CAPITAL IMPROVEMENT MASTER PLAN FOR HYDROPOWER

NASHVILLE DISTRICT

US Army Corps of Engineers®

17 SEPTEMBER 2021

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Introduction

1. Purpose and Objectives of the Master Plan for Capital Improvements

The purpose of this Capital Improvement Master Plan for Hydropower is to serve as a guide for the long-term sustainability and development of the Nashville District's (LRN) hydropower facilities. It is a subcomponent of the overarching LRN Hydropower Program Management Plan that defines the scope, objectives and vision of the entire LRN Hydropower Program. This Capital Improvement Master Plan for Hydropower (hereafter referred to as Master Plan) is a comprehensive 20-year project plan and associated 5-year construction work plan that covers non-routine maintenance, rehabilitation or modernization of the Cumberland River hydropower system in Nashville District. It provides an overview of each power plant and its hydropower production, past projects, existing conditions, and scopes, schedules and budgets of future projects. The Plan establishes the scopes, schedules, and budgets for the management and control of the Cumberland River System Hydropower Rehabilitation Program (Program).

The Program includes planning, engineering, design and construction for each individual Project and Work Item defined herein. This Master Plan includes work to be funded by both Appropriations and the Section 212 Program that will be executed in cooperation with "Sponsors" (preference customers) that are signatories to various Memoranda of Agreement with the U.S. Department of the Army and Southeastern Power Administration (SEPA) under Section 212 of the Water Resources Development Act (WRDA) of 2000, (Public Law 106-541, Dec. 11, 2000). If there are discrepancies between the signed Memoranda of Agreement (MOAs) and this Master Plan, the MOAs take precedence.

Comprehensive planning is essential for successful implementation of the Rehabilitation Program. With decades of work and hundreds of millions of dollars at stake, Program risk must be continually assessed and controlled. It is important to note that the Program is dynamic, and the Master Plan must be updated and adapted as the Program evolves. Updates will be accomplished at times recognized by the USACE Nashville District Chief of Hydropower Section and the Section 212 Program Manager as essential to keeping pace with the events and condition of the system, and as required to facilitate the effective and efficient execution of the Program.

The main objectives of the Program are:

- Provide reliable hydroelectric power services at the lowest possible cost, consistent with sound business principles, in partnership with other Federal hydropower generators, the Power Marketing Administrations, and Preference Customers, to benefit the Nation.
- Maintain reliability of the power train, balance of plant (BOP), and auxiliary equipment.
- Enhance performance as appropriate by implementing measures such as:
    - Maintain and improve equipment-related safety features.
    - Improve the efficiency and performance of hydroelectric units.
    - Reduce operations and maintenance costs.
    - Minimize environmental impacts through the use of new technology.
- Prioritize and schedule projects based on risk informed decisions and communications.
    - Utilize the Hydropower Asset Management Partnership (HydroAMP) rating system along with direct input from power plant personnel to get a standardized condition rating for all systems.
- Program and secure funding to sustain and rehabilitate power plant infrastructure according to an established Master Plan by focusing on delivering capacity at peak and associated energy for the benefit of the Preference Customers.

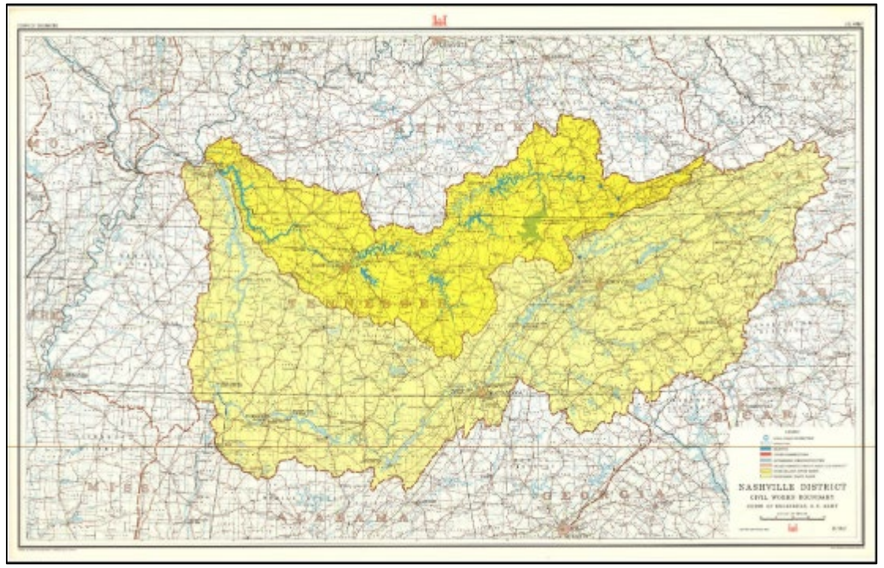
The Program will be executed based on the following general criteria:

- Constantly adapt the Program to changing equipment condition.
- Minimize outage time and maximize energy production by:
    - Coordinating and combining different rehabilitation outages;
    - Coordinating and combining rehabilitation outages with planned maintenance outages; and
    - Scheduling outages during low flow seasons while maintaining power generation capacity commitments.

Program Overview and History

2. Nashville District Hydropower Program Overview and History

The LRN Hydropower Program began under the Flood Control Act of 1938, which authorized minimum provisions for hydropower at flood control projects. The first power plant constructed in the Cumberland River Basin was Dale Hollow, with the first unit coming online in 1948. Over the next thirty years eight other power plants were constructed, ending with Laurel which was completed in 1977. In all, the Nashville District operates and maintains ten dam projects in the Cumberland River Basin, nine of which are multi-purpose projects with hydroelectric power plants, and remotely operates one power plant (which consists of two powerhouses) at the Sault Ste. Marie project in Michigan. The nine power plants in the Cumberland River Basin have a total of 28 generating units with a current aggregate generating capacity of more than 928 megawatts (MW). The Nashville District provides management, operation and maintenance of all electrical, mechanical, and structural features at these projects, including the power plants, dams, spillways, and high voltage switchyards. SEPA markets the power from these plants through negotiated power sales and operating agreements with Tennessee Valley Authority (TVA) and regional utility companies.



Existing Infrastructure Condition

3. Hydropower Asset Management Program

The LRN Asset Management Plan assists in managing the organization's infrastructure and other assets to deliver an agreed upon standard of service. Within USACE and hydropower specifically, the HydroAMP program is used to assess the condition for powertrain and auxiliary hydropower plant components. An unexpected failure can have a significant economic impact due to the high cost of emergency repairs and replacement power costs during an extended outage. Therefore, HydroAMP gauges the condition of existing equipment through a two-part assessment framework.

The first part of the assessment framework uses basic equipment conditions used by project personnel as condition indicators. These condition indicators are evaluated using inspections, tests, and field measurements conducted by plant personnel during general maintenance activities. Generally, the following condition indicators are used to determine the equipment's overall condition:

- Age or Number of Operations
- Operational Performance
- Maintenance History
- Physical Inspection
- Test and Measurements

The second part of the assessment framework uses a more detailed technical assessments, or "Tier 2" assessments, if deemed necessary. Tests done as part of the Tier 2 assessments are more technically based and analyze specific component functions rather than a general overview of the component. Assessments done in support of this Master Plan update were all "Tier 1" estimates.

Individual, stand–alone Equipment Condition Assessment Guides were used to evaluate the condition of the power plant equipment. Each set of equipment was given a condition rating related to the above condition indicators. The scores are weighted and summed to develop a rating from 0 to 10 with 10 being the best. The following table explains the numeric scores qualitatively:

HydroAMP Condition Index		
Rating Categories	**Condition Index (CI)**	**Description**
Good	8-10	There is a high level of confidence that the component will perform well under normal operating conditions.
Fair	6-8	There is a medium level of confidence that the component will perform well under normal operating conditions. The component may require additional investigations to confirm adequacy. Continue current O&M practices, minimal restrictions to operation and/or minor maintenance may be necessary.
Marginal	3-6	There is a low level of confidence that the component will perform well under normal operating conditions. The component requires additional investigation to confirm adequacy. Restricted operation and/or non–routine maintenance are necessary.
Poor	0-3	The component does not perform well under normal operating conditions. Physical signs of serious damage or deterioration are present. Significant restrictions to operation and/or non-routing maintenance are necessary. Major upgrades or other repairs may be required within one to five years.

The following paragraphs in this section provide a breakdown of the lowest score for each powertrain component at the power plants across the district. Additional detail on the HydroAMP scores are included in the project-specific sections of this document.

