US Army Corps
of Engineers ®
Wilmington District

Philpott Lake, Virginia

Water Storage Reallocation

Feasibility Study and Environmental Assessment

Draft

July 2022

EXECUTIVE SUMMARY

This study evaluates the reallocation of water storage at Philpott Lake in south-central Virginia . It examines alternatives and identifies the most cost-effective means of providing additional water for the current and future demands of the region, including actions other than reallocation.

The Recommended Plan transfers 5,200 ac-ft of water storage from the conservation pool at Philpott Lake to water supply which constitutes approximately 3.58% of its total active storage. Based on this analysis, the plan is the most technically feasible, environmentally acceptable, and economically justified alternative of those evaluated. There will be no impacts to flood risk management and flood operations for the plan, but there will be a small impact hydropower generation currently estimated to be 0.21% or $6,077 annually. The plan will not require a change to Philpott Lake's existing authorized purposes.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

ac-ft	Acre-Feet
APE	Area of Potential Effects
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CWA	Clean Water Act
CWCCIS	Civil Works Construction Cost Index System
DSAC	Dam Safety Action Classification
EA	Environmental Assessment
ECB	Engineering and Construction Bulletin
ENR	Engineering News Record
EO	Executive Orders
EOP	Environmental Operating Principle
EQ	Environmental Quality
ER	Engineer Regulation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
FONSI	Finding of No Significant Impact
FY	Fiscal Year
HAC	USACE Hydropower Analysis Center
HCPSA	Henry County Public Service Authority
kW	Kilo Watt
MGD	Million Gallons per Day
MW	Mega Watt
MWh	Mega Watt per Hour
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NCDENR	North Carolina Department of Environment and Natural Resources
NED	National Economic Development
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NSD	Nonstationarity Detection Tool
O&M	Operations and Maintenance
OMRR&R	Operations, Maintenance, Repair, Rehabilitation and Replacement

OSE	Other Social Effects
RED	Regional Economic Development
RR&R	Repair, Rehabilitation and Replacement
TMDL	Total Maximum Daily Load
UOF	Use of Facilities
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VADCR	Virginia Department of Conservation and Recreation
VADEQ	Virginia Department of Environmental Quality
VAWRP	Virginia Water Resources Plan
VDH-ODW	Virginia Department of Health-Office of Drinking Water
VDHR	Virginia Department of Historic Resources
WSA	Water Supply Act
WSS	Web Soil Survey

LIST OF APPENDICES

Philpott Lake, Virginia
Water Storage Reallocation
Feasibility Study and Environmental Assessment
July 2022

1 STUDY OVERVIEW

This study evaluates the reallocation of water storage at Philpott Lake to support additional downstream withdrawals for the Henry County Public Service Authority (HCPSA). It examines alternatives and identifies the most cost-effective means of providing additional water for the current and future demands in south-central Virginia including actions other than reallocation. In addition, the study documents possible impacts to regional environmental, socio-economic, historic and cultural resources by the Recommended Plan pursuant to several Federal laws (*i.e.,* the National Environmental Policy Act (NEPA), Clean Water Act (CWA), National Historic Preservation Act (NHPA), Endangered Species Act, etc.). HCPSA is the non-Federal sponsor (NFS) for this study.

1.1 Purpose and Need

The purpose of this study is to examine HCPSA's current and long-term water supply needs, to determine the available capacity at Philpott Lake, and to evaluate HCPSA's ability and willingness to reimburse the Federal government for the additional water supply. HCPSA currently withdraws an average daily volume of about 3.3 million gallons per day (MGD) from the Smith River from its existing downstream intake and is considering options for increasing water production as industrial and system expansion continue in the region. HCPSA is requesting storage in Philpott Lake that will yield 4.0 MGD or 5,200 acre feet over the 50-year period: 2023-2072.

1.2 Authority and Federal Interest

Authority for the U.S. Army Corps of Engineers (USACE) to reallocate water storage at an authorized Federal project is contained within Public Law 85-500, Title III, Water Supply Act (WSA) of 1958, as amended, codified at 43 U.S.C. § 390b. Section 301(b), of this Act states ". . . it is hereby provided that storage may be included in any reservoir project surveyed, planned, constructed or to be planned, surveyed and/or constructed by the Corps of Engineers. . . to impound water for present or anticipated future demand or need for municipal and industrial water supply." 43 U.S.C. § 390b(b). Section 301(d) of the Act states "[M]odifications of a reservoir project heretofore authorized, surveyed, planned, or constructed to include storage as provided in subsection (b), which would seriously affect the purposes for which the project was authorized, surveyed, planned, or constructed, or which would involve major structural or operational changes shall be made only upon the approval of Congress as now provided by law." 43 U.S.C. § 390b(e). This law established a Federal interest in development of water supplies for municipal and industrial use in connection with

Federal multi-purpose projects.

For reallocated municipal and industrial water supply storage under the 1958 WSA authority, the water supply user must be advised that the reallocation study itself will not specifically address Section 408 considerations but that Section 408 considerations will be taken into account in the drafting of a water storage agreement and associated outgrants or consents. Any requirements for water supply user's facilities (intake structures, etc.) will be included in the agreement and associated outgrants or consents (EC 1165-2-220 POLICY AND PROCEDURAL GUIDANCE FOR PROCESSING REQUESTS TO ALTER US ARMY CORPS OF ENGINEERS CIVIL WORKS PROJECTS PURSUANT TO 33 U.S.C. § 408).

2 PROJECT DESCRIPTION

Philpott Lake is a multi-purpose water resources project originally authorized to address flooding issues associated with communities in south-central Virginia. The lake is formed through the impoundment of the Smith River, considered to be a major tributary of the Dan River. Construction of the Philpott Dam was completed in 1952. The powerhouse was completed shortly after the dam in 1953 and is operated by the U.S. Army Corps of Engineers, Wilmington District. The project includes a concrete gravity dam with an ogee spillway, a powerhouse, and a switchyard. Philpott Lake is 15 miles long and covers approximately 2,741.5 acres at elevation 973.4 feet NAVD88. It extends into Franklin, Henry, and Patrick counties in south-central Virginia. Philpott Dam and associated infrastructure, as well as all land acquired for the Philpott Lake project, approximately 9,515.6 acres, are federally managed and administered by the USACE.

2.1 Location

Philpott Lake is situated in the Piedmont and Blue Ridge Mountains of Virginia in Franklin, Henry, and Patrick Counties, Virginia (Figure 2-1). It is a 2,880-acre impoundment managed by the USACE. The Smith River confluences with the Dan River in North Carolina and generally flows eastward to John H. Kerr Reservoir, Lake Gaston, Roanoke Rapids Lake, the Roanoke River and finally the Atlantic Ocean through the Albemarle Sound. Tributaries to the Smith River that feed the reservoir include Runnett Bag Creek, Ryans Branch, Beards Creek, Nicholas Creek, Osley Branch, Cooper Creek, Roland Branch, Salthouse Branch, Cow Branch, Bowens Creek, Bowens Branch, Spring Branch, Jackson Run, Mines Branch, Puppy Creek, and Small Creek.

The lake's setting is generally described as being pristine, picturesque, and rural with mountainous terrain reaching 799.4 to 1,099.4 feet NAVD88. The nearest towns are Basset located approximately 7 miles downstream and Martinsville located approximately 14 miles downstream of the Philpott Dam. The area has hard, crystalline igneous and metamorphic geologic formations with some areas of sedimentary rocks. Most significant water supplies are found within a few hundred feet of the surface. Larger concentrations of water withdrawal can be obtained along the Western Piedmont along the base of the Blue Ridge Mountains.

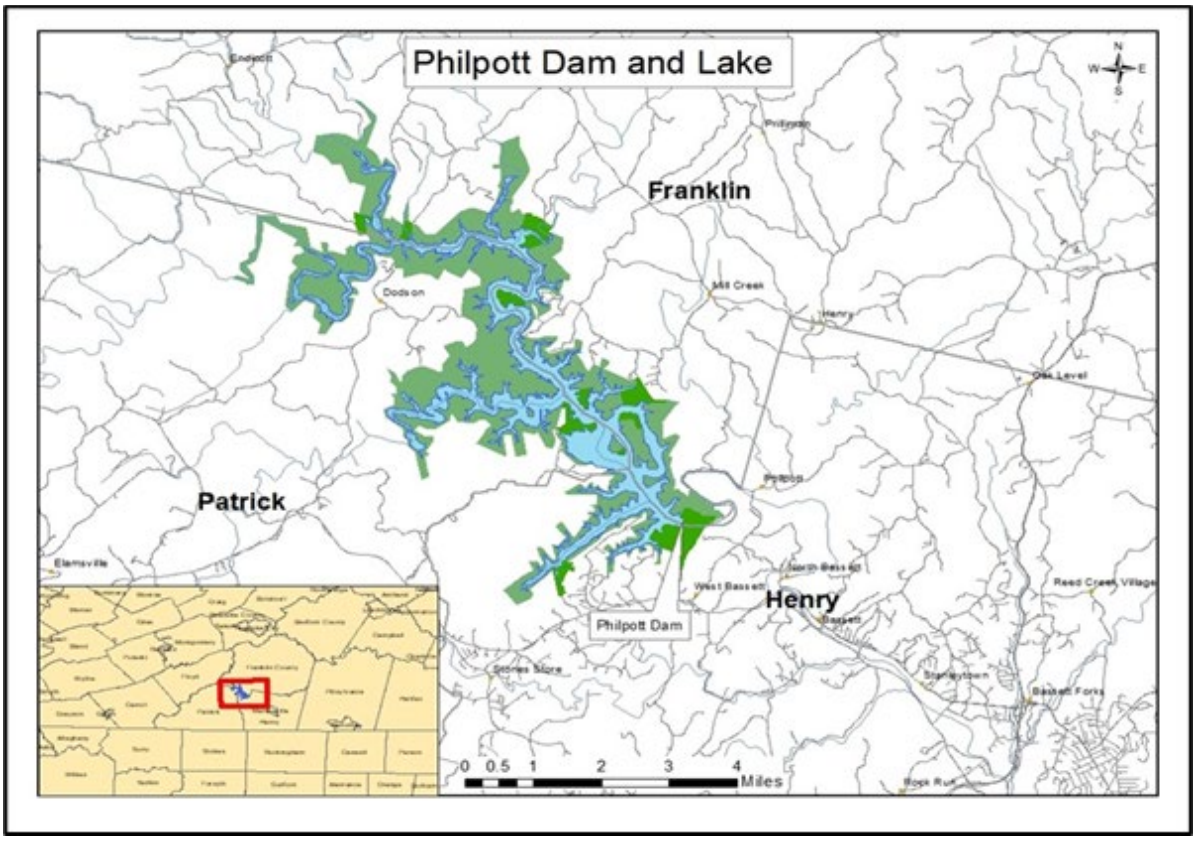

Figure 2-1 Philpott Dam and Lake Location

2.2 Project Background and Data

Philpott Lake was authorized by Section 10 of the Flood Control Act of 1944 (P.L. 78-534), substantially in accordance with the recommendations of the Chief of Engineers in House Document Number 650, Seventy-eighth Congress, second session. Philpott's authorized purposes include flood risk management, hydroelectric power generation, and low flow augmentation. The unit was part of a comprehensive reservoir system designed to control the fluctuations of the Roanoke River and its tributaries (Figure 2-2). Construction of the concrete gravity dam and spillway began in 1948 and was completed in 1952 with a top elevation of 1015.4 feet NAVD88. The Philpott Powerhouse began producing hydroelectric power in 1953. In addition, under the general authority of Section 4 of the Flood Control Act of 1946 (P.L. 79-526), as amended, the Corps operates and maintains public park and recreational facilities at Philpott Lake. The Corps also manages the project in a manner that conserves fish and wildlife resources in accordance with authority granted in the Fish and Wildlife Coordination Act (P.L. 85-624).

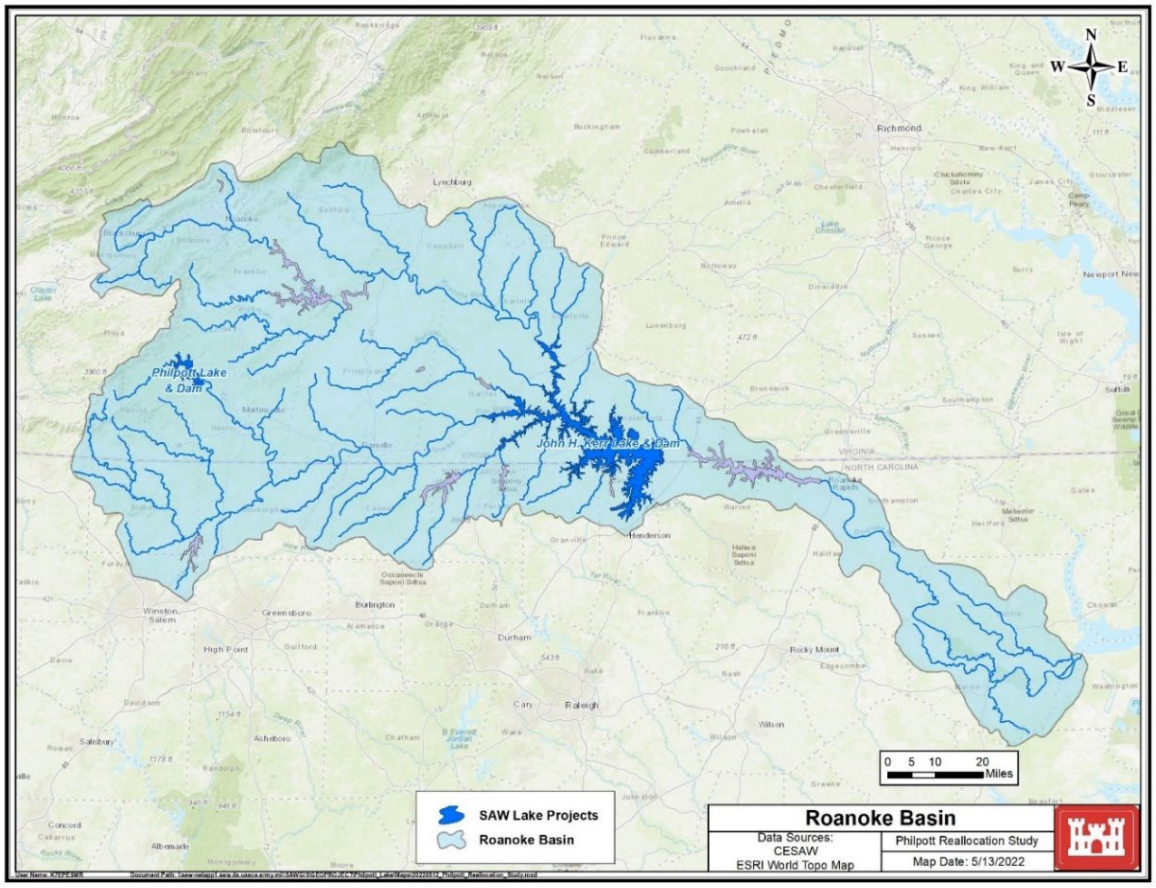

Figure 2-2 Roanoke River Basin

Philpott Lake currently provides no water supply storage for State or local interests. The WSA of 1958 authorizes the Corps to include municipal and industrial water supply storage at Philpott Lake, an action which would effectively make water supply an authorized project purpose. Should this study decide to include storage for HCPSA, water supply storage would be added as a project purpose.

The total project area of Philpott Lake is approximately 9,515.6 acres, with an estimated additional 243.3 acres designated as flowage easement. The lake's design and current plan of operation provides for a full flood control pool at elevation 984.4 feet NAVD88 and a full power pool elevation at elevation 973.4 feet NAVD88. In general, the lake has a seasonally varying guide curve that is higher in the summer and lower in the winter. The lake has approximately 200,400 acre feet (ac-ft) of storage which includes 34,200 ac-ft of flood control storage, 111,200 ac-ft of conservation storage for hydropower, and 55,000 ac-ft of inactive storage (Figure 2-3).

