).

11-22-16 The Service, DRSI, and ERM met to discuss survey results and current project status in WV.

11-29-16 The Service, DRSI, ERM, and U.S. Army Corps of Engineers met to discuss ACP and SHP.

12-30-16 The Service received the FERC's DEIS via the electronic docket.

01-31-17 The Service submitted a letter to FERC outlining key ACP issues recommended for resolution prior to finalizing the BA.

02-24-17 The Service received a letter from DRSI providing response to Service's 1/31/17 letter.

03-02-17 The Service submitted a letter to FERC clarifying the Service's 1/31/17 letter.

03-21-17 to 03-22-17 The Service and FERC met to discuss SHP, ACP, and development of the FEIS.

03-29-17 The Service, DRSI, and ERM met to discuss comments on the BA.

03-30-17 The Service submitted a letter to FERC providing comments on the DEIS.

04-28-17 The Service received a letter from DRSI submitting the ACP RBC Conservation Plan in WV.

07-21-17 The Service received FERC's 7/21/17 request to initiate formal consultation and conference and FEIS.

07-26-17 The Service received a letter from DRSI submitting the ACP SWP Conservation Plan in WV and VA.

09-06-17 The Service submitted a letter to FERC initiating formal consultation.

09-15-17 The Service received a letter from DRSI submitting the RPBB Impact Analysis and Conservation Measures.

09-21-17 The Service received a letter from DRSI submitting the revised ACP SWP Conservation Plan in WV and VA.

10-16-17 The Service issued a non-jeopardy Opinion to FERC on ACP and SHP.

01-19-18 Defenders of Wildlife, Sierra Club, and the Virginia Wilderness Committee filed litigation against the Service seeking review of the Service's Opinion to FERC on ACP and SHP.

04-20-2018 The Service, DRSI, ERM, and WVDNR held a conference call to discuss the Hackers Creek salvage plan.

05-02-18 The Service received the Hacker's Creek salvage plan submitted by ESI on behalf of DRSI.

05-05-18 U.S. Court of Appeals for the Fourth Circuit issued a per curiam order vacating the Opinion's Incidental Take Statement.

05-16-18 FERC sent a letter to DETI stating "...Atlantic Coast Pipeline, LLC (Atlantic) has informed Commission staff that it will not proceed with construction in any areas where such activities may affect listed species covered by the FWS' Incidental Take Statement for the project. Atlantic should, within 5 days, file documentation that specifically identifies by milepost/stationing the habitat areas that will be avoided with respect to each of the listed species, and confirms the company's commitment to avoid construction in these areas."

05-21-18 The Service sent a letter to FERC requesting updated information.

06-01-18 FERC provided information in response to the Service's 5/21/18 letter.

06-28-18 The Service sent a letter to FERC stating "Because ESA Section 7 consultation in NC and PA was concluded informally and the Opinion and associated ITS did not include NC or PA, the vacatur of the ITS does not affect implementation of the referenced actions in NC or PA as they relate to the ESA."

08-06-18 U.S. Court of Appeals for the Fourth Circuit issued an order providing detailed reasoning for its May 15, 2018 order vacating the Incidental Take Statement issued by the Service.

08-23-18 The Service received a letter from FERC dated 8/23/18 requesting reinitiation of formal consultation.

Appendix B. Species-Specific Effects Tables.

Tables 1-8 are color coded as follows:

- NE rows are light green
- NLAA rows are light yellow
- LAA are light red

Table 1. Analysis of effects on Small whorled pogonia.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	physical impacts to individuals, habitat degradation	crushing, competition, collection, chemical contaminants	introduction of invasive species, poaching, exposure to chemicals from surface water runoff	NA	NA	NA	NA	NLAA	AMMs (e.g., Upland Erosion Control Plan, Restoration and Rehabilitation Plan, temporary diversion channels and berms in SWP Conservation Plan, Non-Native Invasive Plant Species Management Plan) will minimize potential effects from surface water runoff and competition from invasive plants in ROW. Cleared ROW and permanent access road near GWNF colony may increase chances of poaching and attract ORV traffic due to increased ease of public access, potentially causing collection, crushing, and death. AMM of installing barriers such as signs, fences, gates, vegetation, or boulders along the ROW and access road to discourage use of ORVs to avoid illegal access will minimize ORV effects.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to evapotranspiration rates and soil moisture, downslope erosion, sedimentation, burial, competition	removal of vegetation in upslope drainage area, erosion, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline construction ROW will affect 22.5. 27.4, 2.4, and 3.6%, respectively, of the Seneca, MNF, MNF-2, and GWNF colonies' upslope drainage areas, based on the locations of new stems identified in 2018. AMMs (e.g., Upland Erosion Control Plan, Restoration and Rehabilitation Plan, temporary diversion channels and berms in SWP Conservation Plan, Non-Native Invasive Plant Species Management Plan) will minimize potential effects from surface water runoff and competition from invasive plants in ROW. Soil compaction and clearing of vegetation in the upslope drainage area and diversion of surface water flow away from SWP colonies will alter the surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture of the SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals.
New Disturbance - Construction	Clearing - trees and shrubs	physical impacts to individuals, habitat degradation	changes to sunlight regime, soil compaction, altered hydrology, increased soil temperature, changes to evapotranspiration rates and soil moisture, downslope erosion, sedimentation, burial, competition	removal of over- and mid-story vegetation in upslope drainage area, erosion, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline construction ROW will affect 22.5. 27.4, 2.4, and 3.6%, respectively, of the Seneca, MNF, MNF-2, and GWNF colonies' upslope drainage areas, based on the locations of new stems identified in 2018. AMMs (e.g., Upland Erosion Control Plan, Restoration and Rehabilitation Plan, temporary diversion channels and berms in SWP Conservation Plan [SWPCP], Non-Native Invasive Plant Species Management Plan [NNIPSMP]) will minimize potential effects from surface water runoff and competition from invasive plants in ROW. Soil compaction and clearing of vegetation in the upslope drainage area and diversion of surface water flow away from SWP colonies will alter the surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture of the SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals. Removal of mid- and over-story trees will also increase direct and ambient light at all 4 colonies, which may increase SWP flowering and population size, but beyond an unknown threshold, is anticipated to degrade the SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, thereby affecting SWP as described above. ERM (2017) conducted qualitative analyses of the potential changes to light regime near each colony as a result of tree removal in the pipeline construction ROW using 3D computer modeling. For the Seneca colony (distance of 70 ft from construction ROW based on stems observed 2016 and 2017), the simulations indicated significant increases in ambient and direct light on the ground and surrounding area during summer, spring, and fall days, although not quantified. For the MNF colony, the simulations indicated changes in ambient light on the ground and surrounding area during early morning on summer and fall days, based on a distance of 113 ft from the construction ROW. With the new stems observed in 2018 at Seneca and MNF colonies closer to the construction ROW, respectively 11 and 45 ft, we anticipate greater changes in direct and ambient light in these 2 colonies. Due to the close proximity of the SWP stems in MNF-2 and GWNF colonies to the construction ROW identified in 2018 (approximately 103 and 115 ft, respectively), we also anticipate changes in light at these two colonies. The NNIPSMP will not address herbaceous and invasive vegetation growing outside of the ROW and near the SWP colonies due to the increased light. Invasive species could compete with SWP for light, space, and nutrients, causing decreased fitness and reproductive success and possibly death of individual SWP. The SWPCP includes temporary AMMs to monitor the population status of the SWP colonies annually for 10 years post-construction and minimize effects from invasive species outside of the ROW and near the SWP colonies for 3 years (e.g., before, during, and 1 year after construction) (VHB 2017). Atlantic funded continuation of population monitoring efforts beyond 1 year post-construction. For the Seneca SWP colony, the SWPCP also includes planting native tree seedlings for 200 ft along the construction ROW edge to the west of the pipeline (e.g., farther from the colony) to ameliorate for changes in sunlight regime and monitoring light levels in the colony for 3 years (e.g., before, during, and 1 year after construction). Approximately 20-30 years after planting, canopy trees (e.g., white oak and eastern white pine found at the Seneca colony) are expected to provide some mid-story shade (Burns et al. 1990), which would contribute to partially restoring the SWP habitat. Based on the evaluation of ERM's (2017) wind analysis of potential changes to wind patterns and speed within a 1 km radius around each of the SWP colonies, we anticipate that changes in wind pattern and speed will be minimal, and are likely to be discountable or insignificant.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	habitat degradation	competition	spread of herbaceous and invasive plant species	NA	NA	NA	NA	NLAA	Methods described in the Non-Native Invasive Plant Species Management Plan will minimize impacts due to invasive species.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	physical impacts to individuals, habitat degradation	changes to sunlight regime, increased soil temperature, changes to evapotranspiration rates and soil moisture, competition	trimming of over- and mid-story vegetation in upslope drainage area, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Trimming of mid- and over-story trees will increase direct and ambient light at all 4 colonies, which may increase SWP flowering and population size. Beyond an unknown threshold, an increase in direct and ambient light is anticipated to degrade SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, causing decreased fitness and reproductive success and possibly death of individuals. Methods described in the Non-Native Invasive Plant Species Management Plan will minimize impacts due to invasive species in the ROW, but not address herbaceous and invasive vegetation growing outside of ROW and near SWP colonies due to increased light. Invasive species could compete with SWP for light, space, and nutrients, causing decreased fitness and reproductive success and possibly death of individual SWP. The Small Whorled Pogonia Conservation Plan includes temporary AMMs to minimize effects from invasive species outside of the ROW and near the SWP colonies for 3 years (VHB 2017).
New Disturbance - Construction	Grading, erosion control devices	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to soil moisture, downslope erosion, sedimentation, burial	grading in upslope drainage area, erosion	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline construction ROW will affect 22.5. 27.4, 2.4, and 3.6%, respectively, of the Seneca, MNF, MNF-2, and GWNF colonies' upslope drainage areas, based on the locations of new stems identified in 2018. AMMs (e.g., Upland Erosion Control Plan, Restoration and Rehabilitation Plan, temporary diversion channels and berms in SWP Conservation Plan) will minimize potential effects from surface water runoff. Soil compaction and ground disturbance in the upslope drainage area and diversion of surface water flow away from SWP colonies will alter the surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture of the SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	physical impacts to individuals, habitat degradation	crushing, altered hydrology, changes to soil moisture, downslope erosion, sedimentation, burial	trenching in upslope drainage area, erosion, movement of soil and larger material (e.g. boulders) when blasting	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline construction ROW will affect 22.5. 27.4, 2.4, and 3.6%, respectively, of the Seneca, MNF, MNF-2, and GWNF colonies' upslope drainage areas, based on the locations of new stems identified in 2018. AMMs (e.g., Upland Erosion Control Plan, Restoration and Rehabilitation Plan, temporary diversion channels and berms in SWP Conservation Plan) will minimize potential effects from surface water runoff. Ground disturbance in the upslope drainage area and diversion of surface water flow away from SWP colonies will alter the surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture of the SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals. Blasting may also loosen large rocks, which could fall and crush SWP.