Existing Infrastructure Condition

3.1 Circuit Breakers

A circuit breaker is an automatically operated electrical switch designed to protect the associated equipment (generator, transformer, transmission line) from damage by disconnecting it from the electrical system. There are four different types of circuit breakers: air blast, oil tank, SF6, and vacuum. All of the generator circuit breakers in the Cumberland River System powerhouses were replaced with modern vacuum circuit breakers that provide better protection with lower maintenance requirements under Legacy MOA 08-09. The design life of these medium voltage vacuum circuit breakers is 50 years.

Circuit Breaker Condition Index	
Powerhouse	Condition Index
Barkley	8.0
Center Hill	8.0
Cheatham	8.0
Cordell Hull	8.0
Dale Hollow	10
J. Percy Priest	10
Laurel	10
Old Hickory	10
Wolf Creek	10

Generator Circuit Beaker at Center Hill

3.2 Exciters

Excitation systems are key powertrain components. The generator will not operate without a properly functioning exciter. An excitation system comprises all the devices responsible for delivering the field current to a synchronous generator along with the equipment responsible for regulating the stator voltage, including the limiting and protecting functions. The evaluation of condition considers age, operation & maintenance history, availability of spare parts, power circuitry test, and control circuitry test.

During operation, excitation systems are continuously subjected to electrical, mechanical, thermal, and environmental stresses. Over time, these stresses deteriorate certain components in the excitation system and can potentially lead to unexpected, catastrophic failure and forced outage.

In the Cumberland River System, the exciters are generally the original rotating exciters. Dale Hollow Power Plant has installed digital pilot exciters. Barkley Power Plant recently replaced both the pilot and main exciters with a static excitation system. Center Hill Power Plant had all exciters refurbished during the Turbine Generator Rehabilitation project. The design life of these exciters is 40 years.

Exciter Condition Index	
Powerhouse	Condition Index
Barkley	10
Center Hill	10
Cheatham	2.1
Cordell Hull	2.1
Dale Hollow	2.1
J. Percy Priest	4.2
Laurel	2.1
Old Hickory	2.1
Wolf Creek	1.7

Rotating Exciter at Old Hickory

3.3 Generator Rotor

The age of the generator field winding is an important factor to consider when identifying candidates for replacement. Age is one indicator of remaining life and upgrade potential to state-of-the-art materials and designs. The design life (or life expectancy) of the insulation of field windings is 50 to 60 years. Although age is a useful indicator of remaining life, it is also important to recognize that the actual service life that can be realized varies widely depending on the specific equipment manufacturer and date of manufacture; the insulation system design, materials, and production methods; the quality of installation; and the generator's operation and maintenance history.

Maintenance history, past operations, and any limitations in place may provide a useful indication of generator rotor condition. In addition, several types of rotor problems can be detected during the course of physical inspections, such as overheating, loose and vibrating components, impact damage, and contamination.

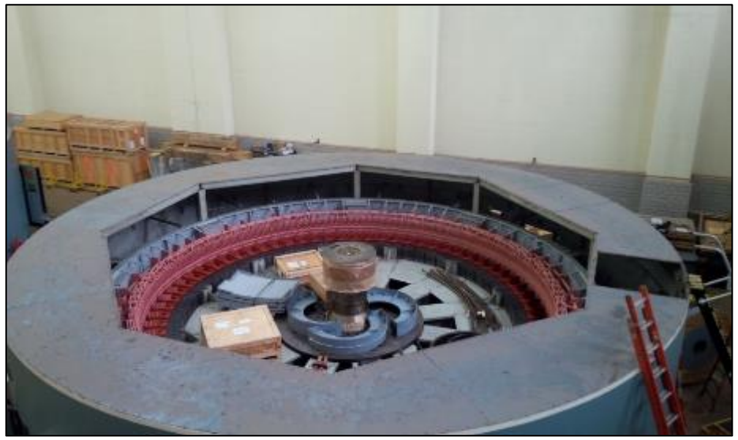
Generator Rotor Condition Index	
Powerhouse	Condition Index
Barkley	2.6
Center Hill	10
Cheatham	2.6
Cordell Hull	5.2
Dale Hollow	5.3
J. Percy Priest	6.0
Laurel	5.3
Old Hickory	5.8
Wolf Creek	2.6

Barkley Unit #1 Rotor Removed for Refurbishment

3.4 Generator Stator

During operation, large synchronous generators are continuously subjected to electrical, mechanical, thermal, and environmental stresses. These stresses act and interact in complex ways to degrade the machine's components and reduce its useful life. Deterioration of the stator winding insulation is a leading factor for determining serviceability of hydroelectric generators. Unexpected stator winding failure can result in forced outages and costly emergency repairs. The age of the generator stator winding plays a significant factor when identifying its condition. The design life of a stator winding is typically 25 to 35 years.

Generator Stator Condition Index	
Powerhouse	Condition Index
Barkley	1.6
Center Hill	10
Cheatham	1.6
Cordell Hull	1.6
Dale Hollow	1.6
J. Percy Priest	6.5
Laurel	2.8
Old Hickory	3.2
Wolf Creek	1.6



Refurbished Center Hill Unit #1 Generator

Existing Infrastructure Condition

3.5 Governors

Governors control the speed of the unit by operation of the wicket gates through a combination of hydraulic, mechanical, and electrical means. Hydraulic pumping units pressurize oil and store it in a pressure tank to be directed for use by the governor. The governor is connected electrically to the turbine's speed through the permanent magnet generator (PMG). The governor, through a series of mechanical and hydraulic linkages, directs the pressurized oil to the servomotor which opens and closes the wicket-gates and allows speed droop control. The governors also use auxiliary equipment such as gate position limit switches, oil pressure relays, rectifier resistor packs, solenoid operated generator air brake valves, and continuous and intermittent brake timer control.

The age of the governor is among the factors to consider when identifying candidates for mechanical rehabilitation, partial replacement (digital retrofit), or complete replacement. Age is one indicator of remaining life and upgrade potential to current state-of-the-art materials and design. As a governor ages, the mechanical parts become affected by wear and are more susceptible to internal leaks, thus affecting performance. In the same way, the electronic parts are subjected to more deterioration due to overheating, excessive vibration, or contamination. The design life for a governor control system is 20 years and it is 40 years for the hydraulic system.

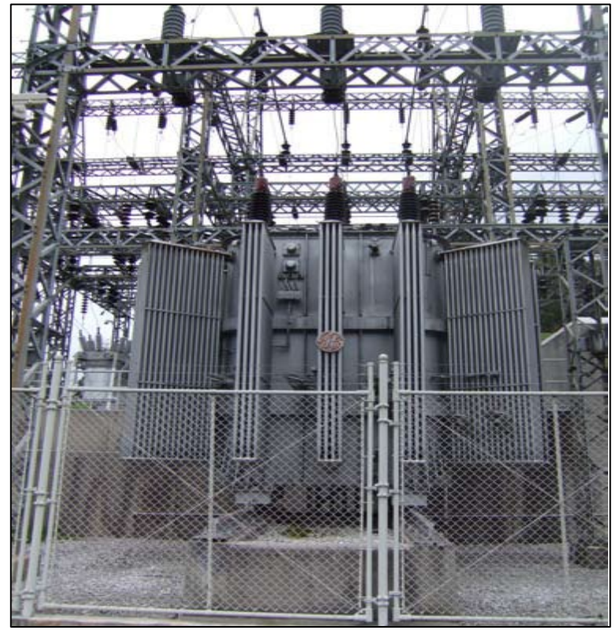
Governor Condition Index	
Powerhouse	Condition Index
Barkley	3.2
Center Hill	3.0
Cheatham	3.0
Cordell Hull	3.3
Dale Hollow	3.0
J. Percy Priest	6.1
Laurel	7.3
Old Hickory	6.1
Wolf Creek	6.1

Barkley Governor Actuator Cabinet

3.6 Transformers

The Nashville District has 35 generator step-up transformers (GSU). These transformers step the voltage supplied by the generators at 13.8 kV to the voltage of the transmission lines leaving the switchyard at the power plant at a voltage of either 69 kV or 161 kV depending on the plant. The condition of a transformer is evaluated using four factors: oil analysis, power factor and excitation current tests, operation & maintenance history, and age. The design life for oil filled GSUs is 60 years.

