ENVIRONMENTAL ASSESSEMENT

GATHRIGHT DAM LOW FLOW AUGMENTATION PROJECT ALLEGHANY COUNTY, VIRGINIA

Norfolk District
803 Front Street
Norfolk, VA 23510-1096
December 2012

US Army Corps of Engineers ®

ENVIRONMENTAL ASSESSMENT
FOR THE
GATHRIGHT DAM LOW FLOW AUGMENTATION PROJECT
ALLEGHANY COUNTY, VIRGINIA

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ENVIRONMENTAL ASSESSMENT
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1 PROJECT PURPOSE AND NEED

1.1 PROJECT AUTHORITY

As authorized by the Flood Control Act of 1946, the Norfolk District has the responsibility to maintain the Gathright Dam as a multipurpose project. It is regulated to reduce flood damages at downstream locations, to augment natural flows during periods of low flow, and to provide the opportunity for water-based recreation. An additional purpose of regulation, although not a Congressionally-authorized purpose, is the creation of a habitat downstream suitable for maintaining a trout fishery.

This Environmental Assessment (EA) has been developed to insure compliance with the National Environmental Policy Act of 1969 (NEPA) and in accordance with U.S. Corps of Engineers (USACE) regulation, ER 1110-2-240 entitled “Water Control Management”. Paragraph 6.b. allows for necessary actions to be taken to keep the approved water control plans up-to-date. The current effort is confined solely to the low flow augmentation releases and utilizes the existing authorized conservation storage allocation.

1.2 PROJECT LOCATION

As shown on Plate 1, the study area is located in the western part of Virginia and includes Lake Moomaw and the 43.4 mile section of the Jackson River that runs from Gathright Dam to the confluence with the Cowpasture River. Lake Moomaw is created by Gathright Dam, which backs up 12 miles of the Jackson River to form the body of the lake extending into both Alleghany and Bath Counties. The Jackson River, below Gathright Dam, runs through open countryside and the urbanized areas of Covington, approximately 19 miles downstream of the dam, and Clifton Forge. This section of the river is located in Alleghany County. The Jackson River converges with the Cowpasture River to form the James River in Botetourt County.

Gathright Dam is a multipurpose project, authorized by the Flood Control Act of 1946. The project became fully operationally in April 1982, when filling of the reservoir was completed. The structure is a rolled, rockfill embankment 1,172 ft in length, with a maximum height of 257 ft and a top width and elevation of 32 ft and 1,684.5 ft, respectively. The outlet works consist of a 1,075-foot-long tunnel with an inside diameter of 17.5 ft that discharges into a stilling basin 60 ft wide and 144 ft long. A 272-foot-high intake tower is located at the upstream end of the tunnel. The intake tower has two main sluice passages for releasing water from storage after a flood. Each passage is 8 feet wide and 17.5 ft high with flow in each controlled by hydraulically-operated slide gates in tandem. Plate 2 is a schematic diagram showing storage allocations for flood control and conservation (low flow augmentation), flood pool surcharge (dam safety) and inactive storage.

The intake tower has 10 water quality ports located at 9 levels that allow mixing of water from different levels of the lake. The gates are 5 ft high and 3 ft wide. The two vertical wet wells converge into a common vertical passage that then curves downstream into a water quality control outlet between the two sluice gate passages. This outlet is controlled by 2 hydraulically-operated vertical gates in tandem, each 3 ft wide and 5.5 ft high. An ungated emergency spillway consisting of a chute about 2,450 ft long with a bottom width and elevation of 100 ft and 1,667.5 ft, respectively, is located approximately 2 miles south of the embankment.

Public lake access facilities are operated by the U.S. Forest Service and consist of public recreation areas with swimming, picnicking, and camping facilities, boat launching ramps, and scenic overlooks. All facilities are based upon a maximum conservation pool at elevation 1,582 and the minimum conservation pool at elevation 1,554. Whenever possible, elevation 1,582 is maintained, but it must be recognized that the operation of the Gathright multiple-purpose project requires significant drawdown of the conservation pool on an almost annual basis beginning in June and recovering by March of the following year. The average depth of the reservoir is 80 ft, with a maximum depth of 150 ft near the dam.

1.3 PROJECT NEED OR OPPORTUNITY

1.3.1 IMPAIRED BENTHIC COMMUNITIES

Benthic monitoring accomplished prior to and during this assessment indicates impaired benthic communities, characterized by reduced levels of biological diversity, exist in the Jackson River from the Mead Westvaco plant at river mile (RM) 24.21 to the confluence with the Cowpasture River. The impaired benthic community is dominated by invertebrate taxa that are tolerant to low dissolved oxygen (DO) conditions and high levels of organic pollutants. The Virginia Department of Environmental Quality (VDEQ) has studied many elements of water quality in order to determine the cause of the benthic impairment in the Jackson River. The study singled out episodes of low DO in the water column and excess periphyton as the most probable causes of the impairment.

1.3.2 REDUCED DISSOLVED OXYGEN LEVELS

The stretch of the Jackson River from RM 24.21 to RM 13.00 (11.21 miles) has been determined by the VDEQ to be impaired due to low DO concentration in the water column. Data obtained from VDEQ monitoring stations positioned within this section of the Jackson River indicate multiple violations of the minimum DO standard (4.0 mg/L).

Episodes of low DO may be attributed to two different causes. First, periods of low flow have been correlated with incidents of low DO concentrations. Second, excessive periphyton growth can contribute to low DO concentrations. Nuisance periphyton cause large diurnal oxygen swings in which DO concentrations peak during daylight hours and fall to extremely low levels in the evening when aquatic plants stop producing oxygen, but the decomposition process continues.

1.3.3 EXCESSIVE PERIPHYTON GROWTH

Excess periphyton growth, especially during the summer months, is the stressor that is causing the benthic impairment observed in the section of the Jackson River the runs from RM

23.61 to the confluence with the Cowpasture River. By covering all available surfaces, including the interstitial spaces between rocks and cobble, nuisance periphyton blooms reduce suitable benthic habitat for other biota. Periphyton also alters natural species composition by providing a food source for organisms that feed on algae (scrapers) and suspended detritus (collector-filterers).

Immediately downstream of the Gathright Dam, environmental conditions are negatively affected by the presences of a nuisance species of non-toxic, non-native diatom, known as didymo (*Didymosphenia geminate)* during the summer months. The diatom grows in long stalks and can cover the entire river bottom, interfering with recreational fishing by entangling gear and making a river generally unappealing to visitors. The growth of didymo near the dam is not due to excessive concentrations of dissolved nutrients, as is the case further downstream. Instead, the conditions found in the tail water of Gathright Dam (i.e. cold, clear and shallow water), which are optimal for the growth of didymo, are produced by the management of flows from the Gathright Dam.

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1.4 AGENCY GOAL OR OBJECTIVE

The ultimate goal of this EA is to address the problems, needs, and opportunities concerning restoration of the aquatic environment of the Jackson River below Gathright Dam which could be influenced by modifications and/or changes in operations of the dam.

A number of general and specific planning objectives have been established to assist in the development and evaluation of the alternatives that will be assessed. The pursuit and attainment of this objective must be consistent with national legal statutes, applicable executive orders, and other Federal planning requirements. The following general objectives have been identified.

- Meet the specified needs and concerns of the general public;
- Respond to expressed public desires and preferences;
- Be flexible to accommodate changing economic, social, and environmental patterns and changing technologies;
- Integrate with, and be complementary to, other related programs in the study area; and
- Be implementable with respect to the financial and institutional capabilities, as well as public support.

The following specific objectives have been identified.

- Reduce periphyton as measured;
- Increase diversity of macroinvertebrates; and
- Improve biological communities in the Jackson River downstream of Gathright Dam (through scientific measurements of macroinvertebrate populations).

1.5 RELATED ENVIRONMENTAL DOCUMENTS

Table 1 summarizes pertinent reports and design memoranda (DM) that have been conducted in connection with the Gathright Dam and Lake Moomaw project.

Table 1. PRIOR REPORTS

CORPS REPORTS

Description		Date
HD 207/80/1: Survey Report Recommending Authorization of Gathright –Falling Spring Project		1953
DM 1:	Hydrology (Preliminary)	Mar 1953
DM lA:	Hydrology	Jun 1965
DM lA:	Hydrology (Supplement)	May 1967
DM 2:	Site Selection and Alternative Projects (Preliminary)	Aug 1953
DM 3:	Review of Deferred for Restudy Classification	Mar 1964
DM 4:	Project Selection	Jul 1965
DM 5:	Preliminary Master Plan	Jan 1966
DM 6:	Real Estate (Revised)	Aug 1969
DM 6A:	Real Estate (Supplement)	Feb 1967
DM 6B:	Real Estate (Supplement)	Mar 1967
DM 6C:	Real Estate (Supplement)	May 1968
DM 6D:	Real Estate (Supplement)	Aug 1969
DM 6E:	Real Estate (Supplement)	Apr 1973
DM 7:	General Design	Apr 1967
DM 8:	Outlet Works & Administration Building	Mar 1968
DM 9:	Concrete Materials	Aug 1966
DM 10:	Access Road	Oct 1968
DM 11:	Geology and Foundation	Jul 1969
DM 11:	Geology and Foundation (Supplement)	Feb 1976
DM 12:	Embankment and Spillway	Sep 1969
DM 12:	Embankment and Spillway (Revision)	Aug 1974
DM 13:	Shop, Maintenance, and Residential Area	Jan 1971
DM 14:	Master Plan	Jun 1970
DM 15A:	Relocation - Utilities	Feb 1971
DM 15B:	Relocation - Roads	Sep 1971
DM 15B:	Relocation - Roads (Revision)	Feb 1978
DM 15C:	Relocation - Cemeteries	Feb 1974
DM 16:	Clearing	Sep 1970
DM 17:	Instrumentation	Nov 1970
DM 18:	Sedimentation Ranges and Investigations	May 1970
DM 19:	Hydrologic Data Collection (Preliminary)	May 1971
DM 19:	Hydrologic Data Collection	Jul 1974
Review Report on James River, Virginia		Jan 1962
Report on Alternative Plans of Improvement		Aug 1965
James River Basin Water Resources Study		Dec 1975
Intake Tower Operation and Maintenance Manual		Jan 1979
National Hydroelectric Power Resources Study (23 Vols)		1981 - 1983
Gathright Dam and Lake Moomaw Final Regulation Manual		Aug 1984
Section 216 Study Reconnaissance Report Gathright Dam and		

Lake Moomaw, Virginia Hydropower and Water Supply	Mar 1987
Reconnaissance Report Upper James River Basin, Virginia and West Virginia, Flood Control Study	Apr 1992
Fish and Wildlife Restoration Reconnaissance Report, James River Basin, Virginia	Oct 1993
James River Drought Preparedness Study	Jul 1994
Section 216 Study Initial Appraisal Gathright Dam and Lake Moomaw, Virginia Low Flow Augmentation	Jun 2003
Dam Safety Plan, Gathright Dam and Lake Moomaw Project	Mar 2010

REPORTS BY OTHERS

Annual Report for the James River Basin Association

Virginia Department of Environmental Quality. 2010 Characterization of 2010 Base Flow and Pulse Flow Water Quality in the Jackson River Available at <http://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/jacksonpulse2010final.pdf>

Virginia Department of Environmental Quality. 2010. Benthic TMDL Development for the Jackson River, Virginia. Richmond, Virginia. VDEQ TMDL Study. Available at <http://www.deq.virginia.gov/portals/0/DEQ/Water/TMDL/apptmdls/jamesrvr/jackben.pdf>

Virginia Department of Environmental Quality. 2009. Quality Assurance Project Plan For Special Study of Jackson River Watershed in Support of Benthic Total Maximum Daily Load Implementation Plan Alleghany County and Covington City, VA (Waterbodies I04R and I09R). Richmond, Virginia.

Virginia Department of Environmental Quality. 2004. Virginia 2004 Water Quality Assessment 305(b)/303(d) Integrated Report.

Virginia Department of Environmental Quality. 2002. Virginia List of Impaired Waters. Virginia DEQ, 2002.

Virginia Department of Environmental Quality. 1996. Virginia Total Maximum Daily Load Priority and Report. Virginia DEQ, 1996.

1.6 DECISIONS TO BE MADE

This EA investigates the feasibility of restoring environmental resources over a 24.21mile segment of the Jackson River downstream of the Gathright Dam by utilizing a revised low flow augmentation release schedule from Gathright Dam and Lake Moomaw. Existing flow management on the Jackson River reduces peak flows during periods of high runoff and augments flows during times of normally lower flow. Potential benefits could include reduced periphyton growth, increased diversity in the river's benthic communities, improved benthic productivity, enhanced fisheries, and improved recreational opportunities downstream of the dam.

1.7 SCOPING AND ISSUES

The alternatives considered for this project had to fulfill environmental restoration goals, while also meeting a range of scoping criteria. The chosen alternative could not impact any of the authorized purposes of Gathright Dam, which are flood damage reduction, low flow augmentation and water based recreation. Recreation at Gathright Dam includes the cold water fisheries found in the lake and in the tailwater of the dam, the warm water fisheries located in the lake and below the city of Covington and recreational boating for both fishing and pleasure on Lake Moomaw. In addition, the amount of water storage behind the dam would have to remain sufficient to fulfill all required uses. The recommended alternatives could not have a negative effect on water withdrawers on the James and Jackson Rivers and also would not negatively affect the project area during periods of drought conditions.

2 ALTERNATIVES

2.1 ALTERNATIVES ELIMINATED FROM DETAILED EVALUATION

A number of alternatives were considered, but were ultimately rejected and will not be evaluated in detail. Each alternative considered during the planning process would result in environmental improvements to the Jackson River through operation of the Gathright Dam and modification of the low flow release schedule. The first of these alternatives consists of changing the structure of the Gathright Dam. In order to change the conditions downstream, modifications to the existing outlet structure would be made or a new outlet structure would be constructed. The newly configured outlet would allow water to be drawn from the dam differently than the current capability.

A number of nonstructural plans were investigated. Each of these plans would result in increased storage behind the dam, with the additional water be used to create pulsed releases. One option involved increasing pool elevation of reservoir. This plan would take away from the available flood control storage capacity of the dam. Modifying the existing storage allocation was also considered. The amount of Inactive Storage would be reduced in order to allow for pulsed releases.

Finally, combinations of structural and nonstructural options were considered. The non-structural alterations could be paired with modifications to the dam in order to facilitate the release of water.

These alternatives would provide the environmental benefits but were eliminated from consideration because each would have resulted in significant study cost increases (reallocation analyses, flood control benefits foregone, dam safety investigations) and would have resulted in implementation/construction costs without significant habitat improvement over the Preferred Alternative (PA), which has no associated implementation costs.

2.2 PREFERRED ALTERNATIVE

The PA consists of modifying the low flow augmentation of Gathright Dam utilizing the existing authorized conservation storage through a balancing of monthly low flow augmentation flow reductions in order to allow a series of pulse releases. This alternative is preferred because the plan will result in aquatic habitat improvements, and at the same time will require the least change to the operation or the dam, have relatively minor impacts on residents or visitors usage of the area and will have no implementation costs. In addition, the PA is consistent with the Commonwealth of Virginia's Total Maximum Daily Load (TMDL) plan for the Jackson River. This plan has been approved by US Environmental Protection Agency (USEPA) and is consistent with the Executive Order related to the restoration of the Chesapeake Bay (Executive Order 13508, 2009). Therefore, this alternative will be carried through an extensive environmental assessment.

Three variations of the PA were considered. The variations differ only by the size of the releases and by the amount the monthly low flow augmentation must be reduced in order to store enough water behind the dam to allow the pulsed flows (Table 2). The pulse releases considered were 3000 cubic feet per second (cfs), 3500 cfs and 4000 cfs, which are of a magnitude that mimic natural storm events, approximately equivalent to a natural flood that result in fluctuation of river level by 3 to 5 ft (Table 3).

Table 2. CHANGES TO LOW FLOW AUGMENTATION OF THE JACKSON RIVER RESULTING FROM IMPLEMENTATION OF THE PREFERRED ALTERNATIVE

	Low Flow Augmentation		
Alternatives	Flow Reduction	River Elevation Height Reduction (inches)	
Pulsed Releases (CFS)		Below Gathright Dam	Falling Springs
3000	9%	<1	<1
3500	11%	>1	<1
4000	13%	>1	<1

The first variant would store enough water in Lake Moomaw to allow a series of six pulses of 3,000 cfs each. The pulses will occur between the months of June and October. This plan would require a 9 percent reduction of the monthly low flow augmentation between the months of June and September. The change would result in lower water levels in the Jackson River of <1 inch immediately downstream of the Dam and at Falling Springs. The pool level in Lake Moomaw would be slightly higher (no more than 1 ft) for most of the summer recreation

season, due to the reduced low flow augmentation requirements. The pool would be at the same level under this alternative as the current water control plan on November 1st. Each pulse would produce conditions that emulate a natural flood event. The water level would rise >3.4 ft below the dam, <4.1 ft at Falling Spring and <2.8 ft in Covington. These conditions are expected to last between 8 to 13 hours at each point along the river. It is estimated that the elevation of the James River will also be effected by this plan. At Lick Run, a site located immediately downstream from the confluence of the Cowpasture and the Jackson Rivers, it is calculated that the river elevation will rise 2.3 ft. At Buchanan, 40 miles downstream of the confluence that forms the James River, it is expected that the elevation will rise 1.2 ft.

The second variation would allow six pulsed releases of 3500 cfs between the months of June and October. The low flow augmentation between June and September would be reduced by 11 percent to allow storage of water required for larger pulses. The change to the low flow augmentation would cause the river level to be reduced by slightly >1 inch below Gathright Dam and at Falling Spring. The pool level in Lake Moomaw would be slightly higher (no more than 1.3 ft) for most of the summer recreation season, due to the reduced low flow augmentation requirements. The pool would be reach the same level under this alternative as the current water control plan on November 1st. Water level increases during the pulses would be 3.7 ft below the dam, 4.4 ft at Falling Spring and 3.2 ft in Covington. On the James River, it is expected that river elevation will rise up to 2.7 ft at Lick Run and 1.7 ft at Buchanan.

The last variation would create pulsed releases of 4000 cfs. Similar to the previous two plans, six pulses would occur between the months of June and October. The plan would require a reduction of flow augmentation by 13 percent from the current level between June and October. Resulting reductions in the river level would be >1 inch immediately downstream of the dam and 2 inches at the town of Falling Spring. The pool level in Lake Moomaw would be slightly higher (no more than 1.6 ft) for most of the summer recreation season, due to the reduced low flow augmentation requirements. The pool would be at the same level under this alternative as the current water control plan on November 1st. Water level increases during the pulses would be 4.0 ft below the dam, 4.7 ft at Falling Spring and 3.6 ft in Covington. On the James River, it is expected that the river elevation will rise 3.1 ft at Lick Run and 2.2 ft at Buchanan.

Table 3. CHANGES TO THE JACKSON RIVER RESULTING FROM PULSED RELEASES

	Pulsed Releases		
Alternatives	River Height Increase (feet)		
Pulsed Releases (CFS)	Below Gathright Dam	Falling Spring	Covington
3000	>3.4	<4.1	<2.8
3500	<3.7	<4.4	<3.2
4000	<4.0	<4.7	<3.6

The PA was evaluated utilizing two engineering models, the WASP7.2 model and CE-QUAL-W2 model. The CE-QUAL-W2 model is a two-dimensional water quality and

hydrodynamic code. It was used to assess the potential impact of flow pulses on water temperature, DO, and water levels in Lake Moomaw. The water used to create the pulsed releases will come from blending water from the epilimnion and hypolimnion of Lake Moomaw using the multiport tower. The model was used to determine if the implementation of the PA would destabilize the thermal stratification and adversely affect the environmental conditions that support the warm water and coldwater fisheries in the lake. The second model, Water Quality Simulation Program (WASP7.2)**,** was used to assess the potential impact of flow pulses on the water quality in the tailwater of the Jackson River as well as in the Lower Jackson River.

Three variations of the PA are presented in this EA to allow the managers of the Gathright Dam facility the flexibility to adaptively manage the release schedule on an annual basis. The selection of a variation used in a particular year would be based upon past, current, and predicted hydrologic conditions and experience gained from the results achieved by previous years' regulation.

2.3 NO ACTION ALTERNATIVE

The No Action Alternative (NAA) describes the state of the project area if the proposed project is not pursued. In the absence of modifications to the Federal project at Gathright Dam, it is likely that conditions as they currently exist would continue into the foreseeable future. If the proposed project is not completed there will be no changes in the operations of Gathright Dam. The release schedule will remain unchanged, as will the conditions downstream of the dam and in Lake Moomaw. The recreational opportunities and the water conditions necessary to maintain both the warm and cold fisheries will remain consistent.