Table 1. Analysis of effects on Small whorled pogonia.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	neutral	none	NA	NA	NA	NA	NA	NE	No impacts to SWP habitat are anticipated from this action.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to soil moisture, downslope erosion, sedimentation, burial, competition, increased nutrients, chemical contaminants	regrading in upslope drainage area, erosion, spread of herbaceous and invasive plant species, exposure to nutrients from surface water runoff (fertilizers, decomposed vegetation), exposure to chemicals from surface water runoff and wind	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline construction ROW will affect 22.5. 27.4, 2.4, and 3.6%, respectively, of the Seneca, MNF, MNF-2, and GWNF colonies' upslope drainage areas, based on the locations of new stems identified in 2018. AMMs (e.g., Upland Erosion Control Plan, Restoration and Rehabilitation Plan, temporary diversion channels and berms in SWP Conservation Plan, Non-Native Invasive Plant Species Management Plan [NNIPSMP]) will minimize potential effects from surface water runoff, soil compaction, and competition from invasive plants in ROW. Ground disturbance in the upslope drainage area and diversion of surface water flow away from SWP colonies will alter the surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture of the SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals. For controlling invasive plants, hand application methods will be used along the ROW and no herbicides will be applied within 25 ft of federally listed plant species unless approved by the Service or USFS.
New Disturbance - Construction	Compression Facility, noise	neutral	none	NA	NA	NA	NA	NA	NE	Facilities do not occur within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Communication Facility - guy lines, noise, lights	neutral	none	NA	NA	NA	NA	NA	NE	Facilities do not occur within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near Seneca, MNF, and MNF-2 colonies. Activity not proposed within the upslope drainage area and 100-ft buffer downslope of GWNF SWP colony.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near Seneca, MNF, and MNF-2 colonies. Activity not proposed within the upslope drainage area and 100-ft buffer downslope of GWNF SWP colony.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent- tree trimming and tree removal	habitat degradation	changes to sunlight regime, increased soil temperature, changes to evapotranspiration rates and soil moisture, competition	removal and trimming of over- and mid-story vegetation adjacent to colony, spread of herbaceous and invasive plant species	NA	NA	NA	NA	NLAA	No temporary or permanent access roads proposed near Seneca, MNF, and MNF-2 colonies. An existing access road, located near GWNF colony (approximately 187 ft away), is proposed to be improved and maintained as a permanent access road. This access road is not located in the upslope drainage area of this colony. Methods described in the Non-Native Invasive Plant Species Management Plan will minimize impacts due to invasive species and removal of any vegetation within the existing access road (30 ft width) will likely have insignificant or discountable changes in light.
New Disturbance - Construction	Stream Crossings, wet open cut ditch	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, flume	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, dam & pump	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, cofferdam	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, conventional bore	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Crossings, direct pipe	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Stream Equipment Crossing Structures	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	neutral	none	NA	NA	NA	NA	NA	NE	Facilities do not occur within the upslope drainage area and 100-ft buffer downslope of SWP colonies.

Table 1. Analysis of effects on Small whorled pogonia.

Project Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	Vegetation Management - mowing	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to evapotranspiration rates and soil moisture, downslope erosion, burial, competition	removal of vegetation in upslope drainage area, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline permanent ROW will affect 22.5, 8.4, and 1.0%, respectively, of the Seneca, MNF, and GWNF colonies' upslope drainage areas, based on the location of new stems identified in 2018. Soil compaction and removal of vegetation in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals. Methods described in the Non-Native Invasive Plant Species Management Plan will minimize impacts due to invasive species. This subactivity in the pipeline permanent ROW will affect less than 1% of the MNF-2 colony's upslope drainage area based on the locations of new stems identified in 2018; effects are likely to be discountable or insignificant to this colony.
Operation & Maintenance	Vegetation Management - chainsaw and tree clearing	physical impacts to individuals, habitat degradation	changes to sunlight regime, soil compaction, altered hydrology, increased soil temperature, changes to evapotranspiration rates and soil moisture, downslope erosion, burial, competition	removal of over- and mid-story vegetation in upslope drainage area, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline permanent ROW will affect 22.5, 8.4, and 1.0%, respectively, of the Seneca, MNF, and GWNF colonies' upslope drainage areas, based on the location of new stems identified in 2018. Soil compaction and removal of vegetation in the upslope drainage area will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the colonies. Depending on the degree of surface water runoff and sedimentation, SWP habitat may be degraded and individual stems may be buried. Removal of mid- and over-story trees will also increase direct and ambient light at all 4 colonies, which may increase SWP flowering and population size, but beyond an unknown threshold, is anticipated to degrade the SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, causing decreased fitness and reproductive success and possibly death of individual SWP. Methods described in the Non-Native Invasive Plant Species Management Plan will minimize impacts due to invasive species in the ROW, but not address herbaceous and invasive vegetation growing outside of the ROW and near the SWP colonies due to the increased light. Invasive species could compete with SWP for light, space, and nutrients, causing decreased fitness and reproductive success and possibly death of individual SWP. The SWP Conservation Plan includes temporary AMMs to monitor the population status of the SWP colonies annually for 10 years post-construction and to minimize effects from invasive species outside of the ROW and near the SWP colonies for 3 years (e.g., before, during, and 1 year after construction) (VHB 2017). Atlantic funded the continuation of population monitoring efforts beyond 1 year post-construction.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	physical impacts to individuals, habitat alteration	chemical contaminants	exposure to chemicals from surface water runoff and wind	NA	NA	NA	NA	NLAA	Hand application methods will be used along the ROW and no herbicides will be applied within 25 ft of federally listed plant species unless approved by the Service or USFS. The SWP Conservation Plan also includes AMMs to minimize herbicide exposure by prohibiting herbicide use within 60 ft of SWP colonies and only using handpulling within this area (VHB 2017).
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	habitat degradation	competition	spread of herbaceous and invasive plant species	NA	NA	NA	NA	NLAA	Methods described in the Non-Native Invasive Plant Species Management Plan will minimize impacts due to invasive species.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
Operation & Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	habitat degradation	changes to sunlight regime, increased soil temperature, changes to evapotranspiration rates and soil moisture, competition	trimming of over- and mid-story vegetation in upslope drainage area, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Trimming of mid- and over-story trees will increase direct and ambient light at all 4 colonies, which may increase SWP flowering and population size. Beyond an unknown threshold, an increase in direct and ambient light is anticipated to degrade SWP habitat by increasing soil temperature, drying soils, and changing evapotranspiration rates, causing decreased fitness and reproductive success and possibly death of individuals. Methods described in the Non-Native Invasive Plant Species Management Plan will minimize impacts due to invasive species in the ROW, but not address herbaceous and invasive vegetation growing outside of ROW and near SWP colonies due to increased light. Invasive species could compete with SWP for light, space, and nutrients, causing decreased fitness and reproductive success and possibly death of individual SWP. The SWP Conservation Plan includes temporary AMMs to minimize effects from invasive species outside of the ROW and near the SWP colonies for 3 years (e.g., before, during, and 1 year after construction) (VHB 2017).
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	physical impacts to individuals, habitat degradation	soil compaction, altered hydrology, changes to soil moisture, downslope erosion, burial, sedimentation	regrading in upslope drainage area, erosion	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	This subactivity in the pipeline permanent ROW will affect 22.5, 8.4, and 1.0%, respectively, of the Seneca, MNF, and GWNF colonies' upslope drainage areas, based on the location of new stems identified in 2018. Soil compaction and ground disturbance will increase surface water flow and downslope erosion rates and alter surface and subsurface hydrology in the watershed of the colonies, causing changes in evapotranspiration rates and soil moisture in SWP habitat downslope of the ROW. These stressors are likely to affect both the mycorrhizal fungi and SWP and cause decreased fitness and reproductive success and possibly death of SWP individuals. This subactivity will also redistribute and loosen soils, which will cause sedimentation downslope towards the colonies. Depending on the degree of surface water runoff and sedimentation, SWP habitat may be degraded and individual stems may be buried.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	neutral	none	NA	NA	NA	NA	NA	NE	SWP is not an aquatic species and not found in streams and wetland areas.
Operation & Maintenance	Access Road Maintenance - grading, graveling	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near Seneca, MNF, and MNF-2 colonies. Activity not proposed within the upslope drainage area and 100-ft buffer downslope of GWNF SWP colony.
Operation & Maintenance	Access Road Maintenance - culvert replacement	neutral	none	NA	NA	NA	NA	NA	NE	No temporary or permanent access roads proposed near Seneca, MNF, and MNF-2 colonies. Activity not proposed within the upslope drainage area and 100-ft buffer downslope of GWNF SWP colony.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	neutral	none	NA	NA	NA	NA	NA	NE	Activity not proposed within the upslope drainage area and 100-ft buffer downslope of SWP colonies.
Operation & Maintenance	Inspection Activities - ground and aerial	neutral	none	NA	NA	NA	NA	NA	NE	No impacts to SWP habitat are anticipated from this action.

Table 2. Analysis of effects on RBC.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	physical impacts to individuals, habitat degradation	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	physical impacts to individuals, habitat alteration and degradation	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
New Disturbance - Construction	Clearing - trees and shrubs	habitat alteration/degradation	crushing, changes in sunlight exposure	removal of overstory vegetation, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will remove all canopy cover over the construction ROW and significantly reduce canopy cover over access roads. Will create too much sunlight for RBC, which prefers partial to filtered sunlight.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	physical impacts to individuals, habitat alteration and degradation	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	habitat alteration/degradation	burning	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	The plant structure is above ground and plants exposed to fire are likely to be killed. Additionally, topsoil containing RBC plant material and seed source is likely to be submerged in ash piles, restricting further plant growth and recolonization
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	habitat alteration/degradation	changes in sunlight exposure	removal of overstory vegetation, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will remove all canopy cover over the construction ROW and significantly reduce canopy cover over access roads. Will create too much sunlight for RBC, which prefers partial to filtered sunlight.
New Disturbance - Construction	Grading, erosion control devices	physical impacts to individuals, habitat alteration and degradation	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	physical impacts to individuals, habitat alteration and degradation	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	NA	NA	NA	NA	NA	NA	NA	NE	This activity will occur in areas that have already been disturbed and will not effect RBC
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	NA	NA	NA	NA	NA	NA	NA	NE	No impact from hydrostatic testing
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	NA	NA	NA	NA	NA	NA	NA	NE	This activity will occur in areas that have already been disturbed and will not effect RBC
New Disturbance - Construction	Compression Facility, noise	NA	NA	NA	NA	NA	NA	NA	NE	No impact from noise
New Disturbance - Construction	Communication Facility - guy lines, noise, lights	NA	NA	NA	NA	NA	NA	NA	NE	No impact from guy lines, noise, lights.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	physical impacts to individuals, habitat alteration and degradation	crushing, changes in hydrology, contaminants	soil compaction, habitat destruction	individuals, habitat	mortality	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	physical impacts to individuals, habitat alteration and degradation	crushing, changes in hydrology, contaminants	soil compaction, habitat destruction	individuals, habitat	mortality	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.

New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent- tree trimming and tree removal	habitat alteration/degradation	changes in sunlight exposure	soil compaction, habitat destruction	individuals, habitat	mortality	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will remove all canopy cover over the construction ROW and significantly reduce canopy cover over access roads. Will create too much sunlight for RBC, which prefers partial to filtered sunlight.
New Disturbance - Construction	Stream Crossings, wet ditch	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Stream Crossings, flume	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Stream Crossings, dam & pump	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Stream Crossings, cofferdam	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	NA	NA	NA	NA	NA	NA	NA	NE	HDD will not be used in WV where RBC occurs
New Disturbance - Construction	Stream Crossings, conventional bore	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Stream Crossings, direct pipe	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Stream Equipment Crossing Structures	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	NA	NA	NA	NA	NA	NA	NA	NE	no impacts from tree trimming.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	NA	NA	NA	NA	NA	NA	NA	NE	no impacts from pipe stringing component of activity
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	NA	NA	NA	NA	NA	NA	NA	NE	HDD will not be used in WV where RBC occurs
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
Operation &Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	NA	NA	NA	NA	NA	NA	NA	NE	Facilities do not occur near RBC.
Operation &Maintenance	Vegetation Management - mowing	NA	NA	NA	NA	NA	NA	NA	NE	Mowing will occur in areas not suitable for RBC
Operation &Maintenance	Vegetation Management - chainsaw and tree clearing	physical impacts to individuals, habitat alteration	changes to sunlight regime, downslope erosion, competition	removal of overstory vegetation, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will remove all canopy cover over the construction ROW and significantly reduce canopy cover over access roads. Will create too much sunlight for RBC, which prefers partial to filtered sunlight.
Operation &Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	physical impacts to individuals	chemical contaminants	exposure to chemicals from stormwater runoff and wind	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	NLAA	AMMs in place that will limit spraying of herbicides for invasive species management within 25-feet listed species unless FWS and FS are notified
Operation &Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	physical impacts to individuals, habitat alteration and degradation	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
Operation &Maintenance	Vegetation Disposal (upland) - brush pile burning	NA	NA	NA	NA	NA	NA	NA	NE	Burning will occur in areas not suitable for RBC (only in the ROW)
Operation &Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	habitat alteration	changes to sunlight, competition	removal of overstory vegetation, spread of herbaceous and invasive plant species	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will remove all canopy cover over the construction ROW and significantly reduce canopy cover over access roads. Will create too much sunlight for RBC, which prefers partial to filtered sunlight.