Transformer Condition Index	
Powerhouse	Condition Index
Barkley	0.2
Center Hill	3.8
Cheatham	4.3
Cordell Hull	7.7
Dale Hollow	3.1
J. Percy Priest	4.7
Laurel	7.7
Old Hickory	3.1
Wolf Creek	3.1



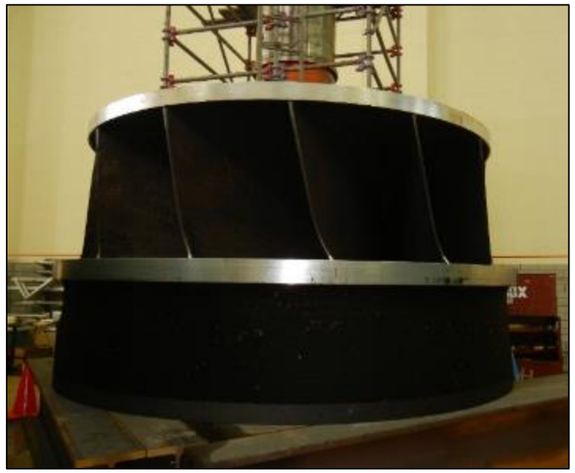
Dale Hollow Main Power Transformer

Existing Infrastructure Condition

3.7 Turbine Runners

The turbine runner is responsible for transmitting the motion of the water across the blades into torque, ultimately allowing the generator rotor to rotate. The Nashville District uses three types of runners: Francis runners at high head plants, Kaplan runners (adjustable blade) at low head plants, and a propeller runner (non-adjustable blade) at J. Percy Priest. The primary concern for turbines is cavitation and stress caused primarily by torque. The condition of a turbine is evaluated using five factors: operational performance, physical inspection, cracking, operation & maintenance history, and age. The design life is 40 years for Kaplan turbine runners and 50 years for Francis and propeller turbine runners.

Turbine Runner Condition Index	
Powerhouse	Condition Index
Barkley	2.2
Center Hill	10
Cheatham	2.2
Cordell Hull	1.0
Dale Hollow	4.0
J. Percy Priest	6.0
Laurel	5.0
Old Hickory	2.3
Wolf Creek	3.8



Center Hill Unit #2 Francis Turbine Runner

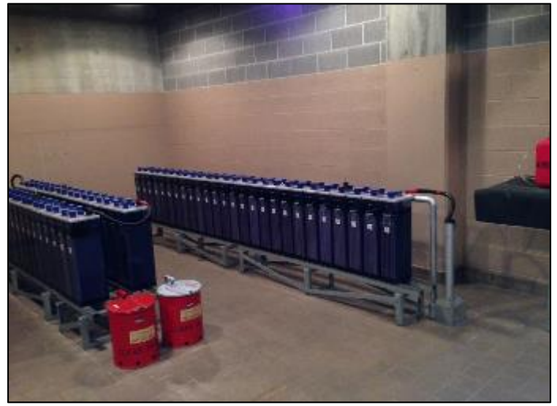
Cheatham Turbine Runner Cavitation Damage

3.8 Auxiliary and Support Components

All equipment within a hydroelectric power plant, regardless of whether it is a part of a unit powertrain or provides support to the power plant and its operations, was analyzed under the HydroAMP program. An unexpected failure can have a significant economic impact due to the high cost of emergency repairs and lost revenues during an extended forced outage. Therefore, additional items such as DC Systems, Station Service Systems, Cranes, Penstocks, Medium Voltage Cables, Compressed Air Systems, Cooling Water Systems, SCADA Systems, Fire Suppression Systems, Gates, Oil Circuit Breakers, Insulating and Lubricating Oil Systems, Relays, etc. were scored. Due to the number of auxiliary components, per-component Condition Indices will not be included in this section.

Cordell Hull Switchyard

Barkley Medium Voltage Cables



Barkley Battery Room

Center Hill Penstock

4. Hydropower Rehabilitation Program and Funding Overview

Most of the major assets in the Cumberland River Hydropower System are well past their expected service life. Power Plant Rehabilitation, replacements, and modernization are needed to keep the plants in proper working order and continue to provide a reliable source of renewable energy for the region. O&M appropriations and Section 212 Program funding are key to maintaining generation capability and reliability on the Cumberland System as shown in the following diagram.

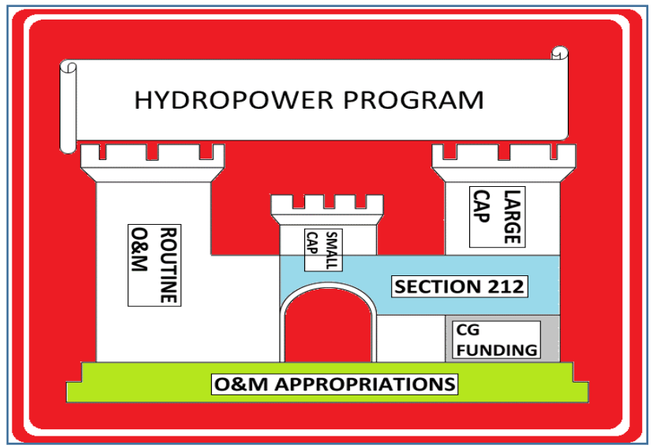


Figure 1. Program Funding Overview

4.1 Appropriated Funding Program

4.1.1 Operations and Maintenance (O&M)

Appropriated O&M funding is utilized to predominately fund the cost of routine operation and maintenance of the power plants including the materials, contracts and labor that support the generation of electricity. It is less commonly utilized to fund either small or large capital improvement projects. O&M funding was used for the generator stator rewinds on Old Hickory Unit #1 in 1990 and the Unit at J. Percy Priest in 1998. In addition to the two rewinds, O&M funding has been used for projects such as generator and transformer cooling water system replacements, station service emergency diesel generator replacements, relays upgrades, etc. However, due to increased demands on the annual USACE O&M appropriations, it has been increasingly unlikely to receive funding for these necessary capital improvements through this means.

4.1.2 American Recovery and Reinvestment Act

The American Recovery and Reinvestment Act of 2009 (Recovery Act) was signed into law on February 17th, 2009. The Recovery Act was a response to a crisis unlike any since the Great Depression, and included, but was not limited to, measures to modernize our nation's infrastructure and to enhance energy independence.

Recovery funds were used to fund critical maintenance work included in the initial 20-year plan. Work Items completed with Recovery funds included rehabilitation of the powerhouse cranes at Dale Hollow and J. Percy Priest, CO2 system replacement, and SCADA system replacement.

4.1.3 Construction General

Construction General (CG) funds can be used for large capital projects such as Turbine Generator Rehabs that have an approved Major Rehabilitation Evaluation Report (MRER) and/or for projects receiving funding via the USACE Hydropower Modernization Initiative (HMI) program. CG funds would be used for Work Items that are part of the 5-year/20-year plans on a case-by-case basis. Prior to customer funding agreements, CG funds were historically the only available means for funding of Turbine Generator Rehabs and other large capital projects. However, the competition for CG funds across the enterprise meant that consistently receiving funds for needed capital improvements was a significant challenge. Beginning with the Water Resources Development Act of 2000 (WRDA 2000), USACE received authorization to begin accepting customer funds for capital improvements. Effectively, the customer funding agreements developed through WRDA 2000 replaced CG funding as the primary means of funding large capital hydropower projects.

4.2 Section 212 Program

4.2.1 Authorization

Section 212 of the Water Resources Development Act of 2000 (Pub. L. 106-541, Dec. 11, 2000) authorizes USACE to accept customer funds to maintain and operate the hydroelectric power plants. Section 212 is codified at 33 U.S.C. §2321a, as noted below:

§ 2321a. Hydroelectric power project uprating

(A) In general

In carrying out the operation, maintenance, rehabilitation, and modernization of a hydroelectric power generating facility at a water resources project under the jurisdiction of the Department of the Army, the Secretary may, to the extent funds are made available in appropriations Acts or in accordance with subsection (c), take such actions as are necessary to optimize the efficiency of energy production or increase the capacity of the facility, or both, if, after consulting with the heads of other appropriate Federal and State agencies, the Secretary determines that such actions

(1) are economically justified and financially feasible;
(2) will not result in any significant adverse effect on the other purposes for which the project is authorized;
(3) will not result in significant adverse environmental impacts;

(4) will not involve major structural or operational changes in the project; and
(5) will not adversely affect the use, management, or protection of existing Federal, State, or tribal water rights.