2.4 COMPARISON OF ALTERNATIVES

Table 4 summarizes the direct and indirect impacts that would result from the alternatives considered in this EA. See section 4.0 Environmental Effects for a more detailed discussion of impacts of alternatives.

Table 4: SUMMARY OF DIRECT AND INDIRECT IMPACTS

ENVIRONMENTAL FACTOR	PREFERRED ALTERNATIVE	NO ACTION ALTERNATIVE STATUS QUO
PROTECTED SPECIES	No negative impacts on protected species. Improvements to water and habitat quality may eventually allow the reintroduction of James Spinymussel.	No Impact
HARD GROUND	No Impact – The effects of this alternative will impact the area in the stream channel.	No Impact
SHORELINE EROSION	The preferred alternative will create conditions identical to minor flooding events and will have the same effect on the stream banks as a natural event.	No Impact
FISH AND WILDLIFE RESOURCES	Scouring of excess periphyton and fine sediment from the river bottom and improved water quality will lead to a more diverse aquatic community. Terrestrial resources will not be affected.	The low flow augmentation schedule will remain the same. However, other agencies and organizations are making changes that will improve water quality on this stretch of the river. These changes may positively impact aquatic flora and fauna.
VEGETATION	Pulsed releases will scour periphyton from the river bottom. Clearing of the river bottom may allow macrophyte colonization. The preferred alternative will not impact terrestrial vegetation.	Not changes to terrestrial or aquatic vegetation
WATER QUALITY	Improved water quality by eliminating the diurnal DO swings associated with excess periphyton. Decrease low flow augmentation which will lower “normal” water levels in the river.	As described above, the NAA will result in no changes in water quality; however water quality may improve due to other ongoing efforts.
HISTORIC PROPERTIES	No impact	No impact
RECREATION	Improve aquatic recreation by improving aquatic habitat. However, the alternative will not change the fish consumption impairment or the recreation impairment. Pulsed releases will cause a temporary (8-13 hours per pulse) interruption of recreational activities on the River. Lake Moomaw will have an increased level during the summer which will benefit recreational activities on the reservoir.	No Impact
AESTHETICS	Removal of excess periphyton will improve the aesthetic quality of the Jackson River.	No impact

ENVIRONMENTAL FACTOR	PREFERRED ALTERNATIVE	NO ACTION ALTERNATIVE STATUS QUO
NAVIGATION	There is no commercial navigation on the Jackson, however a 17 mile reach, is considered legally navigable and is open for recreation. An additional two miles, from the water treatment plant in Covington to City Park in Covington, are also considered legally navigable but is not recommended for recreation due to heavy industry. The project will improve boating through the elimination of nuisance periphyton.	No impact
ECONOMICS	No Impact	No Impact
AIR QUALITY	No Impact	No Impact
NOISE	No Impact	No Impact
HTRW	No Impact	No Impact

3.0 AFFECTED ENVIRONMENT

3.1 GENERAL ENVIRONMENTAL SETTING

3.1.1. PHYSIOGRAPHY AND TOPOGRAPHY

The project area is located in the Allegheny Mountain range, which is one of the two mountain ranges that make up the Ridge and Valley province of the Appalachian Mountains. Elevation in the region ranges from about 500 to 4,300 feet above mean sea level (MSL). The bedrock of the Alleghenies is mostly sandstone and metamorphosed sandstone, quartzite, which is extremely resistant to weathering. The rock layers of the Alleghenies were formed during the Alleghanian Orogeny, approximately 250 million years ago.

The majority of the project area falls within Alleghany County, which consists of a total land area of 444.5 square miles. Elevations found in the county range from 1,025 ft above MSL at the town of Iron Gate to 4,072 ft at Big Knob on Warm Spring Mountain in the northern section of the county. Slopes between 0 to 80 percent, often over 25 percent due to mountainous terrain, are present in Alleghany County. Due to the large amount of mountainous land, development and populations centers within Alleghany County are located in the relatively level valleys, especially along the Jackson River valley (Alleghany County Comprehensive Plan 2007).

3.1.2. CLIMATE

The Jackson River watershed is located in a very temperate region, with hot summers and cold winters. The prevailing winds of the area are from the southwest. The average temperature of Alleghany County is 55°F, with average July temperatures being 74°F and an average January temperature of 34°F (Alleghany County Comprehensive Plan 2007).

In the Jackson watershed, precipitation is well distributed throughout the year, with the wettest month of the year being typically May and the driest is usually February. Average precipitation in Alleghany County is between 36 and 38 inches per year including about 10 inches of snowfall (Alleghany County Comprehensive Plan 2007). In the Jackson River watershed as a whole average precipitation is about 41 inches per year, including approximately 25 inches of snowfall (USACE 2009). Most flood-producing storms in the Jackson watershed occur during the winter and spring. Snow normally melts within a few days of falling and is not generally a significant factor in causing or contributing to floods. Flooding does occur during the summer and fall due to intense local thunderstorms or from tropical disturbances moving into the area from the Gulf of Mexico or the Atlantic Coast.

3.1.3. GEOLOGY AND SOILS

The region's roughly parallel ridges and valleys are comprised of a variety of geologic materials, including limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Specifically at the site of Gathright Dam, the old Jackson River bed flows through the Lake Moomaw area in a wide valley of made up of shale. Western Virginia has not been glaciated and the rocky, patchy soils of the mountainous areas have formed in residual or colluvial material. The soils found in the Jackson River watershed tend to be thin (< 2 m) in depth and skeletal, with a large percentage of rock fragments. Slope position and orientation controls the depth of soil and the concentration of rock fragments in the soil. Near the dam, the old river bed turns abruptly to the east and flows for more than a mile through an anticlinal sandstone limestone ridge forming Kincaid Gorge. The soluble nature of limestone in the gorge area has resulted in typical limestone sinks along the crest of the ridge and springs located at the base of the mountain (USACE 2009). In the reservoir, the overburden soils are predominantly clays and silts resulting from the weathering of the limestones and shales typical of the area. Sandy soils occur to a much lesser extent (USACE 2009).

3 .1.4. HYDROLOGY

3.1.4.1 <u>Gathright Dam and Lake Moomaw Project Existing Conditions</u> - There are five authorized project purposes for the Gathright Dam and Lake Moomaw reservoir project (Gathright Dam). These are flood control, low flow augmentation, water based recreation, hydropower, and fish and wildlife. Hydropower, while authorized, has never been constructed. The remaining four authorized project purposes form the basis for the existing Water Control Plan for Gathright Dam, the document that outlines the operation of the dam. The fish and wildlife purpose is incorporated into in each of the other three project purposes.

Flood control operations involve the storage of flood waters during each high water event, thereby lowering downstream flood levels. Flood control storage is then releases without causing damaging flows downstream. There are 79,900 acre-ft (4.3 watershed inches) of flood control storage in Lake Moomaw between elevations 1582 and 1610 (Plate 2). Release of flood control storage is limited to a maximum rate of river rise of two feet per hour and a maximum discharge of 10,000 cfs in non-emergency situations.

The existing project was authorized for low flow augmentation for downstream water quality in the Flood Control Act of 1946. In 1965 the U.S. Public Health Service (predecessor to USEPA) determined that 60,747 Acre-ft of conservation storage was required based on natural stream temperatures, a DO content of 4 mg/l and Biological Oxygen Demand (BOD) loading at Covington. In 1968 the Federal Water Pollution Control Administration increased the objective DO content to 5 mg/l. The objective flows and the required storage computations to meet these specifications are shown Table 5, which shows the maximum, minimum and average reservoir levels in Lake Moomaw since the project began normal operations in April 1982. Water quality storage requirements would be capable of sustaining a continuous gross average

yield of 200 cfs from Gathright Reservoir (Lake Moomaw) with 95 percent assurance. It represents an average yearly flow augmentation of 84 cfs above the average 95 percent minimum flow at the dam site (USACE 1965).

Table 5. WATER QUALITY STORAGE REQUIREMENTS (a)

Month	Monthly average 20-year minimum flow, cfs	Flow Required cfs Total	Flow Required cfs Additional	Yield required from reservoir, acre-feet
Jan	140	158	18	1,110
Feb	240	168	--	--
Mar	505	171	--	--
Apr	335	194	--	--
May	205	231	26	1,600
Jun	140	269	129	7,700
Jul	90	283	193	11,900
Aug	80	278	198	12,200
Sep	70	245	175	10,800
Oct	75	188	113	6,970
Nov	80	161	81	4,840
Dec	100	158	58	3,580
Total				60,700

(a) Design Memorandum No. 1A, Hydrology, June 1965

Current low flow augmentation operations focus on providing a minimum flow on the Jackson River just upstream of the confluence of Dunlap Creek. These minimum flows vary on a monthly basis and are shown in Table 6.

In an average year, inflows drop below these required flows in June and conservation storage is utilized to provide the required flows. On average, conservation storage is utilized through November to provide the required flows after which the inflows increase and normally refill the conservation pool by March of the following year. The conservation pool in Lake Moomaw contains 60,747 acre-ft between elevations 1582 and 1554.

Water based recreation is provided on and around the 2,532 acre Lake Moomaw (at normal conservation pool, elevation 1582) and along the Jackson River downstream of the dam. Recreation facilities and the recreation mission were transferred to the US Forest Service prior to the beginning of normal operations at Gathright Dam.

Table 6. MONTHLY FLOWS REQUIRED AT COVINGTON FOR FLOW AUGMENTATION (a)

Month	Required Flow
Jan	158
Feb	168
Mar	171
Apr	194
May	231
Jun	269
Jul	283
Aug	278
Sep	245
Oct	188
Nov	161
Dec	158

(a) Above Dunlap Creek

An additional feature of the Gathright Dam project is the inclusion of a multi-level intake tower which allows cold water from the lake to be withdrawn and provide a year round cold-water fishery downstream of the project. This is accomplished by mixing the warmer waters of the reservoir located near the surface with colder waters from lower in the reservoir. The objective release water temperature is 60 degrees Fahrenheit. Generally, the mixing and regulation for water temperature begin in May/June and continue into November. Release temperature is continuously monitored at the tailwater gage, and water quality monitoring is accomplished on a bi-weekly basis from May through November, providing water quality profiles of the reservoir in five foot increments which are utilized in release operations and habitat monitoring.

3.1.4.2 Effect of Gathright Dam on Hydrology - The construction of Gathright Dam and its subsequent operation radically changed the natural stream hydrology of the Jackson River. These changes have affected both flood flows and periods of lower flows.

Project operations stores significant flood flows and then discharge the flood storage in a manner that minimizes downstream flooding. It is estimated that the operation of Gathright Dam during significant flood events in November 1985 and January 1996 resulted in the prevention of 71 and 59 million dollars of flood damages respectively in downstream areas.

The operation of Gathright Dam for low flow augmentation has also had a pronounced impact on the natural hydrology of the Jackson River. During a normal year, conservation storage is utilized to produce a steady monthly release beginning in June. While these low flow augmentation flows vary from month to month (high of 283 cfs in July to low of 158 cfs in December and January), the releases from Gathright Dam remain constant within a given month.

This regulation, along with water temperature regulation, has provided a steady and beneficial flow for the Jackson River allowing for improvements in water quality and the establishment of a cold-water trout fishery. However, this regulation plan significantly reduced the natural variability of the Jackson River by storing any excess inflow to the project until the conservation pool is refilled and minimizing any periods of naturally occurring low flow.

3.2 VEGETATION

Much of the project area falls within the limits of George Washington National Forest. This forest is a part of the Appalachian Hardwood Forest which is located within the Eastern Deciduous Forest Province. At one time the George Washington National Forest was heavily logged, but now it has been revegetated with second growth hardwoods and hemlocks. There are over 40 tree species represented in the National Forest and over 2,000 species of shrubs and herbaceous plants. Hardwood-dominated forest types comprise approximately 80 percent of the acreage and conifers comprise about 20 percent. Two plant species, the regal fritillary (*Speyeria idalia idalia*) and the Diana fritillary (*Speyeria diana*), found in the project area are Federal species of concern (VDGIF, 2011).

3.3 THREATENED AND ENDANGERED SPECIES

3.3.1 FEDERAL SPECIES

Fish and Wildlife Service lists six threatened and endangered species within Alleghany County, seven species for Bath County, and five in Botetourt County (USFWS 2011) Both the brown pelican (*Pelecanus occidentilis*) and Arctic peregrine falcon (*Falco peregrinus tundrius*) are listed as being in recovery status for all three counties; while the James spinymussel (*Pleurobema collina*) is listed as endangered in all three counties. The Northeastern bulrush (*Scirpus ancistrochaetus*) and Shale barren rock-cress (*Arabis serotina*) are endangered in Bath County and Alleghany County, and the smooth coneflower (*Echinacea laevigata*) is listed as endangered in both Bath and Botetourt Counties. The Indiana bat (*Myotis sodalist*) and the Virginia big-eared bat (*Corynorhinus (=Plecotus) townsendii virginianus*) have endangered status in Bath County, and the Madison cave isopod (*Antrolana lira*) is listed as endangered in Botetourt County.

The Virginia Department of Game and Inland Fisheries' (VDGIF) online Fish and Wildlife Information Service (FWIS) database lists several Federally-listed species that have either been documented as occurring or may potentially occur within 10-miles of the project area. These species include four that are listed as Federally-endangered, namely, the Indiana bat (*Myotis sodalist*), James Spinymussel (*Pleurobema collina*), gray bat (*Myotis grisescens*), and Virginia big-eared bat (*Corynorhinus townsendii virginianus*). FWIS also includes 19 species, listed in Table B-1 in Appendix B, of Federal special concern (VDGIF 2011).

3.3.2 STATE SPECIES

The VDGIF describes nine state-listed endangered species and 10 state-listed threatened species that either occur or potentially occur within ten miles of the project area. The timber rattlesnake (*Crotalus horridus*) is included as collection concern species. Table B-1, located in Appendix B, lists species that have been identified as state endangered , state threatened, and collection concern, in addition to Federally listed endangered, threatened, and candidate species that may be found within 10-mile radius of the search point that includes the entire project area (VDGIF 2011).

More than 110 species that are found within a ten-mile radius of the Gathright Project site are included in Virginia's Wildlife Action Plan as having the greatest conservation need (Table B-2 of Appendix B). The Action Plan outlines a ten-year strategy for conserving not only the species highlighted in the plan but all wildlife in Virginia (VDGIF 2011).

3.4 FISH AND WILDLIFE RESOURCES

3.4.1 TERRESTRIAL RESOURCES

3.4.1.1 <u>Avian Resources</u> - The Jackson River watershed provides diverse habitat and a wide range of elevations that support many bird species. The open water associated with Lake Moomaw and the Jackson River attracts many North American waterfowl species, while George Washington National Forest, which surrounds most of Lake Moomaw, offers forests and open fields that support songbirds and birds of prey. The forests are home to approximately 200 species of birds. Sixty percent of the neo-tropical birds that inhabit forest habitats are interior species and require large blocks of undisturbed forest habitat, while 40 percent of them require early successional habitat.

According to the VDGIF online database, 202 species of birds have been either documented or determined likely to occur in the project area. The area that was queried included a ten-mile radius of the point latitude 37°52′00.6″, longitude 79°53′ 58.8″. Bird species include a variety of warblers, hawks, waterfowl, owls, and woodpeckers. More than seven species have been afforded state or federal conservation status, including threatened and endangered species, species of special concern, and candidate species, while more than 60 species are part of the Virginia Wildlife Action Plan. Table B-3 lists bird species within the project area. Table B-1 of Appendix B includes state and federally listed species, and Table B-2 includes species identified in the Virginia Wildlife Action Plan, which is described in further detail in the section entitled "Threatened and Endangered Species" (VDGIF 2011).

3.4.1.2 <u>Mammals</u> - More than 60 species of mammals inhabit the area of the proposed project, most of which are small creatures, such as mice, rats, squirrels, shrews, squirrels, rabbits, skunks, and voles. Larger mammals found in the area surrounding the project, which are more closely associated with uplands, include white-tailed deer (*Odocoileus virginianus*), common grey fox *(Urocyon cinereoargenteus cinereoargenteus*), red fox (*Vulpes vulpes fulva*), and coyote (*Canis latrans*). In addition, eleven bat species may be found in the project area. Three of

the bat species, Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*) and Virginia big-eared bat (*Corynorhinus townsendii virginianus*), are listed as federally and state endangered species. Wetland habitats support populations of muskrat (*Ondatra zibethica*), American beaver (*Castor canadensis*), and raccoon (*Procyon lotor*). The American water shrew (*Sorex palustris*) and the rock vole (*Microtus chrotorrhinus*) are listed as endangered by the Commonwealth of Virginia. Table B-4 of Appendix B lists all of the mammal species that may occur in the project area (VDGIF 2011).

3.4.1.3 <u>Reptiles and Amphibians</u> - A variety of reptiles and amphibians occur within the project area. Table B-5 lists more than 60 species of frogs, toads, tree frogs, salamanders, skinks, snakes, and turtles that may be found within project area. Two species have been assigned protection status. The Peaks of Otter salamander (*Plethodon hubrichti*) is a federal species of concern, and the timber rattlesnake (*Crotalus horridus*) is a collection concern species (VDGIF 2011).

3.4.1.4 <u>Terrestrial Invertebrates</u> - More than 110 species of butterflies, moth, ticks, spiders, and flies inhabit the study area. Eleven species are listed as federally species of concern. Two terrestrial snails, the springsnail (*Fontigens morrisoni*) and shaggy coil (*Helicodiscus diadema*), are listed by the state as endangered, while a butterfly, the Appalachian grizzled skipper (*Pyrgus Wyandot*), is a State Threatened Species. Table B-6 is a list of all terrestrial invertebrate species that occur within the project area (VDGIF 2011).

3.4.2 AQUATIC RESOURCES

3.4.2.1 <u>Habitat</u> – The Jackson River watershed includes parts of Alleghany, Bath, Craig, and Highland Counties in Virginia and a small section of West Virginia. The watershed is approximately 584,686 acres or 916 square miles in size (Louis Berger Group, Inc. 2010). Elevations within the watershed range from 912 feet to 4,116 feet above MSL, with the average elevation of the watershed being 2,223 feet above MSL. Major tributaries of the watershed are Back Creek (141 sq miles), which enters the Jackson River just upstream of Lake Moomaw, Dunlap Creek (170 sq miles), and Potts Creek (174 sq miles), both of which enter the river in the Covington area, downstream of the dam (USACE 2009).

The Gathright Dam plays a pivotal role in the quality of aquatic resources that are present downstream of the structure. The dam is equipped with multilevel intakes on the intake tower, which allows water to be drawn from more than one level in the lake in order to control the temperature and dissolve oxygen concentrations in water released into its tailwater. Releases from Gathright Dam are managed to achieve specific water quality objectives, including low flow augmentation, controlled release temperature, and maintenance of dissolved oxygen levels downstream while meeting state water quality standards.

The Gathright Dam backs up over 12 miles of the Jackson River to form Lake Moomaw. The lake is the second largest impoundment in western Virginia, with the body of the lake extending into two counties, Bath and Alleghany. The maximum conservation pool of the lake is

elevation 1582.0 ft. At maximum conservation pool, the lake provides 123,739 acre feet of storage and 2,532 acres of surface area. The lake has 43.5 miles of shore line and a maximum depth of 152 ft. During the operational history of the project, Lake Moomaw normally begins to draw down beginning in June. In utilizing conservation storage to provide low flow augmentation releases, Lake Moomaw is drawn down an average of 14 ft, reaching its lowest level in early November. The draw down experienced during project operation has ranged from almost no draw down in wet years to draw downs approaching 28 ft in dry years. Lake Moomaw is normally returned to full conservation pool, 1582.0, by the following March.

The stretch of the Jackson River that flows downstream of Gathright Dam drops about 450 ft in elevation over the 43.4 miles from the dam to its mouth. The river runs through open countryside and the urbanized areas of Covington and Clifton Forge. Recreational activities are concentrated in the river segment that begins below the stilling basin at Gathright Dam and extends to the water treatment plant intake in Covington. From the water treatment plant to City Park in Covington, a section approximately 2 miles in length, the river is legally navigable, but it is not recommended for recreation due to heavy industry located on the banks of the river. In Botetourt County, approximately 90 miles from its source, the Jackson River converges with the Cowpasture River to form the James River.