Operation &Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	physical impacts to individuals	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
Operation &Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in wetland areas
Operation &Maintenance	ROW repair, regrading, revegetation - in stream stabilization and/or fill	NA	NA	NA	NA	NA	NA	NA	NE	RBC does not occur in riparian zones
Operation &Maintenance	Access Road Maintenance - grading, graveling	physical impacts to individuals, habitat alteration and degradation	crushing, chemical contaminants	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
Operation &Maintenance	Access Road Maintenance - culvert replacement	physical impacts to individuals, habitat alteration and degradation	crushing, chemical contaminants	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	habitat alteration	crushing	soil compaction, habitat destruction	habitat, population, individuals	injury, death	reproduction, nutrition, habitat	numbers, reproduction	LAA	Will kill RBC plants and seeds. Conducting these activities in wet conditions will increase soil compaction, which may restrict seed germination preventing reestablishment of RBC in the temporary construction ROW post-construction.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	NA	NA	NA	NA	NA	NA	NA	NE	These activities will occur in areas not suitable for RBC
Operation & Maintenance	Inspection Activities - ground and aerial	NA	NA	NA	NA	NA	NA	NA	NLAA	Aerial will nave no effect; ground inspection foot traffic could pass over RBC populations but would not adversely affect the species because these inspections are periodic in nature which the species is accustomed to and can benefit from

Table 3. Analysis of effects on RLP.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides stormwater filter or shade to stream	Discountable	NA	NA	NA	NLAA	Temperature increases from herbaceous vegetation removal would be slight. ACP will implement AMMs to minimize sedimentation (e.g. compost filter sock w/in 300ft of ESA sensitive waterbodies and priority 1 belted silt retention fence and inspect on a daily basis).
New Disturbance - Construction	Clearing - trees and shrubs	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Moderately silted and high turbidity areas will be unusable to RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items. Loss of streambank vegetation is expected to result in increased water temperatures and changes in light regime in small areas. Changes in water temperature and light regime may affect the RLP prey base and make the habitat less suitable for the RLP themselves.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	Habitat degradation and water quality degradation, Stress on eggs	Increase in Water Temperatures, Decrease of dissolved oxygen	habitat and water quality degradation since vegetation no longer provides shade to stream	Unlikely	NA	NA	NA	NLAA	Temperature increases from herbaceous vegetation removal would be slight. ACP is narrowing their construction ROW at waterbody crossings to 75ft to minimize clearing of trees and riparian vegetation. Post construction ACP will maintain a 10ft wide ROW, which will further lessen impacts from vegetation removal.
New Disturbance - Construction	Grading, erosion control devices	Temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation	storm water erosion	Unlikely	NA	NA	NA	NLAA	ACP will implement AMMs to minimize sedimentation (e.g. compost filter sock w/in 300ft of ESA sensitive waterbodies and priority 1 belted silt retention fence and inspect on a daily basis).
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Cofferdams will be used to trench across waterbodies. Installation and dewatering of cofferdams is anticipated to injure or kill some RLP by crushing individuals during placement of cofferdams and through stranding or entrainment as cofferdams are dewatered. Moderately silted and high turbidity areas will be unusable to RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items. If blasting is needed for any crossings, RLP in the immediate blast area may be killed and RLP in the vicinity will be temporarily stunned and/or permanently injured. Installation and dewatering of cofferdams may injure or kill RLP by crushing individuals during placement of cofferdams and through stranding or entrainment as cofferdams are dewatered.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Moderately silted and high turbidity areas will be unusable to RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	Temporary loss of habitat, Habitat degradation	Minor sedimentation, Altered flow	Withdrawal and discharge of water	Discountable	NA	NA	NA	NLAA	ACP will use municipal water sources rather than withdraw water at the RLP crossings. ACP will not discharge into ESA sensitive waterbodies, and will discharge in upland areas a minimum of 300 ft from ESA sensitive water bodies.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	Permanent or temporary loss of habitat, Habitat degradation, Water quality degradation, Physical impacts to individuals, Reduction of prey	Minor sedimentation, Loss of prey, Contaminants	tributary and/or near stream earth disturbance can cause minor increase in sedimentation , Storm water runoff, fertilizers used in revegetation can cause algae blooms which will lower dissolved oxygen,	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Any ground disturbance that may result in sedimentation in habitat where RLP presence is assumed is considered LAA. Moderately silted and high turbidity areas will be unusable to RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items.
New Disturbance - Construction	Compression Facility, noise	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.

Table 3. Analysis of effects on RLP.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Communication Facility - guy lines, noise, lights	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants, Loss of prey, Disruption of spawning, Crushing or removal of eggs	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction	LAA	Adjacent upland ground-disturbing activities such as grading and constructing/improving access roads may introduce sediment into RLP habitat. Moderately silted and high turbidity areas will be unusable to RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items. If instream work occurs during spawning, RLP will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely to occur.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	Permanent or temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation, Contaminants, Altered flow,	tributary and instream earth disturbance can cause increase in sedimentation and turbidity, Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in-water work, minor noise from construction activities in water. water work, minor	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Sediment introduction into RLP habitat. Moderately silted and high turbidity areas will be unusable to RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items. If instream work occurs during spawning, RLP will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely to occur.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - tree trimming and tree removal	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Loss of streambank vegetation is expected to result in increased water temperatures and changes in light regime in small areas. Changes in water temperature and light regime may affect the RLP prey base and make the habitat less suitable for the RLP themselves.
New Disturbance - Construction	Stream Crossings, wet open cut ditch	Neutral	None	NA	NA	NA	NA	NA	NE	This is not proposed as a crossing method at the 4 RLP crossings (FEIS pg 4-288).
New Disturbance - Construction	Stream Crossings, flume	Neutral	None	NA	NA	NA	NA	NA	NE	This is not proposed as a crossing method at the 4 RLP crossings (FEIS pg 4-288).
New Disturbance - Construction	Stream Crossings, dam & pump	Temporary loss of occupied habitat, Physical impacts to individuals, Habitat degradation and water quality degradation, reduction of prey population	Sedimentation, Altered flow, Contaminants, Impoundment	tributary and near stream earth disturbance may result in increased sedimentation altered flow may result in increased sedimentation, contaminant spills from equipment located in tributary stream, dam could restrict up/down stream movement of species, noise from in water work	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Temporary loss of instream habitat will occur at stream crossings. Instream activities will temporarily re-suspend sediments and increase turbidity. We expect RLP will avoid these areas until the instream structures are removed and turbidity returns to baseline levels. If instream work occurs during spawning, RLP will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely to occur. Implementation of Fish relocation plan will minimize direct impacts.
New Disturbance - Construction	Stream Crossings, cofferdam	Temporary loss of occupied habitat, Physical impacts to individuals, Habitat degradation and water quality degradation, Reduction of prey population	Sedimentation, altered flow, contaminants, impoundment, noise	tributary and near stream earth disturbance may result in increased sedimentation altered flow may result in increased sedimentation, contaminant spills from equipment located in tributary stream, dam could restrict up/down stream movement of species, noise from in water work	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Temporary loss of instream habitat will occur at stream crossings that use cofferdams and bridge center supports. Additionally cofferdam placement/removal, installation of bridge center supports, and other instream activities will temporarily re-suspend sediments and increase turbidity. We expect RLP will avoid these areas until the instream structures are removed and turbidity returns to baseline levels. If instream work occurs during spawning, RLP will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely to occur. TOYR will minimize direct impacts at Nottoway River 1. Implementation of Fish relocation plan will minimize direct impacts.
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	Water quality degradation, Physical Impacts to Individuals, Reduction of prey population	Sedimentation, Frac-out, Noise	tributary, near and in stream earth disturbance may result in increased sedimentation, risk of frac-out during drilling operations, noise from drilling activities	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	NLAA	HDD at the Nottoway River 2 (MP 32.6) crossing. RLP presence assumed. Based on the frack-out report, risk of frac-out is low.
New Disturbance - Construction	Stream Crossings, conventional bore	Neutral	None	NA	NA	NA	NA	NA	NE	This is not proposed as a crossing method at the 4 RLP crossings (FEIS pg 4-288).
New Disturbance - Construction	Stream Crossings, direct pipe	Neutral	None	NA	NA	NA	NA	NA	NE	This is not proposed as a crossing method at the 4 RLP crossings (FEIS pg 4-288).

Table 3. Analysis of effects on RLP.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Stream Equipment Crossing Structures	Permanent or temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation, Contaminants, Altered flow, Noise	tributary and in stream earth disturbance can cause increase in sedimentation and turbidity , Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in- water work, minor noise from construction activities in water.	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Temporary loss of instream habitat will occur at Sturgeon Creeks because the bridge center support will be installed during the RLP TOYR. Additionally, installation of bridge center supports will temporarily re-suspend sediments and increase turbidity. We expect RLP will avoid these areas until the instream structures are removed and turbidity returns to baseline levels. If instream work occurs during spawning, RLP will be unable to successfully spawn in these areas. If work occurs after completion of spawning, crushing or removal of eggs is likely to occur.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	Neutral	None	NA	NA	NA	NA	NA	NE	Activity is not located in streams or rivers. In addition, if non-riparian then activity would not be adjacent to occupied habitat and therefore this would be a no effect.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	Neutral	None	NA	NA	NA	NA	NA	NE	Activity is not located in streams or rivers. In addition, if non-riparian then activity would not be adjacent to occupied habitat and therefore this would be a no effect.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	Neutral	None	NA	NA	NA	NA	NA	NE	Activity is not located in streams or rivers. In addition, if non-riparian then activity would not be adjacent to occupied habitat and therefore this would be a no effect.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	Neutral	None	NA	NA	NA	NA	NA	NE	Activity is not located in streams or rivers. In addition, if non-riparian then activity would not be adjacent to occupied habitat and therefore this would be a no effect.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	Neutral	None	NA	NA	NA	NA	NA	NE	Activity is not located in streams or rivers. In addition, if non-riparian then activity would not be adjacent to occupied habitat and therefore this would be a no effect.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	Neutral	None	NA	NA	NA	NA	NA	NE	Activity is not located in streams or rivers. In addition, if non-riparian then activity would not be adjacent to occupied habitat and therefore this would be a no effect.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	Habitat degradation, Water quality degradation	Sedimentation, Contaminants	Stormwater runoff from pollution generating pavement, Stormwater erosion	Unlikely	NA	NA	NA	NLAA	
Operation & Maintenance	Vegetation Management - mowing	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.
Operation & Maintenance	Vegetation Management - chainsaw and tree clearing	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	Unlikely	NA	NA	NA	NLAA	ACP is narrowing their construction ROW at waterbody crossings to 75ft to minimize clearing of trees and riparian vegeation. Post construction ACP will maintain a 10ft wide ROW, which will further lessen impacts from vegetation removal.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Chemical Contaminants	direct exposure to chemicals from spills and stormwater runoff	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction	NLAA	Herbicides or pesticides will not be used within 100 feet of a waterbody except as allowed by the appropriate land management or state agency (Construction, Operations, and Maintenance Plans pg. 143). Aerial spraying would not be utilized for invasive species control along the ROW.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action.
Operation & Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	Habitat degradation and water quality degradation, Stress on eggs,	Increase in Water Temperatures, Decrease of dissolved oxygen	habitat and water quality degradation since vegetation no longer provides shade to stream	Unlikely	NA	NA	NA	NLAA	ACP is narrowing their construction ROW at waterbody crossings to 75ft to minimize clearing of trees and riparian vegeation. Post construction ACP will maintain a 10ft wide ROW, which will further lessen impacts from vegetation removal.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	Habitat degradation, Water quality degradation	Minor sedimentation, Lowered dissolved oxygen, Contaminants	tributary and/or near stream earth disturbance can cause minor increase in sedimentation , Storm water runoff, fertilizers used in revegetation can cause algae blooms which will lower dissolved oxygen	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	E&S measures will minimize impacts through erosion control and restoration of graded areas. In addition, the FEIS states that grubbing will not occur within 50 feet of ESA sensitive waterbodies between November 15 - April 1 (FEIS pg 4-252). RLP TOYR is March 15 - June 30 so this only somewhat benefits the RLP.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	Permanent or temporary loss of habitat, Habitat degradation, Water quality degradation, Physical impacts to individuals, Reduction of prey	Minor sedimentation, Lowered dissolved oxygen, Contaminants	tributary and/or near stream earth disturbance can cause minor increase in sedimentation , Storm water runoff, fertilizers used in revegetation can cause algae blooms which will lower dissolved oxygen, Equipment located in connected wetland can increase chance of spills	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Although there is a chance for contaminant spills from equipment, this would not likely jeopardize this species as spills would take place outside of habitat. In addition, contaminant spill impacts should be minimal in any habitat if BMPs outlined in the ECS are followed. The FEIS states that grubbing will not occur within 50 feet of ESA sensitive waterbodies between November 15 - April 1 (FEIS pg 4-252). RLP TOYR is March 15 - June 30 so this only somewhat benefits the RLP.