(b) Consultation

Before proceeding with any proposed uprating under subsection (a) of this section, the Secretary shall provide affected State, tribal, and Federal agencies with a copy of the proposed determinations under subsection (a) of this section. If the agencies submit comments, the Secretary shall accept those comments or respond in writing to any objections those agencies raise to the proposed determinations.

(c) Use of funds provided by preference customers

In carrying out this section, the Secretary may accept and expend funds provided by preference customers under Federal law relating to the marketing of power.

(d) Application

This section does not apply to any facility of the Department of the Army that is authorized to be funded under section 839d-1 of Title 16.

(e) Effect on other authority

This section shall not affect the authority of the Secretary and the Administrator of the Bonneville Power Administration under section 839d-1 of Title 16.

(Pub.L. 104-303, Title II, § 216, Oct. 12, 1996, 110 Stat. 3694; Pub.L. 106-541, Title II, § 212,

Dec. 11, 2000, 114 Stat. 2593.)

4.2.2 Funding Strategy

The provisions of the Flood Control Act of 1944 require power marketing administrations such as SEPA to develop and propose rate schedules that recover the cost of producing and transmitting electric energy, including the amortization of capital investments. Rate schedules are also impacted by other factors and proposed changes to rates are subject to notice and comment.

SEPA's final marketing policy (1993) for the Cumberland River System of projects provides peaking capacity, along with 1,500 hours of energy annually with each kilowatt of capacity, to customers outside the Tennessee Valley Authority (TVA) transmission system. In FY 2015, Southeastern proposed a rate adjustment that included the cost recovery of dam safety repairs at Wolf Creek and Center Hill. The rates were effective on October 1, 2015 and were approved on a final basis by FERC for the Cumberland System on May 6, 2016.

Replacement of the existing turbine runners was categorized in the initial "Needs and Opportunities" study performed by MWH (now Stantec) as "opportunities." Since most of the existing turbines are more than 50 years old and are in need of rehabilitation and modernization over the next 20 years, it was deemed prudent to include turbines in the 2020 Program Master Plan, pending a unit-by-unit determination of turbine needs as the Hydropower Rehabilitation Analysis Report (HRAR) for each power plant is developed. This Master Plan continues to include turbines as part of the overall Cumberland River Hydropower Rehabilitation Strategy.

Previous and ongoing Work Items have been funded by the three Legacy MOAs, the Long-Term (L-T) MOA executed in August 2011 and the Short Term (S-T) MOA executed in 2016. Funding of Work Items either by reallocation of Legacy MOA funding or via the L-T MOA or S-T MOA will continue to be governed by the terms of the respective executed MOA(s).

USACE continues its efforts to add signatories to the L-T MOA and/or to execute additional S-T MOAs with those entities that chose not to enter into the August 2011 L-T MOA.

4.2.2.1 Program Funding

Under Section 212, funding levels for the Program are directly dependent on power generation and rates. Funding for Work Items will be authorized following the Sub-Agreement and balloting requirements under applicable MOAs and based on actual revenue stream as defined in this Section and in Appendix A "Section 212 Funding Process."

As recommended by SEPA and incorporated within USACE Hydropower Modernization Initiative (HMI) Implementation Guidance, the Cumberland System has a total scheduled outage goal of no more than 140 MW. New projects that may cause this scheduled outage goal to be exceeded will be discussed with the stakeholders prior to implementation.

Therefore, only four scheduled unit outages will be planned at any one time, with a maximum of one scheduled unit out at any plant. At plants in which a single transformer serves two generators, work could require two units to have a scheduled outage. At plants with several units and excess capacity, more flow may be passed through each unit to compensate for the outage of any unit undergoing rehabilitation. However, plants with fewer units and less excess capacity will be impacted, and generation at these plants will decrease. Loss in generation will result in reduced revenues, and therefore reduced Program funding. However, as plants get rehabilitated, it is anticipated that there will be an increase of revenue due to higher unit efficiency and system performance. This increase is not considered at this time.

A Reserve Fund(s) for legal liabilities has been established and specific information regarding the Reserve Fund is contained within the respective MOA(s). The plan schedule, costs, and Appendices will be updated, as appropriate when the level of this fund(s) is known.

Sub-Agreements

Sub-Agreements authorize funds to the program and to specific Work Items in accordance with the terms of the governing MOA. See Appendix A for an illustration of the Sub-Agreement approval process.

Ballots

Execution of the Rehabilitation Program may require budget, schedule, and scope changes. Potential changes will be handled as described in the governing MOA and as part of the program change management plan described in the Change Management Plan. At times this may involve a Ballot for consideration by members of the PCC. See Appendix A for an illustration of the Ballot approval process.

Gateway and Document Approval Process

Execution of the Rehabilitation Program may require approvals of Project and Work Item gateways, Master Plan revisions, and other program related documents. See Appendix A for an illustration of the Gateway and Document approval process

4.2.3 Section 212 Legacy MOAs

In 2003 (FY04) USACE, SEPA and the Sponsors signed the first Memorandum of Agreement (MOA). Two additional short-term MOAs were subsequently signed for FY05-06 and FY08-09, reaching a total of $45M for all three MOAs. These three MOAs are called Legacy MOAs in this document.

4.2.4 Section 212 Long Term MOA

In August 2011, USACE, SEPA and twenty-four Sponsors executed a Long-Term Memorandum of Agreement (L-T MOA), expiring September 30, 2032. Seven Sub-Agreements have been executed pursuant to the L-T MOA (S-A #1 on August 29, 2011, S-A #2 on August 29, 2011, SA #3 on July 13, 2012, S-A#4 on June 4, 2013, S-A#5 on March 26, 2014, S-A #6 on March 19, 2015, S-A #7 on March 7, 2016, S-A #8 on May 26, 2017, S-A #9 on April 3, 2019, and S-A #10 on October 8, 2020).

4.2.5 Section 212 Short Term MOA

In June 2016, USACE, SEPA, TVA and the Tennessee Valley Public Power Association (TVPPA) executed a Short-Term Memorandum of Agreement (S-T MOA), expiring September 30, 2017. The most recent extension of this MOA was executed on October 12, 2019 for two additional years with an expiration date of September 30, 2021. A third extension is currently in the development process.

4.2.6 Program Stakeholders

U.S. Department of the Army acting through USACE (Corps), U.S. Department of Energy acting through the Administrator, SEPA,

Program Sponsors (Representing Preference Customers)

- Barbourville Utility Commission, City of Barbourville, Kentucky
- City of Bardstown, Kentucky
- City of Bardwell, Kentucky
- Benham Power Board, City of Benham, Kentucky
- Big Rivers Electric Corporation
- Corbin Utilities Commission, City of Corbin, Kentucky
- East Kentucky Power Cooperative, Inc.
- City of Falmouth, Kentucky
- Frankfort Plant Board, City of Frankfort, Kentucky
- French Broad Electric Membership Corporation
- Haywood Electric Membership Corporation, North Carolina
- Henderson Municipal Power & Light, City of Henderson, Kentucky
- Madisonville Municipal Utilities, City of Madisonville, Kentucky
- Mississippi Delta Energy Agency
- Municipal Energy Agency of Mississippi (MEAM)
- City of Nicholasville, Kentucky
- Owensboro Municipal Utilities, City of Owensboro, Kentucky
- Paducah Power System, City of Paducah, Kentucky
- City of Paris, Kentucky
- Princeton Electric Plant Board, City of Princeton, Kentucky
- City of Providence, Kentucky
- Southern Illinois Power Cooperative
- South Mississippi Electric Power Association (SMEPA)
- Town of Waynesville, North Carolina
- Tennessee Valley Authority (TVA)
- Tennessee Valley Public Power Association (TVPPA)

5. Definitions

Funding Requirement: The amount of estimated costs, including applicable contingency amounts, specified in a Sub-Agreement for each Work Item to be funded by the Sponsors in accordance with such Sub-Agreement and the terms specified in the governing MOA.

Master Plan: This document which is the comprehensive 20-year project plan and associated 5-year construction work plan for non-routine maintenance, rehabilitation or modernization of the Cumberland River hydropower system, also referred to as the Program Management Plan. The initial version was approved concurrently with execution of the L-T MOA. The Master Plan is a living document to be updated periodically. If there are discrepancies between the governing MOA(s) and this document, the MOA(s) takes precedence.