Aquatic organisms, such as fish, insects and plants, have varying habitat requirements that encompass both the living and non-living elements of the environment and therefore, many

Table 7. RAPID BIOASSESSMENT PROTOCOL HABITAT SCORE FOR THE JACKSON RIVER

	Sites				
Parameter	Clearwater Park	City Park	Rt. 18 Bridge	Low Moor Cave	Dabney Lancaster
Substrate	19	15	16	19	16
Embeddedness	17	5	8	10	13
Velocity	19	19	19	19	20
Sediment Deposition	19	16	18	18	19
Flow	20	18	19	20	20
Channel Alteration	15	15	15	14	15
Riffle Frequency	19	17	16	19	19
Bank Stability	18	15	16	16	17
Bank Vegetation	16	12	16	18	15
Riparian Vegetation	11	10	7	8	14
Total Score	173	142	150	161	168

habitat types are necessary to support a diverse aquatic community. In August of 2010, the VDEQ assessed current habitat conditions in the Jackson River, below Gathright Dam, prior to a single test pulse of 3,000 cfs (VDEQ 2011b). The quality of aquatic habitat was measured using the Rapid Bioassessment Protocol (RBP). Values produced through the evaluation of ten habitat parameters were compiled, producing a final score between 0 and 200. Scores lower than 120 represent degraded habitats, while scores above 150 indicate habitat conditions that are favorable for supporting a healthy aquatic community (USEPA 1999). Five sites on the Jackson River were tested using the RBP, as shown in Table 7. The scores ranged from the lowest of 142 at the City Park Site to the highest of 173 produced at the Clearwater Park site. All but one site (City Park) had habitat scores above 150, signifying high quality habitat that could sustain a healthy and diverse aquatic community (VDEQ 2011b).

The VDEQ also investigated the amount of sedimentation that was occurring below Gathright Dam and along the Jackson River (VDEQ 2011b). Excessive sedimentation can significantly degrade benthic habitat and negatively impact aquatic communities, as sediment fills interstitial spaces and smothers organisms. The relative bed stability (RBS) tool was used to assess the rate of sedimentation (Kaufmann 1999). The results of the study show that the mean particles size, percent fine particles (percent Fines), and log RBS (LRBS) are similar and show a stable river system at all sites except for the Route 18 Bridge site (Table 8). A larger percentage of fine particles were present at that site than would normally be expected. This condition may be attributed to the land cover around the sample site or from the large amount of fine particles observed below the Covington Sewage Treatment Plant (STP) (VDEQ 2011b).

Table 8. RELATIVE BED STABILITY DATA FOR THE JACKSON RIVER

	Sites			
Parameter	Clearwater Park	City Park	Rt. 18 Bridge	Dabney Lancaster
% Slope	0.17	0.21	0.11	0.2
Mean Particle Size	2.24	2.28	1.04	2.46
LRBS	0.09	0.08	-1.15	0.29
% Fines	0.03	0	0.41	0
Segment Length (M)	2000	2000	2000	2000

3.4.2.2 Fish and Fisheries - The VDGIF online database found 60 fish species, including darters (7 species), bass (3 species), dace (3 species), shiners (12 species) and trout (3 species), have been either documented or expected to occur within the project area. Two species of fish found in this search area, the orangefin madtom (*Noturus gilberti*) and the roughhead shiner (*Notropis semperasper*), have been granted Federal Species of Concern status. Table B-7 found in Appendix B includes a complete list of species identified within project area (VDGIF 2011).

A "two-story" sport fishery exists in Lake Moomaw. The reservoir is deep enough to maintain both warm water fish (black bass, catfish, sunfish, yellow perch, chain pickerel, common carp and crappie) and coldwater fish (trout). In order to establish the warm water fisheries when Lake Moomaw was first created in 1980, the lake was stocked with thousands of largemouth bass, bluegill, redear sunfish, and channel catfish. Black crappie and yellow perch were later added to the fishery. Lake Moomaw also has a significant trout fishery. Stocked rainbow, brown, and brook trout live in a layer of cold, oxygenated water below the surface. Alewives, a member of the herring family, were stocked in the early 1980's as prey food for both trout and other predators (VDGIF 2011).

During planning and design of the Gathright Dam and Lake Moomaw project, a multi-level intake tower was incorporated into the project's design so that a cold-water fishery could be established downstream of the project. This cold-water fishery would take the place of an existing put-and-take fishery that would be inundated by the construction of the project. The final intake tower design provided ten, 3'x 5' Water Quality Ports at nine different levels ranging from 12 feet to 87.5 feet below the top of the conservation pool. This would allow cold water of a suitable quality to be released for the establishment and sustainability of the cold-water fishery.

From 1982 to 1989, surface water exclusively was released from Lake Moomaw into the Jackson basin. Summer water temperatures in the tailwater were too warm for a reproducing trout population. Smallmouth bass, rock bass, redbreast sunfish, and chain pickerel, and stocked trout provided most of the angling during that 7 year period. Beginning in October, 1989 water was "pulled" from the cold, oxygenated layer of Lake Moomaw, creating conditions that would allow trout management in the Jackson River. Water was taken exclusively from the thermocline until June, 1993. After 1993 water was drawn from the warm, oxygenated surface of Lake Moomaw and the cold, anoxic layer deep in the lake and then "blended" before it was released into the river. By doing this, the thermocline stayed intact further into the summer, providing much needed habitat for trout in the lake. Today, water temperatures immediately downstream of Gathright Dam are usually between 58°F and 60°F.

Trout stocking began in December 1989 with the release of 25,000 brown trout and 25,000 rainbow trout fingerlings. Stocking continued annually until 1997 when natural reproduction was observed in the tail-waters. Once stocking efforts stopped, the trout population declined for a few years. The populations of wild brown and rainbow trout began to rebound in 2004. In 2006, the VDGIF investigated the populations of the two species of trout at three sites along the Jackson River. At the upper river station (Big Rock), the population of rainbow trout was estimated to be about 1000 fish per mile, while the population of brown trout was greater than 200 fish per mile. The trout populations at the middle river station (Skips) were estimated to be approximately 900 rainbow trout per mile and a little less than 200 brown trout per mile. The lower river station (Intervale) had the lowest number of trout, with less than 400 rainbow trout and approximately 100 brown trout per mile (VDGIF 2010).

The VDEQ sampled all fish species in the Jackson River during 2010 in order to assess the health of the fish community. The agency evaluated ten commonly used fish community metrics in order to summarize the current health of the fish community (VDEQ 2011b). Many metrics suggested that river conditions decline at the City Park site.

Occurrences of fish kills in the lower Jackson River suggest that some segments of the river experience degraded environmental conditions. Fish kills have occurred in rivers of western Virginia, including the Shenandoah and James Rivers, since 2004. However, there were no reports of similar occurrences in the Jackson River until 2008. During that year, anglers on the lower Jackson River downstream of Covington reported dead fish and fish with lesions, similar to the events recorded in the James River and VDGIF sampling found 25 to 30 percent of fish exhibited lesions. In general, fish health in 2009 was good throughout the Jackson River, although scattered individual smallmouth bass, rock bass, and redbreast sunfish had bacterial lesions. Very few reports of dead fish were reported in the Jackson River prior to June 1st, 2010, though the VDGIF observed rock bass and smallmouth bass with lesions and other signs of disease. Although research has focused on water chemistry, the bacterium *Aeromonas salmonicida* was present; no definitive cause of fish death and lesions was determined.

3.4.2.3 <u>Benthos</u> - Benthic organisms are those aquatic species that are associated with the bottom of a river, including mussels, crayfish and many insects (Table B-8). Benthic creatures are an essential part of the aquatic community as many are at the base of the food web and are prey items for fish and top predators. The health and diversity of the benthic community can be used as a proxy for the overall health of the river.

As part of its water quality monitoring program, the VDEQ surveyed macro-invertebrates at sites on the Jackson River from 1994 to the present. The Virginia Stream Condition Index (VSCI) was used to assess the health of the river's biological invertebrate community. The index incorporates eight standard metrics to assess taxonomic richness, taxonomic composition, community balance and diversity, community tolerance, and trophic levels. Streams that score less than 60 are considered impaired, while stream with scores higher than 60 are unimpaired (Louis Berger Group, Inc 2006). VSCI scores show that the benthic community found north of Intervale (RM 28.69) and at the Rt. 687 Bridge (RM 30.65) have unimpaired benthic communities, while sites from City Park (RM 23.61) to Dabney Lancaster (RM 6.67) have had an impaired benthic community for many years (Table 9) (Louis Berger Group, Inc. 2010).

A significant characteristic of the benthic habitat of the lower Jackson River is the amount of nuisance periphyton, algae that grows on the river bottom. Periphyton growth is often associated with clear, flowing waters with rocky bottoms (i.e. actively moving waters such as stream and rivers) and is stimulated by high concentrations of nitrogen and phosphorus in the water. Excessive blooms of periphyton can degrade the aquatic environment, impairing the aquatic community by further reducing water quality and limiting recreation use of the river (Louis Berger Group, Inc. 2010). A detailed discussion of the periphyton blooms which occur on the Jackson River is included in the next section of this report.

Table 9. VSCI SCORES FOR THE JACKSON RIVER

Collection Period	Dabney Lancaster (2JK006.67)	Rt. 696 near Low Moor Cave (2JK0013.29)	Rt. 18 Bridge (2JK0018.68)	City Park (2JK0023.61)	North of Intervale (2JK0028.69)	Rt. 687 Bridge (2JK0030.65)
Fall 1994	44	33	37	30	-	80
Spring 1995	40	46	48	24	-	84
Fall 1995	-	-	40	24	-	79
Spring 1996	-	-	46	33	-	87
Fall 1996	28	35	43	16	-	73
Spring 1997	44	54	61	29	-	78
Summer 1997	-	-	43	28	-	74
Fall 1997	39	37	50	18	-	73
Spring 1998	50	44	62	25	-	71
Fall 1998	38	34	53	29	-	79
Spring 1999	40	33	37	33	-	74
Fall 1999	42	42	48	32	-	74
Spring 2000	37	28	29	38	-	82
Fall 2000	42	30	33	28	-	80
Spring 2001	40	-	-	31	-	78
Fall 2001	-	-	-	34	-	79
Spring 2002	-	-	-	38	-	75
Spring 2003	-	-	-	-	-	77
Fall 2003	56	50	-	39	-	73
Spring 2004	-	-	-	-	80	-
Fall 2004	-	-	-	-	77	-
Fall 2006	-	61	51	34	-	-
Spring 2007	64	37	57	33	-	-
Fall 2007	67	59	46	38	-	-
Fall 2008	66	-	50	38	-	-
Average	46.1	41.5	46.3	30.5	78.5	77.4

Freshwater mussels are a high profile aquatic resource. It is estimated that 70 percent of the freshwater mussels of the United States are extinct, endangered, or in need of special protection. Eight species of freshwater mussels are listed on the VDGIF online database as being present in the project area as described above. One of those species, James spineymussel

(*Pleurobema collina*), is listed as being endangered both federally and by the Commonwealth of Virginia. A list of mussel species within the project area is included in Table B-8 of Appendix B, located in the Environmental Appendix (VDGIF 2011).

3.5 WATER QUALITY

Several sections of the Jackson River were included in the most recent Clean Water Act (CWA) Section 303(d) list of impaired waters. The impairments included in the draft 2012 report are as follows (DEQ 2012):

> A 12.43 mile stretch, from the Covington water intake downstream to just above the Lowmoor community, does not fulfill the fish consumption designated use. Polychlorinated biphenyls (PCB), from an unknown source, were found in the tissue of fish collected from the reach.
>
> A 12.43 mile stretch of river, from the Covington water intake downstream to below the Lexington Avenue Bridge, and a 5.19 reach from the US 60 crossing downstream to the Jackson River confluence with the Cowpasture River do not attain recreational uses due to *Escherichia coli* (*E. coli*) impairment. The sources of this contamination are municipal (urbanized high density area), sanitary sewer overflows (collection system failures), and urban runoff/storm sewers.
>
> A 14.37 mile stretch, from the Westvaco main processing outfall downstream to the confluence of the Jackson and Cowpasture Rivers, was listed because of general standard benthic impairment, due to dissolved nutrients and organics. The sources are identified as industrial point source discharge, municipal (urbanized high density area), and municipal point source discharges.
>
> A 11.19 mile stretch, between the main processing outfall at Westvaco downstream to just above the Lowmoor community, does not meet the aquatic life designates use due to dissolved oxygen levels. The sources are identified as industrial point source discharge, and municipal point source discharges.

The current project will not affect the amount of PCBs in fish tissue or change the quantity of *E. coli* in the Jackson River; therefore these impairments will not be discussed further.

While developing a TMDL for the impaired section of the Jackson River, the VDEQ identified the stressors responsible for the impairment of the benthic community. Temperature, pH, dissolved metals, organics, and sedimentation were parameters that the VDEQ concluded were not acting as stressors on the benthic community. Possible causes of the impairment were identified as toxicity, flow modification, and low DO concentrations. Dissolved nutrient

concentration in the water column, however, was singled out as being the most probable stressor source of impairment in the Jackson River (Louis Berger Group, Inc. 2010).

Adequate dissolved oxygen levels are necessary for invertebrates and other aquatic organisms to survive in the benthic sediments. Decreased instream oxygen levels can result in oxygen depletion or anoxic sediments, which adversely impacts the river's benthic community. Adequate DO concentrations within the water column are imperative to maintain a healthy fish community living in rivers and streams. The Jackson River is classified as a Class IV "Mountainous Zone" waterbody, as defined in Virginia's Water Quality Standards (9 VAC 25-260-50) and must have a minimum DO concentration of 4.0 milligrams per liter (mg/L) and a minimum daily average DO concentration of 5.0 mg/L. Data obtained from VDEQ monitoring stations along the Jackson River indicate multiple violations of the minimum DO standard of 4.0 mg/L (Louis Berger Group, Inc. 2010).

Incidents of low DO downstream were attributed to two possible causes. First, low DO concentrations can be associated with low-flow events. Flows in the Jackson River are primarily controlled by releases from the Gathright Dam. The operational objectives (i.e. water storage, flood control and recreation) of the dam result in a flow regime below the dam that is different from flows that would occur on a wild river. Flow management on the Jackson River reduces peak flows during periods of high runoff and augments flows during times with less precipitation. Low flow events resulting from flow modification often correlate to incidents of low DO concentrations; however not all DO violations took place during times of low flow. Also, key habitat scores indicate a healthy benthic community upstream of the impaired reach in the Jackson River. Because of these finding, flow modification is classified as only a possible stressor affecting the benthic macroinvertebrate community.

The second cause of low DO concentrations in the Jackson River is excessive periphyton growth. Periphyton is a complex community of algae, cyanobacteria, and microbes that is attached to submerged surfaces in most aquatic ecosystems. Though it is an important part of the ecosystem, once periphyton density exceeds 150 mg/m, it is considered a nuisance and is extremely detrimental to the aquatic environment. By covering all available surfaces, including the interstitial spaces between rocks and cobble, nuisance periphyton reduce suitable benthic habitat for other biota. Conditions that allow the growth of excess periphyton will alter natural species composition by favoring opportunistic invertebrates, allowing them to easily outcompete more sensitive species and dominating the community (USEPA 2000). Excessive periphyton will also cause large diurnal oxygen swings, during which DO concentrations peak during daylight hours and fall to extremely low levels in the evening.

Immediately downstream of the Gathright Dam, environmental conditions are negatively affected by the presence of nuisance periphyton during the summer months. In this area, the periphyton is dominated by a species of a non-toxic diatom, known as didymo (*Didymosphenia geminata*). Originally native to the Faroe Islands off of the coast of Scotland, this organism was first observed in Jackson River during the summer of 2006 and is thought to have been brought

unintentionally to Virginia on fishing gear. The conditions found in the tailwaters of Gathright Dam and other trout fisheries in the state (i.e. cold, clear and shallow water) are optimal for the growth of didymo. The diatom grows in long stalks and can cover the entire river bottom, interfering with recreational fishing by entangling gear and making a river generally unappealing to visitors. Due to its uniquely unpleasant qualities, didymo is more commonly called "rock snot" (Bugas 2008).

Further downstream, the composition of the periphyton community changes. Algal community composition shifted from diatom dominated communities immediately downstream of MeadWestvaco at the City Park site to Cladophora dominated communities at the Industrial Park site further downstream (Patrick Center for Environmental Research, 2000). In a recent study of periphyton levels in the Jackson River completed by the VDEQ in 2010 the amount of periphyton was low upstream of the Mead Westvaco discharge, but levels increase significantly below the discharge, especially at City Park and Route 18 (DEQ 2011b). These findings are consistent with findings produced by studies that were sponsored by Mead Westvaco during the late 1990's and early 2000's, which also found that the lowest algal biomass values occurred upstream of the MeadWestvaco facility, and higher concentrations occurred downstream of the facility at the Industrial Park site (Patrick Center for Environmental Research,2000; 2001).

The VDEQ has determined that high nutrient concentrations, specifically nitrogen and phosphorus, are the primary reason for excessive periphyton growth observed during the summer months downstream of Gathright Dam. And that the presence of elevated concentrations of dissolved nutrients in the water column is the most probable stressor causing impairment to the benthic community in the Jackson River.

The excessive nutrient loading present in the river appears to originate predominantly from point sources, as opposed to non-point sources (e.g. storm runoff). Only two major dischargers (i.e., facilities with design flows greater than 1 million gallons per day) monitor their effluent for total nitrogen and total phosphorus. Effluent phosphorus concentrations from both of the major discharges, MeadWestvaco and the Clifton Forge City STP, were generally elevated. Effluent nitrogen concentrations are fairly high at the Clifton Forge STP, and on some occasions at the MeadWestvaco plant. Additionally, monitoring conducted immediately downstream of other outfalls (e.g., the Covington City STP) that don't monitor their effluent indicates these facilities may be contributing large nutrient loads to the Jackson River (Louis Berger Group, Inc. 2010).

3.6 HAZARDOUS, TOXIC AND RADIOACTIVE WASTE

ER 1165-2-132, "Water Resources Policies and Authorities, Hazardous, Toxic and Radiological Waste (HTRW) Guidance for Civil Works Projects," and NAD DR 1165-2-1, "Procedures for Conducting and Coordinating HTRW Investigations for Civil Works Projects" guide the investigation of HTRW for USACE Projects. Current operations for the project are not constrained by any HTRW considerations, since the alternative plan considered for this study is

simply a variation of the existing water control plan and do not involve any construction or land disturbance. The alternative is contained within the river banks below the authorized flood release; therefore it was determined that there would be no impacts either by or from HTRW by the PA.

3.7 AIR QUALITY

The USEPA is required to set air quality standards for pollutants considered harmful to public health and welfare. The Primary National Ambient Air Quality Standards (NAAQS) set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, and prevention of damage to animals, crops, vegetation, and buildings. These standards have been established for the following six principal pollutants, called criteria pollutants (as listed under Section 108 of the Clean Air Act):

- Carbon monoxide;
- Lead;
- Nitrogen dioxide;
- Ozone;
- Particulate matter, classified by size as follows:
    - An aerodynamic size less than or equal to 10 micrometers;
    - An aerodynamic size less than or equal to 2.5 micrometers;
- Sulfur dioxide

All three counties in which the project area is located are part of the Valley of Virginia Intrastate Air Quality Control Region (Chapter 20, Section 200). According to the VDEQ Air Regulations, this Air Quality Control Region has not exceeded the standards for any of the criteria pollutants and, therefore, is not identified as either a maintenance area (Chapter 20, Section 203) or a nonattainment area (Chapter 20, Section 204) (VDEQ 2011a).

3.8 NOISE

Noise is defined as an undesirable or “unwanted sound”. Accurately predicting the levels of noise produced during construction is difficult due to variability of several factors, including the distance from the construction site, vegetation, changes in elevation, temperature, and humidity. Noise affects the full range of human activities and must be considered in local and regional planning (NYDEC 2001).

The project area includes the reach of the Jackson River that runs from the spillway of the Gathright Dam until the confluence with the Cowpasture River. A range of levels of development and land uses is found throughout this area. Immediately below the dam, the river runs through undeveloped, forested tracts. The Jackson River also runs through more urbanized and developed areas, such as the city of Covington. The ambient noise levels experienced within

the project area can range from 10 decibel A (dBA) of an undeveloped area to 70dBA of a typical commercial area.

3.9 RECREATION RESOURCES

The Jackson River and its surrounding areas provide a great variety of outdoor recreational opportunities. The majority of the project site falls within the central region of George Washington National Forest, a 1-million-acre forest located in the western Virginia and eastern West Virginia. Gathright Dam and Lake Moomaw Project are located in two separate Forest Service Districts. The part of the project located in Alleghany County is managed and operated by the James River District and the part located in Bath County is managed and operated by the Warms Springs District. The forest offers hiking, mountain biking and hunting opportunities.