Table 3. Analysis of effects on RLP.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	Permanent or temporary loss of habitat, Habitat degradation, Water quality degradation, Physical impacts to individuals, Reduction of prey	Sedimentation, Contaminants, Altered flow	tributary and in stream earth disturbance can cause increase in sedimentation and turbidity , Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in- water work	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	The FEIS states that grubbing will not occur within 50 feet of ESA sensitive waterbodies between November 15 - April 1 (FEIS pg 4-252). RLP TOYR is March 15 - June 30 so this only somewhat benefits the RLP. In addition the ECS outlines the use of erosion control measures and restoration of graded areas.
Operation & Maintenance	Access Road Maintenance - grading, graveling	Temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation	tributary and in stream earth disturbance can cause increase in sedimentation	Unlikely	NA	NA	NA	NLAA	The FEIS state that vegetation maintenance will be limited in the 50 feet adjacent to waterbodies, minimizing ground and vegetation disturbance (FEIS pg 4-252). In addition the ECS outlines the use of erosion control measures and restoration of graded areas.
Operation & Maintenance	Access Road Maintenance - culvert replacement	Permanent or temporary loss of habitat, Habitat degradation, Physical impacts to individuals, Reduction of prey population	Sedimentation, Contaminants, Altered flow	tributary and in stream earth disturbance can cause increase in sedimentation and turbidity , Equipment located in stream or tributary can increase chance of spills, altered flow velocities and temporary impoundment from in- water work, minor noise from construction activities in water.	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	The FEIS states that grubbing will not occur within 50 feet of ESA sensitive waterbodies between November 15 - April 1 (FEIS pg 4-252). RLP TOYR is March 15 - June 30 so this only somewhat benefits the RLP. In addition the ECS outlines the use of erosion control measures and restoration of graded areas.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	Habitat degradation and water quality degradation, Stress on individuals, Reduction in prey population	Sedimentation, Increase in Water Temperatures, Decrease of dissolved oxygen	denuding bank, grubbing with heavy equipment, disturbing soil, water quality degradation since vegetation no longer provides shade to stream	Unlikely	NA	NA	NA	LAA	The FEIS states that grubbing will not occur within 50 feet of ESA sensitive waterbodies between November 15 - April 1 (FEIS pg 4-252). RLP TOYR is March 15 - June 30 so this only somewhat benefits the RLP. In addition the ECS outlines the use of erosion control measures and restoration of graded areas.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	Temporary loss of habitat, Water quality degradation, Physical impacts, Reduction of prey population	Sedimentation, Short-term altered flow, Contaminants	near, in-stream, and tributary earth disturbance may result in increased sedimentation, altered flow result in increased sedimentation and short-term impoundment, contaminant spills from equipment located in- stream and tributary, noise from in water work	Habitat, Population, Individuals	Harm, Kill	Breeding, Feeding, Sheltering	Numbers, reproduction, distribution	LAA	Trenching will cause sedimentation. Moderately silted and high turbidity areas will be unusable to RLP for foraging and spawning in the immediate vicinity of the crossing. Heavy siltation is also anticipated to result in a loss of prey items.
Operation & Maintenance	Inspection Activities - ground and aerial	Neutral	None	NA	NA	NA	NA	NA	NE	No impacts to stream habitats are anticipated from this action. Will not introduce sediment or contaminants into the streams or rivers.

[1]The Service has determined that expected take impacts to the species addressed in this ITS properly fall within the definition of "harm" rather than "harass;" therefore, the term "harass" has been removed from the ITS.

Table 4. Analysis of effects on Clubshell.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response	Conservation Need Affected	Demographic Consequences	NE or NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	neutral	none	NA	NA	NA	NA	NA	NLAA	Foot traffic and vehicle operation is not likely to adversely affect clubshell.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	habitat degradation	altering habitat	increased sedimentation	juveniles, adults	harm	breeding, feeding, sheltering	reproduction	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Clearing - trees and shrubs	habitat degradation	altering habitat	increased sedimentation	juveniles, adults	harm	breeding, feeding, sheltering	reproduction	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	neutral	none	NA	NA	NA	NA	NA	NE	Vegetation disposal will not effect clubshell.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	Brush pile burning will not effect clubshell.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	neutral	none	NA	NA	NA	NA	NA	NE	Side trimming of trees will not effect clubshell.
New Disturbance - Construction	Grading, erosion control devices	habitat degradation	altering habitat	increased sedimentation	juveniles, adults	harm	breeding, feeding, sheltering	reproduction	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	habitat degradation	altering habitat	increased sedimentation	juveniles, adults	harm	breeding, feeding, sheltering	reproduction	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	neutral	none	NA	NA	NA	NA	NA	NE	Pipe stringing will not effect clubshell.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	neutral	none	NA	NA	NA	NA	NA	NE	No water withdrawals from Hackers Creek or nearby streams. Water will be jumped between segments and not discharged near clubshell.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	habitat degradation	altering habitat	increased sedimentation and contaminant impacts to habitat	juveniles, adults	harm	breeding, feeding, sheltering	reproduction	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Compression Facility, noise	neutral	none	NA	NA	NA	NA	NA	NE	Noise will not effect clubshell
New Disturbance - Construction	Communication Facility - guy lines, noise, lights	neutral	none	NA	NA	NA	NA	NA	NE	Noise and lights will not effect clubshell.

New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	physical impact to individuals, habitat degradation	direct impacts to individuals, altering habitat	dislocating and crushing individuals, alteration of aquatic habitat	juveniles, adults	kill, harm	breeding, feeding, sheltering	numbers	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	habitat degradation	altering habitat	increased sedimentation	juveniles, adults	harm	breeding, feeding, sheltering	reproduction	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - tree trimming and tree removal	habitat degradation	altering habitat	increased sedimentation	juveniles, adults	harm	breeding, feeding, sheltering	reproduction	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Stream Crossings, wet ditch	neutral	none	NA	NA	NA	NA	NA	NE	No wet ditch crossings near clubshell.
New Disturbance - Construction	Stream Crossings, flume	physical impact to individuals, habitat degradation	direct impacts to individuals	dislocating and crushing individuals, alteration of aquatic habitat	juveniles, adults	kill, harm	breeding, feeding, sheltering	numbers	LAA	Installation of crossing structures may cause increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Stream Crossings, dam & pump	physical impact to individuals, habitat degradation	direct impacts to individuals	dislocating and crushing individuals, alteration of aquatic habitat	juveniles, adults	kill, harm	breeding, feeding, sheltering	numbers	LAA	Installation of crossing structures may cause increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Stream Crossings, cofferdam	neutral	none	NA	NA	NA	NA	NA	NE	No cofferdam crossings near clubshell.
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	neutral	none	NA	NA	NA	NA	NA	NE	No HDD in WV.
New Disturbance - Construction	Stream Crossings, conventional bore	neutral	none	NA	NA	NA	NA	NA	NE	No horizontal bore in WV.
New Disturbance - Construction	Stream Crossings, direct pipe	neutral	none	NA	NA	NA	NA	NA	NE	No direct pipe crossings near clubshell.
New Disturbance - Construction	Stream Equipment Crossing Structures	physical impact to individuals, habitat degradation	direct impacts to individuals	dislocating and crushing individuals, alteration of aquatic habitat	juveniles, adults	kill, harm	breeding, feeding, sheltering	numbers	LAA	Installation of crossing structures may cause increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	physical impact to individuals, habitat degradation	direct impacts to individuals	dislocating and crushing individuals, alteration of aquatic habitat	juveniles, adults	kill, harm	breeding, feeding, sheltering	numbers	LAA	Installation of crossing structures may cause increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.

New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	neutral	none	NA	NA	NA	NA	NA	NE	Side trimming will not adversely affect clubshell.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading, dewatering, restoration	physical impact to individuals, habitat degradation	direct impacts to individuals	dislocating and crushing individuals, alteration of aquatic habitat	juveniles, adults	kill, harm	breeding, feeding, sheltering	numbers	LAA	Increased sediment load to stream will impair feeding of clubshell. Mussel gills can become overwhelmed with excessive suspended sediment, causing a mussel to either reduce its water and food intake rate or close altogether. Increased turbidity causing impaired feeding can result in reduced physiological function; depressed rates of growth, reproduction, and recruitment. Siltation resulting from increased sediment loads may also alter and degrade habitat conditions which may suffocate and kill some individual clubshell.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	neutral	none	NA	NA	NA	NA	NA	NE	Pipe stringing will not adversely affect clubshell.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	neutral	none	NA	NA	NA	NA	NA	NE	No HDD in WV.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	neutral	none	NA	NA	NA	NA	NA	NE	No conventional bore in WV.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	neutral	none	NA	NA	NA	NA	NA	NLAA	Take due to sedimentation is assumed from other activities occurring on the pipeline corridor prior to these activities.
Operation & Maintenance	Vegetation Management - mowing	neutral	none	NA	NA	NA	NA	NA	NE	Mowing will not effect clubshell.
Operation & Maintenance	Vegetation Management - chainsaw and tree clearing	neutral	none	NA	NA	NA	NA	NA	NLAA	While this activity may increase sediment loads, the effects will be temporary and is not likely to adversely affect clubshell.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	neutral	none	NA	NA	NA	NA	NA	NE	
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	neutral	none	NA	NA	NA	NA	NA	NE	Vegetation disposal will not effect clubshell.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	neutral	none	NA	NA	NA	NA	NA	NE	Brush pile burning will not effect clubshell.
Operation & Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	neutral	none	NA	NA	NA	NA	NA	NE	Side trimming of trees will not effect clubshell.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	neutral	none	NA	NA	NA	NA	NA	NLAA	While this activity may increase sediment loads, the effects will be temporary and is not likely to adversely affect clubshell.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	neutral	none	NA	NA	NA	NA	NA	NLAA	Physical impacts to wetlands would not likely transport to streams.
Operation & Maintenance	ROW repair, regrading, revegetation - in stream stabilization and/or fill	neutral	none	NA	NA	NA	NA	NA	NLAA	While this activity may increase sediment loads, the effects will be temporary and is not likely to adversely affect clubshell.
Operation & Maintenance	Access Road Maintenance - grading, graveling	neutral	none	NA	NA	NA	NA	NA	NLAA	While this activity may increase sediment loads, the effects will be temporary and is not likely to adversely affect clubshell.
Operation & Maintenance	Access Road Maintenance - culvert replacement	neutral	none	NA	NA	NA	NA	NA	NLAA	While this activity may increase sediment loads, the effects will be temporary and is not likely to adversely affect clubshell.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	neutral	none	NA	NA	NA	NA	NA	NLAA	While this activity may increase sediment loads, the effects will be temporary and is not likely to adversely affect clubshell.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	neutral	none	NA	NA	NA	NA	NA	NE	These activities will not effect clubshell.
Operation & Maintenance	Inspection Activities - ground and aerial	neutral	none	NA	NA	NA	NA	NA	NE	Inspection activities will not effect clubshell.

The Service has determined that expected take impacts to the species addressed in this ITS properly fall within the definition of "harm" rather than "harass;" therefore, the term "harass" has been removed from the ITS.