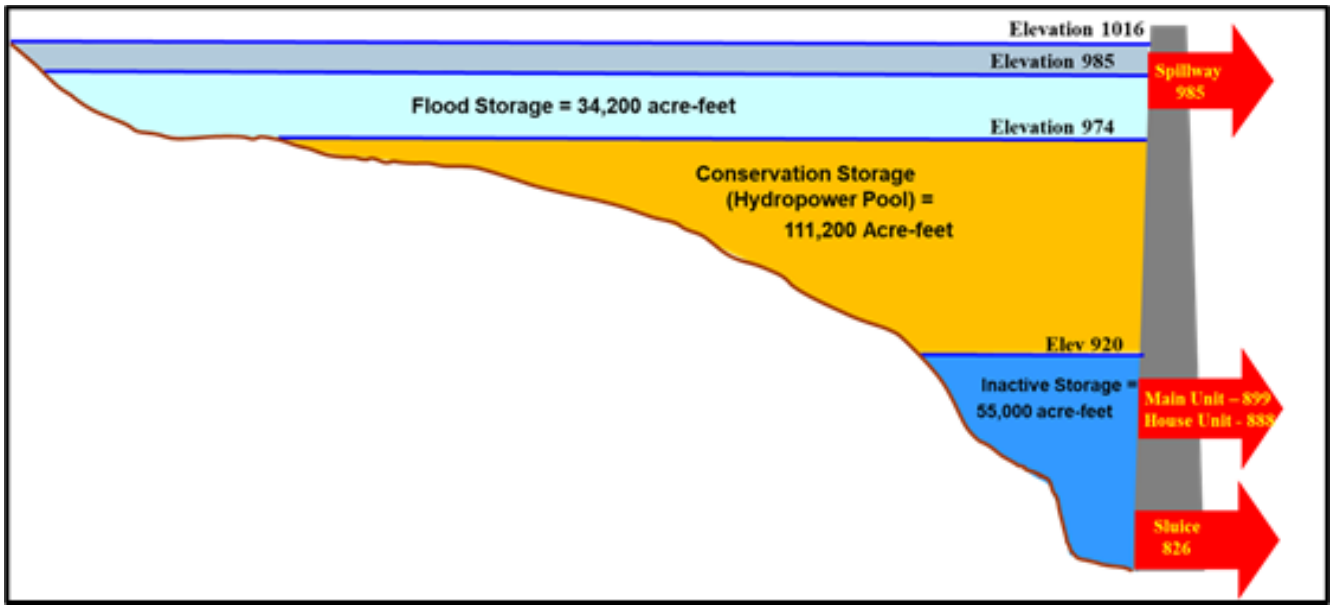

Figure 2-3 Existing Philpott Lake Water Storage and Use

2.3 Current Project Operations

Philpott Lake operates with a seasonal guide curve, with an elevation of 970.9 feet NAVD88 October through January, 972.9 feet NAVD88 April through July, and varies linearly between the two elevations the remainder of the year. Controlled flood control storage space is provided between elevations 973.4 and 984.4 feet NAVD88 with surcharge or uncontrolled storage provided above the crest of the free over-flow spillway (elevation 984.4 feet NAVD88). Conservation pool storage between elevation 950.4 and 973.4 feet NAVD88 is reserved for dependable power generation and low flow augmentation.

Controlled flood storage is utilized to reduce downstream flood risks on the Smith and Dan Rivers, with the gage at Bassett being the primary flood control point. Flood releases specified in the water control plan (consisting of full turbine capacity plus sluice gate releases as specified) are normally delayed until 24 hours after the local runoff peak at the Bassett gage occurs; however, normal scheduled generation may be allowed to continue depending on the river stage at Bassett. In floods which do not fill the lake above spillway crest, flood releases up to 4400 cubic feet per second (cfs) are allowed, which is the combined capacity of one sluice gate and full turbine capacity. In floods which fill the lake above spillway crest, all three sluices can be opened as necessary to make the total discharge at Bassett about 7,800 c.f.s. (10 feet on Bassett gage), including full turbine discharges.

Water stored in the lake below the maximum conservation pool elevation is managed as necessary to support hydropower, environmental stewardship, and recreation. The Smith River, downstream from Philpott Dam, supplies industrial and public water supplies for the region. The minimum flow required to provide water of suitable quality at Stanleytown, VA,

was originally established as 59 cfs and was about 20 percent more than the minimum of record and equal to the natural flow that would be relied upon in the design of sewage treatment facilities at that time. Since there is no gage at Stanleytown, the nearby Bassett gage is used for monitoring and maintaining minimum flows in the Smith River. Generally, normal hydropower operations ensures that minimum flow requirements are met, even when only the station service unit is operating. When the lake is below the top of the conservation pool, weekly power generation is limited to minimum weekly energy requirements determined by the Southeastern Power Administration.

2.4 Dam Safety Action Classification

Dam Safety Action Classification (DSAC) is a tool used by the USACE to prioritize funding for the study and repair of the USACE dam inventory. This classification scale ranges from DSAC 1, being most urgent and prioritized, to DSAC 5, being the least in urgency for funding. The classification assigned to a project is determined by looking at a combination of the likelihood of failure of the dam and the consequences that would result if the dam were to fail. This combination of factors results in a concept of the overall risk presented by the dam. Specific hypothetical types of dam failures, the condition of the dam, frequency and intensity of precipitation and flooding, and factors that could affect life loss and other consequences are considered in this evaluation. The risk of a project and assigned DSAC is re-evaluated every 10 years during a Periodic Risk Assessment or more frequently by other risk analysis types such as Issue Evaluation Study. The risks at Philpott Dam are driven by stability concerns at extreme pool elevations and consequences downstream, in the unlikely event of a dam failure. As a result, Philpott Dam is assigned a DSAC of 3 or “moderate urgency” by the USACE Dam Safety Program. The most recent Periodic Assessment of the Dam performed in February 2013 supported this rating. Due to the DSAC 3 rating, Philpott Dam is in the USACE queue for an Issue Evaluation Study. To reduce risk, an Interim Risk Reduction Measures Plan is in place.

3 INVENTORY OF CURRENT AND FUTURE CONDITIONS

The following provides an overview of existing water resources and expected future conditions with a specific focus on projected water demands and supplies and anticipated needs for additional water supplies. More detailed analysis of these topics is included in Appendices A and B of this report.

3.1 Hydrology and Hydraulics

The hydrologic model selected for use in this reallocation study is the HEC-Res Sim. The reservoir network consists of the Philpott Lake with computation points for inflows, outflows, and Smith River at Bassett, Virginia. Philpott Lake's physical properties were designed for ungated spillway flow, sluice gate flow, hydropower main unit flow, hydropower house unit flow and an additional leakage term when the pool elevation is above the minimum power pool.

The HEC-Res Sim model was reviewed and verified numerous aspects of the model deemed critical to successful modeling of Philpott Lake operations for the Philpott Lake Reallocation Study, including:

- Storage pool elevations (inactive/conservation/flood)
- Storage volumes by elevation (and surface area by elevation)
- Minimum release protocols (at dam and at Bassett)
- Routing of flows (travel times, lagging, etc)
- Critical period inflows

Modeling is done on a daily time-step, with a constant daily water demand and hydropower releases varying with the monthly minimum energy needs.

The Firm Yield simulation using the seasonal guide curve has a lookback period starting January 1, 1958 with the simulation running from January 1, 1960 to January 1, 2020, which determines the largest minimum release possible that will empty the lakes storage exactly once in the simulation period. HEC Res-Sim runs two statistical searches on the maximum minimum daily release until a firm yield value is determined. The firm yield release was calculated to be 147.2 cfs. A critical period, where the storage is not recovering, was found from August 24, 1998- June 06, 2003, with the lake level draining to the bottom of the power pool on October 27, 2002 before beginning to refill.

3.2 Sedimentation

Inactive pool storage in Philpott Lake (55,000 ac-ft below elevation 919.4 ft NAVD88 and below the bottom of the conservation pool) is intended to provide head for power generation and storage for accumulation of sediment during the life of the project. The "Definite Project Report on Philpott Reservoir" (Serial No. PR-66, 30 November 1946) indicates that a silting rate of 0.5 ac-ft per square mile of drainage area per year was deemed adequate and

applicable. Per the definite project report, siltation at this rate would require over 500 years to fill the inactive storage.

Sedimentation surveys conducted include the initial survey of sediment ranges in 1951 and resurveys in 1960, 1976, and 1997. Analysis of resurvey results has indicated varying rates of sedimentation over time. However, between the initial 1951 survey and the latest 1997 survey, the total sediment volume has increased by only 530 ac-ft, or a reduction of less than 0.3% of the total project storage and less than 1% of the inactive storage. An updated sedimentation survey would be beneficial; however, extrapolation of this historic sedimentation rate through 2022 results in a total sediment volume increase of about 850 ac-ft, which is still less than 0.5% of the total project storage and just over 1.5% of the inactive storage. Compared to the assumed siltation of 0.5 ac-ft per square mile of drainage area per year in the Definite Project Report, the most recent survey indicates sedimentation of only about 0.06 ac-ft per square mile of drainage area per year. As mentioned, an updated survey is needed and would be beneficial for confirming these low historical sedimentation rates; however, based on available information, sedimentation appears to be well below rates assumed during project design. It is also recommended that an updated survey be conducted prior to reallocating any storage from the inactive storage pool.

3.3 HCPSA's Existing State Water Withdrawal Permit

HCPSA provides potable water to residential, commercial, and industrial customers in Henry County and nearby residential areas of Patrick and Pittsylvania counties. Treated water comes from the Upper Smith River Water Filtration Plant, also referred to as the Philpott Water Filtration Plant. Raw water is pumped from the Smith River in accordance with a 401 Certification (Number 12-0052) issued by the Virginia State Water Control Board in 2016. The treatment plant intake is about 3 river miles downstream of Philpott Dam and immediately upstream of the confluence of Town Creek and the Smith River.

The Water Filtration Plant withdrawal permitted by the State is currently 6.0 MGD. Other restrictions apply based on the U.S. Geological Survey (USGS) Bassett Gage (02072500000) located approximately 6 miles downstream of Philpott Dam. The Smith River flow requirements incorporated into the Water Control Plan and Reservoir Regulation Manual for Philpott Lake were established by the U.S. Environmental Protection Agency. These requirements include maintenance of minimum river flows at Stanleytown, Fieldale and Martinsville, VA, which were established to provide sufficient flows to support water withdrawals, wastewater discharges, and other uses in these downstream communities.

3.4 Water Supply Demand Analysis

The USACE conducted a water supply demand analysis to identify the need from the NFS over a 50-year period of analysis: 2023-2072. Projected water use based on average daily

demands will reach 4.8 MGD (VDH 80 percent rule trigger for 6.0 MGD permit) within an approximate time frame ranging from 2027 through 2033 depending upon the future demand scenario (high, medium or low). Thus, over the next few years the county will have to start developing a plan to expand treatment capacity that will require additional permitted supplies from the State of Virginia.

According to the HCPSA, the state of Virginia will not upgrade the existing 6.0 MGD permit without additional storage from Philpott Lake. HCPSA demand will reach that 80 percent rule trigger threshold somewhere between 2035 with the high growth scenario to 2050 with the low growth scenario. Based on the medium growth scenario projections, this demand will occur in 2040. Figure 3-1 shows peak or maximum daily demands based on recent historical data from the HCPSA. For more information on the demand analysis see Appendix A. When measured by peak or maximum daily use, their need will manifest between 2025 to 2035 depending on the demand scenario. For both average daily and peak daily use, an initial 4.0 MGD provided via storage in Lake Philpott will likely meet forecasted demand at least through 2072.

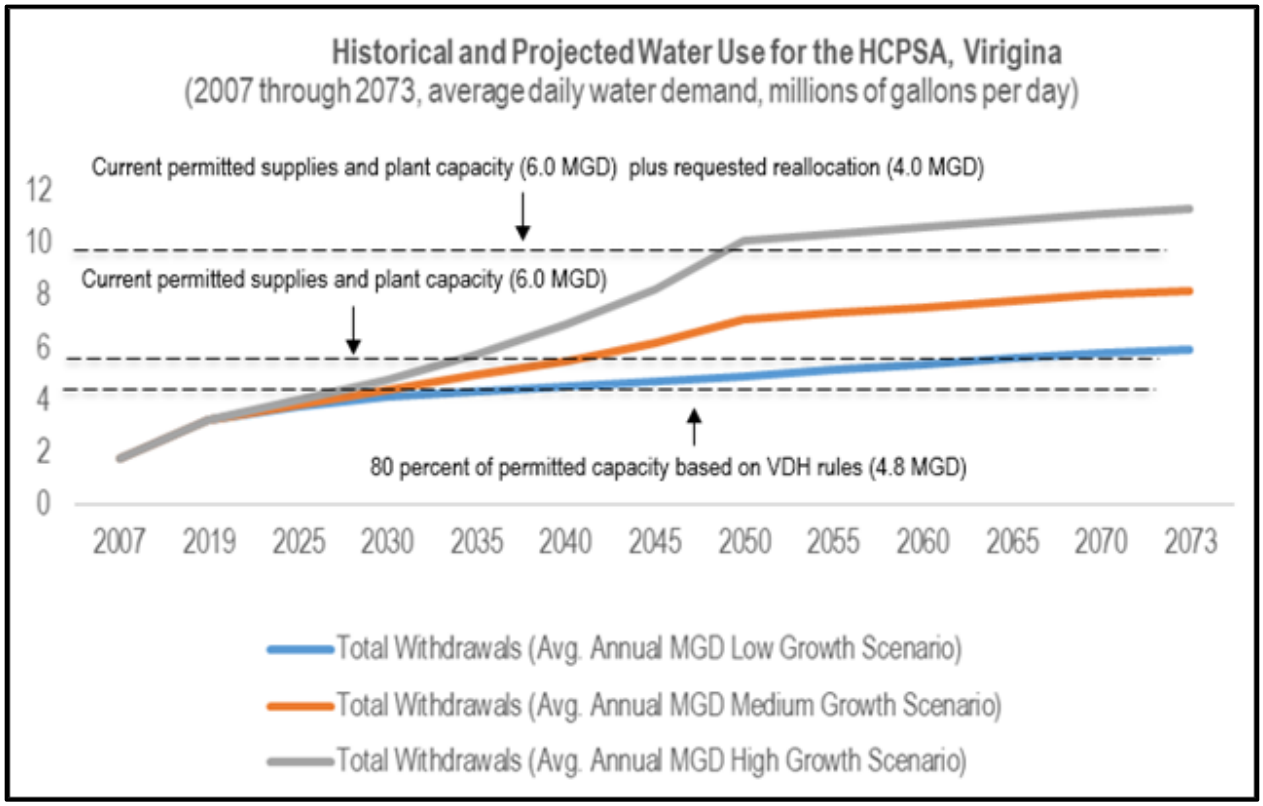

Figure 3-1 Water Demand Scenarios, Appendix A

4 PLAN FORMULATION AND EVALUATION

Plan formulation and the evaluation of alternatives for this study were conducted in accordance with the Corps Planning Guidance Notebook (ER 1105-2-100) and the Corps' Water Supply Handbook, both emanating from the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Planning Act (P.L. 89-80) and Executive Order 11747, which was approved by the U.S. Water Resources Council in 1982, and by the President in 1983.

Based on guidance and policy, the Corps has a well-defined six-step process used to identify and respond to problems and opportunities associated with federal water resources planning objectives, and specific state and local concerns:

1) Identify problems and opportunities
2) Inventory and forecast conditions
3) Formulate alternative plans
4) Evaluate alternative plans
5) Compare alternative plans
6) Select Recommended Plan.

Management measures and alternatives were developed to address the water resource problems, meet the stated objectives while avoiding constraints and taking advantage of opportunities. The results of the analysis identified an economically viable and environmentally acceptable Recommended Plan, as well as a nonstructural plan, a comprehensive benefits plan, and if needed a locally-preferred plan.

In the interest of report brevity, the inventory of current and future conditions is located in different sections of the report and appendices. Current and future environmental conditions under the No-Action and future condition are discussed in Section 8 of this report. Discussion on current and future hydrologic conditions is contained in Appendix B Hydrologic Analysis. Discussion on current and future economic conditions is contained in Appendix C Economics Analysis.

4.1 Problems and Opportunities

The water resource problem addressed by this study is the inadequate supply of water to meet the increasing water supply demand for HCPSA and its customers in south-central Virginia. They currently withdraw water from the Smith River downstream of Philpott Lake utilizing existing releases made during normal operations, but it is not enough supply to meet the increasing needs of their service area.

HCPSA has adequate infrastructure capable of processing the quantity of water needed to meet current demand. Allocating storage for water supply from Philpott Lake will create an

opportunity for the Federal government to meet the region's "… need for municipal and industrial water supply…" The study will also assist HCPSA in the identification of alternative water supply sources to meet future demand.

4.2 Objectives and Constraints

The primary objective of this study is to identify and assess the Federal interest in a plan at Philpott Lake that meets the current and future water needs of HCPSA for the period of 2023 to 2072.

The formulation of measures and alternatives to address this objective were limited by the following constraints:

1) Fulfilling requirements of existing Federal laws, regulations, directives, executive orders (EO), and policies.
2) The Recommended Plan may not constitute a major structural or operational change or seriously affect Philpott's authorized project purposes without additional Congressional authorization.
3) Maintaining downstream minimum flow rates on the Smith River.
4) Avoiding significant impacts to environmental and cultural resources.
5) Limited NFS resources (i. e. funds, manpower, equipment)

4.3 Evaluation Criteria

Alternative plans are evaluated by applying technical agency criteria. According to the Planning Guidance Notebook (PGN, ER 1105-2-100), four general criteria are used to evaluate the array based upon the information gathered and developed, as well as with NFS and resource agency input:

- *Completeness*: This is the extent that an alternative provides and accounts for all investments and actions required to ensure the planned output is achieved. These criteria may require that an alternative consider the relationship of the plan to other public and private plans if those plans affect the outcome of the project. Completeness also includes consideration of real estate issues, operations and maintenance (O&M), monitoring, and sponsorship factors.