Lake Moomaw is almost completely surrounded by the George Washington National Forest and the Gathright Dam and Lake Moomaw Recreation Area is the largest recreation complex located in the limits of the forest. All recreational facilities, except Gathright Dam's tail-water area and a visitor center are managed by the James River Ranger District of the US Forest Service. The area offers public boat ramp/launch facilities, docks, campgrounds, picnic areas and hiking trails. Visitors use the lake for boating, swimming and wildlife watching. Both cold and warm water fisheries are present in Lake Moomaw.

There is a 17 mile reach, from the Gathright Dam to the water treatment plant intake in Covington which is considered legally navigable and is open for recreation. An additional two miles, from the water treatment plant in Covington to City Park in Covington, are also considered legally navigable but is not recommended for recreation due to heavy industry. Recreational opportunities below Gathright Dam along the Jackson River include fishing, hiking, biking and boating. The USACE manages the downstream fishing area immediately below the dam. Trout can be caught from the tail-waters of Gathright Dam to the Mead Westvaco plant while warm water sport fish can be caught further downstream of Mead Westvaco. There are seven river access points on Jackson River from Gathright Dam to its confluence with the Cowpasture River (listed below); four are managed by the US forest Service, two are managed by the Virginia Department of Game and Inland Fisheries, while the final one is managed by the USACE.

- Petticoat Junction north of Covington on Route 687 (Jackson River Road) near Clearwater Park.
- Johnson Spring north of Covington on Route 638 (Natural Well Road) near Natural Well.
- Indian Draft north of Covington on Route 687 (Jackson River Road) approximately three miles from Clearwater Park.
- Old Smith Bridge north of Covington on Rt. 721 (N. Smith Bridge Road) near the Falling Spring Gardens development.
- Island Ford about 2 miles west of Covington on Rt. 1104 (Valley Ridge Road) at the

Island Ford Transfer Station.

- Low Moor at the Clifton Middle/Mountain View Elementary Schools on Rt. 735 (Irvine Farm Road)
- Jackson River tailwaters directly below Gathright Dam.

The Jackson River Scenic trail offers walking, hiking, biking, and horseback-riding. A 17 mile stretch of C&O Railroad, running from old Alleghany Central Scenic Railroad station in Intervale north to the Bath County line, was purchased by Alleghany County and converted into a recreational trail. It is hoped that the Jackson River Scenic Trail will be connected to the Lake Moomaw/Gathright Dam recreational areas as well as other trails and places of interest along the Jackson River in the Falling Springs Valley.

3.10 HUMAN RESOURCES

3.10.1 POPULATION

The Gathright study area is a predominantly rural area with a generally declining population (Table 10). The only county or city in the study area to show population growth during the last decade is Botetourt County, and only a very small portion of the study area is located in that county. The largest portion of the study area is located in Alleghany County, which had a 2010 population of 16,250. This county now includes the town of Clifton Forge, which gave up its status as an independent city as of July 2001. Covington, which is an independent city, is physically located within Alleghany County and is the largest urban area within the study area. The other town within the county is Iron Gate, which is located along the Jackson River near the Alleghany County/Botetourt County line, had a 2010 population of 388. Bath County, the third county in the study area, is the second smallest county in the state in terms of population with 4,731 residents.

Table 10. POPULATION DATA

	1990	2000	2010	2020	2030
Alleghany County	13,176	12,926	16,250*	15,922*	15,920*
Clifton Forge	4,679	4,289	3,884		
Bath County	4,799	5,048	4,731	4,908	4,910
Botetourt County	24,992	30,496	33,148	35,756	38,437
Covington	6,991	6,303	5,961	5,952	5,946

* Includes population of Clifton Forge
Sources: U.S. Census, Virginia Employment Commission

Population projections from the Virginia Employment Commission indicate a somewhat mixed picture for the region. Alleghany County and Covington show small declines, while Bath shows a small increase. The projections for Botetourt indicate more substantial growth with an

annual growth rate of 0.7 percent from 2010 to 2030; however, this is still smaller than the annual rate of 1.0 percent that is projected for the state as a whole.

3.10.2 LAND USE

Forestry and agriculture are the predominant land uses within the study area, especially in Alleghany and Bath Counties. Approximately 88 percent of the Alleghany County's acreage is forest land, and over half of this lies within the Jefferson and George Washington Forests (Alleghany County Comprehensive Plan 2007). The forested land is spread throughout the county except for the river valleys, which are the location of much of the county's flatter land and developed uses. In Bath County almost 51 percent of the total acreage is national forest land, and an additional five percent consists of state natural areas (such as the Gathright Wildlife Management Area) and forest. About 14 percent of the county's land is agricultural, and most of the remaining land is undeveloped, privately owned forested land (Bath County, Virginia Comprehensive Plan 2007-2012). Development is concentrated in the small communities that are located along the state highways that cross the county.

Development in the study area is concentrated in the City of Covington, the town of Clifton Forge, and the smaller communities located along the Jackson River. The majority of the residential development in the study area (and Alleghany County as well) is located in and around Covington and Clifton Forge and in areas along I-64 between the two municipalities. Commercial development tends to be located in the same general areas as the residential development. In addition to the downtown areas of Covington and Clifton Forge, concentrations of commercial development can be found just east of Covington at the Mallow Mall and east of Clifton Forge at the Cliftondale Park. The major industrial areas in the study area are located in the Covington and Low Moor areas. Property at the northern end of Covington and county property adjacent to this area are dominated by the MeadWestvaco facilities. Other industrial properties are located at the southwestern end of the city and north of I-64 at Low Moor.

Future development in the study area will be limited by the area's steep topography and high proportion of public land ownership. Alleghany County's Comprehensive Land Use Plan envisions the county's primary growth areas to be located chiefly along I-64 between Covington and Clifton Forge and from the eastern boundary of Clifton Forge to the interchange at Cliftondale and slightly north. Secondary growth may occur to the north of Covington along Route 220.

3.10.3 EMPLOYMENT

Data on employment from 2001 to 2008 show a 6.9 percent decrease in total employment in Alleghany County and Covington together and a 1.8 percent increase in Bath County (Bureau of Economic Analysis, 2011). Total employment figures for 2008 give Alleghany County and Covington 11,283 jobs and Bath County 2,777 jobs (BEA, 2011). The largest employers in the region are MeadWestvaco, Alleghany Highlands Public School Board, The Homestead, Alleghany Regional Hospital, Walmart, and the Bath County Public Schools.

The most recent unemployment figures from the Virginia Employment Commission show Covington with a December 2010 rate of 10.9 percent, while the unemployment rate for Alleghany County's rate was 9.4 percent and 7.4 percent for Bath County. These rates are higher than the state figure of 6.4 percent and the national figure of 9.1 percent except for Bath County, which was below the national average.

The employment of the residents of the localities that cover the study area tends to be concentrated in the services, manufacturing, and trade sectors. The services sector provides, by far, the largest percentage of jobs, with an estimated 45 percent of the employed residents in Alleghany County, 44 percent in Bath County, and 37 percent in Covington working in the various service industries according to data from the U.S. Census Bureau, 2005-2009 American Community Survey. Manufacturing is a more significant source of employment in the region than it is in the state as a whole. This occupation provides about eight percent of Virginia's jobs compared to 22 percent for Alleghany County, 19 percent for Covington and 16 percent of Bath County residents. In this region, MeadWestvaco is the primary employer in this sector. Trade is a significant source of employment in Alleghany County and Covington but much less so in Bath County.

3.10.4 INCOME

Income levels in the study area as measured by both median household income and per capita income are below those of the state. For Alleghany County median household income was $42,005 (in 2009 dollars); for Covington, $35,758; and for Bath County $48,250. The state figure was $60,316 (U.S. Census Bureau, 2005-2009). Per capita income showed a similar pattern with Bath County having a figure of $38,231 for the year 2008 and Alleghany County and Covington together having a figure of $30,356. Bath County's figure was 87 percent of t he state average and 95 percent of the national average. Alleghany County and Covington's figure was 69 percent of the Virginia per capita income and 76 percent of the U.S. figure (BEA, 2011).

3.10.5 ENVIRONMENTAL JUSTICE COMMUNITIES

Executive Order 12898 requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations from potential projects and actions. In order to determine if there are any populations in the Gathright study area that fit these criteria, census tract data was collected for the tracts that encompass study area (see Table 11).

As Table 11 shows, Tract 701, which encompasses the town of Clifton Forge, has somewhat higher percentages of poverty level and non-white residents than Alleghany County as a whole. None of the other tracts have significantly higher percentages of residents that are either non-white or below the poverty level.

Table 11. ENVIRONMENTAL JUSTICE COMMUNITY DATA

	Percent Below Poverty Level	Percent Non-White
Alleghany County	11.6	7.2
Tract 701	20.9	23.3
Tract 801	5.9	2.3
Tract 802.01	11.6	4.0
Tract 802.02	12.9	2.6
Tract 803.01	4.8	0.0
Bath County	10.1	3.4
Warm Springs District	7.6	4.9
Botetourt County	7.0	6.3
Tract 401	5.1	4.9
Covington	16.1	17.3
Tract 601	23.1	16.2

Sources: U.S. Census Bureau, 2005-2009 American Community Survey

3.11 HISTORIC RESOURCES

Earliest human inhabitation of the Americas remains one of the most debated issues in archaeology, but clearly Native Americans began to inhabit the western Virginia region over 12,000 years ago. Many of the sites left by the 'Paleo-Indians' of this period may now be submerged on the bottom of the bay and the Atlantic continental shelf, for sea-levels during the Wisconsin Glaciation of the Pleistocene epoch, or Ice Age were some 400 feet below contemporary levels. No known sites in Alleghany hold Paleo-Indian artifacts, and only three in Botetourt County do. Populations were evidently low, but grew considerably during the Archaic Period, which is divided into Early (8000-6500 BC), Middle (6500 to 3000 BC) and Late (3000 to 1200 BC) Archaic Periods. Along with increasing population there is evidence of an increased diversity in resources hunted and gathered for food, with an expansion in the use of plant foods most notable.

Around 1200 BC people in the region began making and using pottery. This marks the beginning of the Woodland Period, also divided into Early (1200-500 BC), Middle (500 BC to AD 900), and Late (AD 900-1600) Woodland Periods. There seems to have been little change in settlement between the Late Archaic and Early Woodland Periods, apart from the use of pottery, but during the Middle Woodland people seem to have dispersed into smaller, though perhaps more sedentary, settlements. It was during this period that the maize-beans-squash crop combination of American Indians was adopted in the region. During the Late Woodland Period populations increased with an expansion of agriculture, as did political hierarchy. Village and hamlet sized settlements appear in the Ridge and Valley section of Virginia during this period,

the village sites were sometimes palisaded. These settlements were most often located on fertile but relatively well drained first terraces area occurring at bends in rivers, and especially at confluences with major tributaries.

The first Euro-American settlement in the area took place in 1746. Early immigrants came largely from Pennsylvania and New York. Much of the early activity within the region centered around the many mineral springs found in both Virginia and West Virginia. Road development generally linked the various springs until the early 1800s when cross-mountain stage roads were constructed.

In general, the economic history of the region was centered on the iron industry. Until 1900, the region was an important producer of iron products through its many mines and furnaces. The oldest furnace in Virginia, Longdale in Alleghany County, supplied many of the cannons and cannon balls to the Confederacy. The rise of mining in the Great Lakes region and the steel industry in the Pittsburgh area led to the end of Virginia's iron industry.

The decline of farming operations in the Jackson River Valley area paralleled the out-migration of the family members of the older, established landholders. In the 1920s, the Virginia Power Company entered into an agreement with the valley's principal landowner, Tom Gathright, to acquire land in his name and hold it until such time as Virginia Power would formally buy it for a hydroelectric power plant in the area. Virginia Power never did exercise its option to buy the property, although Gathright managed to acquire most of the property in the middle Jackson River area by the early 1930s. During this period, some farming activities were carried on by tenant farmers working shares owned by Gathright. Thus, Gathright's acquisition of land was a significant factor in the decline of the region as a self-supporting agricultural community.

Because of Gathright's interest in hunting and conservation, he turned the valley into an outstanding wildlife preserve and fishing and hunting club. After his death, the state acquired 18,500 acres of land from his heirs, which became the T.M. Gathright Wildlife Management Area.

Since the colonial era, the Alleghany-Bath County area has changed names and boundaries several times. The present boundaries were fixed by the Virginia General Assembly in 1922. The city of Covington was designated as a town in 1818 and was incorporated as a city in 1833. The largest period of growth for Covington occurred between 1890 and 1920 with the establishment of the West Virginia Pulp and Paper Company, now MeadWestvaco, in 1900, and other smaller industries. Clifton Forge, which developed primarily because of the Chesapeake and Ohio Railroad, became incorporated in 1884. The closing of the city's railroad facilities in

Table12. ARCHAEOLOGICAL SITES

Site Number	Size	Components	Site Type	NRHP Status	Comment
44AY0488	800 x 400 ft	Late Archaic	Transient Camp	Recommended Not Eligible	
44AY0009	361 x 361 ft	Prehistoric/Unidentified	Lithic Scatter	Recommended Not Eligible	40 ft above river
44AY0521	361 x 197 ft	Archaic, Woodland	Transient Camp	Recommended Not Eligible	
44BO0049	450 x 175 ft	Late Woodland	Transient Camp	Potentially Eligible	
44AY0040	300 x 300 ft	Late Woodland	Palisaded Village	Recommended Eligible	40-50 ft above river
44AY0055	125 x 50 ft	Late Archaic	Camp	Unevaluated	Extensive disturbance reported, site probably not eligible
44AY0190	200 x 100 ft	Prehistoric/Unidentified	Lithic Quarry/Reduction	Unevaluated	
44AY0192	600 x 200 ft	Woodland	Undetermined	Unevaluated	Site has probably been destroyed by development
44AY0194	600 x 250 ft	Late Archaic, Early Woodland, Late Woodland	Hamlet	Unevaluated	Unknown portions of site destroyed
44AY0195	750 x 350 ft	Prehistoric/Unidentified	Undetermined	Unevaluated	Site has probably been destroyed by development
44AY0166	250 x 250 ft	Middle Archaic	Undetermined	Unevaluated	Unknown portions of site destroyed
44AY0068	200 x 570 ft	Late Woodland	Hamlet	Unevaluated	Features reported support eligibility
44AY0038	500 x 75 ft	Prehistoric/Unidentified	Undetermined	Unevaluated	
44AY0120	unavailable	20th Century, 1st half	Mill	Unevaluated	
44AY0007	200 x 150 ft	Middle Archaic, Late Archaic, Historic Unidentified	Camp	Unevaluated	
44AY0164	20 x 12 ft	Late Woodland, 20th Century	Lithic Scatter, Railroad Section House	Unevaluated	
44AY0493	20 x 100 ft	Historic Unidentified	Undetermined	Unevaluated	Submerged remains of 4 timber 'cribs'
44AY0044	300 x 225 ft	Late Woodland	Hamlet, Camp	Unevaluated	196 feet from river
44AY0045	200 x 100 ft	Middle Archaic	Camp	Unevaluated	Closer to Mill Creek
44AY0050	60 x 60 ft	Woodland	Camp	Unevaluated	
44AY0051	150 x 180 ft	Prehistoric/Unidentified, Historic 19th-20th c	Camp	Unevaluated	

the late 1980s led to a significant population decline and financial stress for the city, resulting in its reversion to town status in 2001.

The entire study area has numerous archaeological and architectural sites that have been recorded in the Virginia Department of Historic Resources database. The Gathright Dam and Lake Moomaw area was the subject of extensive cultural resource investigations during its planning and construction. At least 250 sites were recorded during the many field investigations that covered the areas inundated by the conservation and flood control pools, and these investigations resulted in 27 reports on their results. Copies of these reports can be found at the Norfolk District USACE library. The overall conclusion of these reports was that, despite the large amount of archaeological data recovered during the investigations, not enough data was discovered that could be used to propose reliable models of cultural routines occurring during most of the episodes of settlement.

The immediate area along the Jackson River downstream from Gathright Dam to its confluence with the Cowpasture River to form the James River is the location of dozens of archaeological and architectural properties listed in the Virginia Department of Historic Resources database. The majority of which have not been evaluated for significance (listing on the National Register of Historic Places (NRHP)). Most of the archaeological sites are Native American sites from the Archaic and Woodland periods and seem to indicate use of the area next to the river for transient camps; however there are a few larger village and hamlet sites. A review of this inventory found 21 archaeological sites in proximity to the Jackson River, although many are on bluffs or otherwise not immediate to the shoreline. These sites and their NRHP statuses are listed in Table 12.

The architectural sites consist predominantly of houses, which date from the early 19th century through the middle of the 20th century, along with some commercial and industrial buildings and a few bridges. There are also four historic districts within the study area that have been recommended eligible for listing on the National Register. These are the Clifton Forge Commercial Historic District, Luke's Mountain Historic District, Covington Historic District, and the Rosedale Historic District. The Clifton Forge Commercial Historic District occupies about 10 acres and encompasses the city's business district. It contains 57 mostly commercial frame, brick, and concrete block buildings that date to late 19th and early 20th centuries. Luke's Mountain Historic District covers approximately 100 acres and contains a cluster of historic estates owned by various family members of a former general manager of what is now the MeadWestvaco plant in Covington. This district, which overlooks the Jackson River and city of Covington, covers the sides and summit of Luke Mountain. The Covington Historic District encompasses most of the historic downtown, which dates from 1820, although most of the buildings date to the period between 1890 and1940. Most of the 109 buildings which are contributing structures to the district are commercial. The district is located adjacent to the Jackson River. The Rosedale Historic District covers 430 acres adjacent to the Jackson River, U.S. 60, and Luke's Mountain and contains 78 structures dating from 1850-1949. The eleven

architectural properties and three historic districts in the study area which are in close proximity to the Jackson River are listed in Table 13.

Table 13. ARCHITECTURAL PROPERTIES

DHR #	Year Built	Name	Description	NRHP Status	Comment
105-0096	1937	Route 220 Bridge	Steel deck girder bridge	Not eligible	demolished
011-0395	ca. 1915	Bridge #6140	One land two-span bridge	Not eligible	demolished
107-5179	1928	Industrial Rayon Corp. Plant	Industrial building	Recommended Contributing	
003-0348	unavailable	Rosedale Historic District	5 single dwellings contribute	NRHP Listed	
003-5006	ca. 1916	Luke's Mountain Historic District	Residential development	NRHP Listed	
003-5016	ca. 1930	Westvaco Industrial Building 1	Industrial building	Not eligible	
003-5019	ca. 1950	Westvaco Industrial Building 4	Industrial building	Not eligible	
003--5020	ca. 1940	Westvaco Industrial Building 5	Industrial building	Not eligible	
003-5022	1929	Bridge #1900	concrete arch bridge	Not eligible	
107-0006	1833	King House	single dwelling	Not eligible	demolished
107-0025	1818-1940	Covington Historic District	112 contributing properties on 40 acres	NRHP Listed	
107-0133	unavailable	Westvaco	Office building	Unevaluated	
107-0137	ca. 1970	State Bank of the Alleghenies	Office building	Unevaluated	
107-0023	ca. 1798	Fudge House	single dwelling	NRHP Listed	on bluff

4.0 ENVIRONMENTAL EFFECTS

This section is the scientific and analytic basis for the comparisons of the alternatives. The following includes anticipated changes to the existing environment including direct, indirect, and cumulative effects. Where it was determined that the environmental impact of the three PA variations in the pulse release rates (3000 cfs, 3500 cfs, or 4000 cfs) was predicted to be distinct from one another, then these differences were described for each variation more fully in the following section. However, where no differences in environmental impact are predicted for the three pulse rates variations, then no distinction between the variations are made and the environmental effects described in the following section can be applied to all three variations. If an environmental element is not included in this section, then no environmental impacts are anticipated. A summary of impacts can be found in Table 4 in Section 2.0 “Alternatives.

4.1 GENERAL ENVIRONMENTAL EFFECTS

The PA will cause no impacts to most elements of the general environment, including climate, soils, geology, physiography or topography, with the exception of hydrology. Implementation of the PA will require alteration of the low flow release schedule and will increase the number of high flow events that occur annually on the Jackson River.