Memorandum of Agreement (MOA):

> Legacy Memoranda of Agreement (Legacy MOAs): the three MOAs between SEPA, the Corps, and various preference customers, executed July 14, 2004 (the 2004 MOA), executed June 28, 2005 (the 2005-06 MOA), and November 7, 2008 (the 2008-09 MOA).
>
> Long-Term Memorandum of Agreement (L-T MOA): the MOA between SEPA, the Corps, and 24 preference customers, executed August 1, 2011.
>
> Short-Term Memorandum of Agreement (S-T MOA): two-year duration MOA executed between the Corps, SEPA, TVA and TVPPA.

Program: Cumberland River System Hydropower Rehabilitation Program.

Program Coordination Committee or PCC: The committee consisting of the Corps, SEPA, and representatives of the Sponsors as identified in applicable MOA(s) which shall administer and oversee the planning and performance of work under this Master Plan.

Program Coordination Group or PCG: The committee consisting of the Corps, SEPA, and representatives of the Sponsors as identified in applicable MOA(s) which shall administer and oversee the planning and performance of work under this Master Plan.

Project: One or more Work Items with a common goal that when accomplished results in an overhauled system in a power plant. The term Project as part of this Program is not to be confused with the commonly used hydroelectric project referring to the power plant, dam structure and the infrastructure around it.

Project Review Committee or PRC: The committee consisting of the Corps, SEPA, and representatives of the Sponsors as identified in applicable MOA(s) which shall consider and recommend to the PCC Work Items to be included in Sub-Agreements to be funded in accordance with the terms and conditions specified in the governing MOA.

Pro Rata Share: Pro Rata Share is the estimate of a Legacy MOA Sub-Agreement signatory's percentage share, listed in a table in each Sub-Agreement, of each Work Item Funding Requirement specified in that Sub-Agreement.

Reserve Fund: A separate, non-replenishing account, as identified under applicable MOA(s) established for paying or reimbursing Sub-Agreement costs under the terms of the governing MOA, resulting from claims incurred by the Corps under the Contract Disputes Act of 1978, administrative proceedings or litigation before the Armed Services Board of Contract Appeals or U.S. Court of Federal Claims (or any successor tribunals thereto) and any resulting settlements or judgments pursuant to proceedings before any of the aforementioned tribunals.

Section 212 Allowance: As identified on a Sponsor's power bill from SEPA, Section 212 Allowance means the credit to be applied by SEPA toward partial or full satisfaction of amounts that are otherwise payable by the Sponsor to SEPA under its power supply contract with SEPA, for funds paid by the Sponsor to SEPA for transfer to the Corps to meet the Sponsor's Pro Rata Share of Work Item Funding Requirements or other obligations under the governing MOA, including transfers into the respective MOA's Reserve Fund.

Section 212 Funds: The amount of hydropower revenues or receipts, collected by SEPA from Sponsors, determined by SEPA to be available for transfer to the Corps to meet Funding Requirements of a Sub-Agreement under the terms of the governing MOA.

Sponsors: Hydropower customers who receive a capacity allocation and associated energy from SEPA in accordance with Section 5 of the Flood Control Act of 1944, 58 Stat. 890, 16 U.S.C. §825s, and who are signatories to and provide funding under the terms and conditions of an MOA which facilitates the implementation of this Master Plan.

Sub-Agreement: An agreement for one or more Work Items pursuant to the governing MOA or a Previous MOA.

Work Item: A project or scope of work identified in a Sub-Agreement for certain non-routine maintenance, rehabilitation or modernization work at the Facilities to be performed by the Corps pursuant to and in accordance with the governing MOA. A Work Item may include planning, engineering, design, material procurement, and construction activities, as well as the related supervisory and administrative activities, associated with non-routine maintenance, rehabilitation or modernization work at the Facilities.

6. Program Implementation

The Nashville District will follow a detailed process in implementing the Hydropower Rehabilitation Program. The process will require planning, internal and external communication, collaboration and timely execution. At the same time, the process is intended to be responsive to changing conditions within the system and allow flexibility to respond to equipment emergencies or urgencies that change Work Item priorities. The overarching goal is to continue to meet generation commitments while performing system improvements to enhance hydropower generation and reliability.

The Chief of Hydropower (OPS-H) and staff will monitor and update project priorities and needs at the plants and use tools such as HydroAMP and HMI to recommend Program adjustments as needed. This process has been used to develop the project list in Appendix B and the project schedules in each power plant development plan. Updates will be made to the list when significant system changes or a number of minor changes warrant a revision to the Master Plan.

Prior to approaching the stakeholders with a recommended Sub-Agreement or Ballot, the Program Management Team (PgMT) will meet to discuss the scopes, schedules and budgets for proposed Work Items. The PgMT is comprised of Nashville District Chief OPS-H, Section 212 PgM, resource providers, and the Hydroelectric Design Center (HDC). It is during this meeting that the composition of the Project Delivery Team (PDT), engineering technical lead, PM assignment, and the preliminary acquisition strategy will be determined.

The Section 212 PgM will report Program performance to the stakeholders in accordance with the MOA. In addition to the monthly project and Program reports required by the MOA, the Section 212 PgM will also track metrics adapted from the Consolidated Command Guidance (USACE CERM). Program performance tracking will be accomplished by a number of metrics. The first metric will be program execution measured by the percentage of projects meeting project performance goals. Green performance will be 85% to 100% of projects with cost and schedule performance indices of 0.85 or more. Amber performance is identified as 75% to 84% of projects with cost and schedule performance indices of 0.85 or more. Red performance is defined as fewer than 75% of projects with cost and schedule performance indices of 0.85 or more.

Another program performance metric will be timely submittal of required reports and posting to the SharePoint site. Green will be 90% or greater of all reports submitted and posted on time. Amber will be 85% to 89% of all reports submitted and posted on time. Red will be less than 85% of all reports submitted and posted on time. An additional program performance metric will be the projects meeting milestones within 30 days of the due date. Green performance will be 90% to 100% of projects meeting milestone dates. Amber performance will be 80% to 89% of projects meeting milestone dates, and Red performance will be fewer than 80% of projects meeting milestone dates.

While the Section 212 Program differs in some ways from traditional Corps programs, the Nashville District will continue to hold the high standards and time-proven procedures used by the Corps to ensure project efficacy and quality. It may be necessary to adapt certain processes for use with non-appropriated funds, but generally speaking, planning, engineering and design, and project acquisition will follow normal procedures. Not only will this help implement an effective, high-quality project, but it will also provide fair and open competition for construction work and ensure the best product at the best price. Some of the standards used in the Program include, but are not limited to, those listed below.

USACE technical references, manuals and guidelines are:

USACE Project Management Delivery Process (PMDP) Manual	
EM 385-1-1	Corps Safety Manual
LRNR 10-1-3	Nashville District Mission Statement
ER 1110-2-1463	Hydrologic Engineering for Hydropower
ER 1130-2-551	Hydropower Operations and Maintenance Policy Bulk Power System Reliability Compliance Program
ER 1110-1-8159	Engineering and Design, DrChecks
ER 10-1-53	Hydroelectric Design Center
ER 1110-2-1150	Engineering and Design for Civil Works Projects
ER 1130-2-510	Hydroelectric Power Operations and Maintenance Policies
EM 1110-2-1701	Hydropower
EM 1110-2-3001	Planning and Design of Hydroelectric Power Plant Structures
EM 1110-2-3006	Hydroelectric Power Plants Electrical Design
EM 1110-2-4205	Hydroelectric Power Plants Mechanical Design
EP 1130-2-551	Hydropower Operations and Maintenance Policy Implementation of Bulk Power System Reliability Compliance Program
EP 1130-2-510	Hydroelectric Power Operations and Maintenance Guidance and Procedures

The Program will be executed in a three phase process: Planning; Engineering & Design; and Acquisition. The first two phases will be followed by pauses during which the Nashville District will report results to stakeholders in accordance with the applicable agreements. Planning efforts involve the examination of a particular piece of equipment or system, either at a single plant or at every plant throughout the Cumberland River System. During planning the PDT will review the condition of the component, as well as needs and opportunities. The PDT will be comprised of members of the Nashville District staff and HDC staff in the appropriate disciplines for the work. Due to the age of Nashville District hydropower equipment, in-kind replacement may not be an option, and even in cases that allow in-kind replacement, the PDT will evaluate alternatives for

advances in technology and other opportunities that can enhance the performance of the system. The output of the Planning Phase will be a technical report detailing the conditions observed, alternatives considered for the component, recommendations, and a cost estimate. The Chief, OPS-H and Section 212 PgM will review the recommendation before forwarding to the stakeholders for approval prior to moving into the Engineering & Design Phase. The Section 212 PgM will provide the results in executive summary form to the stakeholders and conduct a virtual meeting to obtain stakeholder input and answer questions regarding the recommendations. The plan for major hydropower plant rehabilitations will be outlined in the HRAR. This study and report will inventory existing equipment at the plant and examine problems and opportunities, water availability, environmental considerations, and alternatives in a step-wise process in order to reach a recommended alternative for the plant rehabilitation. The PDT will develop the performance characteristics (power and efficiency) for turbine alternatives across the range of power options judged to be reasonable possibilities. The study will also evaluate the powertrain and balance of plant equipment needed to support the output for each alternative. One of the alternatives shall consist of all units and associated systems/equipment sized and operated as per the original output. All this will be considered in conjunction with an economic analysis of costs/benefits, O&M considerations and other impacts. Stakeholder views will be taken into consideration prior to recommending a plan.