- *Effectiveness:* This is defined as the degree to which the plan will achieve the planning objective. The plan must make a significant contribution to the problem or opportunity being addressed.

- *Efficiency*: The project must be a cost-effective means of addressing the problem or opportunity. The plan outputs cannot be produced more cost-effectively by another institution or agency.

- *Acceptability*: A plan must be acceptable to Federal, state, and local government in terms of applicable laws, regulation, and public policy. The project should have evidence of broad-

based public support and be acceptable to the non-Federal cost sharing partner.

These criteria may not be fully evaluated at the initial stages of plan formulation process but are fully evaluated for the final array of alternatives. There are also specific technical criteria related to engineering, economics, and the environment, which also are considered in evaluating alternatives. These are:

Engineering Criteria:

- The design of a safe, efficient, and reliable project that incorporates best engineering principles/practices in support of the Recommended Plan.

Economic Criteria:

- The Recommended Plan must contribute benefits to National Economic Development (NED).
- Tangible benefits of a Recommended Plan must exceed economic costs.
- Each separable unit of improvement must provide benefits at least equal to costs.

Environmental Criteria:

- The plan must fully comply with all relevant environmental laws, regulations, policies, and EO's.

Lastly, per January 5, 2021 policy directive from Assistant Secretary of the Army for Civil Works, the study includes analysis of the total benefits for each plan within the final array of alternatives. This analysis is organized and presented under four established accounts: the NED account, the Regional Economic Development (RED) account, Environmental Quality (EQ) account, and the Other Social Effect (OSE) account.

4.4 Formulation of Measures and Alternatives

Alternatives are features, actions and/or activities that addresses the study problems and objectives, while avoiding constraints and taking advantage of opportunities. They are generally comprised of structural and nonstructural measures. In this study, structural measures and alternatives are physical features and modifications to the dam, spillway, intakes and appurtenant facilities that address the future water supply needs of the region, such as a new reservoir or water intake. Nonstructural measures and alternatives are actions and activities that address future water supply needs without physical additions or modifications to the dam, spillway, intakes, and appurtenant facilities, such as the reallocation of water storage and water conservation.

4.4.1 Preliminary Measures

Potential measures were developed to address the increased demand for water supply in the study area. The following structural and nonstructural measures were identified in

coordination with the NFS:

- Additional groundwater wells (Structural): A well is a hole drilled into the ground to access water contained in an aquifer or fractured rock. A pipe and a pump are used to pull water out of the ground, and a screen filters out unwanted particles that could clog the pipe. This measure can be accomplished by the NFS without involvement of the Federal government.

- New water supply reservoir (Structural): This measure involves the NFS constructing a new reservoir creating a new source of water to meet demand without involvement of the Federal government.

- New downstream intake structure (Structural): This measure involves the NFS constructing a new intake downstream from the dam to increase the volume of water taken from the river during scheduled releases without involvement of the Federal government. This measure can be accomplished by the NFS without involvement of the Federal government.

- Dredge lake (Structural): This measure involves the Corps removing wet material from the Philpott reservoir to increase its overall water storage. The additional storage is then passed onto the region to meet future demand. Wet materials taken from the lake would be placed in an environmentally acceptable disposal site. This measure may require a separate study under NEPA and/or permit under the CWA to accomplish.

- Raise dam height (Structural): This measure involves the Corps raising the existing Philpott Lake dam to increase overall storage volume of the project. The additional storage is then passed onto the NFS to meet future demand. Adjustment to the spillway, intakes, and other appurtenant facilities may also be required. This measure may require a separate Corps study to accomplish.

- Inter-basin transfer (Structural): This measure involves the conveyance of water from one basin to another through the construction of pipes and pumping infrastructure. This measure can be accomplished by the NFS without involvement of the Federal government.

- New reservoir intake (Structural): This measure involves the NFS constructing a new intake above the dam and/or within the operational pool to allow for direct withdrawal from the lake. This measure may require a Corps separate study and supporting infrastructure (i.e. pipelines, utilities, treatment plants) from the NFS to accomplish.

- Off-line raw water storage (Structural): This measure involves the constructing of raw water storage containers. The stored water is pulled from the containers when the primary water source runs low due to drought, low rainfall or other causes. This

measure can be accomplished by the NFS without involvement of the Federal government.

- Water conservation (Nonstructural): This measure involves the practice of using water efficiently to reduce unnecessary water usage. It is often the first step in reducing overall demand for water supply. Examples of this measure include conservation pricing, leak detection and repair, plumbing and toilet retrofit programs, education programs, and multifamily submetering. and water recycling (e.g., car washes). This measure can be accomplished without involvement of the Federal government.

- Water reuse (Nonstructural): Commonly known as water recycling or water reclamation, this measure reclaims water from a variety of sources then treats and reuses it for beneficial purposes. Sources of water for potential reuse include municipal wastewater, industry process and cooling water, stormwater, agriculture runoff and return flows, and produced water from natural resource extraction activities. This measure can be accomplished without involvement of the Federal government.

- Flood storage reallocation (Nonstructural): This measure involves the Corps re-assigning existing water storage from the Philpott flood pool to water supply, which can then be used to meet the future needs. This measure requires raising the guide curve at Philpott Lake and a water supply agreement with the Federal government.

- Inactive storage reallocation (Nonstructural): This measure involves the Corps re-assigning existing water storage at Philpott Lake from the inactive pool to water supply. The additional supply is then used for future demand. This measure requires a water supply agreement with the Federal government.

- Conservation storage reallocation (Nonstructural): This measure involves the Corps re-assigning existing water storage at Philpott Lake from the conservation pool to water supply. The additional supply is then used for future demand. This measure requires a water supply agreement with the Federal government.

- Wholesale water purchase (Nonstructural): This measure involves the purchase of water supply from another utility. It can be accomplished by the NFS without involvement of the Federal government.

- Aquifer storage and recovery (Nonstructural): This measure involves pumping existing water into an aquifer for temporary storage. The water is then pulled from the aquifer and used when the primary water source runs low due to drought, low rainfall or other causes. This measure can be accomplished by the NFS without involvement of the Federal government.

- Change existing dam operations (Nonstructural): This measure involves the Corps changing Philpott Lake project operations to increase overall water supply. There are no physical changes to the dam, spillway, intakes or appurtenant facilities. This

measure may require a separate Corps study to accomplish.

- Withdrawal from local rivers and streams (Nonstructural): This measure involves the NFS withdrawing surface water from another local river or stream within the basin. This measure can be accomplished by the NFS without involvement of the Federal government.

4.4.2 Evaluation of Measures

These measures were evaluated qualitatively against the study objective and other preliminary criteria, including sufficient storage capacity, effects on other project purposes, and efficiency (Table 4-1). The sufficient storage capacity metric indicates whether or not there was sufficient existing capacity, or the ability to create new capacity, for each measure. The "Effect on Other Project Purposes" metric considers impacts to other authorized project purposes. The efficiency criteria is the extent to which the measure is the most cost-effective means of achieving the objectives.
Existing information, perimetric cost estimates from previous studies, and best professional judgement was used to evaluate this criterion. Generally, those measures that met the study objective and had no effect to other project purposes were carried forward for consideration as an alternative.

Table 4-1 Evaluation of Preliminary Measures Array

Philpott Lake, VA Water Reallocation Study Measures Evaluation					
Measure	**Meets Objective**	**Sufficient Storage Capacity**	**Effects Other Project Purposes**	**Cost Efficient**	**Carried Forward**
Structural:					
Additional groundwater wells	Yes	Yes	No	No	Yes
New water supply reservoir	Yes	Yes	No	No	Yes
New downstream intake	Yes	Yes	No	No	Yes
Dredge lake	Yes	No	No	No	No
Raise dam height	Yes	Yes	Yes	No	No
Inter-basin transfer	Yes	Yes	No	No	No
New reservoir intake	Yes	Yes	No	No	No
Off-line raw water storage	Yes	Yes	No	No	Yes
Nonstructural:					
Water conservation	Yes	No	No	Yes	Yes
Water reuse	Yes	No	No	Yes	Yes
Flood storage reallocation	Yes	Yes	Yes	Yes	No
Inactive storage reallocation	Yes	Yes	Yes	Yes	Yes
Conservation storage reallocation	Yes	Yes	Yes	Yes	Yes
Wholesale water purchase	Yes	Yes	No	No	Yes
Aquifer storage and recovery	Yes	No	No	No	No
Change existing dam operations	Yes	Yes	Yes	Yes	No
Withdrawal from local rivers and streams	Yes	No	No	No	No

4.5 Preliminary Array of Alternatives and Evaluation

Eleven preliminary alternatives comprising of structural, nonstructural, and combined measures, were formulated for the study, designated as Alternatives 2-12. Four of these alternatives required Federal participation while the remaining six could be accomplished by the NFS without Federal involvement (Table 4-2).

A "no action" alternative, designated as Alternative 1, was also developed for this study to serve as baseline of comparison for the other alternatives. The no action alternative was generally defined as the absence of any *Federal* action to address the water storage shortfall but can include predictable *non-Federal actions*. Through communications with the NFS, it was determined that if a reallocation of water storage from Philpott Lake was infeasible then the most likely non-Federal action would be the implementation of water conservation and/or

water re-use programs for its patrons.

In all, 12 preliminary alternatives were developed for this study. They include three structural alternatives (#'s: 4, 5 and 10), six nonstructural alternatives (#'s: 2, 3, 6, 7, 8, and 9), two alternatives with combined measures (#'s: 11 and 12), and the No Action Alternative (#1).

Each preliminary alternative was evaluated qualitatively under four criteria: the study objective, implementability (or "physically constructable"), cost efficiency, and the time horizon of implementation (short-term = 3-5 years or long-term = 5-15 years).

Two alternatives did not meet the study objective and were immediately screened from the array: Alternative 6-Water conservation, and Alternative 7-Water re-use. It was also determined through the Hydrologic Analysis (see Appendix B) that the inactive pool within the reservoir lacked sufficient storage to meet the NFS water supply needs and could have an impact on the hydropower operations. Thus, Alternatives 3 and 9 were screened from the final array. Finally, Alternative 10 required additional investments to implement and was screened from the final array (see Table 4-2).

Table 4-2 Evaluation of Preliminary Array of Alternatives

Philpott Lake, VA Water Reallocation Study Preliminary Alternatives Array Evaluation								
#	Alternative	Type of Alternative	Federal Action/ Non-Federal Action	Meets Objective	Implementable	Cost Efficient	Long-term (LT)/ Short-term (ST) Time Horizon	Carried Forward
1	No action	Not Applicable	Non-Federal	No	N/A	N/A	N/A	Yes
2	Conservation storage reallocation	Nonstructural	Federal	Yes	Yes	Yes	ST	Yes
3	Inactive storage reallocation	Nonstructural	Federal	No	Yes	Yes	ST	No
4	New water supply reservoir	Structural	Non-Federal	Yes	Yes	No	LT	Yes
5	Off-line raw water storage	Structural	Non-Federal	Yes	Yes	No	LT	Yes
6	Water conservation	Nonstructural	Non-Federal	No	Yes	Yes	ST	No
7	Water reuse	Nonstructural	Non-Federal	No	Yes	Yes	ST	No
8	Wholesale water purchase	Nonstructural	Non-Federal	Yes	Yes	Yes	ST	Yes
9	Conservation and inactive storage reallocation	Nonstructural	Federal	Yes	Yes	Yes	ST	No
10	Additional groundwater wells	Structural	Non-Federal	Yes	Yes	No	LT	Yes
11	New reservoir intake and conservation storage reallocation	Combined	Federal	Yes	Yes	No	LT	No
12	Off-line raw water storage, Wholesale water purchase and Additional groundwater wells	Combined	Non-Federal	Yes	Yes	Yes	LT	Yes

4.6 Final Array of Alternatives and Evaluation.

Seven preliminary alternatives were forwarded into the final array and evaluated. They included the no action alternative (#1), the conservation storage reallocation alternative (#2), the new watershed supply reservoir (#4), the off-line raw water storage alternative (#5), the wholesale water purchase alternative (#8), the additional groundwater wells alternative (#10), and the combined alternative (#12). Of these, only Alternative 2 would require federal participation. Each alternative was evaluated based on the four PGN criteria, their overall cost and benefits (i.e. Comprehensive Benefits Analysis). They are presented in Table 4-3.

4.6.1 PGN Criteria Evaluation

All alternatives in the final array were evaluated as "Acceptable", but only three alternatives were "complete" and "effective". They included Alternate 2 – Conservation storage reallocation, Alternative 4 – New water supply reservoir, and Alternative 12 – the combined plan.

Alternative 1- the No Action, Alternative 5 – Offline Raw Water Storage, Alternative 8 Wholesale Water Purchae, and Alternatives 10 - Additional Groundwater Wells did not meet the water demand for the NFS and were not evaluated as "effective". Finally Alternative 2 was identified as the most cost-effective alternative and thus considered to be most "efficient" within the final array (see Table 4-3).

Table 4-3 Final Array of Alternatives and PGN Criteria Evaluation

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	**Alternative 1: No Action**	**Alternative 2: Conservation Storage Reallocation**	**Alternative 4: New Water Supply Resevoir**	**Alternative 5: Raw Water Offline Storage**	**Alternative 8: Wholesale Water Purchase**	**Alternative 10: Additional Ground Water Wells**	**Alternative 12: Combined Plan**
Acceptability:	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.	Alternative is acceptable in regards to Federal laws, regulations, and guidelines.
Completeness:	Alternative is not a complete solution to the problem.	Alternative is a complete solution to the problem.	Alternative is a complete solution to the problem.	Alternative is not a complete solution to the problem.	Alternative is not a complete solution to the problem.	Alternative is not a complete solution to the problem.	Alternative is a complete solution to the problem.
Effectiveness:	Alternative is not an effective solution to the problem.	Alternative is an effective solution to the problem.	Alternative is an effective solution to the problem.	Alternative is not an effective solution to the problem.	Alternative is not an effective solution to the problem.	Alternative is not an effective solution to the problem.	Alternative is an effective solution to the problem.
Efficiency:	Alternative is an inefficient solution to the problem.	Alternative is an efficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.	Alternative is an inefficient solution to the problem.

4.6.2 Cost Evaluation

A Class 5 Civil Works cost estimate was prepared of all the alternatives in the final array (Table 4-4). According to ER 1110-2-1302, *Civil Works and Cost Engineering* a Class 5 cost estimate, commonly referred to as "Rough Order of Magnitude (ROM)" estimate, is based on limited information and possess considerable risk and uncertainty, resulting in high contingencies. There is great reliance on broad-based assumptions, costs from comparable projects and data, cost book, cost engineering judgment and parametric cost data. Development may consist of lump sum costs.

Alternative 4, a new water supply reservoir, was the costliest alternative within the final array at $440m but would not require participation from the Federal government. Alternative 12, the most likely and least costly alternative to meet the NFS's water needs, was the second costliest alternative within the final array at $170m and would not require participation from the Federal government. Alternative 2, conservation storage reallocation, was the least costly alternative within the final array and would require participation from the Federal government. The cost of the Alternative 12 ($170M) was far greater than the cost of Alternative 2 ($8.5M). (see Table 4-4).

Table 4-4 Final Array of Alternatives and Cost Evaluation

Philpott Lake, VA Water Reallocation Study Final Alternatives Evaluation							
#	Alternative	Type of Alternative	Federal Action/Non-Federal Action	Meets Objective	Additional Sufficient Supply	Effects On Other Project Purposes	Cost
1	No action	Not Applicable	Non-Federal	No	No	No	$0
2	Conservation storage reallocation	Nonstructural	Federal	Yes	Yes	No	$8,460,000
4	New water supply reservoir	Structural	Non-Federal	Yes	Yes	No	$444,400,000
5	Off-line raw water storage	Structural	Non-Federal	Yes	No	Yes	$63,998,000
8	Wholesale water purchase	Nonstructural	Non-Federal	Yes	No	No	$42,428,000
10	Additional groundwater wells	Structural	Non-Federal	Yes	No	No	$63,754,600
12	Water storage, Water purchase, and Wells	Combined	Non-Federal	Yes	Yes	No	$170,180,600

4.6.3 Comprehensive Benefits Evaluation

A System of Accounts was used to compare the alternatives and identify a Comprehensive Benefits Plan per the 5 January 2021 policy directive from Assistant Secretary of the Army for Civil Works. The four accounts used in this analysis are defined by the Principles and Guidelines (para. 1.6.2(c)) as the following:

- *National Economic Development (NED) account.* NED calculations include both financial costs to implement, maintain, and operate each alternative, and forgone economic benefits of implementing an alternative. NED financial costs include project capital cost, such as real estate and operations, maintenance, repair, rehabilitations and replacement (OMRR&R) costs. Forgone benefits for the study consist of hydropower, flood risk management, and recreation benefits.
- *Regional Economic Development (RED) account.* RED addresses economic benefits important at a regional level: State, counties, and communities in the broad study area. Items in this account relate to economic activities such as employment and income. Unquantified RED benefits would also include benefits to the region due to an ensured water supply for additional population inflow and support for water-related development.
- *Environmental Quality (EQ) account.* EQ is an assessment of favorable or unfavorable changes in the ecological, aesthetic and cultural or natural resources. This review is being conducted with the participation of agencies, local governments, and stakeholders through an on-going and engaging series of scoping meetings, public input meetings, agency and stakeholder meetings, and State and Agency reviews.
- *Other Social Effects (OSE) account.* OSE considers the effects of alternative plans in areas that are not already contained in the NED and RED accounts. The categories of effects contained within the OSE account include: urban and community impacts; displacement; long-term productivity, energy requirements and energy conservation; and public health and safety.