Each variation of the PA (3000 cfs, 3500 cfs or 4000 cfs) includes six pulsed releases spread over the months of June and October. In order to store the amount of water needed for the series of pulses, the low flow augmentation release schedule must be modified. Reduction of the low flow augmentation translates into a smaller volume of water entering the Jackson River throughout the summer months than the amount that is currently being released. To create pulses of 3000 cfs, the minimum flow will be reduced by 9 percent, resulting in a sustained drop in water level of <1 inch immediately downstream of the dam and of <2 inches at Falling Springs. Pulsed releases of 3500 cfs would require an 11 percent reduction in the low flow augmentation. This reduction would likely result in a sustained drop in the Jackson River by slightly >1 inch below Gathright Dam and <2 inches at Falling Spring. A 13 percent reduction of the minimum flow would be required for pulses of 4000 cfs, translating into a >1 inch drop in the water level of the Jackson River immediately downstream of the dam and a 2 inch drop at the town of Falling Spring.

Although beneficial in many ways, the current water control plan significantly alters the natural hydrology of the river. The plan reduces the natural variability of the Jackson River by storing excess water during high flow events and minimizing periods of low flow. Flood waters are stored behind the dam in order to lower downstream water levels and reducing potential flood damages below Gathright Dam. However, this practice ultimately reduces the number and magnitude of high flow events downstream. Current management of the Gathright Dam also provides a steady amount of water that is released during times of low precipitation in order to protect downstream water quality.

The PA will increase the amount of variability in the Jackson River downstream of the Gathright Dam by providing additional high flow events. Pulsed releases, as proposed in the PA, will produce conditions similar to naturally occurring small flood events. These events are predicted to be beneficial to the aquatic environmental, but they do not recreate the flow patterns of a wild river. Most high flow events occur during the winter and spring on the Jackson River. The controlled pulsed releases will instead occur between June and October, which are typically times of low flow. This timing was chosen to avoid spawn seasons for particular fish species and to maximize the impact on water quality.

The NAA will not have any effect on elements of the general environment. The Water Management Plan will not change; therefore the hydrology of the Jackson River below the Gathright Dam will be unchanged.

4.2 THREATENED AND ENDANGERED SPECIES

Of the Federally listed threatened and endangered species that currently inhabit the three counties included in the project area, only six are identified by the US Fish and Wildlife Service (USFWS) Information, Planning and Conservation (IPaC) System as being potentially affected by the implementation of the PA. Five of these species (shale barren rock cress, small whorled pogonia, smooth coneflower, Indiana bat and Virginia bat) are terrestrial and are not predicted to be negatively affected.

One species, the James spinymussel, could be affected by the project. This animal is a species of freshwater mussel. Populations of this mussel have declined rapidly during the past two decades and now can only be found in small, headwater tributaries of the James River basin in the Virginia and West Virginia and in the Dan River. This mussel is not currently found in Jackson River, so the implementation of the PA will not negatively impact existing populations. However, a population of James spinymussels is currently located in Potts Creek, a tributary of the Jackson River. The goal of this project is to improve water quality of the Jackson River and if the PA improves specific elements of the aquatic environment that are essential to the success for the James spiny mussel, it is possible that the PA would have a positive impact on the species by allowing it to recolonize the Jackson River. For example, it is predicted that the scouring affect of the pulsed releases will clean the sand and bottom sediment of the river, which is a habitat requirement of the mussel. However, the life cycle of the mussel is very complicated, including multiple larval forms and fish host species; therefore it is difficult to predict if environmental conditions would allow the mussel to spread into the project area.

The NAA will result in no changes to the existing conditions to the river; therefore it is expected that this course of action will have no effect, either positive or negative, on the James spinymussel or any other federally listed species.

4.3 FISH AND WILDLIFE RESOURCES

The PA is predicted to have positive impacts on the aquatic habitat quality within the Jackson River. On August 17th, 2010, a test pulse was released from the Gathright Dam. This pulse allowed river flows, below the dam, to reach 3000 cfs for two hours. The VDEQ collected an extensive amount of water quality, habitat, and biological data before and after the event in order to capture any changes caused by the pulse release. From that data, the changes to the aquatic environment resulting from the implementation of the PA can be extrapolated.

The pulses will flush fine sediment from the river bottom. Areas where rocks and snags are covered in silt, sand, or muck are not suitable for many aquatic organisms. The pulsed releases will clean bottom sediment and remove fine material from interstitial space, allowing those areas to be inhabited by aquatic fauna.

The most significant improvement resulting from the PA will be the removal of excess periphyton from the project area. A day after the test pulse, benthic Chlorophyll A (*Chl A*), a measure of periphyton, was 30 percent lower and Ash Free Dry Mass (AFDM) was 20 lower at City Park. The scouring effect of the pulse diminished the further each collection site was located from the dam. VDEQ conducted follow-up monitoring two weeks after the test pulse to determine the duration of the pulse's impact. The first week after the pulse, the City Park *Chl A* and AFDM levels decreased an additional 57 percent and 33 percent, respectively. Two weeks later, City Park *Chl A* levels increased by 433 percent and AFDM increased by 325 percent.

The improvement in aquatic habitat is expected to translate into more diverse benthic and fish communities. Removal of excess fine sediment and periphyton will create clean bottom habitat and open interstial spaces, which are environmental conditions needed to maintain a healthy indigenous benthic community. The fish community within the Jackson River is also expected to become more diverse, since many fish species also require clean riverine substrate. Excess sediment will no longer smother demersal eggs. Many species of benthic invertebrate are prey items for fish; therefore the improvements to the benthic community will positively affect predatory fish.

The PA will have no impact on the stratification or water quality of Lake Moomaw, so its implementation will not affect either the cold and warm water fisheries in the reservoir. The change to the release schedule will not change the temperature or water quality of water released from the dam. The pulses may scour the didymo from the river bottom; therefore it is predicted that the suggested release schedule would either have no impact or a positive impact on the cold-water fishery in the Jackson River.

The implementation of any one of the variations of the PA will result in improvements to stream habitat quality, and will in turn correlate to more diverse and robust aquatic community.

The NAA will not change the habitat quality or the aquatic resources of the Jackson River.

4.4 WATER QUALITY

A number of water quality parameters were not affected by the test pulse and are not expected to be altered by implementation of the PA. The releases and additional storage of water in Lake Moomaw are not expected to be affected the reservoir. Stratification of the lake that occurs during the summer months is not expected to be changed. Additionally, temperature, pH, and specific conductivity in the Jackson River will not be negatively impacted by the flood events.

The pulse events will mimic naturally occurring storm events and will cause an increase in total suspended solid (TSS) and turbidity throughout the entire reach. The size of the impact will be site dependent. Immediately below the dam, very little sediment has built up from

tributary deposition and therefore turbidity will be very low. Larger increases in turbidity and TSS are expected to occur downstream of Covington, where an excess of fine sediment has accumulated. These increases will be temporary in nature and water quality will return to normal levels following each release. The VDEQ suspects multiple pulse events over the entire growing season would result in more moderate TSS and turbidity levels as the amount of sediment buildup would be reduced with each event.

The PA will also impact dissolved nutrient levels of the river. Immediately after the test pulse, dissolved nutrient concentrations increases were observed below the MeadWestvaco Mill discharge and remain elevated downstream to the Route 18 Bridge. Gradually nutrient levels decreased and benthic algae growth returns to a more normal levels. It is predicted that a series of pulsed releases will result in temporary increases in dissolved nutrient concentrations, with a gradual return to normal levels. It is predicted that, similar to increase in TSS and turbidity, the magnitude of each spike will decrease with each pulse.

The test pulse was also observed to cause an immediate increase in dissolved oxygen in the water column, especially downstream from the city of Covington. It is expected that regular pulses will result in increase DO levels in the Jackson River. The increase will be caused directly by the pulsed releases, as observed with the test pulse. It is also expected that the PA will result in increased levels of DO indirectly, through the scour and ultimate removal of excess periphyton. As described in Section 3.5, excessive amounts of periphyton can cause large drops of DO in the water column to levels that impair aquatic life at night.

It is expected that NAA will result in no changes to the water quality of the Jackson River. High levels of nutrients will result in continued periphyton blooms during the summer months. Low DO concentrations will also be observed during the summer months. These parameters will continue to negative impact the aquatic system.

4.5 RECREATION

The PA would have long term, positive effects on the quality of recreation in the portion of Jackson River located in the study area. While the state recommends that people do not pursue certain recreational activities in river from the water treatment plant in Covington to City Park in Covington, other areas of the river are popular destinations for fishing, canoeing, and kayaking. This proposed project will improve some elements of water quality and remove nuisance periphyton, thereby improving habitat for fish and improving the experience of boaters on the river. The project will also improve recreational opportunities on Lake Moomaw, since all three variations of the PA require additional water to be stored behind Gathright Dam during the summer, resulting more watered area within the reservoir.

No significant negative consequences to recreation on the Jackson River are expected from the implementation of the project, although, fishing and boating activities will be interrupted when pulses are released from the dam. The amount of time that recreational

activities will be stopped on the river depends on the size of the pulse and the location on the river. Data collected from recent test pulses suggest that recreation will be suspended between 8 to 13 hours per pulse. The impact of each pulse could be mitigated with the timing of the releases. Fishers and boaters should be aware of the pulse schedules and pattern their use of the river accordingly. It also should be noted that although this project will result in improvements to water quality, it cannot address some elements of water quality, e.g. PCB fish tissue content or E. coli contamination, which are also causes of impairment to recreational activities in the Jackson River.

The NAA is predicted to have no significant impact on the recreational activities available in the project area.

4.6 HUMAN RESOURCES

No negative impacts to population, employment, income, or land use would result from the proposed project, and there are no environmental justice issues. Some benefit to employment and income may result from the project with a possible increase in recreation on the Jackson River. Increased tourism could expand employment for canoe and kayak liveries, lodging establishments, and restaurants.

The NAA is predicted to have no significant impact on human resources in the project area.

4.7 HISTORIC RESOURCES

No adverse effects to historic properties would result from the proposed undertaking. There would be no effect to architectural properties, as the pulses would be below the flood stage of the river. Shoreline erosion would be within the parameters of common yearly precipitation events. As the low flow augmentation would be at or less than releases due to high precipitation, and releases during high precipitation events would be decreased, rates of shoreline erosion would not be increased and might be lessened by the proposed project. Thus, the proposed undertaking would not cause effects to archaeological sites. The Virginia Department of Historic Resources concurred that the undertaking would not cause effects and that further Section 106 consultations should not be necessary (telephone conversation, B. MacDonald VDHR – J. Haynes USACE 12 September 2012).

The NAA is predicted to have no significant impact on historic resources in the project area.

4.8 CUMULATIVE IMPACTS

A cumulative impact is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable

future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7).

4.8.1 ADDITIONAL DEVELOPMENT

Past development of the project area has been described in Section 3.10.2. Currently, the majority of land in the watershed is still forested, with very little development. The amount of development that can occur along the Jackson River is limited due to the steep topography of the area. Although expected population changes do not suggest increased regional development, there are two areas which might experience additional development. The first is located along the I-64 corridor, near Covington offering access to the interstate highway. The second area extends from Gathright Dam to the Mead Westvaco, where there is a potential for the additional development of new vacation houses and fishing cabins. Land adjacent to the Jackson River is desirable to sportsmen because it allows access for recreational activities, such as boating and fishing. Development of these two areas could result in the reduction of riparian vegetation, increased amounts of impervious surfaces and construction activities, and ultimately increased amounts of non-point source pollution. Non-point sources of pollution are typically related to development, and can include runoff from parking lots, road dirt, and grit, and runoff and leachate from construction or from activities which disturb the land, such as agriculture, feedlots, mining, and logging. Increased development could negatively affect water quality and add stress to the aquatic system.

4.8.2 WATER QUALITY REGULATION AND ENFORCEMENT

Past development and industry on the Jackson River have led to lowered water quality and aquatic habitat. The enactment of Clean Water Act and other environmental legislation by the Commonwealth has led to the decrease of pollutants into the river through regulation. The stretch of Jackson River located below the Gathright Dam is a point-source dominated waterbody. This means that the environmental quality of the river depends upon the effluence released from facilities holding individual discharge permits. During the permit renewal process for each facility with an active release permit, the state set limits for effluent discharged into a waterbody. When permit limits are not met, the violator is required to work directly with the state to identify and implement solutions to meet attainment goals. Harsher consequences, such as fines and even jail time, could be levied if permit limits are continually broken.

The recent implementation of more stringent release limits has resulted in the closure of a treatment facility on the Jackson River. The Clifton Forge STP, which was permitted to discharge 2,200,000 gallons per day, repeatedly violated its permitted limits. The municipality chose to close the facility and pump the material to the new regional STP in Iron Gate, because it could not meet the nutrient limits. Due to the closure of this facility, the amount of dissolved nutrients entering the river will decrease, positively impacting the aquatic ecosystem.

Mead Westvaco Packaging Resource Group is the largest permitted discharger on the mainstem of the Jackson River. In an effort to improve water quality conditions in the river, Mead Westvaco has invested in readily available treatment technologies and has been successfully in reducing concentrations of dissolved nutrients, especially phosphorous, in the effluent released from its facility. If more stringent permit limits are required by the state, the company many not be able to attain those limits without significant action, such as the investment of large amounts of capital and installation of cutting edge treatment technologies. Without changes to the Mead Westvaco treatment facility, discharge quality will remain the same, resulting in no change to river quality.

In the past, the city of Covington has violated the assigned limits of the permit granted for its STP outfall. The municipality has been working with the state to develop a plan that will address effluent quality released from the facility and has applied for millions of dollars in grant money, allowing the city to invest in major improvements to the treatment facility. Phase 1 of Covington's improvement plan involves successfully transporting untreated sewage to the treatment facility, while Phase 2 will upgrade the actual treatment process. Once these upgrades are implemented, it is predicted that the STP will meet permitted limits for phosphorus and be very close to meeting limits set for DO. Aquatic habitat improvements downstream of the facility should become evident as effluent quality improves.

Current regulation of the river is directed towards achieving a river that is unimpaired and is able to meet all of the designated uses set by the Commonwealth of Virginia. Future limits on nutrient concentrations will most likely be stricter than the current limits. The cumulative effects of all of the actions being taken and will be taken in the future to improve water and habitat quality may result in significantly larger improvements than can be accomplished with the PA alone.

4.8.3 NON-FEDERAL HYDROPOWER DEVELOPMENT

In 2006 a non-federal developer initiated the process to implement hydropower at Gathright Dam with the Federal Energy Regulatory Commission (FERC). The developer's current plan envisions the construction of a module abutting one of the flood passages. This module would be designed to mimic the operation of the existing water quality withdrawal system for flows up to 350 cfs. Discharges from the module would be released through the flood passage the module is abutted against. Flows above 350 cfs would need to be discharged either through the existing water quality system, the other flood passage or combinations of the two. In flood or pulse releases, the module could be raised out of the way of the flood passage so releases could be made out of both flood passages.

FERC granted a license to the developer in March 2012. The developer can commence detailed designs and the preparation of a Section 408 report which must be approved at the Headquarters of USACE. These designs, their supporting analyses, and all agreements protecting the operational, engineering, and dam safety aspects of the Gathright Dam and Lake Moomaw

project, are subject to the approval of the Norfolk District USACE. The non-federal hydropower development, if implemented, should not preclude or have any impact on the alternatives considered in this study. The developer currently lists 2014 as the scheduled start of hydropower operations.

4.9 COMPATIBILITY WITH FEDERAL, STATE, AND LOCAL OBJECTIVES

The Commonwealth of Virginia, acting through the Secretary of Natural Resources, recognizes the continuing problems with water quality along the Jackson and James Rivers and has initiated the current project the USACE to evaluate the possibility of adjusting or increasing releases at Gathright Dam for improving and restoring environmental resources downstream. Proposed activities for low flow augmentation will be consistent with the Commonwealth's *Draft Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the James River, Lynnhaven and Poquoson Coastal Basins* in terms of point source sediment and nutrient reduction goals. The strategy is viewed as an implementation process that connects and incorporates local water quality initiatives, such as ongoing local watershed planning, which address the need for and location of individual Best Management Practices.

Mandated TMDL plans are also part of the James River Tributary Strategy in that these plans deal with impaired stream segments that are in violation of water quality standards for bacteria or DO. TMDL plans address benthic macroinvertebrate impairments where nutrients or sediment are the pollutant (primary stressor) and TMDL equations (pollution budgets) are written in the units of nutrients or sediment. Therefore, all proposed activities will also be in concert with TMDL's developed for specific impaired reaches of the Jackson River and James River. Coordination will occur throughout the study with project delivery team members from the VDEQ and the Virginia Department of Conservation and Recreation to ensure that all proposed activities to augment flows in the Jackson River will be supported by the Commonwealth as being in agreement with state initiatives.

4.10 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

1. Archaeological and Historic Preservation Act of 1974, as amended, 16 U.S.C. 469 et seq.

<u>Compliance:</u> The Virginia Department of Historic Resources (VDHR) has been coordinated with concerning historic and archaeological resources in the project area, and agreed that there was no potential for the project to cause effects to archaeological resources.

2. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

<u>Compliance:</u> Submission of this report to the Regional Administrator of the USEPA for review pursuant to Sections 176 (c) and 309 of the Clean Air Act signifies compliance.

No impacts to air quality will result from the project; therefore no permits would be required for this project.

3. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972 and Water Quality Act of 1987) PL 100-4, 33 U.S.C. 1251 et seq.

Compliance: The project is in compliance with this Act.

4. Coastal Barrier ResourcesAct and Coastal Barrier Improvement Act of 1990

Compliance: There are no designated coastal barrier resources in the project area that would be affected by this project.

5. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1431 et seq.

Compliance: Not applicable. This project is not located in a coastal zone.

6. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with USFWS is ongoing pursuant to Section 7 of the Endangered Species Act.

7. Estuarine Protection Act, 16 U.S.C. 1221 et seq.

Compliance: Not Applicable. No designated estuary would be affected by project activities.

8. Farmland Protection Policy Act of 1981

Compliance: No prime or unique farmland would be impacted by implementation of this project. This act is not applicable.

9. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the USFWS and VDGIF signifies compliance with this act. Coordination Act comments will be included in Appendix C of the final document.

10. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Submission of this report to the National Park Service and the VDCR

relative to the Federal and state comprehensive outdoor recreation plans signifies compliance with this act.

11. Migratory Bird Treaty Act and Migratory Bird Conservation Act

Compliance: No migratory birds would be affected by project activities.

12. National Environmental Policy Act of 1969, as amended, 42 U.S.C. 432 et seq.

Compliance: Preparation of this report, public coordination and addressing public comment signify partial compliance with NEPA. Full compliance is noted with the signing and issuing of the Finding of No Significant Impact.

13. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.
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Compliance: In consultation with representatives of the State Historic Preservation Officer it was determined that the project has no potential to cause effects to historic properties. Preparation of the Draft EA and public coordination and comment signifies partial compliance with National Historic Preservation Act. Full compliance is noted with the signing and issuing of the Finding of No Significant Impact (FONSI).

14. Rivers and Harbors Appropriation Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: The proposed work would not obstruct navigable waters of the U.S.

15. Watershed Protection and Flood Prevention Act, as amended, 16 U.S.C. 1001 et seq.

Compliance: No requirements for USACE activities.

16. Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271 et seq.

Compliance: The Jackson River has not been designated as a national wild and scenic river and it is not part of Virginia's Scenic Rivers Program.

17. Resource Conservation and Recovery Act. 42 U.S.C 6901 et seq (1979)

Compliance: No hazardous substances have been definitively identified in the project area. Project is in compliance with this act following state and Federal agency concurrence with the findings of the Draft EA.

Executive Orders

1. Executive Order 11988, Floodplain Management, 24 May 1977, as amended by Executive Order 12148, 20 July 1979.
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Compliance: The proposed project would not stimulate development in the flood plain. Circulation of this report for public review fulfills the requirements of Executive Order 11988, Section 2(a)(2).

2. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: No wetlands are present in the proposed project area. Circulation of the Draft EA for public review fulfills the requirements of Executive Order 11990, Section 2(b).

3. Executive Order 12898, Environmental Justice in Minority Populations and Low-Income Populations, 11 February 1994.

Compliance: No impacts are expected to occur to any minority or low income communities in the project area. The Draft EA was made available for comment to all individuals who have an interest in the proposed project.

Executive Memorandum

1. Analysis of Impacts of Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: The project does not involve or impact agricultural lands.

5. LIST OF PREPARERS

5.1 PREPARERS

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5.2 REVIEWERS

This EA will be circulated for a 30-day review and comment period with at least the following state and Federal agencies and local interests.