The Engineering & Design Phase will be a collaborative effort between HDC and the Nashville District. Engineering regulations separate hydroelectric design into three levels (categories), dependent upon the complexity and criticality of the component under consideration. Engineering & Design responsibilities will be determined appropriate to these criteria and the availability of expertise within the Nashville District. Quality control/assurance of the work will be accomplished by the Nashville District performing District Quality Control (DQC) and HDC performing Agency Technical Review (ATR). Reviewers at each location will be staff members who were not involved in design development or production of plans and specifications. Quality reviews will be documented in accordance with Corps procedures appropriate to the complexity and size of the project. This could include the use of DrChecks to record review comments, responses and back-checks, or documentation through memoranda for file.

The Acquisition Phase will be another collaborative effort between the Nashville District and HDC and will be conducted pursuant to the Federal Acquisition Regulations and related supplements (DFARS, AFARS, UAI). This phase could take a number of forms because the needs could be met by a supply/service contract for simple replacements-in-kind or require a construction contract that is executed by one of the available acquisition strategies. Most requirements are solicited as firm fixed price contracts using the sealed bid method of procurement, either with or without the use of Definitive Responsibility Criteria. However, for higher risk requirements, as determined by safety considerations, technical complexity, industry capabilities, and estimated dollar value of the work, the Nashville District may elect to use a Best Value Trade Off (BVTO) procurement mechanism. In short, the BVTO procurement mechanism requires a Source Selection Evaluation Board (SSEB) to evaluate and score proposals submitted by Offerors. The SSEB's evaluations are turned over to the Source Selection Authority, who then selects the Offeror providing the best value to the Government. In some cases, sole-source acquisitions may be necessary in the event of proprietary equipment or specialized skill sets particular to one business. After contract award, contractor submittals will be reviewed by both HDC and the Nashville District for contract compliance. The Nashville District will provide day-to-day Quality Assurance (QA) at the facility, and HDC will assist with QA at critical junctures, for critical parts/components, during performance testing, or at other times requested by the Nashville District.

The descriptions to this point in this section have been somewhat tailored toward Section 212 funded work. However, the principles and procedures are similar for work funded by appropriated funds. Since the Master Plan applies to the Cumberland River System Hydropower Rehabilitation Program, which includes both appropriated funds and Section 212 funds, the stakeholders will be informed of all Work Item execution. Nashville District will continue to submit hydropower work packages for consideration in the President's Budget each year. The work packages will consist of Work Items contained in the Master Plan in an effort to leverage the funding sources and speed Program execution. Successful funding through appropriations will be reported to Section 212 stakeholders.

7. Program Scope

7.1 20-Year Master Program Plan

Work Items are ranked based on their condition (probability of failure) and their impact (criticality and consequence of failure). Work Items were then grouped into Projects to reduce cost and optimize contracting and scheduling.

Within the Program, priority for all projects is based on a risk assessment that evaluates the existing condition and consequence of the failure of various systems and equipment in the Cumberland system. In addition to risk, project scheduling also considers grouping complementary Work Items to schedule outage times more efficiently, better manage contracts, minimize administrative and engineering costs, and enable taking advantage of discount pricing for multiple orders. Other deviations from strictly score-based scheduling include scheduling practical work to prepare for upcoming unit rehabs to include, but not limited to, powerhouse cranes, exciters, transformers and medium voltage cables. Smaller Projects may be scheduled ahead of their ranking to fill in cash flow gaps and expedite Program completion.

To minimize the impact on the river system, the impact on the revenue stream, and considering the availability and optimal use of resources, it is assumed that at a given time, there will be no more

than one planned turbine-generator unit outage at a plant. Turbine-generator projects at multiple plants may overlap as funds allow. Following Center Hill, the next highest ranked plants to be rehabilitated are: Barkley, Old Hickory, and Wolf Creek. However, this ranking order is subject to Preference Customer funding approval for each project.

Program and Project gateways are used to match the flow of work to the available funds. If a wet year or change in operation increases the generation and available revenue, work can be released ahead of schedule. Likewise, if a dry year or change in operation reduces the funding available from revenue, gateways can be used to delay the approval of scheduled work.

To allow for proper execution of the Program and in agreement with the MOAs, Projects were broken down into Work Items. Following a proper sequence, the Work Items can be carried out independently from the remaining Work Items and provide a finished product. However, to realize the full benefit of a Project, all Work Items for a Project need to be completed.

Tables showing a summary of the projects included in the program, estimated costs, and schedule as well as a 20-Year Master Project List are included in Appendix B. Historic averages for monthly income under the Section 212 MOAs were used for detailed revenue projections and programming.

7.2 5-Year Program Detailed Plan

Work Items in the 5-year detailed plan were prioritized to complete Work Items that had previously completed Planning, Engineering, and Design; to complete practical Work Items for power plants with upcoming unit rehabs; and to complete Work Items throughout the System with high risk and consequence of failure. The Projects and the Work Items were scheduled based on their predefined priority. Historic averages for monthly income under the Section 212 MOAs were used for detailed programming.

7.3 Project Ranking Methodology

7.3.1 Ranking Equation

$$Score = W_1C_1 + W_2C_2 + W_3C_3A_E$$

$W_{1\text{-}3}$ are weights assigned to each criteria

C_1 is the condition factor
C_2 is the criticality factor
C_3 is the consequence factor
A_E is the energy loss factor

7.3.2 Weights

The purpose of the weights is to assign importance to each term. The sensitivity analysis performed for the initial Master Plan was referenced for evaluating multiple cases of the scoring factors. The intent of the sensitivity analysis was to ensure the scoring provided the best possible ranking with minimal needs for manual adjustments.

7.3.2.1 Section 212 Capital Improvement Projects:

For the base case for Section 212 capital improvement projects, the three weights were valued at 0.333 each. After performing the sensitivity analysis by adjusting the weights and evaluating the subsequent rankings, the base case was determined to be the best methodology for ranking the Section 212 capital improvement projects since condition, criticality, and consequence of energy loss are all equally important to prioritizing projects for the Rehabilitation Program.

7.3.2.2 Appropriated Funding Projects:

For the base case for Appropriated Funding projects, the three weights were also valued at 0.333 each. After performing the sensitivity analysis, the final weight was adjusted to 0.750 for condition and the weights for criticality and consequence were adjusted to be equally valued at 0.125. The higher condition weighting allows for a better representation of the goals of the Operations and Maintenance program which focuses on components throughout the power plant to ensure continued operation of the system while still considering the system criticality and the consequence of energy loss. This ranking methodology addresses failing components throughout the power plant, including those not directly related to power production.

7.3.3 Condition

The Condition score is derived from the HydroAMP Tier 1 Assessments for the components that comprise each of the projects. Existing HydroAMP scores were verified with project personnel, and for systems with components not yet in HydroAMP, OPS-H personnel worked with the superintendent, senior mechanic and senior electrician at each plant to score each component. Remarks were documented where applicable to justify each of the ratings.