The comprehsive benefits analysis centered on relavent economic, environmental and social factors in the region that may be effected by the implementation of a project. These factors were identified by the Corps, the NFS, government resource agencies, and statistical research on region. The factors were then organized by one the above accounts and evaluated quantitatively for the NED account and qualitatively for the EQ, OSE, and RED accounts. Tables 4-5 through 4-7 presents the results of this evaluation.

In addition, the following observations were noted during the analysis:

1) The NED water supply benefit is calculated based on the substitution method using the cost for the next most-likely/least costly alternative in the final array which is the cost

of Alternative 12. Thus, the estimated NED benefit for the study is $170 million (see Table 4-4).

2) HCPSA is rural and has a median household income of $38,511 with approximately 12.9% of the population living below the poverty line. In comparison, the median household income for the state is approximately $76,000.

Three alternatives in the final array evaluated favorably across the four accounts. They included Alternative 2 – a conservation storage reallocation, Alternative 4 - a new watershed supply reservoir, and Alternative 12 – the combined measures of offline storage, wholesale water purchase, and additional groundwater wells. However, Alternative 2 provided the greatest annualized NED benefits of the three, and thus was identified as both the comprehensive benefits plan and NED plan for this study.

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	**Alternative 1: No Action**	**Alternative 2: Conservation Storage Reallocation**	**Alternative 4: New Water Supply Resevoir**	**Alternative 5: Raw Water Offline Storage**	**Alternative 8: Wholesale Water Purchase**	**Alternative 10: Additional Ground Water Wells**	**Alternative 12: Combined Plan**
NED Criteria:							
Cost	$0	$8,460,000	$444,400,000	$63,998,000	$42,428,000	$63,754,000	$170,180,600
Annual NED Cost	N/A	$353,677	$15,063,535	$2,170,176	$1,439,081	$2,161,926	$5,771,183
Annual NED Benefit	$0	$5,771,183	$0	$0	$0	$0	$0
Hydropower Benefits	N/A	$2,873,837	$0	$0	$0	$0	$0
Recreation Benefits/Loss	N/A	No effect.	No effect.	No effect.	No effect.	No effect.	No effect.
RED Criteria:							
Regional Cost	$0	No effect.	No effect.	No effect.	No effect.	No effect.	$0
Regional Benefits	$0	No effect.	No effect.	No effect.	No effect.	No effect.	$0

Table 4-5 Comprehensive Benefits Analysis, NED and RED accounts

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	**Alternative 1: No Action**	**Alternative 2: Conservation Storage Reallocation**	**Alternative 4: New Water Supply Resevoir**	**Alternative 5: Raw Water Offline Storage**	**Alternative 8: Wholesale Water Purchase**	**Alternative 10: Additional Ground Water Wells**	**Alternative 12: Combined Plan**
EQ Criteria:							
Cultural Resources	This alternative is not expected to result in an effect to NRHP properties.	This alternative is not expected to result in an effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.	This alternative is not expected to result in an effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.	This alternative could result in an adverse effect to NRHP properties.
Air Quality	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative	No changes in air quality from this alternative
Water Quality	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.	No changes in water quality from this alternative.
Noise Levels	There will be no changes in noise levels from this alternative.	There will be no changes in noise levels from this alternative.	Noise levels will increase as a result of the construction and increased visitation.	Noise levels will be a temporarily increase as a result of the construction and placement of this alternative.	There will be no changes in noise levels from this alternative.	Noise levels will be a temporary increase as a result of this alternative.	There will be no changes in noise levels from this alternative.
Aesthetics	There will be no changes in aethetics from this alternative.	There will be no changes in aethetics from this alternative.	This alternative would significantly change the aesthetics in the area.	There will be no changes in aethetics from this alternative.	There will be no changes in aethetics from this alternative.	There will be no changes in aethetics from this alternative.	There will be no changes in aethetics from this alternative.
Flooding	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.	This alternative could change flooding in the area.	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.	There will be no changes in flooding from this alternative.
Wetlands	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.	There will be no changes in wetlands from this alternative.
Threatened and Endangered Species	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative could have a significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.	This alternative will have no significant impact to threatened and endangered species.

Table 4-6 Comprehensive Benefits Analysis, EQ account

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	**Alternative 1: No Action**	**Alternative 2: Conservation Storage Reallocation**	**Alternative 4: New Water Supply Resevoir**	**Alternative 5: Raw Water Offline Storage**	**Alternative 8: Wholesale Water Purchase**	**Alternative 10: Additional Ground Water Wells**	**Alternative 12: Combined Plan**
OSE Criteria:							
Security of Life, Health and Safety	This alternative will decrease this factor during times of reduced water supply.	This alternative will increase this factor during times of reduced water supply.	This alternative will increase this factor during times of reduced water supply.	This alternative will modestly and temporarily increase this factor during times of reduced water supply.	This alternative will modestly and temporarily increase this factor during times of reduced water supply.	This alternative will modestly and temporarily increase this factor during times of reduced water supply.	This alternative will increase this factor during times of reduced water supply.
Social Bonds/Connections	This alternative will diminish this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will diminish this factor in times of reduced water supply.
Community Cohesion	This alternative will diminish this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will modestly improve this factor in times of reduced water supply.	This alternative will diminish this factor in times of reduced water supply.
Resiliency	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Community Growth/Economic Vitality	This alternative slows this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative slows this factor in times of reduced water supply.	This alternative slows this factor in times of reduced water supply.	This alternative slows this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.
Property Values	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.

Table 4-7 Comprehensive Benefits Analysis, OSE account

Philpott Lake, VA Water Reallocation Study Final Alternatives Array Evaluation							
Criteria:	**Alternative 1: No Action**	**Alternative 2: Conservation Storage Reallocation**	**Alternative 4: New Water Supply Resevoir**	**Alternative 5: Raw Water Offline Storage**	**Alternative 8: Wholesale Water Purchase**	**Alternative 10: Additional Ground Water Wells**	**Alternative 12: Combined Plan**
Public Services	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative maintains this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Improvement to Median Household Income (2020)($38,511 vs. median for U.S. - $76,398 – 50% of U.S. median)	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Improvement to per Capita Income (2020)($23,051 vs. $41,255 U.S. – 55% of U.S. per capita)	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Improvement to Persons in Poverty (2020 – 12.9%)	This alternative decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative slightly decreases this factor in times of reduced water supply.	This alternative increases this factor in times of reduced water supply.
Risks to known Environmental Justice Populations	This alternative increases this factor in times of reduced water supply.	This alternative decreases this factor in times of reduced water supply.	This alternative decreases this factor in times of reduced water supply.	This alternative modestly decreases this factor in times of reduced water supply.	This alternative modestly decreases this factor in times of reduced water supply.	This alternative modestly decreases this factor in times of reduced water supply.	This alternative decreases this factor in times of reduced water supply.

Table 4-7 Comprehensive Benefits Analysis, OSE account continued

5 RECOMMENDED PLAN

Alternative 2 is the Recommended Plan for this study. It is nonstructural plan that will reallocate 5,200 ac-ft from the conservation storage pool at Philpott Lake to water supply with cooperation from the Federal government (Figure 5-1). To do this, USACE will increase the output or releases from the station service hydropower unit which will then feed HCPSA's existing downstream water intake. During times when the station service unit is unavailable, water supply releases will be maintained through low flow valves in the dam that have comparable discharge capacity.

Since the reallocation is being made from the conservation pool and not the flood storage pool, there will be no impacts to flood risk management or low flow augmentation. However, there will be a small impact hydropower generation, since the conservation pool at Philpott Lake is currently dedicated to power production. Based on the Hydropower Analysis, the average annual hydropower value losses are currently estimated to be 0.21% or $6,077. (See Appendix D).

The degree of operational changes and hydropower impacts do not fundamentally depart from what Congress intended when it authorized Philpott Lake. As such, congressional authorization would not be needed for the Recommended Plan.

With the Recommended Plan the annual minimum lake elevations will rise no more than 1 ft, with no changes in the recurrence interval for lake levels dropping below the minimum conservation pool. In addition, no adverse downstream flow impacts are expected. Between the dam and HCPSA's water withdrawal flows are expected to be slightly higher (6 cfs) and flows at Bassett (downstream of HCPSA intake) are expected to remain the same, meeting the minimum flow target at Bassett (see Appendix B).

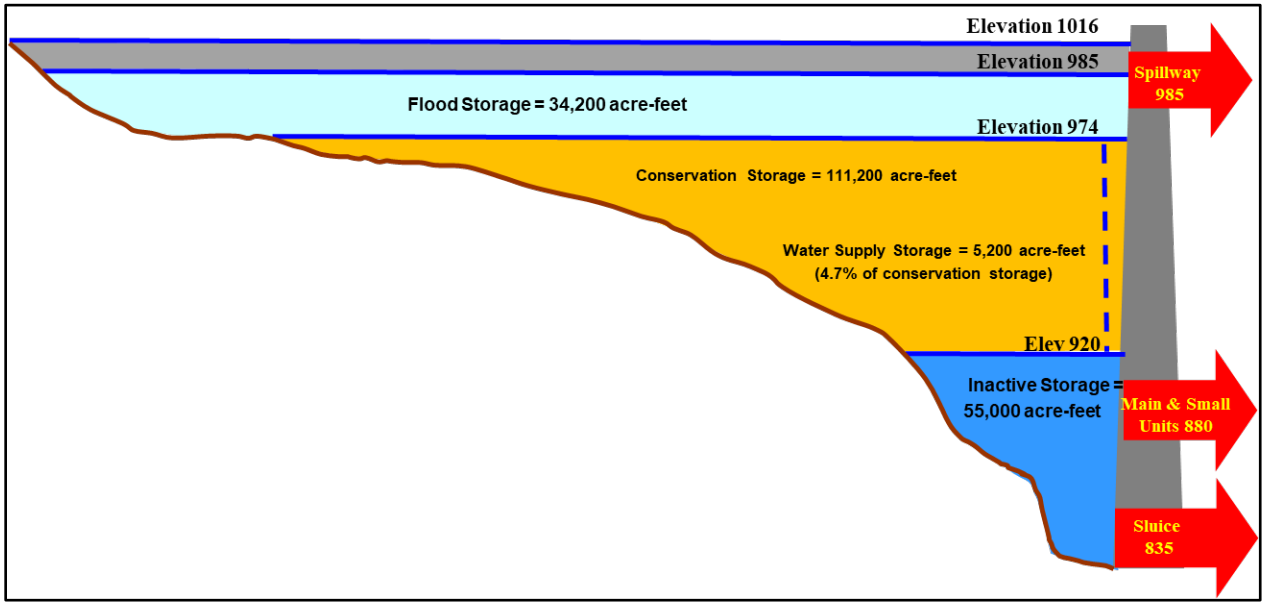

Figure 5-1 Proposed Storage Reallocation

6 DERIVATION OF USER COST

The Recommended Plan reallocates water supply from the conservation storage at Philpott Dam to meet the estimated 4 MGD for the HCPSA. In addition to determining user cost, USACE must ensure that the reallocation of Federal storage to water supply is the most economical alternative compared to other sources of water (including the Next Least Costly Alternative), which is discussed in Section 4.6. Reallocated storage to water supply can be repaid over a period not to exceed 30 years. Details of annual storage costs are discussed in Section 6.5.

USACE's ER 1105-2-100 specifies the four pricing methods used to calculate the value of storage considered for reallocation (*i.e.*, the price to be charged for the capital investment for reallocated storage). They include benefits foregone, revenues foregone, replacement cost, and updated cost of storage. The value placed on the storage is the highest of the four methods.

- **Benefits Foregone**. Benefits foregone are generally estimated using the standard Nation Economic Development (NED) evaluation criteria in compliance with ER-1105-2-100. The benefits forgone are evaluated over a 50-year period of analysis.

- **Revenues Foregone**. Hydropower revenues foregone are defined as the reduction in revenues accruing to the Treasury as a result of reallocating storage from hydropower to water supply. The revenues are based on the existing repayment agreement between the power marketing agency and the USACE. Revenues forgone from other project purposes are the reduction in revenues accruing to the U.S. Treasury based on existing repayment agreements.

- **Replacement Cost**. Notwithstanding unforeseen circumstances, replacement costs are equal to benefits foregone. In the event that reallocated storage is being taken from the flood control pool, the USACE will estimate the replacement cost of equivalent protection if necessary.

- **Updated Cost of Storage**. The updated cost of reallocated storage is estimated by updating the cost of the joint use features from the midpoint of construction to the fiscal year in which the reallocation of storage is approved. The updated cost of the joint use features is then multiplied by the proportion of usable storage that is the reallocated to estimate the value of reallocated storage.

6.1 Hydropower Benefits Foregone

Philpott hydropower plant has three units for a combined Output of 15 mega watts (MW), two main units and a small station service unit. Electrical power generated at Philpott hydropower plants is dispatched by Dominion Power and transmitted by Appalachian Power to customers of power from Philpott. Power from Philpott is marketed to customers under contract with Southeastern Power Administration of the US Department of Energy.

Water flow operations through the power plant for the period of record (1960-2019) is made using HEC-RESSIM, a sequential streamflow model to simulate daily Philpott Lake

operations under alternative operations for water supply.

Simulated generation dispatch was developed from plan operations data available for 2010-2014. Daily averages were converted to ratios of weekly power flow for each month which were applied to weekly power plan flow volumes from HEC-RESSIM model output. Daily power was then computed and validated using the available plant operations data.

Table 6-1 summarizes the Annual Hydropower Benefits Forgone.

Table 6-1 Estimated Annual Hydropower Benefits Under Base Case and Recommended Plan Scenarios

	Annual Energy Benefits (foregone)				**Annual Capacity Benefits (foregone)**				**Total Annual Hydropower Benefits (foregone)**	
	MWh	Δ (MWh)	2022$	Δ ($)	MW	Δ (MW)	2022$	Δ ($)	2022$	Δ ($)
Base Case	22,770	n/a	$722,434	n/a	14.85	n/a	$2,157,480	n/a	$2,879,914	n/a
Reallocation from Cons. Pool	22,786	16	$723,551	$1,117	14.80	-0.05	$2,150,287	($7,194)	$2,873,837	($6,077)

6.2 Revenues Foregone

"Revenues foregone to hydropower are the reduction in revenues accruing to the U.S. Treasury as a result of the reduction in hydropower outputs based on the existing rates charged by the power marketing agency."

"The Corps does not market the power it produces; marketing is done by the Federal power marketing agencies (Southeastern Power Administration, Southwestern Power Administration, Western Area Power Administration, Bonneville Power Administration, Alaska Power Administration) through the Secretary of Energy. The rates are set by the marketing agency to: (a) recover costs (producing and transmitting) over a reasonable period of years (50 years usually); and (b) encourage widespread use at the lowest possible rates to consumers, consistent with sound business principles. …"

Revenue foregone is to be based on the current SEPA contract Rates applicable to power generation by the Ker-Philpott plants. The current rates are:

Energy Rate Total: $17.80/MWh

Monthly Capacity Charge: $4.40/kW-month ($52,800/MW-year)

To compute energy revenues foregone, the contract energy rate is applied to the average annual contract energy foregone, and the capacity charge is applied to foregone dependable capacity. Table 6-2 below shows the Power Revenue Foregone for the Recommended Plan.

Table 6-2 Annual Revenue Summary Across Base Case and Recommended Plan Scenarios

Alternative	Energy (MWh)	SEPA Energy Rate ($/MWh)	Dependable Capacity (MW)	SEPA Capacity Rate ($MW-year)	Revenue ($)	Revenue (foregone) ($)	
Base Case	22,770	$17.80	14.847	$52,800	$1,189,246	---	
Reallocation from Conservation Pool	22,786	$17.80	14.798	$52,800	$1,186,919	($2,327)	-0.20%

6.3 Replacement Cost

No replacement cost was calculated for flood risk management and recreation as no serious effects were identified. The replacement costs of power are equivalent to the hydropower benefits forgone.

6.4 Updated Cost of Storage

The cost allocated to the user under this pricing method updates the joint-use portion of the first costs of reservoir construction to present day price levels and then assigns a percentage of the costs based on the "Use of Facilities" (UOF) cost allocation procedure. See Table 6-3 below. Costs are updated from "as built" costs in 1950 (the mid-point of construction) to 1967 prices by use of the Engineering News Record (ENR) Construction Cost Index, and then from 1967 to current prices by use of the USACE's Civil Works Construction Cost Index System (CWCCIS). Land values are updated by the weighted average update of all other project features. Costs are indexed from the midpoint of the physical construction period to the beginning of the fiscal Year (FY) in which the contract for reallocated storage is expected to be approved (FY2022). Joint-use costs exclude infrastructure costs allocated to specific project purposes such as recreation facilities, hydropower turbines, etc.