Table 5. Analysis of effects on RPBB.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance-Construction	Vehicle Operation and Foot Traffic	human activity & disturbance	decreased foraging; crushing colonies or overwintering queens	human presence	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Vehicle operation off established roads may crush RPBB individuals. There is no evidence that vehicle operation at low speeds on established roads would impact individual RPBB. Foot traffic is not expected to crush RPBB.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	clearing of floral habitat; human activity & disturbance	alteration of summer foraging habitat & colony habitat; decreased foraging efficiency; crushing individuals, colonies or overwintering queens	vegetation removal; human presence	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Clearing of herbaceous vegetation while RPBB are present in habitat is expected to have a direct effect on the quality, quantity, and timing of floral resources, thereby reducing survivability and reproductive success of queens; equipment used could crush individuals, queens, or colonies. Per the September 15, 2017 letter from Dominion, for access road 36-014-AR2 Atlantic agreed to 1) avoid clearing vegetation on access road 36-014-AR2 during the flowering period (approximately April - August), to allow the food source for bees in the area to remain intact during aboveground feeding times, 2) on adjacent GWNF land, restore the ROW per the COM Plan for the ACP. This includes invasive species control measures, and planting native species in some locations for pollinators during restoration, 3) mowing the ROW every 3 years rather than every year, with the exception of 10 ft centered on the pipeline which will be mowed at a frequency to maintain an herbaceous state, and 4) Atlantic will coordinate with the GWNF to restrict access along the access road. Per the August 28, 2018 from Dominion, Atlantic agreed to the above measures on access roads 36-014-AR2, 36-012-AR2, and 36-014-AR1.
New Disturbance - Construction	Clearing - trees and shrubs	clearing of foraging habitat; human activity & disturbance	alteration of summer foraging habitat & colony habitat; decreased foraging efficiency; crushing individuals, colonies or overwintering queens	vegetation removal; human presence	all life stages	Kill, harm	breeding, sheltering	numbers, reproduction	LAA	Clearing of trees and shrubs while RPBB are present in habitat is expected to have a direct effect on the quality, quantity, and timing of floral resources, thereby reducing survivability and reproductive success of queens; equipment used could crush individuals, queens, or colonies. We expect this will occur along the construction ROW.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	human activity & disturbance	alteration of summer foraging habitat & colony habitat; decreased foraging & travel efficiency; crushing individuals in colonies or overwintering		all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Vegetation disposal may crush foraging individuals. We expect this will occur along the construction ROW.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	human activity & disturbance; smoke	decreased foraging	smoke; human presence & noise	all life stages	none expected	NA	NA	NLAA	Impacts to RPBB from smoke caused by burning brush piles in summer is insignificant and discountable because the effects are difficult to detect and measure and burn piles will be small, spaced far apart, and will not occur in the vast majority of the HPZ.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	No side trimming occurs for new construction.	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Grading, erosion control devices	physical impacts to individuals, habitat degradation	alteration of foraging habitat	vegetation removal; human presence	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Construction in the HPZ associated with grading and erosion control devices could crush individuals, queens, or colonies.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	physical impacts to individuals, habitat degradation	Removal of foraging vegetation and nesting habitat; crushing of individuals	trenching in the HPZ	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Ground disturbance associated with the construction ROW between MP 92.7 - 93.7 in the HPZ is proposed to occur during the active foraging season for RPBB workers. RPBB workers are expected to be crushed by machinery during vegetation removal and construction, which will affect the ability of the workers to provide sufficient resources to the colony, resulting in reduced survival of individual workers and reduced reproductive capacity of the queen. Nests or overwintering foundress queens may be crushed during trenching activities.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	human activity	NA	human presence & noise	unlikely	none expected	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in disturbance of RPBB.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	withdrawal/discharge of water into aquatic habitats; human activity	NA	water alterations; human presence & noise	unlikely	none expected	NA	NA	NLAA	This activity is not expected to occur in the HPZ.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	human activity & disturbance	Removal of foraging vegetation and nesting habitat; crushing of individuals	habitat disturbance, human presence & noise	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Construction in the HPZ associated with this activity could crush individuals, queens, or colonies.
New Disturbance - Construction	Compression Facility, noise	noise disturbance	NA	human presence	unlikely	none expected	NA		NLAA	Noise created from this activity is anticipated to be insignificant and would not result in disturbance to RPBB.
New Disturbance - Construction	Communication Facility- guy lines, noise, lights	human activity and facilities	NA	human presence	unlikely	none expected			NLAA	Noise created from this activity is anticipated to be insignificant and would not result in disturbance to RPBB.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent-grading, graveling	alteration of surface water flow; vegetation removal; human activity	Removal of foraging vegetation and nesting habitat; crushing of individuals in colonies or overwintering	removal of foraging habitat	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Construction in the HPZ associated with this activity could crush individuals, queens, or colonies.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent-culvert installation	tree removal; loss or alteration of forested habitat; human disturbance	Removal of foraging vegetation and nesting habitat; crushing of individuals in colonies or overwintering	vegetation removal; human presence	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Construction in the HPZ associated with this activity could crush individuals, queens, or colonies.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent-tree trimming and tree removal	tree removal; loss or alteration of forested habitat; human disturbance	Removal of foraging vegetation and nesting habitat; crushing of individuals in colonies or overwintering	vegetation removal; human presence	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	RPBB nests and overwintering queens are expected to be crushed by machinery during vegetation removal and construction. We expect RPBB workers foraging in the area would fly away or avoid the area during vegetation removal. Displaced workers will have to travel further to forage, which will affect the ability of the workers to provide sufficient resources to a colony, resulting in reduced health of some individual workers, reduced reproductive capacity of the queen, and reduced production of foundress queens and males.
New Disturbance - Construction	Stream Crossings, wet open cut ditch	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Stream Crossings, flume	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Stream Crossings, dam & pump	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Stream Crossings, cofferdam	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Stream Crossings, conventional bore	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Stream Crossings, direct pipe	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance- Construction	Stream Equipment Crossing Structures	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA

Table 5. Analysis of effects on RPBB.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	No side trimming occurs for new construction.	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	RPBB not present	NA	NA	NA	NA	NA	NA	NE	NA
Operation & Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	increased human activity/disturbance	decreased foraging efficiency; crushing individuals	human presence; vehicle traffic	all life stages	Kill, harm	breeding, feeding	numbers, reproduction	LAA	Traffic may disrupt foraging behavior and displace individual RPBBs. We expect RPBB workers foraging in the area would fly away or avoid the area during vegetation removal. Displaced workers will have to travel further to forage, which will affect the ability of the workers to provide sufficient resources to a colony, resulting in reduced health of some individual workers, reduced reproductive capacity of the queen, and reduced production of foundress queens and males.
Operation & Maintenance	Vegetation Management - mowing	loss or alteration of forested habitat; increased human activity/disturbance;	decreased foraging efficiency;	vegetation removal	all life stages	none expected	NA	NA	NLAA	Mowing may reduce RPBB foraging resources, alteration of habitat, mowing blades may crush RPBB. Conservation measure to maintain a minimum blade height of 10 inches during maintenance of the ROW should significantly reduce the likelihood of impacts from crushing. Per the September 15, 2017 letter from Dominion, for access road 36-014-AR2 Atlantic agreed to 1) avoid clearing vegetation on access road 36-014-AR2 during the flowering period (approximately April - August), to allow the food source for bees in the area to remain intact during aboveground feeding times, 2) on adjacent GWNF land, restore the ROW per the COM Plan for the ACP. This includes invasive species control measures, and planting native species in some locations for pollinators during restoration, 3) mowing the ROW every 3 years rather than every year, with the exception of 10 ft centered on the pipeline which will be mowed at a frequency to maintain an herbaceous state, and 4) Atlantic will coordinate with the GWNF to restrict access along the access road. Per the August 28, 2018 from Dominion, Atlantic agreed to the above measures on access roads 36-014-AR2, 36-012-AR2, and 36-014-AR1.
Operation & Maintenance	Vegetation Management - chainsaw and tree clearing	loss or alteration of foraging habitat; increased human activity/ disturbance	alteration of summer foraging habitat & nesting habitat; kill or injure overwintering queens	vegetation removal; human disturbance	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	Vegetation alterations to foraging habitat should be small. Tree felling and heavy equipment may crush individuals, queens, or colonies.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	chemical contamination; vegetation loss; loss of floral habitat	lethal or sublethal exposure to toxins; alteration of travel corridors, summer foraging habitat	contamination of water & vegetation; loss of foraging vegetation (e.g. rhododendrons and woody flowering shrubs)	all life stages	none expected	NA	NA	NLAA	Voluntary conservation measure to avoid aerial or broadcast pesticide and herbicide application. Use of targeted spot-spraying or wiping, or mechanical pulling to target invasive and noxious weeds should significantly reduce the likelihood of impacts from vegetation management. Per the September 15, 2017 letter from Dominion, for access road 36-014-AR2 Atlantic agreed to 1) avoid clearing vegetation on access road 36-014-AR2 during the flowering period (approximately April - August), to allow the food source for bees in the area to remain intact during aboveground feeding times, 2) on adjacent GWNF land, restore the ROW per the COM Plan for the ACP. This includes invasive species control measures, and planting native species in some locations for pollinators during restoration, 3) mowing the ROW every 3 years rather than every year, with the exception of 10 ft centered on the pipeline which will be mowed at a frequency to maintain an herbaceous state, and 4) Atlantic will coordinate with the GWNF to restrict access along the access road. Per the August 28, 2018 from Dominion, Atlantic agreed to the above measures on access roads 36-014-AR2, 36-012-AR2, and 36-014-AR1.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	human activity & disturbance; obstructed nest entrances	loss or alteration of nesting, overwintering habitat	vegetation removal; human disturbance	all life stages	Kill, harm	breeding, sheltering	numbers, reproduction	LAA	Vegetation disposal may crush individuals, queens, or colonies.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	human activity & disturbance; smoke disturbance	smoke inhalation	smoke in foraging or nesting habitat	all life stages	none expected	NA	NA	NLAA	Impacts to RPBB from smoke caused by burning brush piles in summer is insignificant and discountable because the effects are difficult to detect and measure and burn piles will be small, spaced far apart, and will not occur in the vast majority of the HPZ.
Operation & Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	loss or alteration of foraging habitat; human disturbance; compaction of soil	alteration of foraging habitat; alteration of nesting and overwintering habitat	vegetation removal; human disturbance	unlikely	none expected	NA	NA	NLAA	AMMs minimize potential effects; vegetation alterations to foraging habitat should be small. Noise and activity levels are anticipated to be low with no disturbance to colonies. Although some foraging habitat may be altered, we do not expect indirect effects to occur because the majority of habitat will not be altered. Trimming may result in increased light to the forest floor, creating opportunity for increased floral resources. Effects are expected to be insignificant.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	tree removal; loss or alteration of floral resources and forested habitat; human disturbance	alteration of summer foraging habitat & colony habitat; crushing of colonies & overwintering queens	vegetation removal; human disturbance	all life stages	Kill, harm	breeding, feeding, sheltering	numbers, reproduction	LAA	ROW repairs occur in areas of soil erosion where floral resources may be of higher quality. ROW repairs may remove nesting habitat, or crush individuals, queens, or colonies.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	tree removal; loss or alteration of forested habitat; human disturbance	alteration of summer foraging habitat	vegetation removal; human disturbance	all life stages	none expected	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on RPBB or their foraging habitat.
Operation & Maintenance	ROW repair, regrading, revegetation - in stream stabilization and/or fill	tree removal; loss or alteration of forested habitat; human disturbance	alteration of summer foraging habitat	vegetation removal; human disturbance	unlikely	none expected	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on RPBB or their habitat.
Operation & Maintenance	Access Road Maintenance - grading, graveling	removal; loss or alteration of floral habitat; human disturbance	alteration of summer foraging habitat & colony habitat; crushing of colonies & overwintering queens	vegetation removal; human disturbance	all life stages	Kill, harm	feeding, breeding, sheltering	numbers, reproduction	LAA	Vegetation alterations will remove high quality foraging habitat, impacting survival and reproduction. Activities could crush individuals, queens, or colonies.
Operation & Maintenance	Access Road Maintenance - culvert replacement	tree removal; loss or alteration of floral habitat; human disturbance	alteration of summer foraging habitat & colony habitat; crushing of colonies & overwintering queens	vegetation removal; human presence	all life stages	none expected	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on RPBB or their habitat.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	tree removal; loss or alteration of forested habitat; human disturbance	loss or alteration of summer foraging habitat (e.g. rhododendrons); overwintering habitat	vegetation removal; human presence	all life stages	none expected	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on RPBB or their habitat.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	human disturbance	decreased foraging & travel efficiency	human presence	all life stages	none expected	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on RPBB or their habitat.
Operation & Maintenance	Inspection Activities -ground and aerial	human activity & disturbance	decreased foraging & travel efficiency	human presence	all life stages	none expected	NA	NA	NLAA	The level of impact from these activities is not expected to have noticeable or measurable impacts on RPBB or their habitat.

[1]The Service has determined that expected take impacts to the species addressed in this ITS properly fall within the definition of "harm" rather than "harass;" therefore, the term "harass" has been removed from the ITS.