Alleghany County
Bath County
City of Covington
James River Association
James River Basin Association
National Park Service
Trout Unlimited
Upper James River Riverkeepers
USEPA
USFWS
VDCR, Division of Soil and Water Conservation
VDEQ, Office of Environmental Impact Review
VDEQ, Water and Air Quality Divisions
VDGIF
Virginia Department of Health
VDHR
Virginia Department of Transportation

Comments that are received will be addressed in a comment/response section that will be included in the final version of this document.

6. PUBLIC INVOLVEMENT

The Commonwealth of Virginia, acting through the Secretary of Natural Resources, recognized the continuing problems with water quality along the Jackson and James Rivers and requested the USACE to evaluate the possibility of adjusting or increasing releases from Gathright Dam for improving and restoring environmental resources downstream. A diverse group of individuals from organizations including the Virginia Department of Natural Resources, VDEQ have been involved during the entire development of this project.

The draft EA and FONSI will be made available to the public by notice of availability for a thirty day review period as required by the National Environmental Policy Act. A Note of Availability (NOA) was prepared and published in the local newspaper regarding this document.

All comments received during the public review period have been considered in the Final Environmental Assessment**.**

7. CONCLUSION

The project will improve water and habitat quality of the Jackson River from the City of Covington to the confluence of the James River. Ecosystem improvements will be accomplished though alteration of the low flow augmentation schedule and the release of a series of six pulses between the months of June and October. As discussed herein, this assessment has determined that the full range of expected outcomes due to varying the pulse rates, to the extent the outcomes differ if any, will cause no significant adverse impacts. Accordingly, implementation of the Preferred Alternative will be accomplished through adaptive management where one of the three variations presented in this EA would be selected for implementation during that year, depending on past, current, and predicted hydrologic conditions and experience gained from the results achieved by previous years' regulation. The pulsed releases will scour excess periphyton from river sediment and flush fine material that has accumulated on the river bottom. These actions will improve the aquatic habitat by scouring river sediment, increase the amount of dissolved oxygen in the water column and increasing variability in the flow regime, which will lead to a more diverse and robust aquatic community. This project is also predicted to improve recreational opportunities on the lower Jackson River.

The proposed action will have no significant negative impacts on the existing environment. The pulsed releases will increase turbidity and TSS levels in the river temporarily, but levels will return to normal levels after each release. In addition, each release will reduce the amount of fine material stockpiled in the river, resulting in progressively smaller spikes. The implementation of the proposed action would not have a significant adverse impact on the quality of the environment, and an environmental impact statement is not required.

8.0 LIST OF ABBREVIATIONS

AFDM - Ash Free Dry Mass
TSS - BOD – Biological Oxygen Demand
CFS – Cubic Feet Per Second
CHL A – Chlorophyll A
CWA – Clean Water Act
dBA – Decibel A
DM - Design Memoranda
DO - Dissolved Oxygen
EA - Environmental Assessment
FERC - Federal Energy Regulatory Commission
FONSI - Finding of No Significant Impact
FWIS - Fish and Wildlife Information Service
HTRW - Hazardous, Toxic and Radiological Waste
IPAC - Information, Planning and Conservation
MSL – Mean Sea Level
NAA - No Action Alternative
NAAQS - National Ambient Air Quality Standards
NEPA - National Environmental Policy Act
NOA - Note of Availability
NRHP - National Register of Historic Places
PA – Preferred Alternative
PCB - Polychlorinated biphenyls
RBP - Rapid Bioassessment Protocol
RBS - Relative Bed Stability
RM – River Mile
STP - Sewage Treatment Plant
TMDL - Total Maximum Daily Load
TSS - Total Suspended Solid
USACE - U.S. Corps of Engineers
USEPA - US Environmental Protection Agency
USFWS – US Fish and Wildlife Service
VDEQ - Virginia Department of Environmental Quality
VDGIF - Virginia Department of Game and Inland Fisheries’
VDHR - Virginia Department of Historic Resources
VSCI - Virginia Stream Condition Index
WASP7.2 - Water Quality Simulation Program

DRAFT FINDING OF NO SIGNFICANT IMPACT
GATHRIGHT DAM LOW FLOW AUGMENTATION PROJECT
ALLEGHANY COUNTY, VIRGINIA

I have reviewed and evaluated the Environmental Assessment (EA) for this project in terms of the overall public interest. The possible consequences of the alternatives were considered in terms of probable environmental impact, social well being, and economic factors. The proposed project consists of utilizing the existing authorized conservation storage through a balancing of monthly low flow augmentation flow reductions in order to allow a series of six pulse releases between the months of June and October. Three variations of the Preferred Alternative, differing only by the size of the pulsed releases and by the reduction to the monthly low flow augmentation, were considered. The pulse sizes of 3000 cubic feet per second (cfs), 3500 cfs and 4000 cfs were investigated.

The goal of this project is to improve aquatic habitat quality in the Jackson River downstream of the Gathright Dam. The pulsed releases are predicted to scour excess periphyton from river sediment and flush fine material that has accumulated on the river bottom. The change in the release schedule is also predicted to cause an increase the amount of dissolved oxygen in the water column and increasing variability in the flow regime. These changes would ultimately lead to a more diverse and robust aquatic community.

The proposed action would have no significant negative impacts on the existing environment. In essences, each pulsed release would have the same affect on the Jackson River as a minor flooding event. The releases would increase turbidity, nutrient concentration and total suspended solids levels in the river temporarily, but levels would return to normal levels after each release. Each release would reduce the amount of fine material and periphyton stockpiled in the river, resulting in progressively smaller spikes. The pulsed releases would require a reduction of the monthly low flow augmentation between the months of June and September. This reduction would result in a small drop in the elevation of the Jackson River, but no adverse environmental impacts are expected from this change.

No significantly adverse economic or social impacts are foreseen as a result of the proposed action. The Preferred Alternative is predicted to enhance aquatic recreation by improving aquatic habitat; although the alternative will not change the fish consumption impairment or the recreation impairment that currently is in place on this section of the Jackson River. Additionally, pulsed releases will cause a temporary (8-13 hours per pulse) interruption of recreational activities on the river.

This report is based on an evaluation of the effects that the proposed action would have on the entire ecosystem; including the land, air, and water resources of the Jackson River downstream of the Gathright Dam and Lake Moomaw. Cumulative impacts of other activities were also considered in this evaluation. It is concluded that implementing the Preferred Alternative would

not have a significant adverse effect on the environment. The expected long-term positive ecological effects gain by altering the release schedule of the Gathright Dam are greater than the short-term, minor negative impacts. Due to the absence of significant adverse environmental impacts, an Environmental Impact Statement will not be required.

_____ _____

Date

PAUL B. OLSEN, P.E.
Colonel, Corps of Engineers
Commanding

REFERENCES

Alleghany County. 2007. Comprehensive Plan of Alleghany County, Virginia. Available online: <http://www.alleghanycounty.us/CompPlan/.

Bath County, Virginia. 2007. Bath County, Comprehensive Plan 2007-2012. Available online: <http://s3.amazonaws.com/zanran_storage/www.bathcountyva.org/ContentPages/46276510.pdf>.

Bugas, P. 2008. Didymo (Invasive Freshwater Algae in Virginia. Available online: <http://www.dgif.virginia.gov/fishing/waterbodies/reports/Didymo%20in%20Virginia%202008.pdf>

Bureau of Economic Analysis, 2011. BEAR Facts, Bath, Virginia. Available online: <http://www.bea.gov/regional/bearfacts/pdf.cfm?geoType=4&baseyear=2010&fips=51017&areatype=51000>

Kaufmann, P. R., P. Levine, E. G. Robinson, C. Seeliger, and D. Peck. 1999. Quantifying physical habitat in wadeable streams. EPA/620/R-99/003, USEPA, Washington, D.C.

Louis Berger Group, Inc. 2006. Benthic TMDL Development: Stressor Identification for the Jackson River, Virginia. Submitted to the Virginia Department of Environmental Quality.

Louis Berger Group, Inc. 2010. Benthic TMDL Development for the Jackson River, Virginia. Submitted to the Virginia Department of Environmental Quality. Available online: <http://www.deq.virginia.gov/portals/0/DEQ/Water/TMDL/apptmdls/jamesrvr/jackben.pdf Group. Inc.>.

NYDEC. New York State Department of Environmental Conservation, 2001. "Assessing and Mitigating Noise Impacts Conservation". Available online: <http://www.dec.ny.gov/docs/permits_ej_operations_pdf/noise2000.pdf>.

The Patrick Center for Environmental Research, 2000. Jackson River Algal Biomass Report: May 9, 2000 Survey; Report No. 00-9. The Patrick Center for Environmental Research, The Academy of Natural Sciences; Philadelphia, PA.

The Patrick Center for Environmental Research. 2001. Jackson River Algal Biomass 2000. The Patrick Center for Environmental Research, The Academy of Natural Sciences; Philadelphia, PA.

U.S. Army Corps of Engineers (USACE). 1965. Design Memorandum No. 1A Hydrology Gathright Reservoir James River Basin, Jackson River, Virginia.

U.S. Army Corps of Engineers (USACE). 2009. Gathright Dam and Lake Moomaw: Annual

Water Quality Data Report. Norfolk District. DAEN-CWH-4.

U.S. Census Bureau, 2005-2009. Alleghany County, Virginia, S1701 Poverty Status in the Past 12 Months, 2005 – 2009 American Community Survey 5-Year Estimates. Available online (accessed 2/15/2011): http://factfinder.census.gov/

U.S. Environmental Protection Agency (EPA). 1999. Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers. Office of Water. EPA/841/B-99/002.

U.S. Environmental Protection Agency (EPA). 2000. Stressor Identification Guidance Document. EPA, Office of Water, EPA/822/B-00/025, Washington DC.

U.S. Fish and Wildlife Service (USFWS). 2011. Endangered Species Program. Website visited March 16, 2011. Available at: <http://www.fws.gov/endangered/>.

Virginia Department of Environmental Quality (VDEQ), 2011a. Air Regulations. Website visited March 18, 2011. Available at: <http://www.deq.virginia.gov/air/regulations/airregs.html>.

Virginia Department of Environmental Quality (VDEQ), 2011b. Characterization of 2010 Base Flow and Pulse Flow Water Chemistry in the Jackson River. VDEQ Technical Bulletin WQA/2011-001, 2011.

Virginia Department of Environmental Quality (VDEQ), 2012. Draft 2012 305(b)/303(d) Water Quality Assessment Integrated Report. Available online: <http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2012305b303dIntegratedReport.aspx>.

Virginia Department of Game and Inland Fisheries (VDGIF). 2010. "2010 Jackson River Tailwater Biologist Report". Virginia Department of Game and Inland Fisheries. Website visited March 18, 2011. Available online: <http://www.dgif.virginia.gov/fishing/waterbodies/reports/2010%20Jackson%20RiverTailwater%20Bio%20Rpt.pdf>.

Virginia Department of Game and Inland Fisheries (VDGIF). 2011. Virginia Fish and Wildlife Information Service (VaFWIS). Website visited March 18, 2011. Available at: <http://vafwis.org/fwis/>.

APPENDICES

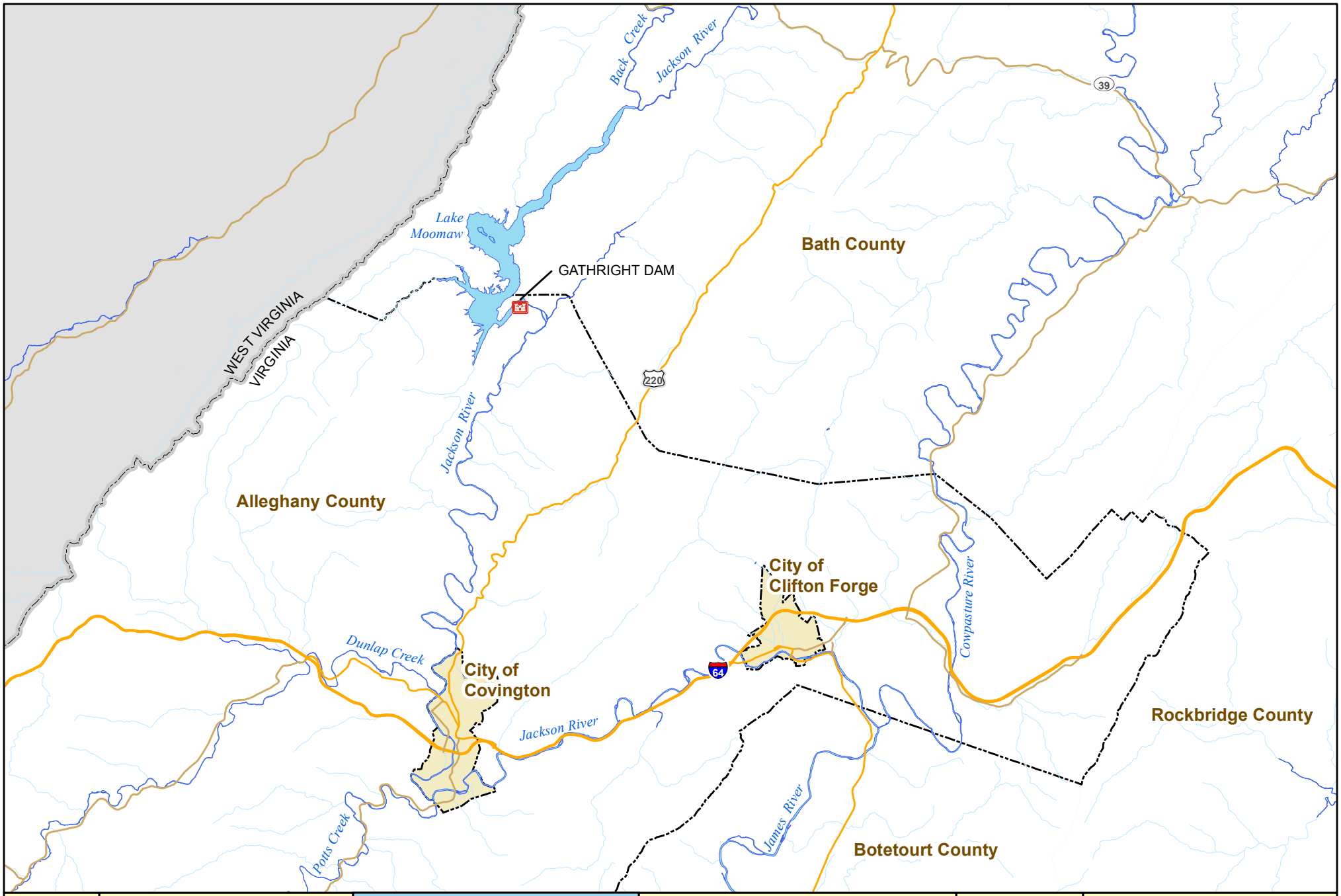
GATHRIGHT DAM LOW FLOW AUGMENTATION PROJECT ALLEGHANY COUNTY, VIRGINIA

Norfolk District
803 Front Street
Norfolk, VA 23510-1096
December 2012

US Army Corps of Engineers ®

APPENDIX A

PLATES



US Army Corps of Engineers
Norfolk District

Gathright Dam and Lake Moomaw

Overview of Study Area

STUDY AREA OVERVIEW

0 1 2 4 Miles

N

Projection:
Virginia State Plane
South Zone - NAD 83
U.S. Survey Feet

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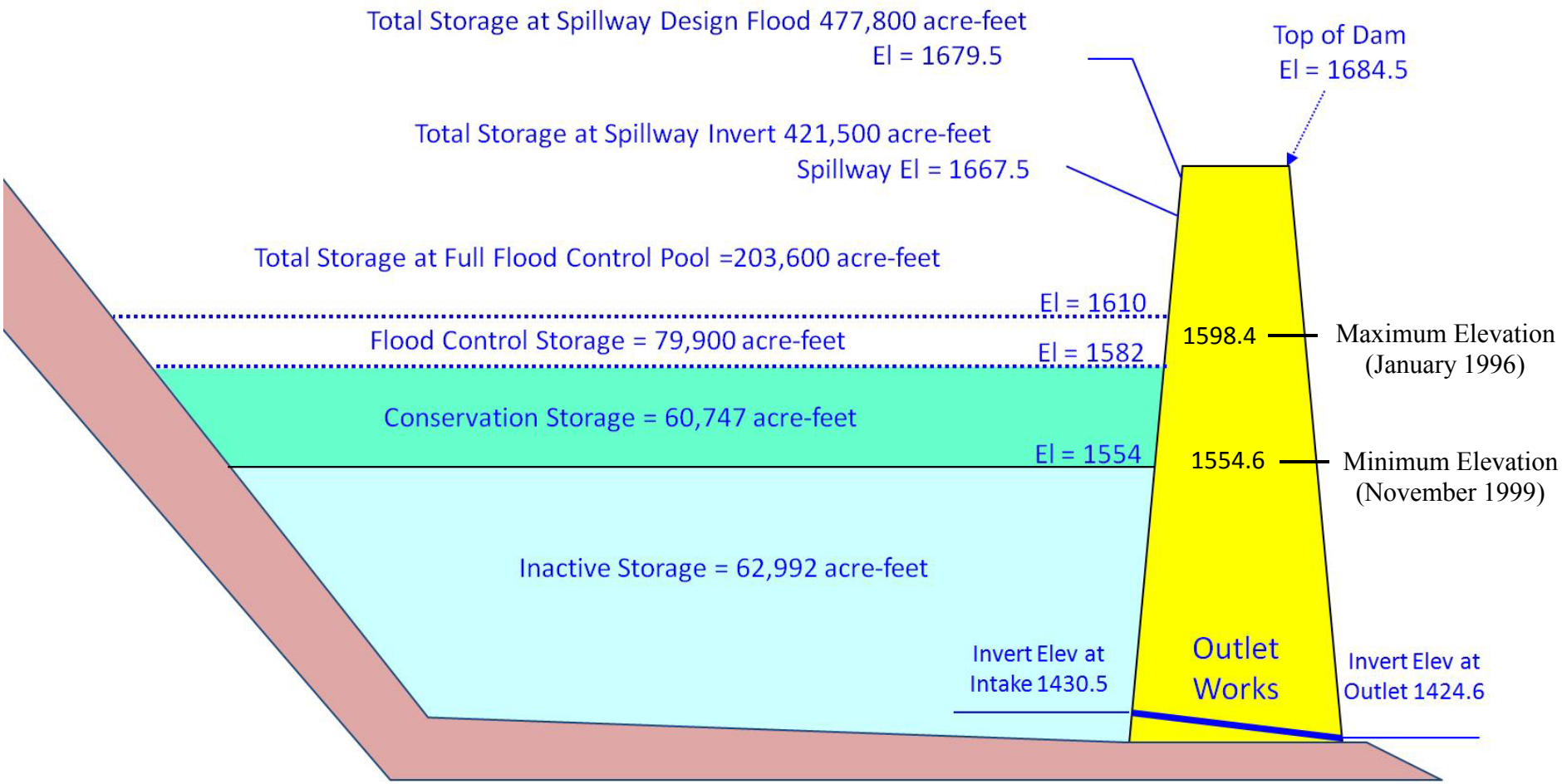
Prepared by: Jason O'Neal
Geospatial Section

Map File: Gathright_Dam_216_OVERVIEW.mxd
Map Date: 20 September 2012



Gathright Dam and Lake Moomaw, VA
Low Flow Augmentation

National Geodetic Vertical Datum of 1929
(NVGD 29)

Plate 2:
Reservoir Storage Allocation
Not to Scale

APPENDIX B

TABLES

APPENDIX B

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TABLES

This section includes tables which have been referenced in the main body of the report. The tables describe the fauna that resides within the project area, which includes Lake Moomaw, the Gathright Dam and the stretch of the Jackson River from the dam to the confluence with the Cowpasture River.