Construction is considered as having been initiated at the start of the month when lands for the project were first acquired or on the date when the first construction contract was awarded whichever was earlier. Construction is considered as having been completed at the end of the government FY in which final deliberated impoundment of the reservoir point was initiated.

The USACE policy on pricing storage reallocated from one authorized project purpose to another is based on the UOF methodology. UOF methodology allocates join-use costs (costs that cannot be specifically allocated to a specific project purpose) based on overall percentage of storage reallocated. For example, if 15 percent of the usable storage is reallocated, then the reallocated storage is apportioned 15 percent of the joint-use costs. The cost of reallocated storage changes each government FY. This is due to the fact that the Federal discount rate changes on an annual basis as well as varying annual OMRR&R costs. Section 932 of the 1986 WRDA requires recalculation of the interest rate at 5-year intervals if the storage is paid annually over a 30-year period.

6.5 Potential Costs for Repair, Rehabilitation and Replacement (RR&R)

Potential costs for RR&R were calculated based on existing deficiencies and recommendations noted in the most recent dam safety Periodic Inspection report. Recommendations and expenses associated with electrical infrastructure are not included in the total estimated RR&R cost as the sponsor is not expected to share in these costs. The RR&R costs are estimated to cover a 50-year time period, starting in calendar year 2023. The estimated annual RR&R costs to the NFS is $31,038, see Table 6-3 below shows the User's Cost for reallocation of 5,200 ac-ft from the conservation pool.

Category	Actual Joint use as of Mid-point of construction 1950	1950 ENR Index Value	1967 ENR Index	ENR Ratio	1967 CWCCIS Index Base 100	Updated Joint-Use as of 1967	Apr 2022 CWCCIS Index	Update Factor	FY 2022 Joint Costs
Lands and Damages	492,000	510	1074	2.11	100	1,036,000	1,148.94	11.51	11,928,000
Relocations	668,000	510	1074	2.11	100	1,407,000	1,158.95	11.59	16,306,000
Dam	7,993,000	510	1074	2.11	100	16,832,000	1,097.62	10.98	184,751,000
Roads, Railroads & Bridges	375,000	510	1074	2.11	100	790,000	1,158.95	11.59	9,156,000
Reservoirs	416,000	510	1074	2.11	100	876,000	1,165.77	11.66	10,212,000
Buildings, Grounds & Utilities	99,000	510	1074	2.11	100	208,000	1,163.43	11.63	2,420,000
Permanent Operation Equipment	73,000	510	1074	2.11	100	154,000	1,163.43	11.63	1,792,000
Total	10,116,000								236,565,000
Specific Costs Water Supply Conduit	Intakes already present								

Table 6-3 Updated Joint Costs

7 TEST OF FINANCIAL FEASIBILITY

As a test of financial feasibility, the annual cost of the reallocated storage for Alternative 2 was compared to the annual cost of the most likely, least costly alternative that would provide an equivalent quality and quantity of water. The period of analysis for this test is 50 years: 2023-2072.

NED costs include both financial costs to implement, maintain, and operate each alternative, and forgone economic benefits of implementing an alternative. NED financial costs include project capital costs including real estate, and OMRR&R costs. NED costs used in comparing final alternatives are based on FY 2022 price levels and the FY 22 interest rate.

The next least costly, and most likely, alternative within the final array is Alternative 12 or the combined measures of offline storage, wholesale water purchase and additional groundwater wells. This alternative would generate an equivalent amount of water in terms of both quality and quantity for the NFS and can be accomplished without Federal participation. As shown in Table 7-1, the annualized cost of Alternative 2 is significantly less than the annualized cost of Alternative 12.

Table 7-1 Test of Financial Feasibility

Philpott Lake, VA Water Reallocation Study					
#:	*Alternative Description:*	*Capital Cost:*	*Annual Capital Cost:*	*Annual OMRR&R Cost:*	*Total Annual Cost:*
2	Reallocation from Conservation Storage	$8,460,000	$378,000	$85,038	$463,038
12	Combined Plan (Wholesale Purchase and Off-line Storage)	$170,180,600	$5,771,183	$85,038	$5,856,221

7.1 User's Cost

Table 7-2 below shows the User's Cost for reallocation of 5,200 ac-ft from the conservation pool.

Table 7-2 User's Cost

Description		Amount
Total Usable Storage for Philpott Dam (STot)		145,000 ac-ft
Storage Recommendation (SRec)		5,200 ac-ft
Percent of Total Usable Storage		3.58%
Total Updated Cost of Storage for Philpott Dam (CTot)		$236,565,000
Annual Cost of Storage Recommendation (ARec)		$378,000
$ARec = CRec \frac{i(1+i)^{n}-1}{(1+i)^{n}-1}$	Where CRec = $ I=2% N=30 year	
Operation and Maintenance for Philpott Dam (O&M Tot)		$1,520,286
Philpott Dam Annual Operation and Maintenance Estimate (O&M Req)		$54,000
Replacement and Rehabilitation for Philpott Dam (R&R Tot)		$867,857
Philpott Dam Annual Replacement and Rehabilitation Estimate (R,R&Rreq)		$31,038
Total Annual Cost=ARec + O&MRec + R,R&Rreq		$463,038

.

8 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

This section discusses the resources in the study area and the probable effects or impacts of the proposed federal action on environmental resources. The Recommended Plan is to reallocate 5,200 ac-ft from conservation storage to water supply storage. The effects discussed can be either beneficial or adverse and were considered over the period of 2023 through year 2072. Figure 2-2 shows the location of the Philpott Dam and Lake. In addition to the Recommended Plan, the impacts of the No Action alternative are addressed in this section. "No Action" is the alternative that proposes to continue current operations: the status quo. No action alternative means that a federal action would not take place, and the environmental effects resulting from taking no action would be compared with the effects of implementing the recommended plan. Water demand growth for the period ending in year 2072, as presented in Appendix A Water Demand Analysis is projected to result in a need for approximately 4 MGD of additional water supply by the year 2072, even with implementation of additional and more significant water conservation and recycling actions. Failure to address water supply shortfalls would have significant negative economic, community, and potential biological effects. This has the potential to seriously affect population growth, maintenance of property values, and quality of life for those affected. This Recommended Plan is technically feasible as there is no construction or new infrastructure required for its implementation.

The No Action alternative takes into account there are no projects under construction or authorized and likely to be constructed during at least the initial portion of the period of analysis. A future without-project condition would reasonably expect Henry County to implement programs that reuse wastewater from the system and to incorporate water conservation and efficiency measures. Appendix A Water Demand Analysis, contains detail on additional plans to implement further conservation and reuse improvements.

The most significant impacts of the No Action alternative will be to water supply and socio-economics. Water demand growth for the period ending in year 2072 is projected to result in a need for approximately 4 MGD of additional water supply by the year 2072, even with implementation of additional and more significant water conservation and recycling actions. Over that period, even in the presence of lower per capita usage, increasing demand will create shortfalls in water supply. When the demand exceeds the availability, significant negative economic impacts, such as to population growth, maintenance of property values, and quality of life, will occur to the communities and inhabitants.

Impacts of the No Action plan are compared to the Recommended Plan in Table 8-1 and are discussed in more detail in the following sections.

Table 8-1 Comparison of Environmental Effects of No Action Alternative vs. Recommended Plan

	Effects of Alternative Plans	
Environmental Resources	**No Action**	**Reallocation (RP)**
Geology and Sediments	No Change	No Effect
Floodplains	No Change	No Significant Impacts
Operations and Flood Risk Management	No Change	No Effect
Water Quality	No Change	Slight average increase in minimum annual pool elevations. No increase in historic lake elevation range. No significant impact to downstream water quality. Overall, no significant impacts.
Water Supply	Insufficient water supply for projected industrial and municipal demand growth.	Provide sufficient water supply to meet projected water demand growth through year 2072.
Wetlands	No Change	No Effect

	Effects of Alternative Plans	
Vegetation	No Change	No Effect
Fish and Wildlife	No Change	No Effect
Endangered Species	No Change	No Effect
Cultural Resources	No Change	No Effect
Socio-economics and Environmental Justice	Reduction or reversal of expanded industrial and commercial activity. Will not result in a disproportionately high or adverse human health or environmental effects	Maintain or increase expanded industrial and commercial activity. Will not result in a disproportionately high or adverse human health or environmental effects.
Recreation and Aesthetics	No Change	No Effect
Air Quality and Noise	No Change	No Effect

	Effects of Alternative Plans	
Climate Change	No Change	No Effect
HTRW	No Change	No Effect

USACE strives to protect the environment to the maximum extent practicable. As with any USACE civil works project, the study process included incorporation of USACE's Seven Environmental Operating Principles (EOP). These are the following:

- Foster sustainability as a way of life throughout the organization.
- Proactively consider environmental consequences of all Corps activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

The USACE EOPs were developed to ensure that the U. S. Army Corps of Engineers missions include sustainable environmental practices. The plan formulation for the Philpott Reallocation project meets the Federal planning requirements. The feasibility study is being carried out in a manner consistent with the USACE EOPs. The principles are consistent with NEPA; the Army's Environmental Strategy with its four pillars (prevention, compliance, restoration, and conservation); and other environmental statutes that govern USACE activities.

Specifically for the Philpott Reallocation project, the EOPs were utilized during the planning

process with regards to screening of the potential alternatives to limit the impacts to the human environment. The NEPA defines the human environment, as the natural and physical environment and the relationship of people with that environment. Additionally, USACE has worked closely with federal and state agencies as well as local officials to ensure the project alternatives selected are the most environmentally sustainable choices.

8.1 Physical Resources

8.1.1 Geology and Sediments

Philpott Lake is situated within two physiographic provinces: the Piedmont and the Blue Ridge Mountains. According to the Virginia Department of Environmental Quality (VADEQ, 2020a), the Piedmont Province is the largest physiographic province in Virginia, which extends from the fall line on the east to the Blue Ridge Mountains to the center of the Commonwealth. The area is described as having hard, crystalline igneous and metamorphic formations with some areas of sedimentary rocks. Most significant water supplies are found within a few hundred feet of the surface (VADEQ, 2020a). Larger concentrations of water withdrawal can be obtained along the Western Piedmont along the base of the Blue Ridge Mountains (VADEQ, 2020a).

The Blue Ridge Province is a relatively narrow zone to the west of the Piedmont, approximately four to 25 miles wide (VADEQ, 2020a). Underlying geology includes a thin layer of soil above bedrock. The eastern flank of the Blue Ridge Mountains includes igneous and metamorphic rocks, while sedimentary rocks are more common along the western flank. However, the steep terrain and thin soil coverings result in rapid surface run-off and low groundwater recharge (VADEQ, 2020a).

The topography within the Philpott Lake area varies from approximately 800 to 1,100 feet above MSL, with 300 to 500 feet of local relief from the reservoir (see Appendix B, Figure B2 Project Area Topography). In the northern reaches of the watershed, elevations reach approximately 1,100 feet relative to MSL. Elevations then drop to approximately 981 feet above MSL at Philpott Dam (USGS, 2020a). The terrain in the immediate vicinity of the lake ranges from steep hills and wooded slopes to sheer rock cliffs above the main body of the reservoir. Because of Philpott Lake's proximity to the Blue Ridge Mountains, the topography is more rugged than what is commonly associated with the Piedmont physiographic province. This area is characterized more predominantly by steep ridges and cliffs, with narrow valleys, and rolling hills (Belden, 2001). Typical slopes are between 30-35 degrees, and some slopes are greater than 80 degrees. Elevations typically range between 800 feet to over 1100 feet in the general area (Belden, 2001). Since publication of the original 2021 Master Plan and its subsequent updates, little to no development has occurred that may have impacted geologic resources.

Numerous soil types are located within the Philpott Lake study area (USDA-NRCS, 2020) (see Appendix B, Figure B8 Soil Type Map). Current soil surveys are published for each county and can be accessed from the U.S. Department of Agriculture Natural

Resources Conservation Service (USDA-NRCS) web soil survey (WSS) (USDA, 2020). Henry County was last surveyed in 1994, Patrick County was last surveyed in 1999, and Franklin County was last surveyed in 2000 (USDA-NRCS, 2020). Because Philpott Lake is situated in three different counties (Franklin, Henry, and Patrick), this report summarizes the most commonly occurring soil series in each county. In Franklin County, Bluemount gravelly silt loam (3E) is the dominant soil series. This soil series occurs on hillslopes, is well drained with slopes ranging between 25 to 45 percent and is typically a gravelly silt loam (USDA-NRCS, 2020). In Henry County, the largest soil series is Buffstat-Bugley complex (3E). This soil series occurs on mountain slopes, is well drained with slopes ranging between 23 to 60 percent and has a silt loam profile (USDA-NRCS, 2020). Lastly, in Patrick County, the predominant soil series is Bluemount-Spriggs complex (4E). Bluemount-Spriggs soils typically occur on hillslopes with 25 to 45 percent slopes, are well drained, and have a gravelly silt loam profile (USDA-NRCS, 2020). These soil conditions support most types of development. The primary constraint has been and continues to be the slope at which these soils exist.

The U.S. Department of Agriculture (USDA), Web Soil Survey (WSS) uses specific criteria for assessing recreational soil suitability and a rating process implemented to map the soil suitability for recreation within the project. The ratings of 'Somewhat Limited' or 'Very Limited' were obtained from the USDA's WSS suitability and limitations for use guidelines. The USDA WSS maps rate both recreational development camp areas and recreational development paths and trails based on the USDA WSS rating criteria. The rating criteria for camping areas is slope, stoniness, depth of bedrock or the commented pan. For paths, hiking and horseback riding trails its stoniness, depth of water table, ponding, flooding and the texture of the surface.

Specific agency consultation for physical resources is discussed in Chapter 7 of the Master Plan Update. Soils and topography are regulated by standards and laws included in the Virginia Erosion and Sediment Control Planning program (VADEQ, 2020b). The VADEQ provides guidance on designing, implementing, and monitoring erosion and sediment controls and stormwater management measures. The Virginia Department of Environmental Quality Erosion and Sediment Control Program and the USACE are responsible for approving these measures.

Alternative 1, No Action: No changes in geology or sediment would occur.

Alternative 2, Recommended Plan: This alternative should not have an effect on the geology of the area or to increase or affect sediment inflow or sedimentation in the lake.

8.1.2 Floodplains

Areas along the western half of Philpott Lake are primarily classified as Flood Zone Hazard A, whereas areas along the eastern half of the lake are most often designated as

Zone D. Zone A has a 1 percent annual chance of flood (i.e., 100-year floodplain), also known as the base flood area, which has a 1 percent chance of being equaled or exceeded in a given year. The Special Flood Hazards area is subject to flow in the 1 percent annual chance of flood areas. Zone D is the area in which flood hazards are undetermined, but possible (FEMA FIRM, 2008). Additionally, other areas are considered in Zone X, which are areas determined to be outside the 0.2 percent annual chance floodplain (i.e., 500-year floodplain) (FEMA FIRM, 2008). The 100-year floodplain elevation within the project boundary is at 985 feet above MSL (USACE, 1982).

The 100-year floodplain elevation is determined by the different pool levels that are maintained by the USACE to meet its mission of controlling floodwaters and generating power. Philpott Lake has many structures, campsites, trails, and beaches within the floodplain. It is understood that these structures and areas are designed to withstand flood events and not hinder flood control operations.

Other structures in the floodplain include shoreline stabilization features (i.e., rock piles). These features were constructed primarily to protect the shoreline from erosion. Although these features alter wave action along select portions of the shoreline, they are not considered to have a major impact on floodwater conveyance.

Floodplains are defined and regulated by the Federal Emergency Management Agency (FEMA) and mapped on Flood Insurance Rate Maps (FIRM) and Virginia Department of Conservation and Recreation (VADCR). Local municipalities' planning offices may also play a role in defining floodplains and regulating their use. Development occurring within floodplains must be consistent with Executive Order 11988: Floodplain Management and related USACE policy.

Alternative 1, No Action: The No Action alternative will result in no changes to the existing floodplain.

Alternative 2, Recommended Plan: Executive Order 11988 requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "[e]ach agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities…" This alternative will result in very similar flow rates as compared to current rates throughout the study area and therefore will not alter existing hydrology in the floodplain.

1. Floodplain and/or wetland determination; the Recommended Plan will not impact any floodplains or wetlands, upstream, within, or downstream of the project. All impacts of the Recommended Plan are contained within the channel of the Smith River downstream of the project, and within the reservoir only, and are extremely minor in nature.

2. Public notification; The Recommended Plan was fully discussed during public scoping and the Recommended Plan will have no significant impact to the public other than provision of a more reliable water supply in the future. This Draft report will be provided to the public and agencies for a 30-day review. All comments will be addressed and noted in the final report.