Table 6. Analysis of effects on Madison Cave isopod.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	Physical impacts to individuals	chemical contaminants	NA	NA	NA	NA	NA	NLAA	No impacts from foot traffic. AMMs address contaminants from vehicles.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	Physical impacts to individuals, Habitat alteration	smothering, sedimentation, changes in hydrology	NA	NA	NA	NA	NA	NLAA	Primary impact from new construction is from earth disturbing actions (grading and trenching) not from the vegetation removal. ACP has committed to AMMs to address the potential for this impact. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS. Based on aerial imagery, the 40.8 acre CY in Rockbridge County has been previously cleared and therefore will not affect the MCI. The August 1, 2018, tree felling update does not change the anticipated expected impacts to MCI because tree felling is a subactivity that is considered NLAA.
New Disturbance - Construction	Clearing - trees and shrubs	Physical impacts to individuals, Habitat alteration	smothering, sedimentation, changes in hydrology	NA	NA	NA	NA	NA	NLAA	Primary impact from new construction is from earth disturbing actions (grading and trenching) not from the vegetation removal. ACP has committed to AMMs to address the potential for this impact. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS. Based on aerial imagery, the 40.8 acre CY in Rockbridge County has been previously cleared and therefore will not affect the MCI. The August 1, 2018, tree felling update does not change the anticipated expected impacts to MCI because tree felling is a subactivity that is considered NLAA.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Physical impacts to individuals	chemical contaminants, smothering	NA	NA	NA	NA	NA	NLAA	AMMs address potential contaminants from chipper. No stacking or piling will be done in potential MCI habitat.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	NA	NA	NA	NA	NA	NA	NA	NE	No impacts from burning. Will not affect the MCI because they will not introduce sediment or contaminants into the phreatic water.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	NA	NA	NA	NA	NA	NA	NA	NE	No impacts from tree trimming. Will not affect the MCI because they will not introduce sediment or contaminants into the phreatic water.
New Disturbance - Construction	Grading, erosion control devices	Physical impacts to individuals, Habitat degradation	smothering, sedimentation	grading near the karst "caves" disturbs the ground, may cave in sinkholes, displaced topsoil and vegetation may be placed in karst features	individuals, habitat	Harm, Kill	breeding, feeding, sheltering	numbers, reproduction	LAA	Grading redistributes and loosens soil making it more prone to erosion. Depending on the amount and speed of the erosion event, MCI will either avoid a particular area until the sediment is settled or be smothered. Effects include a temporary reduction in feeding or reproducing. Due to the distance from the construction ROW and ATWS (0.5 mi), we anticipate the population of MCI at the Barterbrooke Blue-Cave Hill Conservation Site will receive little to no sedimentation and effects to MCI at this site is NLAA.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, contaminants	digging into karst areas causes direct movement of sediments into MCI habitat and may smother MCI, blasting fractures the rock and materials may fall onto MCI either smothering or crushing	individuals, habitat	Harm, Kill	breeding, feeding, sheltering	numbers, reproduction	LAA	Digging redistributes and loosens soil making it more prone to erosion. Depending on the amount and speed of the erosion event, MCI will either avoid a particular area until the sediment is settled or be smothered. Effects include a temporary reduction in feeding or reproducing. Loosened subsurface rocks from trenching or blasting is expected to disrupt the subsurface water flow and alter MCI travel corridors. Trenching or blasting is anticipated to intercept a subsurface void, creating a direct conduit for soil and sediment to enter into the subsurface habitat. These changes will render habitat temporarily or permanently unsuitable for use by the MCI and is likely to prevent movements among or between populations. Due to the distance from the construction ROW and ATWS (0.5 mi), we anticipate the population of MCI at the Barterbrooke Blue-Cave Hill Conservation Site will receive little to no sedimentation and effects to MCI at this site is NLAA.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	NA	NA	NA	NA	NA	NA	NA	NE	
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	Hydro test water AMMs reduce any impacts to insignificant/discountable. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Compression Facility, noise	NA	NA	NA	NA	NA	NA	NA	NE	No impacts anticipated from noise.
New Disturbance - Construction	Communication Facility - guy lines, noise, lights	NA	NA	NA	NA	NA	NA	NA	NE	No impacts anticipated from communication towers.

Table 6. Analysis of effects on Madison Cave isopod.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, changes in hydrology, contaminants	NA	individuals, habitat	Kill	breeding, feeding, sheltering	numbers, reproduction	LAA	Creation of new surface features (roads) may alter hydrology. Grading redistributes and loosens soil making it more prone to erosion. Depending on the amount and speed of the erosion event, MCI will either avoid a particular area until the sediment is settled or be smothered. Any MCI present in the zones of impact will likely be crushed or smothered.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, changes in hydrology, contaminants	NA	individuals, habitat	Kill	breeding, feeding, sheltering	numbers, reproduction	LAA	Digging redistributes and loosens soil making it more prone to erosion. Depending on the amount and speed of the erosion event, MCI will either avoid a particular area until the sediment is settled or be smothered. These changes will render habitat temporarily or permanently unsuitable for use by the MCI and is likely to prevent movements among or between populations. Effects include a temporary reduction in feeding or reproducing. We do not anticipate culvert installation would generate a sediment plume large enough to smother MCI, nor do we anticipate culvert installation would loosen subsurface rocks, which could fall and crush MCI. Due to the distance from the construction ROW and ATWS (0.5 mi), we anticipate the population of MCI at the Barterbrooke Blue-Cave Hill Conservation Site will receive little to no sedimentation and effects to MCI at this site is NLAA.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent- tree trimming and tree removal	Physical impacts to individuals, Habitat degradation	sedimentation	NA	NA	NA	NA	NA	NLAA	No impact anticipated from selective tree removal. AMMs address sedimentation. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Stream Crossings, wet ditch	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Stream Crossings, flume	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Stream Crossings, dam & pump	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Stream Crossings, cofferdam	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	HDD will not be used within mapped MCI potential habitat zone.
New Disturbance - Construction	Stream Crossings, conventional bore	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	Conventional bore will not be used within MCI potential habitat.
New Disturbance - Construction	Stream Crossings, direct pipe	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	Direct pipe will not be used within MCI potential habitat
New Disturbance - Construction	Stream Equipment Crossing Structures	NA	NA	NA	NA	NA	NA	NA	NE	Impacts from stream crossings considered above.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	Physical impacts to individuals, Habitat degradation	smothering, sedimentation	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	NA	NA	NA	NA	NA	NA	NA	NE	No anticipated impacts from tree trimming. Will not affect the MCI because they will not introduce sediment or contaminants into the phreatic water.

Table 6. Analysis of effects on Madison Cave isopod.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, contaminants	grading activity disturbs the ground and sedimentation into possible connections to MCI habitat. Trenching may result in connections with subsurface habitat.	individuals, habitat	Harm, Kill	breeding, feeding, sheltering	numbers, reproduction	LAA	Grading redistributes and loosens soil making it more prone to erosion. Depending on the amount and speed of the erosion event, MCI may either avoid a particular area until the sediment is settled or be smothered. Loosened subsurface rocks from trenching may disrupt the subsurface water flow and alter MCI travel corridors. Trenching may intercept a subsurface void, creating a direct conduit for soil and sediment to enter into the subsurface habitat. These changes will render habitat temporarily or permanently unsuitable for use by the MCI and is likely prevent movements among or between populations.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	NA	NA	NA	NA	NA	NA	NA	NE	No impacts from pipe stringing component of activity.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	HDD will not be used within mapped MCI potential habitat zone.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	Physical impacts to individuals	chemical contaminants	NA	NA	NA	NA	NA	NLAA	Conventional bore will not be used within mapped MCI potential habitat zone.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	Physical impacts to individuals	chemical contaminants, sedimentation	NA	NA	NA	NA	NA	NLAA	No impacts from foot traffic. AMMs address contaminants and sedimentation from general vehicle-use; NOTE vehicle impacts for all O&M subactivities are evaluated here (i.e., vehicle impacts will not be considered under the remaining O&M subactivities). Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	Vegetation Management - mowing	NA	NA	NA	NA	NA	NA	NA	NE	Mowing is not an earth disturbing activity- no expected increased sedimentation or contamination from mowing.
Operation & Maintenance	Vegetation Management - chainsaw and tree clearing	Physical impacts to individuals, Habitat degradation	sedimentation	NA	NA	NA	NA	NA	NLAA	No impact from selective tree removal. AMMs address sedimentation. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS. Based on aerial imagery, the 40.8 acre CY in Rockbridge County has been previously cleared and therefore will not affect the MCI. The August 1, 2018, tree felling update does not change the anticipated expected impacts to MCI because tree felling is a subactivity that is considered NLAA.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	Physical impacts to individuals	chemical contaminants	NA	NA	NA	NA	NA	NLAA	AMMs address herbicides. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS. No spraying of insecticides or herbicides would be allowed within the 300 ft karst feature buffer, except where allowed by state or federal agencies. Aerial spraying would not be utilized for invasive species control along the ROW.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Physical impacts to individuals,	chemical contaminants, smothering	NA	NA	NA	NA	NA	NLAA	AMMs address potential contaminants from chipper. No stacking or piling will be done in potential MCI habitat. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	NA	NA	NA	NA	NA	NA	NA	NE	No impacts from brush burning. Will not affect the MCI because they will not introduce sediment or contaminants into the phreatic water.
Operation & Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	NA	NA	NA	NA	NA	NA	NA	NE	No impacts from tree trimming. Will not affect the MCI because they will not introduce sediment or contaminants into the phreatic water.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	Physical impacts to individuals	smothering, sedimentation	NA	NA	NA	NA	NA	NLAA	No impacts from hand repair. Mechanical repair impacts are addressed by AMMs. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	Physical impacts to individuals	smothering, sedimentation	NA	NA	NA	NA	NA	NLAA	No impacts from hand repair. Mechanical repair impacts are addressed by AMMs. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	ROW repair, regrading, revegetation - in stream stabilization and/or fill	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants, changes in hydrology	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	Access Road Maintenance - grading, graveling	Physical impacts to individuals, Habitat degradation	smothering, sedimentation, chemical contaminants	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS. We anticipate impacts from road maintenance would be smaller because the majority of impacts are expected from the creation or widening of road.

Table 6. Analysis of effects on Madison Cave isopod.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	Access Road Maintenance - culvert replacement	Physical impacts to individuals, Habitat degradation	smothering, sedimentation	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation, contaminants and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	Habitat alteration	sedimentation	NA	NA	NA	NA	NA	NLAA	AMMs address sedimentation and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	Habitat alteration	sedimentation		NA	NA	NA	NA	NLAA	AMMs address sedimentation and impacts to karst features. Details are located in the Karst Terrain Assessment Construction, Monitoring and Mitigation Plan (GeoConcepts Engineering, Inc. 2017c) in Appendix I of the FEIS and page 4-300 of the FEIS.
Operation & Maintenance	Inspection Activities - ground and aerial	NA	NA	NA	NA	NA	NA	NA	NE	No impacts from inspections. Will not affect the MCI because they will not introduce sediment or contaminants into the phreatic water.

[1] The Service has determined that expected take impacts to the species addressed in this ITS properly fall within the definition of "harm" rather than "harass;" therefore, the term "harass" has been removed from the ITS.