Table B-1. SPECIES WITH EITHER FEDERAL OR STATE STATUS

Status	Common Name	Scientific Name
FESE	Bat, Indiana	*Myotis sodalis*
FESE	Spinymussel, James	*Pleurobema collina*
FESE	Bat, gray	*Myotis grisescens*
FESE	Bat, Virginia big-eared	*Corynorhinus townsendii virginianus*
SE	Wren, Bewick's	*Thryomanes bewickii*
FSSE	Springsnail	*Fontigens morrisoni*
FSSE	Coil, shaggy	*Helicodiscus diadema*
SE	Shrew, American water	*Sorex palustris*
SE	Vole, rock	*Microtus chrotorrhinus*
ST	Falcon, peregrine	*Falco peregrinus*
ST	Sandpiper, upland	*Bartramia longicauda*
ST	Shrike, loggerhead	*Lanius ludovicianus*
ST	Sparrow, Henslow's	*Ammodramus henslowii*
FSST	Skipper, Appalachian grizzled	*Pyrgus wyandot*
FSST	Madtom, orangefin	*Noturus gilberti*
FSST	Eagle, bald	*Haliaeetus leucocephalus*
ST	Floater, green	*Lasmigona subviridis*
FSST	Pigtoe, Atlantic	*Fusconaia masoni*
ST	Shrike, migrant loggerhead	*Lanius ludovicianus migrans*
FS	Fritillary, regal	*Speyeria idalia idalia*
FS	Shiner, roughhead	*Notropis semperasper*
FS	Salamander, Peaks of Otter	*Plethodon hubrichti*
FS	Amphipod, Alleghany County Cave	*Stygobromus hoffmani*
FS	Amphipod, Bath County Cave	*Stygobromus mundus*
FS	Amphipod, Morrison's Cave	*Stygobromus morrisoni*
FS	Isopod, Vandel's Cave	*Caecidotea vandeli*
FS	Beetle, Maureen's shale stream	*Hydraena maureenae*
FS	Butterfly, Persius duskywing	*Erynnis persius persius*
FS	Coil, talus	*Helicodiscus triodus*
FS	Pseudoscorpion, cave	*Kleptochthonius anophthalmus*
FS	Lance, yellow	*Elliptio lanceolata*
FS	fritillary, Diana	*Speyeria diana*
CC	Rattlesnake, timber	*Crotalus horridus*

***** FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FP=Federal Proposed; FC=Federal Candidate; FS=Federal Species of Concern; SC=State Candidate; CC=Collection Concern; SS=State Special Concern (obsolete January 1, 2011)

Table B-2. SPECIES IDENTIFIED BY THE VIRGINIA WILDLIFE ACTION PLAN OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA

Tier	Common Name	Scientific Name
I	Bat, Indiana	*Myotis sodalis*
I	Spinymussel, James	*Pleurobema collina*
II	Bat, gray	*Myotis grisescens*
II	Bat, Virginia big-eared	*Corynorhinus townsendii virginianus*
I	Wren, Bewick's	*Thryomanes bewickii*
I	Springsnail	*Fontigens morrisoni*
I	Coil, shaggy	*Helicodiscus diadema*
II	Shrew, American water	*Sorex palustris*
II	Vole, rock	*Microtus chrotorrhinus*
I	Falcon, peregrine	*Falco peregrinus*
I	Sandpiper, upland	*Bartramia longicauda*
I	Shrike, loggerhead	*Lanius ludovicianus*
I	Sparrow, Henslow's	*Ammodramus henslowii*
I	Skipper, Appalachian grizzled	*Pyrgus wyandot*
II	Madtom, orangefin	*Noturus gilberti*
II	Eagle, bald	*Haliaeetus leucocephalus*
II	Floater, green	*Lasmigona subviridis*
II	Pigtoe, Atlantic	*Fusconaia masoni*
I	Fritillary, regal	*Speyeria idalia idalia*
II	Shiner, roughhead	*Notropis semperasper*
II	Salamander, Peaks of Otter	*Plethodon hubrichti*
II	Amphipod, Alleghany County Cave	*Stygobromus hoffmani*
II	Amphipod, Bath County Cave	*Stygobromus mundus*
II	Amphipod, Morrison's Cave	*Stygobromus morrisoni*
II	Isopod, Vandel's Cave	*Caecidotea vandeli*
II	Beetle, Maureen's shale stream	*Hydraena maureenae*
II	Butterfly, Persius duskywing	*Erynnis persius persius*
II	Coil, talus	*Helicodiscus triodus*
II	Pseudoscorpion, Cave	*Kleptochthonius anophthalmus*
III	Lance, yellow	*Elliptio lanceolata*
IV	fritillary, Diana	*Speyeria diana*
IV	Rattlesnake, timber	*Crotalus horridus*
I	Pinesnake, northern	*Pituophis melanoleucus melanoleucus*
I	Crossbill, red	*Loxia curvirostra*

Table B-2. SPECIES IDENTIFIED BY THE VIRGINIA WILDLIFE ACTION PLAN OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA (Cont'd)

Tier	Common Name	Scientific Name
I	Sapsucker, yellow-bellied	*Sphyrapicus varius*
I	Warbler, black-throated green	*Dendroica virens*
I	Warbler, golden-winged	*Vermivora chrysoptera*
II	Duck, American black	*Anas rubripes*
II	Owl, northern saw-whet	*Aegolius acadicus*
II	Warbler, cerulean	*Dendroica cerulea*
II	Wren, winter	*Troglodytes troglodytes*
II	Fisher	*Martes pennanti pennanti*
III	Greensnake, smooth	*Opheodrys vernalis*
III	Turtle, eastern box	*Terrapene carolina carolina*
III	Bittern, least	*Ixobrychus exilis exilis*
III	Harrier, northern	*Circus cyaneus*
III	Night-heron, yellow-crowned	*Nyctanassa violacea violacea*
III	Owl, barn	*Tyto alba pratincola*
III	Redhead	*Aythya americana*
III	Tern, common	*Sterna hirundo*
III	Wren, sedge	*Cistothorus platensis*
III	Myotis, eastern small-footed	*Myotis leibii*
III	Rainbow, notched	*Villosa constricta*
III	Springsnail, Blue Ridge	*Fontigens orolibas*
III	Damselfly, Appalachian jewelwing	*Calopteryx angustipennis*
III	Butterfly, mottled duskywing	*Erynnis martialis*
IV	Darter, riverweed	*Etheostoma podostemone*
IV	Salamander, Jefferson	*Ambystoma jeffersonianum*
IV	Ribbonsnake, common	*Thamnophis sauritus sauritus*
IV	Scarletsnake, northern	*Cemophora coccinea copei*
IV	Snake, eastern hog-nosed	*Heterodon platirhinos*
IV	Snake, queen	*Regina septemvittata*
IV	Blackbird, rusty	*Euphagus carolinus*
IV	Bobwhite, northern	*Colinus virginianus*
IV	Catbird, gray	*Dumetella carolinensis*
IV	Chat, yellow-breasted	*Icteria virens virens*
IV	Chuck-will's-widow	*Caprimulgus carolinensis*
IV	Creeper, brown	*Certhia americana*

Table B-2. SPECIES IDENTIFIED BY THE VIRGINIA WILDLIFE ACTION PLAN OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA (Cont'd)

Tier	Common Name	Scientific Name
IV	Cuckoo, yellow-billed	*Coccyzus americanus*
IV	Dowitcher, short-billed	*Limnodromus griseus*
IV	Flycatcher, willow	*Empidonax traillii*
IV	Grosbeak, rose-breasted	*Pheucticus ludovicianus*
IV	Heron, green	*Butorides virescens*
IV	Kingbird, eastern	*Tyrannus tyrannus*
IV	Meadowlark, eastern	*Sturnella magna*
IV	Ovenbird	*Seiurus aurocapilla*
IV	Parula, northern	*Parula americana*
IV	Pewee, eastern wood	*Contopus virens*
IV	Rail, yellow	*Coturnicops noveboracensis*
IV	Scaup, greater	*Aythya marila*
IV	Sparrow, field	*Spizella pusilla*
IV	Sparrow, grasshopper	*Ammodramus savannarum pratensis*
IV	Swallow, northern rough-winged	*Stelgidopteryx serripennis*
IV	Swift, chimney	*Chaetura pelagica*
IV	Tanager, scarlet	*Piranga olivacea*
IV	Tern, Forster's	*Sterna forsteri*
IV	Thrasher, brown	*Toxostoma rufum*
IV	Thrush, wood	*Hylocichla mustelina*
IV	Towhee, eastern	*Pipilo erythrophthalmus*
IV	Vireo, yellow-throated	*Vireo flavifrons*
IV	Warbler, black-and-white	*Mniotilta varia*
IV	Warbler, blue-winged	*Vermivora pinus*
IV	Warbler, Canada	*Wilsonia canadensis*
IV	Warbler, Kentucky	*Oporornis formosus*
IV	Warbler, prairie	*Dendroica discolor*
IV	Warbler, prothonotary	*Protonotaria citrea*
IV	Warbler, worm-eating	*Helmitheros vermivorus*
IV	Warbler, yellow	*Dendroica petechia*
IV	Waterthrush, Louisiana	*Seiurus motacilla*
IV	Whip-poor-will	*Caprimulgus vociferus*
IV	Woodcock, American	*Scolopax minor*
IV	Wren, marsh	*Cistothorus palustris*

Table B-2. SPECIES IDENTIFIED BY THE VIRGINIA WILDLIFE ACTION PLAN OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA (Cont'd)

Tier	Common Name	Scientific Name
IV	Cottontail, Appalachian	*Sylvilagus obscurus*
IV	Shrew, long-tailed (= rock)	*Sorex dispar dispar*
IV	Skunk, eastern spotted	*Spilogale putorius putorius*
IV	Weasel, least	*Mustela nivalis allegheniensis*
IV	Woodrat, Allegheny	*Neotoma magister*
IV	Creeper	*Strophitus undulatus*
IV	Lance, Carolina	*Elliptio angustata*
IV	Mussel, triangle floater	*Alasmidonta undulata*
IV	Spike, Atlantic	*Elliptio producta*
IV	Crayfish	*Orconectes obscurus*
IV	Crayfish	*Orconectes cristavarius*
IV	Butterfly, early hairstreak	*Erora laeta*
IV	Butterfly, frosted elfin	*Callophrys irus*
IV	Butterfly, hoary elfin	*Callophrys polius*
IV	Butterfly, northern metalmark	*Calephelis borealis*

Source: VDGIF Online Database (the search area included a circle with a 10-mile radius around point latitude 37°52′00.6″, longitude 79°53′ 58.8″), 2011.

KEY = Tier I - Critical Conservation Need; II=VA Wildlife Action Plan - Tier II - Very High Conservation Need; III=VA Wildlife Action Plan - Tier III - High Conservation Need; IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need

Table B-3. AVIAN RESOURCES OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME
Bittern, least	*Ixobrychus exilis exilis*
Blackbird, red-winged	*Agelaius phoeniceus*
Blackbird, rusty	*Euphagus carolinus*
Bluebird, eastern	*Sialia sialis*
Bobwhite, northern	*Colinus virginianus*
Bufflehead	*Bucephala albeola*
Bunting, indigo	*Passerina cyanea*
Bunting, snow	*Plectrophenax nivalis nivalis*
Canvasback	*Aythya valisineria*
Cardinal, northern	*Cardinalis cardinalis*
Catbird, gray	*Dumetella carolinensis*
Chat, yellow-breasted	*Icteria virens virens*
Chickadee, black-capped	*Poecile atricapillus*
Chickadee, Carolina	*Poecile carolinensis*
Chuck-will's-widow	*Caprimulgus carolinensis*
Coot, American	*Fulica americana*
Cormorant, double-crested	*Phalacrocorax auritus*
Cowbird, brown-headed	*Molothrus ater*
Creeper, brown	*Certhia americana*
Crossbill, red	*Loxia curvirostra*
Crossbill, white-winged	*Loxia leucoptera*
Crow, American	*Corvus brachyrhynchos*
Cuckoo, black-billed	*Coccyzus erythropthalmus*
Cuckoo, yellow-billed	*Coccyzus americanus*
Dickcissel	*Spiza americana*
Dove, mourning	*Zenaida macroura carolinensis*
Dowitcher, short-billed	*Limnodromus griseus*
Duck, American black	*Anas rubripes*
Duck, ring-necked	*Aythya collaris*
Duck, wood	*Aix sponsa*
Eagle, bald	*Haliaeetus leucocephalus*
Eagle, golden	*Aquila chrysaetos*
Egret, great	*Ardea alba egretta*
Falcon, peregrine	*Falco peregrinus*

Table B-3. AVIAN RESOURCES OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Finch, house	*Carpodacus mexicanus*
Finch, purple	*Carpodacus purpureus*
Flicker, northern	*Colaptes auratus*
Flycatcher, Acadian	*Empidonax virescens*
Flycatcher, alder	*Empidonax alnorum*
Flycatcher, great crested	*Myiarchus crinitus*
Flycatcher, least	*Empidonax minimus*
Flycatcher, willow	*Empidonax traillii*
Gadwall	*Anas strepera*
Gnatcatcher, blue-gray	*Polioptila caerulea*
Goldeneye, common	*Bucephala clangula americana*
Goldfinch, American	*Carduelis tristis*
Goose, Canada	*Branta canadensis*
Goshawk, northern	*Accipiter gentilis*
Grackle, common	*Quiscalus quiscula*
Grebe, pied-billed	*Podilymbus podiceps*
Grosbeak, blue	*Guiraca caerulea caerulea*
Grosbeak, evening	*Coccothraustes vespertinus*
Grosbeak, rose-breasted	*Pheucticus ludovicianus*
Grouse, ruffed	*Bonasa umbellus*
Gull, herring	*Larus argentatus*
Gull, ring-billed	*Larus delawarensis*
Harrier, northern	*Circus cyaneus*
Hawk, broad-winged	*Buteo platypterus*
Hawk, Cooper's	*Accipiter cooperii*
Hawk, red-shouldered	*Buteo lineatus lineatus*
Hawk, red-tailed	*Buteo jamaicensis*
Hawk, rough-legged	*Buteo lagopus johannis*
Hawk, sharp-shinned	*Accipiter striatus velox*
Heron, great blue	*Ardea herodias herodias*
Heron, green	*Butorides virescens*
Hummingbird, ruby-throated	*Archilochus colubris*
Jay, blue	*Cyanocitta cristata*
Junco, dark-eyed	*Junco hyemalis*
Kestrel, American	*Falco sparverius sparverius*

Table B-3. AVIAN RESOURCES OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Killdeer	*Charadrius vociferus*
Kingbird, eastern	*Tyrannus tyrannus*
Kingfisher, belted	*Ceryle alcyon*
Kinglet, golden-crowned	*Regulus satrapa*
Kinglet, ruby-crowned	*Regulus calendula*
Lark, horned	*Eremophila alpestris*
Loon, common	*Gavia immer*
Mallard	*Anas platyrhynchos*
Martin, purple	*Progne subis*
Meadowlark, eastern	*Sturnella magna*
Merganser, hooded	*Lophodytes cucullatus*
Mockingbird, northern	*Mimus polyglottos*
Moorhen, common	*Gallinula chloropus cachinnans*
Nighthawk, common	*Chordeiles minor*
Night-heron, yellow-crowned	*Nyctanassa violacea violacea*
Nuthatch, red-breasted	*Sitta canadensis*
Nuthatch, white-breasted	*Sitta carolinensis*
Oriole, Baltimore	*Icterus galbula*
Oriole, orchard	*Icterus spurius*
Osprey	*Pandion haliaetus carolinensis*
Ovenbird	*Seiurus aurocapilla*
Owl, barn	*Tyto alba pratincola*
Owl, barred	*Strix varia*
Owl, great horned	*Bubo virginianus*
Owl, northern saw-whet	*Aegolius acadicus*
Owl, short-eared	*Asio flammeus*
Parula, northern	*Parula americana*
Pewee, eastern wood	*Contopus virens*
Pheasant, ring-necked	*Phasianus colchicus*
Phoebe, eastern	*Sayornis phoebe*
Pigeon, rock	*Columba livia*
Pipit, American	*Anthus rubescens*
Rail, yellow	*Coturnicops noveboracensis*

Table B-3. AVIAN RESOURCES OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Rail, yellow	*Coturnicops noveboracensis*
Raven, common	*Corvus corax*
Redhead	*Aythya americana*
Redstart, American	*Setophaga ruticilla*
Robin, American	*Turdus migratorius*
Sandpiper, solitary	*Tringa solitaria*
Sandpiper, spotted	*Actitis macularia*
Sandpiper, upland	*Bartramia longicauda*
Sapsucker, yellow-bellied	*Sphyrapicus varius*
Scaup, greater	*Aythya marila*
Scaup, lesser	*Aythya affinis*
Scoter, white-winged	*Melanitta fusca deglandi*
Screech-owl, eastern	*Megascops asio*
Shrike, loggerhead	*Lanius ludovicianus*
Shrike, migrant loggerhead	*Lanius ludovicianus migrans*
Siskin, pine	*Carduelis pinus*
Snipe, Wilson's	*Gallinago delicata*
Sora	*Porzana carolina*
Sparrow, American tree	*Spizella arborea*
Sparrow, chipping	*Spizella passerina*
Sparrow, field	*Spizella pusilla*
Sparrow, fox	*Passerella iliaca*
Sparrow, grasshopper	*Ammodramus savannarum pratensis*
Sparrow, Henslow's	*Ammodramus henslowii*
Sparrow, house	*Passer domesticus*
Sparrow, Le Conte's	*Ammodramus leconteii*
Sparrow, savannah	*Passerculus sandwichensis*
Sparrow, song	*Melospiza melodia*
Sparrow, swamp	*Melospiza georgiana*
Sparrow, vesper	*Pooecetes gramineus*
Sparrow, white-crowned	*Zonotrichia leucophrys*
Sparrow, white-throated	*Zonotrichia albicollis*
Starling, European	*Sturnus vulgaris*
Stork, wood	*Mycteria americana*
Swallow, bank	*Riparia riparia*

Table B-3. AVIAN RESOURCES OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Swallow, barn	*Hirundo rustica*
Swallow, cliff	*Petrochelidon pyrrhonota pyrrhonota*
Swallow, tree	*Tachycineta bicolor*
Swallow, northern rough-winged	*Stelgidopteryx serripennis*
Swift, chimney	*Chaetura pelagica*
Tanager, scarlet	*Piranga olivacea*
Tanager, summer	*Piranga rubra*
Teal, blue-winged	*Anas discors orphna*
Teal, green-winged	*Anas crecca carolinensis*
Tern, common	*Sterna hirundo*
Tern, Forster's	*Sterna forsteri*
Thrasher, brown	*Toxostoma rufum*
Thrush, hermit	*Catharus guttatus*
Thrush, wood	*Hylocichla mustelina*
Titmouse, tufted	*Baeolophus bicolor*
Towhee, eastern	*Pipilo erythrophthalmus*
Turkey, wild	*Meleagris gallopavo silvestris*
Veery	*Catharus fuscescens*
Vireo, blue-headed	*Vireo solitarius*
Vireo, red-eyed	*Vireo olivaceus*
Vireo, warbling	*Vireo gilvus gilvus*
Vireo, white-eyed	*Vireo griseus*
Vireo, yellow-throated	*Vireo flavifrons*
Vulture, black	*Coragyps atratus*
Vulture, turkey	*Cathartes aura*
Warbler, black-and-white	*Mniotilta varia*
Warbler, black-throated blue	*Dendroica caerulescens*
Warbler, black-throated green	*Dendroica virens*
Warbler, blackburnian	*Dendroica fusca*
Warbler, blackpoll	*Dendroica striata*
Warbler, blue-winged	*Vermivora pinus*
Warbler, Canada	*Wilsonia canadensis*
Warbler, Cape May	*Dendroica tigrina*
Warbler, cerulean	*Dendroica cerulea*
Warbler, chestnut-sided	*Dendroica pensylvanica*

Table B-3. AVIAN RESOURCES OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Warbler, golden-winged	*Vermivora chrysoptera*
Warbler, hooded	*Wilsonia citrina*
Warbler, Kentucky	*Oporornis formosus*
Warbler, magnolia	*Dendroica magnolia*
Warbler, mourning	*Oporornis philadelphia*
Warbler, Nashville	*Vermivora ruficapilla*
Warbler, palm	*Dendroica palmarum*
Warbler, pine	*Dendroica pinus*
Warbler, prairie	*Dendroica discolor*
Warbler, prothonotary	*Protonotaria citrea*
Warbler, worm-eating	*Helmitheros vermivorus*
Warbler, yellow	*Dendroica petechia*
Warbler, yellow-rumped	*Dendroica coronata cornata*
Warbler, yellow-throated	*Dendroica dominica*
Waterthrush, Louisiana	*Seiurus motacilla*
Waterthrush, northern	*Seiurus noveboracensis*
Waxwing, cedar	*Bombycilla cedrorum*
Whip-poor-will	*Caprimulgus vociferus*
Woodcock, American	*Scolopax minor*
Woodpecker, downy	*Picoides pubescens medianus*
Woodpecker, hairy	*Picoides villosus*
Woodpecker, pileated	*Dryocopus pileatus*
Woodpecker, red-bellied	*Melanerpes carolinus*
Woodpecker, red-headed	*Melanerpes erythrocephalus*
Wren, Bewick's	*Thryomanes bewickii*
Wren, Carolina	*Thryothorus ludovicianus*
Wren, house	*Troglodytes aedon*
Wren, marsh	*Cistothorus palustris*
Wren, sedge	*Cistothorus platensis*
Wren, winter	*Troglodytes troglodytes*
Yellowthroat, common	*Geothlypis trichas*

Source: VDGIF Online Database (the search area included a circle with a 10-mile radius around point latitude 37°52′00.6″, longitude 79°53′ 58.8″), 2011.