3. Identify and evaluate practicable alternatives to locating in the base floodplain: The report discusses all practicable alternatives and illustrates the deliberative process by which the Recommended Plan was selected.

4. Identify the impacts of the Recommended Plan; Impacts of the Recommended Plan are fully discussed in the report and compared side-by-side in the System of Accounts analysis (Table 4-).

5. Evaluate measures to reduce potential adverse impacts of the Recommended Plan; the Recommended Plan has, the lowest potential to produce adverse impacts of any alternative. The final report contains a thorough analysis of all positive and negative impacts and presents them in a System of Accounts format (Table 4-).

6. Re-evaluate the alternatives; all alternatives were thoroughly evaluated and re-evaluated during the deliberative Corps planning process, and are presented in an evaluative, comparative, and screened process, in the final report.

7. Make the final determination and present the decision; the final determination and presentation of the Recommended Plan are contained in the report.

8. Implement the action. Implementation of the Recommended Plan will result in no significant impacts to floodplains or wetlands.

8.2 Water Resources.

8.2.1 Operations and Flood Risk Management

One of the objectives of the Philpott Lake project is flood risk management below Philpott Lake dam on the Smith River. Storage of 34,000 ac-ft between elevations 973.4 ft NAVD88 (top of conservation storage) and 984.4 ft NAVD88 (spillway crest elevation) is reserved exclusively for the detention storage of floodwaters. An additional 120,400 ac-ft of surcharge storage exists above the free-overflow spillway between elevations 984.4 and 1013.4 ft NAVD88.

The general plan of flood operations provides for maintaining the normal storage elevation with a seasonal guide curve in Philpott Lake by releasing flows that produce non-damage stages in the Smith River downstream of Philpott Lake dam whenever

possible. The flood risk management objective is to store water in the controlled flood storage in Philpott Lake whenever the Smith River downstream is at that time, or is forecast in the future, to exceed the downstream capacity of the channel (i.e., a "bankfull condition"), or reach a depth or condition in which it would cause damage (i.e., "damage stage"). The latter is when flood flows would leave the channel and cause damaging inundation to structures or infrastructure. The USGS stream gage on the Smith River near Bassett is the primary operational flood stage indicator; however, some consideration is also given to river stages farther downstream (such as Stanleytown and Martinsville) based on experience during past major flood events. Because of the distance and the river flow travel time from Philpott Lake dam to downstream areas and coupled with runoff from the uncontrolled drainage areas, releases from Philpott Lake dam will sometimes be reduced to near minimum prior to a storm event to prevent discharges from contributing substantially to those uncontrolled floodwaters. Afterwards when downstream conditions allow, the flood storage pool in the reservoir will be evacuated at a rate that will produce up to non- damaging stages downstream. Flood releases are based on a tiered release schedule, allowing for increased releases and higher regulated flows at Bassett as lake levels rise higher into the flood storage.

Alternative 1, No Action: No change to flood risk management would be expected.

Alternative 2, Recommended Plan: There would be no change in normal operating pool levels, no reduction in available flood storage, and no change to operational flood releases associated with this conservation storage reallocation; therefore, no effects to the flood risk management are anticipated.

8.2.2 Water Quality

Located within the Roanoke River Basin, Philpott Lake is designed with the top of the conservation pool at approximately 973.4 feet NAVD88 (USACE, 1982). At this elevation, the reservoir is nearly 10 miles long with approximately 110 miles of shoreline, covering approximately 2,741.5 acres. The current plan of operation for Philpott Lake calls for maintaining the lake level at or near the guide curve elevation. The guide curve elevation is at 970.9 feet NAVD88, October through January and 972.9 feet NAVD88, April through July and varies linearly between these two elevations during the remainder of the year.

The Roanoke River Basin covers approximately 6,393 square miles or approximately 15 percent of the Commonwealth of Virginia's total area (Virginia Water Resources Plan [VAWRP] 2015). It includes portions of four independent cities and 17 counties. The four cities are Danville, Martinsville, Roanoke, and Salem. The Virginian counties include Appomattox, Bedford, Botetourt, Brunswick, Campbell, Carroll, Charlotte, Craig, Floyd, Franklin, Halifax, Henry, Mecklenburg, Montgomery, Patrick, Pittsylvania, Prince Edward, and Roanoke. (Figure 2-1).

According to the Virginia Water Resources Plan (VAWRP 2015), over 62 percent of the Roanoke River Basin is forested, approximately 25 percent is cropland or pasture, and approximately 10 percent is urban land. The Roanoke River Basin is divided into seven USGS hydrologic unit codes (HUC), which include HUC 03010101 (Upper Roanoke), HUC 03010102 (Middle Roanoke), HUC 03010103 (Upper Dan), HUC 03010104 (Lower Dan), HUC 03010105 (Banister), HUC 03010106 (Roanoke Rapids), and HUC 03040101 (Upper Yadkin) (VAWRP 2015).

Several surface water inputs are located around the lake. The various other surface water inputs include, but are not limited to, the Smith River, Small Creek, Buttermilk Branch, Runnet Bag Creek, Otter Creek, Ryan's Branch, Beard's Creek, Nicholas Creek, Mill Creek, Green Branch, Puppy Creek, and Bowens Creek. Smith River is the primary source of freshwater to Philpott Lake. In addition to the named surface waters, additional tributaries, wetlands, and other surface waters contribute to Philpott Lake water levels.

The VADEQ manages water quality standards by its capacity to support different uses. Based on VADEQ water quality data, most creeks and tributaries that flow into Philpott Lake range from Class III to Class V waters. Class III, IV, and V waters are defined VADEQ water quality standards that are implemented based on usage or consumption (VADEQ, 2020c). The VADEQ designated six uses for surface waters in Virginia, of the six uses the ones that are applicable to Philpott Lake includes aquatic life habitat, fish consumption, public water supplies, recreation, and wildlife. Philpott Lake (listed as Philpott Reservoir) is classified as a Category 5 impaired waterbody, requiring a Total maximum Daily Load Study. (VADEQ 2020f).

Most of the streams and tributaries that flow into Philpott Lake, and the lake waters, are categorized as supporting primary recreation (swimming and boating) and trout waters while also being a water supply. Some select areas of the Roanoke River immediately north and south of the lake do not support primary recreation but still support healthy aquatic life and secondary recreation.

The VADEQ publishes data on water quality throughout the Commonwealth in its Impaired Waters – 303(d) list. The most current 303(d) list available for Virginia was published in 2020. Waters listed on the 303(d) list fail to meet national water quality criteria established in the CWA. Based on the VADEQ 2020 Final Impaired Waters – 303(d) list, Philpott Lake is listed for Fish Consumption (Impaired Use Code: L51L-01-HG) (VADEQ, 2020e), Dissolved Oxygen (Impaired Use Code: L51L-01_DO), and temperature (Impaired Use Code: L51L-01-TEMP).

Philpott Lake was initially listed for Fish Consumption in 2010 as a Category 5 (i.e., waters needing Total Maximum Daily Load (TMDL) Studies). The Lake continued to be classified as a Category 5 waterbody in 2020. No Fish Consumption or Drinking Water Advisories are issued for mercury for these waters since the levels of mercury reported in fish tissue were under Virginia's Department of Health's level of concern (VADEQ 2020f). Philpott Lake was listed on the 303(d) list in 2020 for both dissolved oxygen and

temperature. The dissolved oxygen and temperature levels reported led to the impairment of aquatic life (VADEQ 2020f).

The Smith River is also listed as a Category 5 since 2002 and again in 2018 for temperature (Impaired Used Code: L50R-01-Temp). Aquatic life has potential to be impacted due to temperature variance. Runnet Bag Creek, which drains to Philpott Lake, also has been listed for temperature on the 303(d) list since 2002 (VADEQ 2020f).

The Virginia Department of Health Office of Drinking Water (VDH-ODW) maintains a regulated, public water systems or waterworks database known as Drink Water Watch (VDH-ORW, 2020). For Franklin County, there are eight sites where the VDH-ODW collects water data. These eight sites are located around Philpott Lake in specified recreation areas, where potable water can be accessed. These eight sites include the Deer Island Foot Bridge, Horseshoe Point Utility, Jamison Mill Building, Salthouse Branch Utility, Deer Island West, Salthouse Branch Beach, Salthouse Branch Picnic, and Tailrace. For Patrick County, there is one site where the VDH-ODW collects water data. It is the Ryans Branch Picnic area, where potable water is accessed. There are no water data collection sites for Henry County around Philpott Lake.

VADEQ's Virginia Climate Response Network, in conjunction with the USGS, has one groundwater monitoring well in close proximity to Philpott Lake. The well is located in Fairy Stone State Park, just west of Virginia Route VA-623. The site is USGS 364732080070301 30C 1 SOW 010. According to the Groundwater Watch web mapping dated November 19, 2020, at 12:09 p.m., this well exhibited high levels of groundwater (USGS, 2020b). The USGS began collecting data in the field at this site on May 6, 1966. The most recent data collection occurred on October 23, 2020. There have been 262 data collections in this 54-year time frame. As technology is now available to do so, daily data collection (depth to water level, feet below land surface) has been occurring remotely from August 26, 2016, through November 19, 2020 (USGS, 2020b). There have been 3,070 total data collections in this 4-year time frame. This well measured consistent groundwater levels ranging from 1,030 to 1,050 feet. Changes within this range followed a fairly regular pattern of drawdowns and recharges.

Several Flowage Easements exist around Philpott Lake. These areas may retain natural characteristics which allow those areas to absorb stormwater before it reaches surrounding water resources. While the easement areas may help water quality if the land is not cleared, the easements were not acquired to protect water quality. The flowage easements can be cleared of vegetation by property owners if they choose to and some structures may be constructed. Only habitable structures are prohibited. USACE's only interest in easements is to allow water to be impounded as the lake rises.

Alternative 1, No Action: No change in water quality would be expected.

Alternative 2, Recommended Plan: The Recommended Plan would result in reallocation of 5,200 ac-ft of conservation storage to water supply storage within Philpott

Lake conservation pool. Normal current operating levels will be maintained. There will be no impact to the historic lake elevation range. Hydraulic analysis comparing the No Action and the Recommended Plan showed the minimum annual pool elevations are higher for the reallocation every year during the 1960-2019 modeling period, with an average increase of 0.78 feet (Appendix B). Therefore, the Recommended Plan's impact to the lake elevation would be a slight average increase, but not over the historic lake elevation range.

Smith River flows downstream of Philpott Dam were analyzed at the control point of Basset (Appendix B). The minimum flow target at Basset is 52 cfs. Under the No Action Alternative, flow at Basset is below 50 cfs 191 days within the entire 59-year model period. With reallocation from the conservation pool, the flow at Bassett is below 50 cfs 29 days out of the model period, meeting the minimum flow target an additional 162 days within the entire 59-year model period. Therefore, the Recommended Plan would not significantly impact the downstream flow rate between Philpott Lake dam and Henry County's Wastewater Treatment Plant outfall, and water quality flow targets both immediately downstream of Philpott Lake and at Bassett, would continue to generally be met within the 59-year model period.

Overall, the Recommended Plan would have no significant impacts to water quality in the lake or downstream.

8.2.3 Water Supply

Philpott Lake currently does not provide water supply storage for any State or local interest. The Corps, per the WSA of 1958, may include water supply storage at Philpott Lake for municipal and industrial uses.

The HCPSA currently withdraws an average daily volume of about 3.3 MGD from the Smith River using its existing downstream intake.

Alternative 1, No Action: As water use increases over time, meeting 2072 demand is not feasible under current conditions. There will be insufficient water supply for projected industrial and municipal demand. Water storage would have to be developed through one of the other measures described in Section 4.6, which either individually would fail to meet increased demand or would prove cost prohibitive given HCPSA's finances. It is therefore reasonable to assume that under the no action alternative the affected communities would bear negative consequences from a failure to have sufficient long-term water supply, such as stunted regional growth.

Alternative 2, Recommended Plan: The Recommended Plan would result in reallocation of 5,200 ac-ft of conservation storage to water supply storage within Philpott Lake conservation pool. The Recommended Plan would provide sufficient water supply to meet projected water demand through year 2072.

8.3 Biological Resources

8.3.1 Wetlands

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 C.F.R. §328.3(b)). A jurisdictional wetland, as delineated by the USACE, is based on three factors: hydric soils, wetland hydrology, and hydrophytic (wetland) vegetation. Wetlands include a variety of natural systems, such as marshes, swamps, and bottomland hardwoods.

Wetland areas within the project limits exhibit a mix of bottomland hardwood species. Typical species include: sweetgum (Liquidambar styraciflua), green ash (Fraxinus pennsylvanica), black gum (Nyssa sylvatica), swamp black gum (Nyssa biflora), sycamore (Platinus occidentalis), and river birch (Betula nigra).

Alternative 1, No Action: This alternative would result in no change to wetlands.

Alternative 2, Recommended Plan: Executive Order 11990 directs all Federal agencies to issue or amend existing procedures to ensure consideration of wetlands protection in decision making and to ensure the evaluation of the potential effects of any new construction proposed in a wetland. The Recommended Plan would not require filling any wetlands and would not produce changes in hydrology that could affect wetlands.

This alternative would have no effect on wetlands and no adverse impacts to adjacent lands due to the proposed project having a slight average increase of lake elevation, but not over the historic lake elevation range (Appendix B).

8.3.2 Vegetation

Philpott Lake is located in the Piedmont and Blue Ridge Mountain regions of Virginia. Four major vegetation coverage types have been identified in the current project area: upland hardwood, pine, mixed woodland, and open land. In the upland hardwood sections, tree cover is dominated by northern red oak (Quercus rubra), southern red oak (Quercus falcata), white oak (Quercus alba), water oak (Quercus nigra), pignut hickory (Carya glabra), shagbark hickory (Carya ovata), bitternut hickory (Carya cordiformis), and mockernut hickory (Carya tomentosa), with intermittent pine trees associated. In the pine sections, the canopy is dominated by Virginia pine (Pinus virginiana), loblolly (Pinus taedus), white (Pinus strobus), and shortleaf (Pinus echinata). Mixed woodlands contain mixed pine species (Pinus spp.) and hardwoods.

The predominant forest type is mixed forest. The understory of these forests is populated with sourwood (Oxydendrum arboreum), dogwood (Cornus florida), rhododendron (Rhododendron spp.), mountain laurel (Kalmia latifolia), chinquapin (Castanea pumila),

witch hazel (Hamamelis virginiana), red maple (Acer rubrum), sweetgum (Liquidambar styraciflua), and sassafras (Sassafras albidum).

Alternative 1, No Action: This alternative would result in no change to vegetation.

Alternative 2, Recommended Plan: Vegetation along the rim of the lake are used to fluctuating water levels. Although there is a slight increase of average lake levels, the historic lake level range would not change. Therefore, this alternative would have no effect on vegetation.

8.3.3 Fish and Wildlife

Many angler species of fish can be found within Philpott Lake. The primary species include largemouth bass (Micropterus salmoides) and smallmouth bass (Micropterus dolomieui), bluegill (Lepomis macrochirus), sunfish (Centrachus), brown trout (Salmo trutta), brook trout (Salvelinus fontinalis), rainbow trout (Oncorhynchus mykiss), crappie (Pomoxis spp.), walleye (Sander vitreus), and catfish (Siluriformes spp.).

Common wildlife species found at Philpott Lake include white-tailed deer (Odocoileus virginianus), gray squirrel (Sciurus carolinensis), red fox (Vulpes vulpes), gray fox (Urocyon cineroargenteus), raccoon (Procyon lotor), Virginia opossum (Didelphis virginiana), and cottontail rabbit (Sylvilagus spp.).

Birds found in the area include bobwhite quail (Colinus virgianus), wild turkey (Meleagris gallopavo), woodpeckers (Melanerpes spp.), Carolina chickadee (Poecile carolinensis), red-eyed vireo (Vireo olivaceus), ovenbird (Seiurus aurocapilla), mallard (Anas platyrhyochos), and wood duck (Aix sponsa).

Alternative 1, No Action: This alternative would have no effect on fish and wildlife.

Alternative 2, Recommended Plan: This alternative will have no significant effects on the lake water quality, and no adverse impacts to adjacent lands and therefore will have no effect on Philpott Lake fish and wildlife resources. This alternative will result in no significant impacts to downstream flow rates as compared to current rates throughout the study area. Therefore, no effects are expected because adequate flows of suitable water quality will continue to be provided for successful reproduction and growth rates for the brown, brook and rainbow trout and other aquatic resources.

8.3.4 Endangered Species

The USACE and Virginia are committed to the protection of rare and endangered species and communities. Within Franklin, Henry and Partick counties, three Federally-listed species are known to exist (USFWS 2021). These species and their habitat requirements are described below in Table 8-2.