HydroAMP scoring is done using Field Inspection Guides developed specifically for HydroAMP. These Field Inspection Guides are available for the following equipment:

- Governor Controls
- Governor Hydraulic System
- Turbine Runner – Francis
- Turbine Runner – Kaplan
- Turbine Runner – Propeller
- Turbine Runner – Impulse
- Turbine Components
- Generator Rotor
- Generator Stator Core
- Generator Stator Winding (Multi– Turn and Bar Winding)
- Miscellaneous Electrical Equipment
- Excitation Systems
- Circuit Breakers (Air, Oil, SF6 and Vacuum)
- Transformer
- Batteries
- Compressed Air Systems
- Cranes
- Emergency Closure Gates
- Emergency Closure Valves
- Steel Penstocks
- Balance of Plant Equipment

HydroAMP condition scores are based on condition indicators for maintenance history, physical inspection, operational performance and electrical/mechanical test results (where applicable). Weighting factors are applied to the Condition Indicator scores, which are then summed to compute the Condition Index. Weighting factors are used to account for the fact that certain Condition Indicators reflect the actual equipment condition more than other indicators. Projects in the Master Plan are grouped by system rather than component, so it was necessary to group components within a common system. The lowest HydroAMP score within the system was used to determine the condition score that was used for the project. For example, a DC/Preferred AC System project would have separate HydroAMP scores for the batteries, battery chargers, inverters, and the DC/Preferred AC distribution system. If the batteries were in the worst condition of the group, the battery HydroAMP score would be used to determine the Condition Score for the DC/Preferred AC System project. If all of the components in the system were not in need of replacement it would be reflected in the scope of the project as well as the budgetary estimate. Since the Master Plan scores projects on a 0 to 1 scale with 1 being the most critical for replacement and HydroAMP rates on a 0 to 10 scale with 10 being the best, the HydroAMP scores had to be converted into a Condition score value that would work with the ranking equation. This was done using the following equation:

$$Condition\ Score = \frac{10 - HydroAMP\ Score}{10}$$

See Section 3 for more details on the HydroAMP condition assessment program.

7.3.4 Criticality

All systems in the power plant are critical in one sense or another for the operation of the facility. Therefore, all projects were broken down into one of two categories. If the system is critical for power generation, its criticality was set as 1.00, if it was only critical for plant operation, its criticality was set as 0.25.

7.3.5 Consequence

Consequence Factor: Consequence was scored on a system basis, with the intent being to rank each project by the longest length of a forced outage. Systems that do not result in a forced unit outage receive a 0 score for consequence. In order to get an accurate picture of what the durations of forced outages are by system, 19 years of outage data (2000-2019) for LRN was taken from the Operations and Maintenance Business Information Link (OMBIL). This data was then filtered to include only forced outages and to remove inspections and other non-system specific items (such as divers in the tailwater). The maximum outage durations were analyzed further, as the goal was to capture the consequence of a complete system failure.

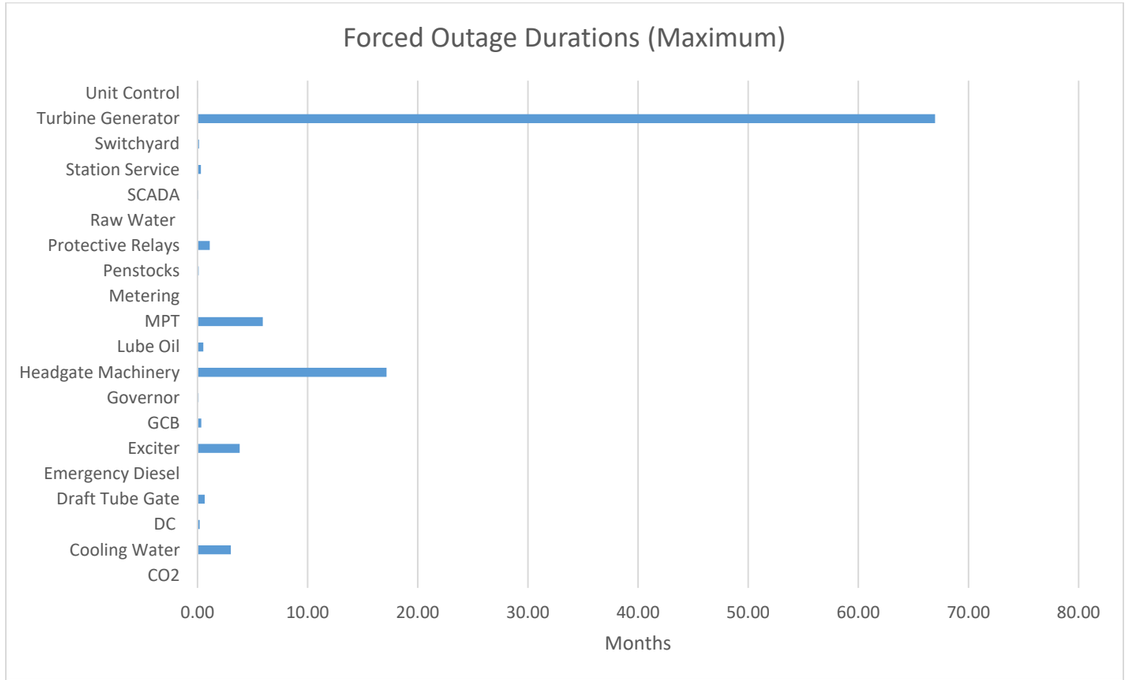


Figure 2: Maximum durations of Forced Outages

The system outage durations were then fit into one of six categories, based on a range of durations. These ranges were determined by analyzing the above graphs and the supporting data to determine a best fit for each range. Each system outage was then categorized into one of six duration ranges. Once the durations were determined from the data, the durations were analyzed by the realistically expected outage for a complete system failure, and changes were made to the durations as needed. For example, the data showed the maximum outage for a transformer as being 180 days. However, due to the age of the transformers, they are more likely to fail catastrophically which would result in an outage of well over a year. The six categories, together with the ranking values, are listed on the following page:

	Duration Category	Ranking Value
One year or more:	6	1.000
Six months to one year:	5	.825
Four to six months:	4	.660
One to four months:	3	.495
Two weeks to one month:	2	.330
Less than two weeks:	1	.165

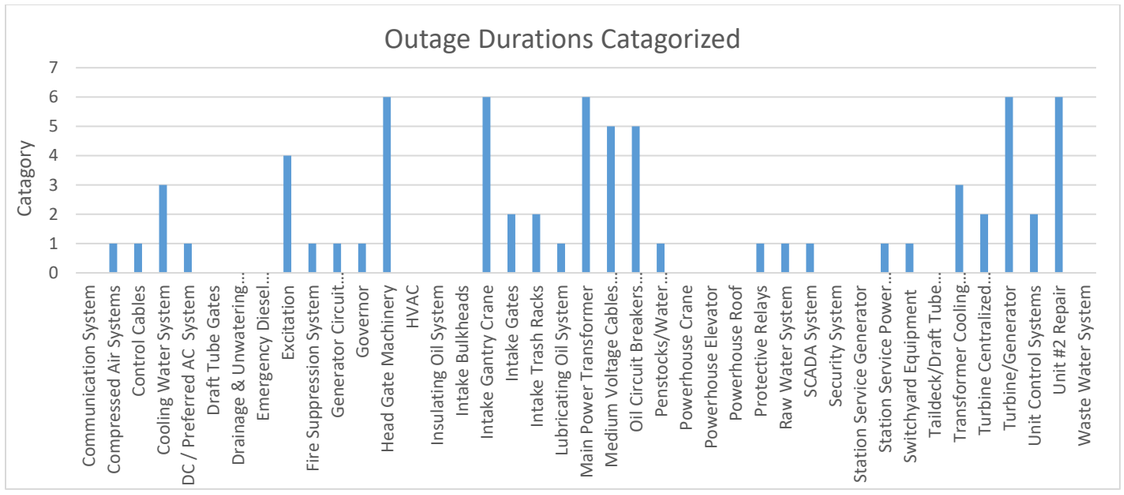


Figure 3: Standardized Outage Durations

7.3.6 Energy Loss Factor (Ae)

The **Ae** term represents the incremental annual energy production from last on/first off unit or grouping of units (for those cases impacting two units or the entire plant). The values were then normalized to put them on a comparable scale from 0 to 1 using the following formula.

$$Normalization\ (Xnew) = \frac{X - Xmin}{Xmax - Xmin}$$

Annual Generation from calendar years 2000-2005 collected from OMBIL was added to the Table below in the yellow highlighted columns. This date range was used as the best representation of the value of each unit and plant because unit availability at that time was high (97.68% in LRN) and was minimally affected by long term unit outages. The incremental unit values were determined by taking the average unit's generation over the six year period.