Table 7. Analysis of effects on Ibat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	Human activity and disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	Clearing of forested habitat, Human activity, and disturbance	alteration of summer roosting habitat, & staging/swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from roost trees or disturb hibernating bats. Mowing of herbaceous vegetation while bats are present in habitat is expected to have a direct effect on the quality, quantity, and timing of prey resources; however, the affect on bats foraging is considered insignificant due to the small area of impact within a bats ~2.5 mile home range.
New Disturbance - Construction	Clearing - trees and shrubs	Clearing of forested habitat, Human activity and disturbance	alteration of summer roosting habitat, & staging/swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, harm	breeding, sheltering	numbers, reproduction	LAA	Tree removal in known use summer habitat will limit roosting options or necessitate roost tree switching when Ibats return the following season. Because maternity roost trees are ephemeral, Ibats have evolved to relocate roosts at the beginning of the season if needed. Tree removal in unknown use spring staging/fall swarming habitat will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., fall swarming or spring emergence). Clearing trees around hibernacula will decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves or spending less time on social interactions, which could delay breeding. We expect the same effects on Ibats from tree removal in known use spring staging/fall swarming habitat as those described for unknown use spring staging/fall swarming habitat. AMMs - TOYR for tree clearing included on Table 4.7.1-6, page 4-264 of the FEIS (FERC 2017) will avoid direct impact from tree clearing. We do not anticipate impacts to bats when they are hibernating based on the protections Karst Mitigation Plan included in Appendix I of the FEIS (FERC 2017).
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	NLAA	AMMs avoid potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from roost trees.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, smoke	alteration of hibernating conditions, daytime arousal	smoke, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	The direct loss of bats from smoke caused by burning brush piles in summer is insignificant because the effects are difficult to detect and measure. Additionally, the majority of the project area is in suitable unoccupied summer habitat. AMMs will prevent smoke from entering hibernacula in the winter.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	Human activity	daytime arousal	human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from roost trees.
New Disturbance - Construction	Grading, erosion control devices	Alteration of water flow, Vegetation removal, Human activity	altered water flow & humidity in hibernacula	altered water flow	all life stages, all seasons	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from roost trees; AMMs prevent discharge of a significant amount of water into the recharge area of known hibernacula potentially flooding hibernating bats.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	Human activity, Ground disturbance, Instream and riparian disturbance, Temporary dewatering	decreased aquatic invertebrates, daytime arousal	instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs limit potential impacts to hibernacula by restricting blasting within 0.5 mile of hibernacula; ECS requirements limit loss of aquatic invertebrates so that any loss of Ibat forage is insignificant.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	Human activity	daytime arousal	human presence & noise	all life stages, spring-fall	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from roost trees.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	Withdrawal/discharge of water into aquatic habitats, Human activity	decreased aquatic invertebrates, daytime arousal	water alterations, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs prevent discharge of a significant amount of water into the recharge area of known hibernacula potentially flooding hibernating bats; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees, ECS requirements limit loss of aquatic invertebrates so that any loss of Ibat forage is insignificant.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	NLAA	AMMs avoid potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees.
New Disturbance - Construction	Compression Facility, noise	Noise disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees.
New Disturbance - Construction	Communication Facility - guy lines, noise, lights	Human activity and Facilities	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	Alteration of surface water flow, Vegetation removal, Human activity	altered water flow & humidity in hibernacula, alteration of summer roosting habitat, & spring staging/fall swarming habitat, daytime arousal	removal of forested habitat, altered surface water flow into hibernacula, human presence	all life stages	kill, harm	breeding, sheltering	numbers, reproduction	NLAA	AMMs limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human presence	all life stages	NA	NA	NA	NLAA	The small area and level of impact from these activities on forested habitat is not expected to have noticeable or measurable impacts on Ibats or their habitat.

Table 7. Analysis of effects on Ibat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent- tree trimming and tree removal	Clearing of forested habitat, Human activity and disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, harm	breeding, sheltering	numbers, reproduction	LAA	We anticipate effects will be greatest to pregnant females that expend additional energy to seek alternate travel corridors as a result of tree clearing. If pregnant females dramatically alter their travel corridor they will divert their energetic demands to seek new corridors and will likely give birth to smaller pups, which could decrease pup survival. Tree removal may fragment the habitat such that Ibats traveling through the area will be more vulnerable to predation, resulting in injury or death. Tree removal in known use summer habitat will limit roosting options or necessitate roost tree switching when Ibats return the following season. Because maternity roost trees are ephemeral, Ibats have evolved to relocate roosts at the beginning of the season if needed. Tree removal in unknown use spring staging/fall swarming habitat will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., fall swarming or spring emergence). Clearing trees around hibernacula will decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves or spending less time on social interactions, which could delay breeding. We expect the same effects on Ibats from tree removal in known use spring staging/fall swarming habitat as those described for unknown use spring staging/fall swarming habitat. AMMs - TOYR for tree clearing included on Table 4.7.1-6, page 4-264 of the FEIS (FERC 2017) will avoid direct impact from tree clearing. We do not anticipate impacts to bats when they are hibernating based on the protections Karst Mitigation Plan included in Appendix I of the FEIS (FERC 2017).
New Disturbance - Construction	Stream Crossings, wet open cut ditch	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will limit blasting activity so that karst features will not be altered or destroyed; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Stream Crossings, flume	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit blasting activity so that karst features will not be altered or destroyed; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Stream Crossings, dam & pump	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit blasting activity so that karst features will not be altered or destroyed; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Stream Crossings, cofferdam	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	Alteration of surface water flow, Vegetation removal, Human activity, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream drilling fluids, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Stream Crossings, conventional bore	Alteration of surface water flow, Vegetation removal, Human activity, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream drilling fluids, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Stream Crossings, direct pipe	Alteration of surface water flow, Vegetation removal, Human activity, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream drilling fluids, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Stream Equipment Crossing Structures	Human activity, Instream and riparian disturbance	increased daytime arousal, decreased aquatic invertebrates	instream sedimentation & changes in water flow, human presence & noise	all life stages	NA	NA	NA	NLAA	It is extremely unlikely that this activity would result in a modification to recharge areas of cave streams and other karst features that are hydrologically connected to known hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to stream biota would be temporary and limited in localized and not expected to cause any noticeable decrease in Ibat foraging.

Table 7. Analysis of effects on Ibat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	Clearing of forested habitat, Human activity and disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, harm	breeding, sheltering	numbers, reproduction	LAA	We anticipate effects will be greatest to pregnant females that expend additional energy to seek alternate travel corridors as a result of tree clearing. If pregnant females dramatically alter their travel corridor they will divert their energetic demands to seek new corridors and will likely give birth to smaller pups, which could decrease pup survival. Tree removal may fragment the habitat such that Ibats traveling through the area will be more vulnerable to predation, resulting in injury or death. Tree removal in known use summer habitat will limit roosting options or necessitate roost tree switching when Ibats return the following season. Because maternity roost trees are ephemeral, Ibats have evolved to relocate roosts at the beginning of the season if needed. Tree removal in unknown use spring staging/fall swarming habitat will remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., fall swarming or spring emergence). Clearing trees around hibernacula will decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves or spending less time on social interactions, which could delay breeding. We expect the same effects on Ibats from tree removal in known use spring staging/fall swarming habitat as those described for unknown use spring staging/fall swarming habitat. AMMs - TOYR for tree clearing included on Table 4.7.1-6, page 4-264 of the FEIS (FERC 2017) will avoid direct impact from tree clearing. We do not anticipate impacts to bats when they are hibernating based on the protections Karst Mitigation Plan included in Appendix I of the FEIS (FERC 2017).
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	unlikely	kill, harm	breeding, sheltering	numbers, reproduction	NLAA	AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; Noise and activity levels are anticipated to be so low as to not cause bats to flush from adjacent roost trees or hibernacula; Although some roosting habitat may be taken during side trimming during the winter, we do not expect indirect effects to occur because the majority of the tree and therefore roosting habitat will not be removed. Thus, the effects are insignificant.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	Alteration of surface water flow, Vegetation removal, Human activity, Wetland disturbance	flooding hibernacula, decreased aquatic invertebrates, alteration of spring staging/fall swarming habitat, daytime arousal	removal of wetland vegetation, water disruption, alteration of water or air flow in/out of hibernacula, human presence & noise	all life stages, all seasons	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to wetland biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	Human activity	daytime arousal	human presence & noise	all life stages, spring-fall	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	Alteration of surface water flow, Vegetation removal, Human activity, Wetland disturbance	flooding hibernacula, decreased aquatic invertebrates, alteration of spring staging/fall swarming habitat, daytime arousal	removal of wetland vegetation, water disruption, drilling fluids in wetland, increased water flow into hibernacula, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to wetland biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	Alteration of surface water flow, Vegetation removal, Human activity, Wetland disturbance	flooding hibernacula, decreased aquatic invertebrates, alteration of spring staging/fall swarming habitat, daytime arousal	removal of wetland vegetation, water disruption, drilling fluids in wetland, increased water flow into hibernacula, human presence & noise	all life stages	NA	NA	NA	NLAA	AMMs will limit potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees; impacts to wetland biota would be temporary and limited & localized and not expected to cause any noticeable decrease in Ibat foraging.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	Increased human activity and disturbance	increased daytime arousal	human presence	all life stages, (not hibernation)	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees, nor would it impact foraging bats or bats using travel corridors; NOTE vehicle impacts for all O&M subactivities are evaluated here (i.e., vehicle impacts will not be considered under the remaining O&M subactivities).
Operation & Maintenance	Vegetation Management - mowing	Loss or alteration of forested habitat, Increased human activity and disturbance	decreased foraging & travel efficiency, increased predation	alteration of spring-summer-fall travel corridors, vegetation removal	all life stages, (not hibernation)	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees, nor would it impact foraging bats or bats using travel corridors.
Operation & Maintenance	Vegetation Management - chainsaw and tree clearing	Loss or alteration of forested habitat	alteration of travel corridors, summer roosting/foraging habitat, & spring staging/fall swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	all life stages, (not hibernation)	Kill, harm	breeding, sheltering	numbers, reproduction	LAA	We anticipate effects will be greatest to pregnant females that expend additional energy to seek alternate travel corridors as a result of tree clearing. If pregnant females dramatically alter their travel corridor they will divert their energetic demands to seek new corridors and will likely give birth to smaller pups, which could decrease pup survival. Tree removal may fragment the habitat such that Ibats traveling through the area will be more vulnerable to predation, resulting in injury or death. Tree removal in known use summer habitat may limit roosting options or necessitate roost tree switching when Ibats return the following season. Because maternity roost trees are ephemeral, Ibats have evolved to relocate roosts at the beginning of the season if needed. Tree removal in unknown use spring staging/fall swarming habitat may remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., fall swarming or spring emergence). Clearing trees around hibernacula will decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves or spending less time on social interactions, which could delay breeding. We expect the same effects on Ibats from tree removal in known use spring staging/fall swarming habitat as those described for unknown use spring staging/fall swarming habitat. AMMs - TOYR for tree clearing included on Table 4.7.1-6, page 4-264 of the FEIS (FERC 2017) will avoid direct impact from tree clearing. We do not anticipate impacts to bats when they are hibernating based on the protections Karst Mitigation Plan included in Appendix I of the FEIS (FERC 2017).