Table 8-2 Federally-listed Species Known to Occur in the Philpott Lake Region and Smith River

Common Name	Scientific Name	Description	Habitat Requirements
Small-anthered Bittercress	Cardamine micranthera	Slender, perennial herb with fibrous roots and a single, sometimes branched stem that grows 20 to 40 cm tall.	Wet, boggy soils of deciduous woodlands and moist to wet soils along the edge of small to intermediate sized streams.
Roanoke Logperch	*Percina rex*	A large darter that attains a length of 14 cm and is characterized by an elongate, cylindrical to slab-sided body, a conical snout, and complete lateral line. The back is dark green, sides are greenish to yellowish, and belly is white to yellowish.	Occupies medium to large warm-water streams and rivers of moderate gradient and relatively unsilted substrates.
Northern Long- Eared Bat	*Myotis septentrionalis*	A medium- sized bat with fur color medium to dark brown on the back and tawny to pale- brown on the underside.	During summer, they feed, roost and raise young in forested areas. Some males and non-reproductive females may use caves and mines during the summer. During winter, the northern long-eared bat hibernates in caves and mines.

Small-anthered Bittercress

This small perennial herb is native to small streambank seeps, adjacent sandbars and stream edges in the Dan River drainage of the North Carolina and Virginia Piedmont. Most of the populations are extremely small. Many are in close proximity to fields and pastures, where they are vulnerable to herbicides, erosion and siltation. All populations are located south of the project and are not in the project area: https://www.fws.gov/species/small-anthered-bittercress-cardamine-micranthera

Roanoke Logperch

The Roanoke logperch is a large darter, growing to about 6 inches long. It has a bulbous snout, lateral blotches, its back is scrawled, and most fins are strongly patterned. The first dorsal fin has an orange band, which is particularly vivid in mature males. The Roanoke logperch is known in the Roanoke River basin. The fish typically inhabits warm, usually clear, small to medium-sized rivers. These waterways have a moderate to low gradient, and the fish usually inhabit riffles and runs, with silt-free sandy to boulder-strewn bottoms. Young are usually found in slow runs and pools with clean sandy bottoms. In winter, logperch may be more tolerant of silty substrates and may also inhabit pools. Spawning occurs in April or May in deep runs over gravel and small cobble. Males are associated with shallow riffles during the reproductive period. Females are common in deep runs over gravel and small cobble, where they spawn.

Northern long-eared bat

The northern long-eared bat's range includes much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. The species' range includes the following 37 States and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming.

Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They use areas in various sized caves or mines with constant temperatures, high humidity, and no air currents. Within hibernacula, surveyors find them hibernating most often in small crevices or cracks, often with only the nose and ears visible. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags (dead trees). Males and non-reproductive females may also roost in cooler places, like caves and mines. Northern long-eared bats are flexible in selecting roosts, choosing roost trees based on suitability to retain bark or provide cavities or crevices. This bat has also been found rarely roosting in structures, like barns and sheds.
https://www.fws.gov/Midwest/endangered/mammals/nleb/nlebFactSheet.html

Alternative 1, No Action: This alternative would result in no effect to threatened or endangered species.

Alternative 2, Recommended Plan: The small-anthered bittercress is not within the project area and therefore this alternative would have no effect. This alternative will have no significant impact on the lake and downstream water quality or adverse impacts to adjacent lands and therefore would have no effect on the Roanoke logperch and northern long-eared bat.

8.4 Cultural Resources

Current theories place the arrival of humans in the project area at approximately 12,000 years ago, at the beginning of the Paleoindian period. The Paleoindian period is characterized by the change from coniferous forests to deciduous forests caused by retreating glaciers and the subsequent rise in temperatures which led to rising sea levels. Paleoindian sites in the Piedmont have all been identified by "scattered, isolated surface finds of Clovis and Folsom like points" (Ward and Davis 1999:2). The largest concentration of Paleoindian materials in Virginia are found along a band from the Southside Piedmont to the Coastal Plain in counties lying south of the James River. Commonly found near major rivers, evidence at these sites points to small, highly mobile groups following game, either the soon to be extinct megafauna (mastodon, bison) or smaller mammals like the white-tailed deer on their migratory routes. It is believed that Paleoindian groups in the eastern United States consumed a varied diet, including plants and small game (Sassaman et al. 1990; Adavasio et al. 1999; McNett et al. 1977; Funk and Steadman 1994; Ward and Davis 1999). As the environment in the eastern United States changed at the beginning of the Holocene period, the megafauna died off and the plant life changed to reflect what is seen in the modern environment. It is now believed, as argued by Metzler (1988:8) that in the Piedmont, as in the rest of the Southeast, a "generalized foraging subsistence strategy" was used (Ward and Davis 1999:37).

The onset of the Archaic Period is associated with the end of the Wisconsin Ice Age. Lithic assemblages associated with the Archaic period reflect an adaptation to the warmer, post-Pleistocene environment. Archaic projectile points in the Virginia Piedmont include various types associated with the Hardaway complex (e.g., Hardaway blades, Hardaway/Dalton, Hardaway side-notched), Big Sandy, Palmer and Kirk corner-notched. Formal end scrapers and side scrapers, first seen in the Paleoindian period, were common in the Early Archaic. Compared to Paleoindian tool assemblages, Archaic assemblages exhibit greater diversity in the types of projectile points which may suggest the development of distinct local cultural traditions. No sites with Early- or Middle-Archaic components have been identified within the area of potential effects (APE) or on federal property associated with Philpott Lake; however, one rock shelter site (44Pk78) contains Late Archaic material. Site 44Pk78 is not within the APE.

The Woodland period is defined by the gradual shift toward agriculture-based economies and the accompanying larger and more permanent settlements. Societies also became more complex, with the development of "elaborate mortuary rituals, sometimes constructed earthen burial mounds and house platforms, and engaged in far-reaching trade and exchange of exotic items" (Ward and Davis 1999:3). The Woodland Period is also defined by the appearance of pottery making, with the various styles of pottery used by archaeologists to refine timelines and relationships between cultures. In the Piedmont region of Virginia, Middle Woodland sites are identified by the appearance of large triangular Yadkin points and Yadkin series ceramics (300 BC-500 AD). The Middle Woodland in southside Virginia, specifically, is probably marked by the appearance of fabric- and net-marked, pottery, along with a continuation of cord-marking. In the Shenandoah Valley, this pottery is tempered with crushed rock.

No sites with Early Woodland components have been identified within the APE or on federal property associated with Philpott Lake; however, one Middle Woodland site (44Pk09) and two Late Woodland sites (44Pk8 and 44Pk226) have been identified on federal property associated with Philpott Lake. None of these sites are within the APE.

The Contact Period in the Piedmont begins in approximately 1525. By 1700 Native Americans and colonists in the Piedmont were experiencing a flourish of intercultural exchange. The presence of colonists in the region had become common and European trade goods had become part of everyday life. The first permanent European settlers in the region of the Philpott Lake migrated south from Pennsylvania and other counties in Virginia, and west from the Coastal Plain and Tidewater areas of Virginia. The earliest settlers came to the three counties surrounding the Philpott Lake by means of paths that Native Americans had used. These settlers were drawn to the Piedmont by the promise of available, fertile land. By the mid-eighteenth century, land in southern Pennsylvania and the north and east of Virginia had become scarce as emigration from Europe increased. Tobacco was the dominant crop in Virginia and much of the Piedmont for over three centuries. Slavery was an important component to the tobacco industry. Planters in the seventeenth century relied on indentured servants to work the tobacco fields and clear the constantly required new land.

Following the American Revolution, tobacco farming in the counties surrounding the Philpott Lake grew and Henry County tobacco developed a reputation as a “superior” product. The light, sandy, well-drained soils of the Piedmont, particularly in upland areas, were perfectly suited to tobacco farming. River commerce began in the early nineteenth century with the formation of the Roanoke Navigation Company. The company was chartered by the North Carolina and Virginia legislatures in 1812 allowing for the first major river improvements in the Roanoke River Basin. With the opening of the Roanoke Canal at Weldon in 1823 bypassing the Roanoke River Rapids, the Roanoke, Dan, and Staunton rivers were open for batteaux navigation. Batteaux craft are double-ended, shallow draft, flat bottomed craft up to 60 feet long with an eight-foot beam drawing no more than 18-inches of water (Trout 2003).

No significant US Civil War battles took place on the Philpott Lake project area during the Civil War and the war did not affect southwest Virginia as severely as it did most of the South. The closest action was a minor skirmish in Martinsville on April 8, 1865, when elements of Union Colonel William J. Palmer with the First Brigade of General George Stoneman’s cavalry division encountered a Confederate force of the Sixth Tennessee Cavalry led by Colonel James T. Wheeler at the Henry Court House. Following the war, many plantations were subdivided due to the loss of the enslaved work force and a significant number of blacks left rural areas for the cities by the 1880s.

In 1933, Junius B. Fishburn donated 4,868 acres to the Commonwealth of Virginia to become "Fairy Stone" State Park (named for the staurolite crosses found throughout the hills) after several years of work by the Civilian Conservation Corps (CCC). Fairy Stone is the largest of Virginia’s six original state parks. In 2004, Fairy Stone State Park was listed on the Virginia Landmarks Register and the NRHP (Williamson 1999). Several structures within Fairy Stone

State Park Historic District (DHR ID 070-0057) overlap with a portion of the APE.

Initial coordination was conducted with the Virginia Department of Historic Resources (VDHR) and federally recognized tribes in the Commonwealth of Virginia to discuss the study's goals and scope, and to initially examine the Recommended Plan's compliance with Section 106 of the NHPA.

Executive Order 11593, The Protection and Enhancement of the Cultural Environment states the Federal Government shall provide leadership in preserving, restoring and maintaining the historic and cultural environment of the nation. Federal agencies shall administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations, initiate measures necessary to direct their policies, plans and programs in such a way that federally owned sites, structures, and objects of historical, architectural or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people, and, in consultation with the Advisory Council on Historic Preservation (16 U.S.C. 470i), institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures and objects of historical, architectural or archaeological significance.

Alternative 1, No Action: The no action alternative would have no effect on NRHP -eligible existing conditions (http://epec.saw.usace.army.mil/philmsr.txt) and may temporarily expose archaeological resources near the lake shore, although exposure is often fleeting. Under the no action alternative, existing conditions would continue.

Alternative 2, Recommended Plan: The Recommended Plan would have no effect on NRHP-eligible or -listed structures in the project area. The Recommended Plan will not include excavation or any ground disturbance. water level changes in Philpott Lake associated with the Recommended Plan would be negligible as compared to the no action alternative (i.e., existing conditions). The Recommended Plan has been coordinated with the VDHR and will be in compliance with Section 106 of the NHPA and E.O. 11593 (Protection and Enhancement of the Cultural Environment). Record of consultation with the VDHR is included in Appendix E. This draft Feasibility Report and Environmental Assessment (EA) will be provided to the VDHR and federally recognized tribes in the Commonwealth of Virginia.

8.5 Socio-Economics and Environmental Justice

The study area is Henry County, Virginia, and the project sponsor is the Henry County Public Service Authority (HCPSA) that provides potable water to 74 percent of the county's population outside of the City of Martinsville (county seat). Nestled in the foothills of Appalachian Mountains, Henry County is in south central Virginia along the border of North Carolina. The HCPSA's service area primarily consists of residential, commercial and industrial customers in Henry County including two industrial parks, although it does provide water to a state park in Patrick County and has an interconnect with Pittsylvania County to provide wholesale water. The City of Martinsville (county seat) operates a separate treatment plant to service customers in their incorporated area, and relies on the 1.5 billion gallon Beaver Creek Reservoir for raw water

supplemented as needed to meet peak daily demands by water pumped from Leatherwood Creek.

The Roanoke River watershed has historically been an area of significant natural resource production. Currently, approximately 60% of the land in the basin is forested and about 22% is cultivated cropland. Cotton, peanuts, tobacco and soybeans are among the most common crops grown. Only six percent of the land falls into the urban or built-up land category.

In recent years, HCPSA withdrawals have increased due to the expansion of the service area and increasing industrial and commercial water use. Henry County and much of southwestern Virginia, has experienced declines in population over the last few decades for reasons discussed in Appendix A; however, over the past decade Henry County has implemented an aggressive and successful economic development program. Expanded industrial and commercial activity has increased water demands in the county. In addition, although population at the county level has declined, the HCPSA has expanded its service areas in Henry County and adjacent communities. Industrial growth and continued expansion of the service area will likely continue.

In the past decade, economic activity has rebounded significantly in the county. From 1990 through 2008 the number of private business establishments in the county remained constant at around 850 to 900, but after 2008, the number increased through the second quarter of 2019 where it stood at 1,676. The number of persons employed, and number of private business establishments are inversely related to the unemployment rate in the county.

The improving business climate in Henry County is largely due to an economic development campaign by the Martinsville-Henry County Economic Development Corp aimed at stemming or reversing trends since the demise of the regional textile industry. The county has two pad ready well-developed modern industrial parks with access to major transportation corridors: 1) the Patriot Centre Industrial Park, and 2) the Commonwealth Crossing Business Centre completed in 2016 at a costs of $40 million that includes the $6.75 million 26,000-square-foot Commonwealth Centre for Advanced Training (CCAT) that opened last year. Companies locating in Commonwealth Crossing have exclusive access to CCAT. The property is 30 miles from Piedmont Triad International Airport and population centers of the Piedmont Triad area of North Carolina (Greensboro, Winston-Salem, and High Point), approximately 40 miles from a FedEx hub, and has rail access. The site also offers four-lane access to the interstate. The industrial park is considered a “mega-site;” which create at least 400 jobs and are characterized by at least $250 million in capital investment. The site is marketed for suppliers and other companies involved with the growing aerospace industry, food and plastics and other industries.

8.5.1 Population

From 1970 through 1980, the number of people living in the county grew rapidly from about 51,000 to nearly 58,000 and for the next 20 years remained stable. Then, in 1999 population in the county began to fall, and has continued to decline through 2019, although there appears to be a slight uptick in 2020.

Several issues led to the decline. A primary factor was the decline in the U.S textile and apparel industry fueled in large part by exchange rate devaluation of major Asian exporters of textile products and regional trade liberalization policies such as the North American Free Trade Agreement of 1994. At the time, the textile and apparel industries were the economic base of Henry County. When the textile factories shut down, families left for new jobs in other areas. As people left, Henry County and the City of Martinsville (county seat) were unable to attract new businesses or population, and people moving out of the region were working-age adults, and the region's population grew older. The long-term effect has been that both Henry County and Martinsville have more deaths than births. In both communities this has caused the bulk of the population decline.

Table 8-3 Population

Area	1960	1970	1980	1990	2000	2010	2020
State of Virginia	3,966,966	4,651,487	5,346,818	6,187,358	7,079,030	8,001,024	8,631,393
Henry County, VA	40,335	50,901	57,654	56,942	57,930	54,151	50,948

8.5.2 Population Projections

According to the Census Bureau 2022 American Community Survey 5-year estimates, Virginia is expected to steadily grow to the year 2045. Henry County shows a decline over that same timeframe.

Table 8-4 Population Projections

Area	2025	2030	2035	2040	2045
State of Virginia	8,993,343	9,331,666	9,604,197	9,876,728	10,149,260
Henry County, VA	48,875	46,764	44,418	42,073	39,728

8.5.3 Race and Ethnicity

Historically, Virginia was characterized by a large White population, substantial Black population, and very small population of other minority groups. Currently, 40.4% of the population in Virginia are minorities. Henry County has a lower percentage at 31.4% as compared to the state as a whole.

Table 8-5 Demographics

Area	Minority (all persons except white, non-Hispanic)	Percentage minority (all persons except white, non-Hispanic)	Persons below poverty	Percentage of persons below poverty	Percent of female persons	Percent of persons 65 years and over	Percentage of persons aged 17 and younger
State of Virginia	3,487,082	40.4%	794,088	9.2%	50.8%	15.9%	15.9%
Henry County, VA	15,997	31.4%	6,572	12.9%	51.9%	24.5%	21.8%

8.5.4 Education

Table 8-6 shows the percent of people over the age of 25 with no high school diploma. This is an important statistic due to its correlation with higher rates of unemployment and underemployment. This percentage is 9.7% in the stage of Virginia and 19.8% in Henry County, VA. Also, the below table shows the percentage of persons with bachelor's degrees which is 39.5% for the state of Virginia and 15.1% for Henry County, VA.

Table 8-6 Education

Area	Percentage of persons with no high school diploma (age 25+)	Percentage of persons with bachelor's degree (age 25+)
State of Virginia	9.7%	39.5%
Henry County, VA	19.8%	15.1%

8.5.5 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires the federal government to achieve environmental justice by identifying and addressing high, adverse and disproportionate effects of its activities on minority and low-income populations. The EO also states that the impacts of the action would not be disproportionate towards any minority or low-income population. The activity cannot: (a) exclude persons from participation in, (b) deny persons the benefits of, or (c) subject persons to discrimination because of their race, color, or national origin. It requires the analysis of information such as the race, national origin, and income level for areas expected to be impacted by environmental actions. It also requires federal agencies to identify the need to ensure the protection of populations relying on subsistence consumption of fish and wildlife, through analysis of information on such consumption patterns, and the communication of associated risks to the public.