Table B-4. TERRESTRIAL MAMMALS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME
Mussel, eastern elliptio	*Elliptio complanata*
Bat, big brown	*Eptesicus fuscus fuscus*
Bat, eastern red	*Lasiurus borealis borealis*
Bat, gray	*Myotis grisescens*
Bat, hoary	*Lasiurus cinereus cinereus*
Bat, Indiana	*Myotis sodalis*
Bat, little brown	*Myotis lucifugus lucifugus*
Bat, silver-haired	*Lasionycteris noctivagans*
Bat, Virginia big-eared	*Corynorhinus townsendii virginianus*
Bear, black	*Ursus americanus americanus*
Beaver, American	*Castor canadensis*
Bobcat	*Lynx rufus rufus*
Chipmunk, Fisher's eastern	*Tamias striatus fisheri*
Cottontail, Appalachian	*Sylvilagus obscurus*
Cottontail, eastern	*Sylvilagus floridanus mallurus*
Coyote	*Canis latrans*
Deer, white-tailed	*Odocoileus virginianus*
Fisher	*Martes pennanti pennanti*
Fox, common gray	*Urocyon cinereoargenteus cinereoargenteus*
Fox, red	*Vulpes vulpes fulva*
Lemming, Stone's southern bog	*Synaptomys cooperi stonei*
Mink, common	*Mustela vison mink*
Mink, southwestern	*Mustela vison vison*
Mole, eastern	*Scalopus aquaticus aquaticus*
Mole, hairy-tailed	*Parascalops breweri*
Mouse, common golden	*Ochrotomys nuttalli aureolus*
Mouse, deer	*Peromyscus maniculatus nubiterrae*
Mouse, house	*Mus musculus musculus*
Mouse, meadow jumping	*Zapus hudsonius americanus*
Mouse, northern white-footed	*Peromyscus leucopus noveboracensis*
Mouse, woodland jumping	*Napaeozapus insignis roanensis*
Muskrat, common	*Ondatra zibethicus zibethicus*
Myotis, eastern small-footed	*Myotis leibii*
Myotis, northern	*Myotis septentrionalis septentrionalis*

Table B-4. TERRESTRIAL MAMMALS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Opossum, Virginia	*Didelphis virginiana virginiana*
Otter, northern river	*Lontra canadensis lataxina*
Pipistrelle, eastern	*Pipistrellus subflavus subflavus*
Raccoon	*Procyon lotor lotor*
Rat, Norway	*Rattus norvegicus norvegicus*
Shrew, American water	*Sorex palustris*
Shrew, ashen masked	*Sorex cinereus cinereus*
Shrew, Kirtland's short-tailed	*Blarina brevicauda kirtlandi*
Shrew, least	*Cryptotis parva parva*
Shrew, long-tailed (= rock)	*Sorex dispar dispar*
Shrew, pygmy	*Sorex hoyi winnemana*
Shrew, smoky	*Sorex fumeus fumeus*
Shrew, southeastern	*Sorex longirostris longirostris*
Skunk, eastern spotted	*Spilogale putorius putorius*
Skunk, striped	*Mephitis mephitis mephitis*
Squirrel, eastern fox	*Sciurus niger vulpinus*
Squirrel, northern gray	*Sciurus carolinensis pennsylvanicus*
Squirrel, red	*Tamiasciurus hudsonicus abieticola*
Squirrel, southern flying	*Glaucomys volans volans*
Vole, coastal Gapper's red-backed	*Clethrionomys gapperi maurus*
Vole, common Gapper's red-backed	*Clethrionomys gapperi gapperi*
Vole, meadow	*Microtus pennsylvanicus pennsylvanicus*
Vole, pine	*Microtus pinetorum scalopsoides*
Vole, rock	*Microtus chrotorrhinus*
Weasel, least	*Mustela nivalis allegheniensis*
Weasel, long-tailed	*Mustela frenata noveboracensis*
Woodchuck	*Marmota monax monax*
Woodrat, Allegheny	*Neotoma magister*

Source: VDGIF Online Database (the search area included a circle with a 10-mile radius around point latitude 37°52′00.6″, longitude 79°53′ 58.8″), 2011.

Table B-5. REPTILES AND AMPHIBIANS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME
Brownsnake, northern	*Storeria dekayi dekayi*
Bullfrog, American	*Lithobates catesbeianus*
Cooter, eastern river	*Pseudemys concinna concinna*
Copperhead, northern	*Agkistrodon contortrix mokasen*
Cornsnake, red	*Pantherophis guttatus*
Earthsnake, eastern smooth	*Virginia valeriae valeriae*
Frog, eastern cricket	*Acris crepitans crepitans*
Frog, northern green	*Lithobates clamitans melanota*
Frog, pickerel	*Lithobates palustris*
Frog, upland chorus	*Pseudacris feriarum feriarum*
Frog, wood	*Lithobates sylvaticus*
Gartersnake, eastern	*Thamnophis sirtalis sirtalis*
Greensnake, northern rough	*Opheodrys aestivus aestivus*
Greensnake, smooth	*Opheodrys vernalis*
Kingsnake, eastern	*Lampropeltis getula getula*
Lizard, eastern fence	*Sceloporus undulatus*
Milksnake, eastern	*Lampropeltis triangulum triangulum*
Newt, red-spotted	*Notophthalmus viridescens viridescens*
Peeper, northern spring	*Pseudacris crucifer crucifer*
Pinesnake, northern	*Pituophis melanoleucus melanoleucus*
Racer, northern black	*Coluber constrictor constrictor*
Racerunner, eastern six-lined	*Aspidoscelis sexlineata sexlineata*
Ratsnake, eastern	*Pantherophis alleghaniensis*
Ribbonsnake, common	*Thamnophis sauritus sauritus*
Rattlesnake, timber	*Crotalus horridus*
Salamander, Allegheny mountain dusky	*Desmognathus ochrophaeus*
Salamander, black-bellied	*Desmognathus quadramaculatus*
Salamander, cave	*Eurycea lucifuga*
Salamander, eastern red-backed	*Plethodon cinereus*
Salamander, four-toed	*Hemidactylium scutatum*
Salamander, Jefferson	*Ambystoma jeffersonianum*
Salamander, long-tailed	*Eurycea longicauda longicauda*
Salamander, marbled	*Ambystoma opacum*
Salamander, northern dusky	*Desmognathus fuscus*

Table B-5. REPTILES AND AMPHIBIANS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Salamander, northern red	*Pseudotriton ruber ruber*
Salamander, northern slimy	*Plethodon glutinosus*
Salamander, northern spring	*Gyrinophilus porphyriticus porphyriticus*
Salamander, northern two-lined	*Eurycea bislineata*
Salamander, Peaks of Otter	*Plethodon hubrichti*
Salamander, seal	*Desmognathus monticola*
Salamander, southern two-lined	*Eurycea cirrigera*
Salamander, spotted	*Ambystoma maculatum*
Salamander, valley and ridge	*Plethodon hoffmani*
Salamander, Wehrle's	*Plethodon wehrlei*
Salamander, white-spotted slimy	*Plethodon cylindraceus*
Scarletsnake, northern	*Cemophora coccinea copei*
Skink, broad-headed	*Plestiodon laticeps*
Skink, common five-lined	*Plestiodon fasciatus*
Skink, little brown	*Scincella lateralis*
Skink, northern coal	*Plestiodon anthracinus anthracinus*
Skink, southeastern five-lined	*Plestiodon inexpectatus*
Snake, eastern hog-nosed	*Heterodon platirhinos*
Snake, northern red-bellied	*Storeria occipitomaculata occipitomaculata*
Snake, northern ring-necked	*Diadophis punctatus edwardsii*
Snake, queen	*Regina septemvittata*
Stinkpot	*Sternotherus odoratus*
Toad, eastern American	*Anaxyrus americanus americanus*
Toad, Fowler's	*Anaxyrus fowleri*
Treefrog, gray	*Hyla versicolor*
Turtle, eastern box	*Terrapene carolina carolina*
Turtle, eastern painted	*Chrysemys picta picta*
Turtle, eastern snapping	*Chelydra serpentina serpentina*
Watersnake, northern	*Nerodia sipedon sipedon*
Wormsnake, eastern	*Carphophis amoenus amoenus*

Source: VDGIF Online Database (the search area included a circle with a 10-mile radius around point latitude 37°52′00.6″, longitude 79°53′ 58.8″), 2011.

Table B-6. INSECTS AND ARACHNIDS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME
Armyworm	*Pseudaletia unipuncta*
Beetle, Maureen's shale stream	*Hydraena maureenae*
Borer, European corn	*Ostrinia nubilatis*
Butterfly, American copper	*Lycaena phlaeas*
Butterfly, American lady	*Vanessa virginiensis*
Butterfly, American snout	*Libytheana carinenta*
Butterfly, Appalachian azure	*Celastrina neglectamajor*
Butterfly, Appalachian brown	*Satyrodes appalachia*
Butterfly, Aprhodite fritillary	*Speyeria aphrodite*
Butterfly, Baltimore checkerspot	*Euphydryas phaeton*
Butterfly, banded hairstreak	*Satyrium calanus*
Butterfly, black swallowtail	*Papilio polyxenes asterius*
Butterfly, brown elfin	*Callophrys augustinus*
Butterfly, cabbage white	*Pieris rapae*
Butterfly, Carolina satyr	*Hermeuptychia sosybius*
Butterfly, carus skipper	*Polites carus*
Butterfly, checkered white	*Pontia protodice*
Butterfly, clouded sulphur	*Colias philodice*
Butterfly, columbine duskywing	*Erynnis lucilius*
Butterfly, common buckeye	*Junonia coenia*
Butterfly, common checkered-skipper	*Pyrgus communis*
Butterfly, common sootywing	*Pholisora catullus*
Butterfly, common wood-nymph	*Cercyonis pegala*
Butterfly, crossline skipper	*Polites origenes*
Butterfly, Delaware skipper	*Anatrytone logan*
Butterfly, dreamy duskywing	*Erynnis icelus*
Butterfly, Dun skipper	*Euphyes vestris*
Butterfly, dusky azure	*Celastrina nigra*
Butterfly, dusted skipper	*Atrytonopsis hianna*
Butterfly, early hairstreak	*Erora laeta*
Butterfly, eastern comma	*Polygonia comma*
Butterfly, eastern tailed-blue	*Everes comyntas*
Butterfly, eastern tiger swallowtail	*Papilio glaucus*
Butterfly, Edwards' hairstreak	*Satyrium edwardsii*

Table B-6. INSECTS AND ARACHNIDS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Butterfly, falcate orangetip	*Anthocharis midea*
Butterfly, frosted elfin	*Callophrys irus*
Butterfly, gemmed satyr	*Cyllopsis gemma*
Butterfly, golden-banded skipper	*Autochton cellus*
Butterfly, gray comma	*Polygonia progne*
Butterfly, gray hairstreak	*Strymon melinus*
Butterfly, great spangled fritillary	*Speyeria cybele*
Butterfly, green comma	*Polygonia faunus*
Butterfly, hackberry emperor	*Asterocampa celtis*
Butterfly, harvester	*Feniseca tarquinius*
Butterfly, hickory hairstreak	*Satyrium caryaevorum*
Butterfly, hoary edge	*Achalarus lyciades*
Butterfly, hoary elfin	*Callophrys polius*
Butterfly, Hobomok skipper	*Poanes hobomok*
Butterfly, Horace's duskywing	*Erynnis horatius*
Butterfly, Indian skipper	*Hesperia sassacus*
Butterfly, Juvenal's duskywing	*Erynnis juvenalis*
Butterfly, least skipper	*Ancyloxypha numitor*
Butterfly, little glassywing	*Pompeius verna*
Butterfly, little wood-satyr	*Megisto cymela*
Butterfly, meadow fritillary	*Boloria bellona*
Butterfly, monarch	*Danaus plexippus*
Butterfly, mottled duskywing	*Erynnis martialis*
Butterfly, mourning cloak	*Nymphalis antiopa*
Butterfly, northern broken dash	*Wallengrenia egeremet*
Butterfly, northern cloudywing	*Thorybes pylades*
Butterfly, northern metalmark	*Calephelis borealis*
Butterfly, northern pearly-eye	*Enodia anthedon*
Butterfly, olive juniper hairstreak	*Callophrys gryneus gryneus*
Butterfly, orange sulphur	*Colias eurytheme*
Butterfly, orange-barred sulphur	*Phoebis philea*
Butterfly, painted lady	*Vanessa cardui*
Butterfly, pearl crescent	*Phyciodes tharos*
Butterfly, Peck's skipper	*Polites peckius*

Table B-6. INSECTS AND ARACHNIDS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Butterfly, Persius duskywing	*Erynnis persius persius*
Butterfly, pepper and salt road-skipper	*Amblyscirtes hegon*
Butterfly, pipevine swallowtail	*Battus philenor*
Butterfly, question mark	*Polygonia interrogationis*
Butterfly, red admiral	*Vanessa atalanta*
Butterfly, red-spotted purple	*Limenitis arthemis astyanax*
Butterfly, sachem	*Atalopedes campestris*
Butterfly, silver-bordered fritillary	*Boloria selene*
Butterfly, silver-spotted skipper	*Epargyreus clarus*
Butterfly, silvery blue	*Glaucopsyche lygdamus*
Butterfly, silvery checkerspot	*Chlosyne nycteis*
Butterfly, sleepy duskywing	*Erynnis brizo*
Butterfly, sleepy orange	*Eurema nicippe*
Butterfly, southern cloudywing	*Thorybes bathyllus*
Butterfly, southern hairstreak	*Satyrium favonius*
Butterfly, spicebush swallowtail	*Papilio troilus*
Butterfly, spring azure	*Celastrina ladon*
Butterfly, striped hairstreak	*Satyrium liparops*
Butterfly, tawny emperor	*Asterocampa clyton*
Butterfly, tawny-edged skipper	*Polites themistocles*
Butterfly, variegated fritillary	*Euptoieta claudia*
Butterfly, viceroy	*Limenitis archippus*
Butterfly, white M hairstreak	*Parrhasius m-album*
Butterfly, wild indigo duskywing	*Erynnis baptisiae*
Butterfly, Zabulon skipper	*Poanes zabulon*
Butterfly, zebra swallowtail	*Eurytides marcellus*
Coil, shaggy	*Helicodiscus diadema*
Coil, talus	*Helicodiscus triodus*
Damselfly, Appalachian jewelwing	*Calopteryx angustipennis*
Earworm, corn	*Heliathis zea*
Gnat	*Culicoides guttipennis*
Moth, codling	*Cydia pomonella*
Moth, gypsy	*Lymantria dispar*
Pseudoscorpion, cave	*Kleptochthonius anophthalmus*

Table B-6. INSECTS AND ARACHNIDS OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA
(Cont'd)

COMMON NAME	SCIENTIFIC NAME
Roadside-skipper, common	*Amblyscirtes vialis*
Skipper, Appalachian grizzled	*Pyrgus wyandot*
Tick, American dog	*Dermacentor variabilis*
Tick, brown dog	*Rhipicephalus sanguineus*
Tick, lone star	*Amblyomma americanum*
Tick, rabbit	*Haemaphysalis leporispalustris*
Tick, winter	*Dermacentor albipictus*

Source: VDGIF Online Database (the search area included a circle with a 10-mile radius around point latitude 37°52′00.6″, longitude 79°53′ 58.8″), 2011.

Table B-7. FISH OCCURING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME
Bass, largemouth	*Micropterus salmoides*
Bass, rock	*Ambloplites rupestris*
Bass, smallmouth	*Micropterus dolomieu*
Bluegill	*Lepomis macrochirus*
Bullhead, brown	*Ameiurus nebulosus*
Bullhead, flat	*Ameiurus platycephalus*
Bullhead, yellow	*Ameiurus natalis*
Carp, common	*Cyprinus carpio*
Catfish, channel	*Ictalurus punctatus*
Catfish, flathead	*Pylodictis olivaris*
Catfish, white	*Ameiurus catus*
Chub, bluehead	*Nocomis leptocephalus*
Chub, bull	*Nocomis raneyi*
Chub, creek	*Semotilus atromaculatus*
Chub, river	*Nocomis micropogon*
Chubsucker, creek	*Erimyzon oblongus*
Crappie, black	*Pomoxis nigromaculatus*
Dace, blacknose	*Rhinichthys atratulus*
Dace, longnose	*Rhinichthys cataractae*
Dace, mountain redbelly	*Chrosomus oreas*
Darter, fantail	*Etheostoma flabellare*
Darter, johnny	*Etheostoma nigrum*
Darter, longfin	*Etheostoma longimanum*
Darter, riverweed	*Etheostoma podostemone*
Darter, Roanoke	*Percina roanoka*
Darter, shield	*Percina peltata*
Darter, stripeback	*Percina notogramma*
Fallfish	*Semotilus corporalis*
Jumprock, black	*Moxostoma cervinum*
Killifish, banded	*Fundulus diaphanus*
Madtom, margined	*Noturus insignis*
Madtom, orangefin	*Noturus gilberti*
Minnow, bluntnose	*Pimephales notatus*
Minnow, cutlips	*Exoglossum maxillingua*
Pickerel, chain	*Esox niger*
Pumpkinseed	*Lepomis gibbosus*

Table B-7. FISH OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA (Cont'd)

COMMON NAME	SCIENTIFIC NAME
Quillback	*Carpiodes cyprinus*
Redhorse, golden	*Moxostoma erythrurum*
Redhorse, shorthead	*Moxostoma macrolepidotum*
Sculpin, mottled	*Cottus bairdii*
Shiner, comely	*Notropis amoenus*
Shiner, common	*Luxilus cornutus*
Shiner, crescent	*Luxilus cerasinus*
Shiner, golden	*Notemigonus crysoleucas*
Shiner, highland (= southern rosyface; = redface)	*Notropis micropteryx*
Shiner, mimic	*Notropis volucellus*
Shiner, rosefin	*Lythrurus ardens*
Shiner, roughhead	*Notropis semperasper*
Shiner, satinfin	*Cyprinella analostana*
Shiner, spottail	*Notropis hudsonius*
Shiner, swallowtail	*Notropis procne*
Shiner, white	*Luxilus albeolus*
Stoneroller, central	*Campostoma anomalum*
Sucker, northern hog	*Hypentelium nigricans*
Sucker, torrent	*Thoburnia rhothoeca*
Sucker, white	*Catostomus commersoni*
Sunfish, redbreast	*Lepomis auritus*
Trout, brook	*Salvelinus fontinalis*
Trout, brown	*Salmo trutta*
Trout, rainbow	*Oncorhynchus mykiss*
Warmouth	*Lepomis gulosus*

Source: VDGIF Online Database (the search area included a circle with a 10-mile radius around point latitude 37°52′00.6″, longitude 79°53′ 58.8″), 2011.

Table B-8. AQUATIC MACROINVERTEBRATES OCCURRING OR POTENTIALLY OCCURRING WITHIN THE PROJECT AREA

COMMON NAME	SCIENTIFIC NAME
Crayfish	*Orconectes obscurus*
Crayfish	*Orconectes cristavarius*
Crayfish	*Orconectes c. f. spinosus*
Crayfish, Appalachian brook	*Cambarus bartonii bartonii*
Crayfish, no common name	*Cambarus longulus*
Crayfish, no common name	*Cambarus acuminatus*
Crayfish, spiny cheek	*Orconectes limosus*
Crayfish, virile	*Orconectes virilis*
Creeper	*Strophitus undulatus*
Floater, green	*Lasmigona subviridis*
Lance, Carolina	*Elliptio angustata*
Lance, yellow	*Elliptio lanceolata*
Mussel, eastern elliptio	*Elliptio complanata*
Pigtoe, Atlantic	*Fusconaia masoni*
Rainbow, notched	*Villosa constricta*
Spike, Atlantic	*Elliptio producta*
Springsnail, Blue Ridge	*Fontigens orolibas*
Springsnail	*Fontigens morrisoni*
Spinymussel, James	*Pleurobema collina*

Source: VDGIF Online Database (the search area included a circle with a 10-mile radius around point latitude 37°52′00.6″, longitude 79°53′ 58.8″), 2011.