Table 7. Analysis of effects on Ibat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure (Resource Affected)	Range of Response[1]	Conservation Need Affected	Demographic Consequences	NE, NLAA, or LAA	Comments
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	Chemical contamination, Vegetation loss	lethal or sublethal exposure to toxins alteration of travel corridors, summer roosting/foraging habitat, & spring staging/fall swarming habitat	contamination of water & vegetation, loss of herbaceous vegetation	unlikely	NA	NA	NA	NLAA	Implementation of AMMs makes potential impacts to hibernating bats extremely unlikely to occur; the amount of area to be treated that could be Ibat roosting, foraging, or travelling habitat is very small, making potential exposure extremely unlikely to occur. Aerial spraying would not be utilized for invasive species control along the ROW.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, spring-fall	NA	NA	NA	NLAA	AMMs avoid potential impacts to hibernacula; noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, Smoke disturbance	smoke inhalation during hibernation, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	smoke in hibernacula or roosting habitat	all life stages, all seasons	NA	NA	NA	NLAA	The harm and resultant flushing of bats from smoke caused by burning brush piles in summer is insignificant because the effects are difficult to detect and measure; AMMs will prevent smoke from entering hibernacula in the winter.
Operation & Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	unlikely	harm	breeding, sheltering	numbers, reproduction	NLAA	AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; Noise and activity levels are anticipated to be so low as to not cause bats to flush from adjacent roost trees or hibernacula; Although some roosting habitat may be taken during side trimming during the winter, we do not expect indirect effects to occur because the majority of the tree and therefore roosting habitat will not be removed. Thus, the effects are insignificant.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on Ibat or their habitat; ROW repairs occur in areas of soil erosion where roost trees are unlikely to occur.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on Ibat or their habitat; ROW repairs occur in areas of soil erosion where roost trees are unlikely to occur.
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on Ibat or their habitat.
Operation & Maintenance	Access Road Maintenance - grading, graveling	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	harm	breeding, sheltering	numbers, reproduction	NLAA	AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; Noise and activity levels are anticipated to be so low as to not cause bats to flush from adjacent roost trees or hibernacula; Although some roosting habitat may be taken during side trimming during the winter, we do not expect indirect effects to occur because the majority of the tree and therefore roosting habitat will not be removed. Thus, the effects are insignificant.
Operation & Maintenance	Access Road Maintenance - culvert replacement	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	all life stages	NA	NA	NA	NLAA	The small area and level of impact from these activities is not expected to have noticeable or measurable impacts on Ibat or their habitat.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human presence	all life stages	kill, harm	breeding, sheltering	numbers, reproduction	LAA	We anticipate effects will be greatest to pregnant females that expend additional energy to seek alternate travel corridors as a result of tree clearing. If pregnant females dramatically alter their travel corridor they will divert their energetic demands to seek new corridors and will likely give birth to smaller pups, which could decrease pup survival. Tree removal may fragment the habitat such that Ibats traveling through the area will be more vulnerable to predation, resulting in injury or death. Tree removal in known use summer habitat may limit roosting options or necessitate roost tree switching when Ibats return the following season. Because maternity roost trees are ephemeral, Ibats have evolved to relocate roosts at the beginning of the season if needed. Tree removal in unknown use spring staging/fall swarming habitat may remove foraging and roosting areas for a concentrated number of Ibats in an abbreviated season (i.e., fall swarming or spring emergence). Clearing trees around hibernacula will decrease foraging and roosting habitat, requiring bats to spend more time searching for food, which could result in bats entering hibernation with less fat reserves or spending less time on social interactions, which could delay breeding. We expect the same effects on Ibats from tree removal in known use spring staging/fall swarming habitat as those described for unknown use spring staging/fall swarming habitat. AMMs - TOYR for tree clearing included on Table 4.7.1-6, page 4-264 of the FEIS (FERC 2017) will avoid direct impact from tree clearing. We do not anticipate impacts to bats when they are hibernating based on the protections Karst Mitigation Plan included in Appendix I of the FEIS (FERC 2017).
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	Human disturbance	increased daytime arousal	human presence	all life stages	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees, nor would it impact foraging bats or bats using travel corridors.
Operation & Maintenance	Inspection Activities - ground and aerial	Human activity and Disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	NLAA	Noise created from this activity is anticipated to be insignificant and would not result in the flushing of bats from adjacent roost trees

[1]The Service has determined that expected take impacts to the species addressed in this ITS properly fall within the definition of "harm" rather than "harass;" therefore, the term "harass" has been removed from the ITS.

Table 8. Analysis of effects on Northern long-eared bat.

Pipeline Activity	Subactivity	Environmental Impact or Threat	Stressor	Stressor Pathway (optional)	Exposure	Range of	Conservation	Demographic	NE, NLAA,	Comments
New Disturbance - Construction	Vehicle Operation and Foot Traffic	Human activity and disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Clearing - herbaceous vegetation and ground cover	Clearing of forested habitat, Human activity, and disturbance	alteration of summer roosting habitat, & staging/swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Clearing - trees and shrubs	clearing of forested habitat; human activity & disturbance	alteration of summer roosting habitat, & staging/swarming habitat; daytime arousal	vegetation removal; human presence	all life stages; spring-fall	kill, harm	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within ¼-mile of a known hibernacula and take is not exempt by the 4(d) rule. Approximately 0.52 acres of forest clearing will occur along an existing access road. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; noise created from this activity is covered by the 4d rule. The flushing of bats from roost trees as they are being cut during daylight hours would increase the likelihood that the bats would become prey for predators.
New Disturbance - Construction	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Vegetation Clearing - tree side trimming by bucket truck or helicopter	human activity	daytime arousal	human presence & noise	all life stages; all seasons	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Grading, erosion control devices	alteration of water flow; vegetation removal; human activity	altered water flow & humidity in hibernacula	altered water flow	all life stages; all seasons	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Trenching (digging, blasting, dewatering, open trench, sedimentation)	human activity; ground disturbance; instream & riparian disturbance; temporary dewatering	decreased aquatic invertebrates; daytime arousal	instream sedimentation & water flow disruption; human presence & noise	all life stages; all seasons	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Pipe Stringing - bending, welding, coating, padding and backfilling	human activity	daytime arousal	human presence & noise	all life stages; spring-fall	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Hydrostatic Testing (water withdrawal and discharge)	withdrawal/discharge of water into aquatic habitats; human activity	decreased aquatic invertebrates; daytime arousal	water alterations; human presence & noise	all life stages; all seasons	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Regrading and Stabilization - restoration of corridor	human activity & disturbance; obstructed cave entrances or vents	loss or alteration of hibernation conditions; daytime arousal	alteration of water or air flow in/out of caves; human presence	all life stages; all seasons	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Compression Facility, noise	noise disturbance	daytime arousal	human presence	all life stages; spring-fall	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Communication Facility - guy lines, noise, lights	human activity and facilities	daytime arousal	human presence	all life stages; spring-fall	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - grading, graveling	alteration of surface water flow; vegetation removal; human activity	altered water flow & humidity in hibernacula; alteration of summer roosting habitat, & staging/swarming habitat; daytime arousal	removal of forested habitat; altered surface water flow into caves; human presence	all life stages;	kill, harm	breeding, sheltering	numbers, reproduction	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent - culvert installation	tree removal; loss or alteration of forested habitat; human disturbance	alteration of summer roosting habitat, & staging/swarming habitat; increased daytime arousal	vegetation removal; human presence	all life stages	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Access Roads - upgrading existing roads, new roads temp and permanent- tree trimming and tree removal	Clearing of forested habitat, Human activity and disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, harm	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within ¼-mile of a known hibernacula and take is not exempt by the 4(d) rule. Approximately 0.52 acres of forest clearing will occur along an existing access road. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; noise created from this activity is covered by the 4d rule. The flushing of bats from roost trees as they are being cut during daylight hours would increase the likelihood that the bats would become prey for predators.
New Disturbance - Construction	Stream Crossings, wet open cut ditch	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages, all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Crossings, flume	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Crossings, dam & pump	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Crossings, cofferdam	Tree removal, Loss or alteration of forested habitat, Human disturbance, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream sedimentation & water flow disruption, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Crossings, Horizontal Directional Drill (HDD)	Alteration of surface water flow, Vegetation removal, Human activity, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream drilling fluids, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Crossings, conventional bore	Alteration of surface water flow, Vegetation removal, Human activity, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream drilling fluids, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.

New Disturbance - Construction	Stream Crossings, direct pipe	Alteration of surface water flow, Vegetation removal, Human activity, Instream and riparian disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal, decreased aquatic invertebrates	vegetation removal, instream drilling fluids, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Stream Equipment Crossing Structures	Human activity, Instream and riparian disturbance	increased daytime arousal, decreased aquatic invertebrates	instream sedimentation & changes in water flow, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - clearing	Clearing of forested habitat, Human activity and disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, daytime arousal	vegetation removal, human presence	all life stages, spring-fall	kill, harm	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within ¼-mile of a known hibernacula and take is not exempt by the 4(d) rule. Approximately 0.52 acres of forest clearing will occur along an existing access road. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; noise created from this activity is covered by the 4d rule. The flushing of bats from roost trees as they are being cut during daylight hours would increase the likelihood that the bats would become prey for predators.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - tree side trimming	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	unlikely	kill, harm	breeding, sheltering	numbers, reproduction	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - grading, trenching, regrading	alteration of surface water flow; vegetation removal; human activity; wetland disturbance	flooding hibernacula; decreased aquatic invertebrates; alteration of staging/swarming habitat; daytime arousal	removal of wetland vegetation; water disruption; alteration of water or air flow in/out of caves; human presence & noise	all life stages; all seasons	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - pipe stringing	human activity	daytime arousal	human presence & noise	all life stages; spring-fall	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - HDD	Alteration of surface water flow, Vegetation removal, Human activity, Wetland disturbance	flooding hibernacula, decreased aquatic invertebrates, alteration of spring staging/fall swarming habitat, daytime arousal	removal of wetland vegetation, water disruption, drilling fluids in wetland, increased water flow into hibernacula, human presence & noise	all life stages	none expected	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
New Disturbance - Construction	Crossings, wetlands and other water bodies (non-riparian) - conventional bore	Alteration of surface water flow, Vegetation removal, Human activity, Wetland disturbance	flooding hibernacula, decreased aquatic invertebrates, alteration of spring staging/fall swarming habitat, daytime arousal	removal of wetland vegetation, water disruption, drilling fluids in wetland, increased water flow into hibernacula, human presence & noise	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Facilities - vehicles, foot traffic, noise, communication facilities	Increased human activity and disturbance	increased daytime arousal	human presence	all life stages, (not hibernation)	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Management - mowing	Loss or alteration of forested habitat, Increased human activity and disturbance	decreased foraging & travel efficiency, increased predation	alteration of spring- summer-fall travel corridors, vegetation removal	all life stages, (not hibernation)	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Management - chainsaw and tree clearing	Loss or alteration of forested habitat	alteration of travel corridors, summer roosting/foraging habitat, & staging/swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	all life stages, (not hibernation)	kill, harm	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within ¼-mile of a known hibernacula and take is not exempt by the 4(d) rule. Approximately 0.52 acres of forest clearing will occur along an existing access road. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; noise created from this activity is covered by the 4d rule. The flushing of bats from roost trees as they are being cut during daylight hours would increase the likelihood that the bats would become prey for predators.
Operation & Maintenance	Vegetation Management - herbicides - hand, vehicle mounted, aerial applications	Chemical contamination, Vegetation loss	lethal or sublethal exposure to toxins alteration of travel corridors, summer roosting/foraging habitat, & spring staging/fall swarming habitat	contamination of water & vegetation, loss of herbaceous vegetation	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Disposal (upland) - dragging, chipping, hauling, piling, stacking	Human activity and disturbance, Obstructed hibernacula entrances or vents	loss or alteration of hibernation conditions, hibernacula no longer suitable, daytime arousal	alteration of water or air flow in/out of hibernacula, human presence	all life stages, spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Disposal (upland) - brush pile burning	Human activity and disturbance, Smoke disturbance	smoke inhalation during hibernation, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	smoke in hibernacula or roosting habitat	all life stages, all seasons	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Vegetation Management - tree side trimming by bucket truck or helicopter	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting/foraging habitat, & spring staging/fall swarming habitat, increased arousal, daytime disturbance, roost abandonment, increased predation due to daytime activity	vegetation removal, human disturbance	unlikely	harm	breeding, sheltering	numbers, reproduction	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	ROW repair, regrading, revegetation (upland) - hand, mechanical	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	ROW repair, regrading, revegetation (wetland) - hand, mechanical	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	ROW repair, regrading, revegetation - instream stabilization and/or fill	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Access Road Maintenance - grading, graveling	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	unlikely	harm	breeding, sheltering	numbers, reproduction	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.

Operation & Maintenance	Access Road Maintenance - culvert replacement	Tree removal, Loss or alteration of forested habitat, Human disturbance	alteration of summer roosting habitat, & spring staging/fall swarming habitat, increased daytime arousal	vegetation removal, human disturbance	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - Off ROW Clearing	tree removal; loss or alteration of forested habitat; human disturbance	alteration of summer roosting habitat, & staging/swarming habitat; increased daytime arousal	vegetation removal; human presence	all life stages	kill, harm	breeding, sheltering	numbers, reproduction	LAA	Effects from this activity will occur within ¼-mile of a known hibernacula and take is not exempt by the 4(d) rule. Approximately 0.52 acres of forest clearing will occur along an existing access road. AMMs minimize potential effects; vegetation alterations to travel corridors and foraging habitat should be extremely small; noise created from this activity is covered by the 4d rule. The flushing of bats from roost trees as they are being cut during daylight hours would increase the likelihood that the bats would become prey for predators.
Operation & Maintenance	General Appurtenance and Cathodic Protection Construction - trenching, anode, bell hole	Human disturbance	increased daytime arousal	human presence	all life stages	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.
Operation & Maintenance	Inspection Activities - ground and aerial	Human activity and Disturbance	daytime arousal	human presence	all life stages, spring-fall	NA	NA	NA	MA	These effects have been previously addressed in the Service's programmatic biological opinion implementing the final 4(d) rule dated January 5, 2016.

The Service has determined that expected take impacts to the species addressed in this ITS properly fall within the definition of "harm" rather than "harass;" therefore, the term "harass" has been removed from the ITS.