The Council on Environmental Quality's (CEQ) Climate and Economic Justice screening tool (Beta Version) was used to identify several Census tracts within Henry County, VA that are identified as disadvantaged. The Recommended Plan is to reallocate 4 MGD reservoir storage, currently used for hydropower, to water supply to furnish about 8 MGD for HCPSA serving municipal water supplies. As a consequence of the proposed reallocation, total annual hydropower benefits foregone will equate to about $6,000 as

reported by the Hydropower Analysis Center (HAC). Such a minor amount of estimated hydropower benefits lost should not materially impact energy prices to the service area nor are any other adverse impacts foreseen. However, it should be documented that according to the CEQ Climate and EJ Screening Tool, some of the Census tracts within Henry County, VA and surrounding the Philpott Lake report above the 90th percentile for *energy burden* criterion which is computed as the average annual energy costs per household divided by the household income.

Alternative 1, No Action: No Action would not satisfy near or long-term water needs. The expanded industrial and commercial activity would likely be reduced or reversed negatively impacting nearby disadvantaged communities. The implementation of the No Action plan will not result in a disproportionately high and adverse human health or environmental effects on minority populations and low-income populations as all communities within the project area will be equally burdened by the impacts from insufficient long-term water supply.

Alternative 2, Recommended Plan: This alternative will provide the Henry County Public Service Authority storage in Philpott Lake that will yield 4.0 MGD in water supply to satisfy needs over a 50-year period: 2023-2072. The implementation of the Recommended Plan will maintain or increase expanded industrial and commercial activity and not cause disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. Instead, the proposed reallocation would provide benefits to the quality of life by improving the water supply to the area residents. No residences or public facilities would be impacted by the proposed action. In public outreach efforts to date, no potential environmental justice issues have been identified.

8.6 Recreation and Aesthetics

The USACE has developed and maintains approximately 11 recreational sites at Philpott Lake. The recreation areas include Philpott Park, Bowens Creek Park, Goose Point Park, Runnett Bag, Ryans Branch Park, Jamison Mill Park, Jamison Mill Picnic Area, Horseshoe Point Park, Salthouse Branch Park, Deer Island, Turkey Island, Franklin County Tailrace, and Twin Ridge Park. Several small, privately owned docks and a USACE (employee only) dock are located on the lake. Recreation opportunities include boating, camping, fishing, hiking, picnicking, and swimming.

Philpott Lake also includes a dedicated visitor center located on Philpott Dam Road, east of Philpott Marina. The visitor center includes history displays, environmental education materials, local and natural history exhibits, cultural events, and other local topics important to the community around Philpott Lake. An environmental education center provides visitors with exhibits targeting environmental topics, threatened and endangered species, trail maps, and an environmental learning classroom.

Philpott Lake provides a variety of scenic vistas, undeveloped shorelines, mature pine and

hardwood forests, steep slopes, and deep water that attracts visitors year-round. With the distant Blue Ridge Mountains and foothills in view from the lake, Philpott Lake provides picturesque panoramic landscape views. Additionally, because future development is not expected, low-intensity recreation will not diminish the beauty around the lake. Maintaining existing development around the lake coupled with no planned and expected future development, Philpott Lake will remain aesthetically appealing for future generations.

Alternative 1, No Action: This alternative would result in no change to recreation or aesthetics.

Alternative 2, Recommended Plan: The insignificant changes in water levels and flow rates would have no effects on recreation, including fishing, boating, canoeing and camping and aesthetics.

8.7 Other Resources

8.7.1 Air Quality and Noise

Philpott Lake is in Franklin, Henry, and Patrick Counties, Virginia. Franklin, Henry, and Patrick Counties are in attainment areas for all federal air quality standards (United States Environmental Protection Agency 2020a). Air quality in this area is primarily influenced by regional climate patterns.

Air quality within the project boundary is influenced by exhaust from motor vehicles and boats, the use of grills and fire pits, and other regional activities. The large open area that is created by the lake allows for strong breezes to blow through the recreational sites. These breezes can rapidly reduce and/or eliminate localized air quality concerns caused by air-borne pollutants.

Lands surrounding Philpott Lake are not heavily developed nor used for intense uses or operations. Instead, the lands surrounding Philpott Lake are primarily rural or Virginia park lands with various recreation areas, which are protected from heavy development. The closest centers of development (cities) are a significant distance away from Philpott Lake. Martinsville is the closest city at approximately 10 miles away.

Air quality is regulated by the Clean Air Act and implemented by the United States Environmental Protection Agency (USEPA) and the Virginia Air Pollution Control Board of the VADEQ. Air quality standards are defined in the National Ambient Air Quality Standards (NAAQS). Actions that result in increased emissions may require a permit issued by the Virginia Air Quality Pollution Control Board, Virginia DEQ. Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance provides further guidance on implementing these regulations.

Philpott Lake is in Henry, Patrick, and Franklin Counties in Virginia, which are relatively rural counties in nature. As such, obtrusive noise sources are generally confined to heavy

traffic road corridors or in close proximity to agricultural or industrial activities. Within the Philpott Lake area there are few obtrusive sources of noise. Vehicles traveling local roads and boat engines on the water are the primary sources of noise. Occasional public events including fishing tournaments and weekend music events that may include amplified voices or music also occur. Sensitive noise receptors adjacent to and within the project area include areas occupied by park visitors and wildlife communities throughout the project. Noise ordinances and regulations are developed and enforced by individual municipalities. These ordinances restrict the level of noise that may exist in certain areas and/or the time of day that they may exist.

Alternative 1, No Action: This alternative would result in no changes to air quality or noise.

Alternative 2, Recommended Plan: The recommended reallocation will not involve construction, so there will be no effects to air quality or noise with implementation of the recommended reallocation.

8.7.2 Climate Change

While temperatures are forecasted to increase in the future with more extreme rain events, there is less consensus on future annual precipitation totals and streamflow. The changing climate could lead to more flood events at Philpott Lake. Henry County has their water intake structure on Smith River downstream from Philpott Dam making damage to the equipment due to flooding less likely with flood operations at Philpott Dam.

Analysis of potential for climate change impacts at Philpott Lake was conducted utilizing the USACE Screening-Level Climate Change Vulnerability Assessment Tool and other tools described in Engineering & Construction Bulletin (ECB) 2018-14, including the Nonstationarity Detection Tool (NSD). More information on potential climate change can be found in Appendix F Climate Change Analysis.

Executive Order (EO) was issued 19 March 2015 (EO 13693 Planning for Federal Sustainability in the Next Decade). Federal Leadership will continue to drive national greenhouse gas reductions and support preparations for the impacts of climate change through a combination of more efficient Federal operations such as outlined in EO 13693. There is an opportunity for agencies to reduce direct greenhouse gas emissions for at least 40 percent over the next decade while fostering innovation, reducing spending, and strengthening the communities where Federal facilities are located. The first priority should be placed on reduction of energy use and cost, and secondly finding renewable or alternative energy solutions. Employing this strategy for the next decade calls for expanded and updated Federal environmental performance goals with a clear overarching objective of reducing greenhouse gas emissions across Federal operations

and the Federal supply chain.

The Philpott Reallocation project's Recommended Plan is the least cost, technically sound, environmentally acceptable (Federal Standard) plan for satisfying the future needs. The Recommended Plan does not require construction or any other activity that will release greenhouse gasses to the atmosphere. The Philpotts Reallocation project complies with EO 13693 and Wilmington District will continue to implement positive changes to meet the goals outlined in EO 13693.

Alternative 1, No Action: No Action would not contribute to climate change and climate change.

Alternative 2, Recommended Plan: This alternative will not contribute to climate change.

8.7.3 Hazardous, Toxic and Radioactive Waste (HTRW)

The area around Philpott Dam contains a mix of natural, residential and commercial areas. A search of EPA's website (https://www3.epa.gov/) on May 26, 2022, produced zero EPA regulated facilities. None of the regulated facilities are on the National Priorities List.

Alternative 1, No Action: This alternative is expected to have no effect on HTRW and would not result in the production of HTRW.

Alternative 2, Recommended Plan: This alternative is expected to have no effect on HTRW and the Recommended Plan would not result in the production of HTRW.

8.8 Compliance with Environmental Requirements

In addition to the indicated public involvement, NEPA, as amended, requires consideration of the environmental impacts for major federal actions. The purpose of the EA for this project is to ensure that the environmental consequences of the Recommended Plan are considered and that environmental and project information are available to the public. This EA was prepared in accordance with NEPA, the CEQ regulations (40 CFR parts 1500-1508), U.S. Army Corps of Engineers Department of the Army procedures for implementing NEPA (33 CFR parts 230), and Engineering Regulation (ER) 200-2-2. The proposed project does not require a Section 404(b)(1) analysis since it does not involve discharge of dredged or fill material into waters of the U.S.

Table 8-7 The Relationship of the Recommended Plan to Applicable Federal Laws and Policies

Anadromous Fish Conservation Act of 1965, As Amended	16 USC 757 et seq.	Full Compliance*
Archeological and Historic Preservation Act of 1974, As Amended	16 USC 469	Full Compliance*
Endangered Species Act of 1973	16 USC 1531	Full Compliance*
Fish and Wildlife Coordination Act of 1958, As Amended	16 USC 661	Full Compliance*
National Historic Preservation Act of 1966, As Amended	16 USC 470	Full Compliance*
Protection and Enhancement of Environmental Quality	EO 11514/11991	Full Compliance*
Protection and Enhancement of the Cultural Environment	EO 11593	Full Compliance*
Floodplain Management	EO 11988	Full Compliance*
Federal Actions to Address Environmental Justice and Minority and Low-Income Populations	EO 12898	Full Compliance*

* Full compliance upon completion of NEPA

9 PUBLIC AND AGENCY INVOLVEMENT

On April 7, 2021, the USACE sent out a Scoping Letter to interested parties, to identify concerns and issues to be considered during development of the feasibility study and EA. Most comments and concerns focused on lake level impacts, downstream water supply availability and downstream impacts to species and fisheries. A Public Scoping Session was held on April 15, 2021. The Wilmington District is providing this draft Feasibility Report/EA (integrated report) as part of a 30-day Public Review. All comments will be addressed in the final Feasibility Report/EA.

10 CONCLUSIONS

The analysis conducted during this study indicates that reallocation of water storage from the conservation pool at Philpott Lake to water supply is the most technically feasible, environmentally acceptable, and economically justified alternative of those evaluated, and thus is the Recommended Plan.

This plan transfers 5,200 ac-ft of water storage to address HCPSA's current and future water needs which constitutes approximately 3.58% of the total active storage within the reservoir. It will have no serious effects on any project purposes but will result in a reduction of payments to the U.S. Treasury of approximately $6,077 annually from hydropower benefits foregone. This reduction will be offset by the return to the U.S. Treasury in payments from the HCPSA accorded by the Water Storage Agreement, which amounts to approximately $378,000 per year for 30 years, and approximately $85,038 per year thereafter, for the NFS's share of Operations and Maintenance, Repair, Rehabilitation and Replacement (O,M,R,R&R) of the project.

The cost of Operations and Maintenance for HCPSA are estimated at approximately $54,000 per year. The cost of Repair, Rehabilitation and Replacement (R,R&R) are estimated at approximately $31,038 per year (conceivably, for the life of the project). HCPSA is aware of these costs.

Any impacts of the Recommended Plan to environmental resources, historic and cultural resources, and the human environment will be minor. Lake levels and downstream flows will not be measurably impacted Water quality will not be affected. No negative effects to life and safety, community cohesion, and other societal effects, are anticipated, and the plan may provide for additional resiliency and ability to adapt under future climate variability, especially in times of drought.

11 RECOMMENDATIONS

I recommend that USACE allow the reallocation of 5,200 ac-ft of water storage from the conservation pool at Philpott Lake to water supply for the current and long-term benefit of HCPSA and its service areas.

I have determined that it is within the discretionary authority of the Chief of Engineers to approve this reallocation as the Recommended Plan. The plan will not seriously affect Philpott Lake's authorized project purposes or involve any major structural or operational changes. A draft Finding of No Significant Impact (FONSI) is provided with this report.

If approved, HCPSA will reimburse the Federal Treasury for the capitalized cost of storage in the amount of $463,038 per annum, which includes a proportional share (3.58 percent) of joint annual OMRR&R costs for lake operations. Similarly, HCPSA will enter into a Water Storage Agreement with the USACE. A draft agreement can be found in Appendix J.

_____

Benjamin A. Bennett
Colonel, EN Commanding

12 REFERENCES

Adavasio, J.M., J. Donahue, and R. Struckenrath

1999 No Vestige of a Beginning nor Prospect for and End: Two Decades of Debate on Meadowcroft Rockshelter. In: *Ice Age Peoples of North America: Environments, Origins, and Adaptations of the First Americans*, edited by R. Bonnichsen and K.L. Turnmire, pp. 416-431. Oregon University Press, Corvallis.

Belden, A. Jr, Walton, D.P.Walton, and Chazal, A. 2001. Draft Report - A Natural Heritage Inventory of Philpott Lake. Natural Heritage Technical Report 01-6. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. 73 pp. plus appendices.

FEMA-FIRM. 2008. Flood Map Service Center. Available at: https://msc.fema.gov/portal/home

Funk, R.E. and D.W. Steadman

1994 *Archaeological and Paleoenvironmental Investigations in the Dutchess Quarry Caves, Orange County, New York*. Persimmon Press Monographs in Archaeology.

McNett, Charles W., Jr., B.A. McMillan, and S.B. Marshall

1977 The Shawnee-Minisink Site. In *Annals of the New York Academy of Sciences*, 277:282-296.

Metzler, David J.

1988 Late Pleistocene Human Adaptations in Eastern North America. In *Journal of World Prehistory* 2:1-53.

Sassaman, Kenneth E., Mark J. Brooks, Glen T. Hanson, and David G. Anderson

1990 *Native American Prehistory of the Middle Savannah River Valley: A Synthesis of Archaeological Investigations at the Savannah River Site, Aiken and Barnwell Counties, South Carolina*. South Carolina Institute of Archaeology and Anthropology, University of South Carolina, Savannah River Archaeological Research Papers 1

Trout, William E., III

2003 *The Dan River Atlas: Rediscovering River History on the Dan, Smith's and Banister*. Prepared for the Virginia Canals and Navigation Society and the Dan River Basin Association.

USACE. 1982. Philpott Master Plan Update Philpott Lake Smith River, Virginia. Wilmington District, U.S. Army Corps of Engineers.

USFWS, ECOS Environmental Conservation Online System. "Listed Species Believed to or Known to Occur in Henry, Virginia." ECOS, https://ecos.fws.gov/ecp/report/species-listings-by-current-rangecounty?fips=51089 (Accessed: May 7, 2021)

USDA-NRCS, 2020. Web Soil Survey. Available at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

USEPA. 2020a. Current Nonattainment Counties for All Criteria Pollutants. Available at: https://www3.epa.gov/airquality/greenbook/ancl.html#Top

USGS. 2020a. 7.5- Minute Topographic Map for Philpott Lake, VA. Available at: https://catalog.data.gov/dataset/usgs-us-topo-7-5-minute-map-for-philpott-Lakeva-2016f0026

USGS. 2020b.Virginia Climate Response Network. Groundwater Watch. Available at: https://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=crn&sc=51

VADEQ. 2020a. Physiographic Provinces of Virginia. Available at: https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity/GroundwaterProtectionSteeringCommittee/PhysiographicProvincesofVirginia.aspx

VADEQ. 2020b. Erosion and Sediment Control Law, Regulations, and Certification Regulations. Available at: https://www.deq.virginia.gov/Programs/Water/StormwaterManagement/ErosionanDSedimentControl.aspx

VADEQ. 2020c. Virginia Water Quality Standards. Available at: https://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/WaTerQualityStandards.aspx

VADEQ. 2020d. Virginia Department of Environmental Quality GIS Web Map. https://apps.deq.virginia.gov/mapper_ext/default.aspx?service=public/Draft_2020_ADB_All_Uses

VADEQ. 2020e. 2018 Impaired Waters – 303(d) List. Available at: https://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityAssessments/IntegratedReport/2018/ir18_Appendix1a_Category5_List.pdf

VADEQ 2020f. Fact Sheets For Impaired (Category 4 or 5) Waters in 2020. Available at: https://www.deq.virginia.gov/home/showdocument?id=2281

VAWRP. 2015. Draft State Water Resources Plan. Roanoke River Basin Summary. Available at: https://deq.virginia.gov/Portals/0/DEQ/Water/SWRP/App%20B%20Roanoke%20River%20Basin%20Summary.pdf

VADH-ODW. 2020. Drinking Water Watch. Available at: https://odw.vdh.virginia.gov/DWW-VA/Login

Ward, H. Trawick, and R.P. Stephen Davis, Jr.

1999 *Time Before History: The Archaeology of North Carolina.* The University of North Carolina Press, Chapel Hill.

Williamson, John P.

1999 *Fayerdale Industries: A history of the land, its owners, and their iron mining, lumbering and railroading in the foothills of Virginia's Blue Ridge Mountains*. Electronic document, http://www.angelfire.com/folk/goblintown_mill/Fayerdale/Fayerdale.html, Accessed March 4, 2022.