Ae with Annual Generation from CY 2000 - 2005									
Project	Incremental Unit (MWh)	Adjusted Incremental Unit	Normalized Incremental Unit	Incremental Two Units (MWh)	Adjusted Two Units	Normalized Incremental Two Units	Total Plant (MWh)	Adjusted Total Plant	Normalized Plant
Barkley	185,977	185977	0.235	371,954	371954	0.470	743,908	743908	0.940
Center Hill	118,254	118254	0.149	236,507	236507	0.299	354,782	354782	0.448
Cheatham	63,133	63133	0.080	126,267	126267	0.160	189,400	189400	0.239
Cordell Hull	126,246	126246	0.160	252,492	252492	0.319	378,738	378738	0.479
Dale Hollow	38,682	38682	0.049	77,364	77364	0.098	116,081	116081	0.147
J.P. Priest	80,896	80896	0.102				80,896	80896	0.102
Laurel	61,515	61515	0.078				61,515	61515	0.078
Old Hickory	124,844	124844	0.158	249,687	249687	0.316	499,374	499374	0.631
Wolf Creek	138,304	138304	0.175	276,608	276608	0.350	829,837	829837	1.000

Example:

$$Normalized\ Incremental\ Unit\ (BAR) = \frac{185{,}977 - 38{,}682}{829{,}837 - 38{,}682} = 0.235$$

7.3.7 Combining the Consequence Factor with Ae

The consequence factor was then multiplied either by the average annual total or the incremental energy as appropriate to the loss of the particular system. In the case of outages affecting the entire plant, the average annual plant energy production is used; in the case of outages that affect one or two units, the incremental annual energy production from last on/first off unit or grouping of units (for those cases impacting two units).

The consequence term, in combination with either unit or project energy, represents energy loss due to unplanned system downtime. The consequence factor also characterizes the relative importance of various systems within a plant compared to similar systems across the district.

Once the two were combined, the resultant consequence term was normalized using the formula above to put it on the same 0 to 1 scale as the other terms.

7.3.8 Developing the Final Score

The final ranking score for each project was calculated using the base case (.333 as the weight for each term). A rank was assigned to each project which was then used to compare against in the cases analyzed after. This method allowed a better visualization of the changing project prioritization with each weight adjustment.

7.3.9 Manual Movement of Rankings

Some projects require manual movements in the ranking due to the order of the Turbine Generator Rehabilitations. Supporting projects, or those that need to be completed prior to the Turbine Generator Rehabilitation, were moved up manually in the ranking to coincide with the schedule of the controlling project. Such determination will be documented in the HRAR for each plant but these projects are assumed to be required for the master planning effort. The following are the projects most commonly required to be performed prior to or concurrently with a Turbine Generator Rehab:

In many cases the Main Power Transformers, Exciters, and MV Cables are original equipment and well beyond their design life. In order to ensure reliable delivery of power from the rehabilitated units, it is prudent to address this equipment along with the Turbine Generator Rehabilitation. Also, when performing a Turbine Generator Rehabilitation, it is common to for units to receive an incidental uprate due to modern advances in winding insulating materials and turbine runner designs. If the approved HRAR alternative provides justification to uprate and operate the units at a higher output, the supporting equipment must often also be modernized and upgraded to support the uprate.

The Powerhouse Bridge Crane Rehabilitation is heavily relied upon by the Turbine Generator Rehabilitation contractor for disassembly and reassembly of the units which requires a large number of lifts including some lifts at or near the rated load of the crane. Due to the risk of delays to the contractor as well as safety concerns it is critical that the Powerhouse Bridge Crane and its corresponding lifting devices are inspected and rehabilitated prior to the Turbine Generator Rehabilitation.

As previously noted, manual movements are required to group Work Items when applicable to efficiently schedule outage times, better manage contracts, minimize administrative and engineering costs, and to provide an ability to take advantage of discount pricing for multiple orders. Smaller Projects may be scheduled ahead of their ranking to fill in cash flow gaps and expedite Program completion.

7.4 Project Cost Estimating

Cost estimates were prepared by the cost estimators in the Technical Services Section in LRN. The baseline cost estimates for total project costs were developed using cost data from awarded contracts and/or planning studies that have been completed for items in multiple systems throughout the power plant. The costs for Pre-construction, Engineering and Design (PED), and Construction Management (a.k.a. S&A) were included as a percentage of the Contract Cost. It is assumed that each Work Item is competitively bid with a defined outage schedule. The cost estimates included in this revision of the Master Plan were prepared in the base year of FY 2020 dollars. The estimates were then escalated to the fiscal year determined during the programming phase using EM 1110-2-1304, Civil Works Construction Cost Index System (CWCCIS). These estimates include all anticipated costs from the design through construction phases of the projects.

These estimates were developed at various Association for Advancements in Cost Engineering International (AACEI) levels of accuracy depending on the availability of recent contract examples or ongoing projects.

- Main Power Transformer Replacement
- Exciter Rehabilitation/Replacement
- Powerhouse Bridge Crane Rehabilitation
- MV Cable Replacement

Programmatic work for Project or Work Item initiation work will be funded under the Program's management budget. This includes preparation of sub-agreements and ballots, scopes of work, minor preparatory work or scoping investigations by HDC, PgMT coordination and similar tasks. All subsequent Project or Work Item work is to be funded under the individual Project or Work Item budget.

There were a total of 41 unique Project identifiers each with up to 9 different project sites in them. For the majority, only one site had historical data regarding that specific project identifier. In this case, that historical data was directly applied to that single site and then escalated to the date of April 1st, 2020 (3Q20FY) with the CWCCIS Total Project Cost Summary (TPCS). To find all of the remaining project sites under that project identifier, a scaling factor was applied using the number of exciters, and power cable lengths. For example, Barkley Dam (Barkley) has 4 exciters and J. Percy Priest (JPP) has 1. Therefore, the ratio in cost from a historical Barkley project to a JPP project under the same project identifier to the 3Q of FY 20 would be Barkley plus the escalation from the CWCCIS, divided by 4, the scaling factor of the exciters. This, however, did not apply to all Project Identifiers. After extensive meetings with project personnel, it was determined that this ratio factor from the exciters and power cables did not apply to every project identifier and many had a simple flat 1 to 1 ratio used for all sites under that particular identifier.

Contingency was applied at the end based on the standard five classes of estimate types. Class Five estimates were estimates deemed to be the ones with the most unknowns and had the highest

contingency applied. Class One estimates were assumed to have the least amount of contingency. Above that were estimates from awarded contracts which had no contingency applied. For every historical project pulled into a project identifier, a judgment was made on what class of estimate it would be based on how much historical data was still available. All other estimates that were based off that initial historical estimate were then marked 'down' two classes of estimates. For example, if a site estimate was determined to be a Class One estimate, then all other sites under that identifier based on that historical estimate would be Class Three estimates with higher contingency applied to those specific sites. There were some exceptions, but this was the primary system used for the majority of the projects. Each cost estimate will be updated for each phase of the Project, as shown in Table 1 below:

Project Stage/Gateway	Estimate Class	Methodology	Expected Accuracy Range
Program Setup	Class 4	Escalate existing reconnaissance level Cost Estimates	Low: -15% to -30% High: +20% to +50%
Project Authorization	Class 4	Utilize Program Setup Cost Estimates	Low: -15% to -30% High: +20% to +50%
Scope Approval/Design Authorization	Class 3	Update for final scope. Semi-detailed unit cost with assembly level line items.	Low: -10% to -20% High: +10% to +30%
Control of Bid	Class 2	Update for final design. Detailed unit cost with forced detailed take-off.	Low: - 5% to -15% High: +5% to +20%

Table 1: Project Cost Estimate by Project Stage

Project contingencies are needed to allow for unaccounted Project costs. At this stage, Project contingencies are defined as 15% of the overall Project cost and are included in the total estimate used in the schedule. As noted above (Cost Model and Assumptions), the costs are currently classified as an AACEI Class 4, which is 20 to 50% above to 15 to 30% below the job's estimated cost (with contingencies). Therefore, it is important to realize this contingency is not meant to cover inaccuracies in costs due to the preliminary nature of the cost estimates. Risk-based contingencies will be added for each project. A Cost and Schedule Risk Analysis (CSRA) may be conducted for all projects over $100M.

7.5 Program Scope Management

All plants have exceeded their design life of 35 years. The condition of the equipment requires that all Projects be completed as soon as possible. However, due to funding and operational constraints the Projects are scheduled to be completed in a sequence based on the current priority.

Over time, condition of equipment, internal and external constraints and limitations may affect the execution of the Program.

To manage the scope of the Program, the plant personnel must participate and be engaged in the Projects and a staff member may be included on the PDT for the project. Minor maintenance required during the Program will be addressed with O&M resources. Work Items that need to be performed earlier due to condition and priority changes, and significant scope changes for ongoing Work Items will be addressed using the balloting process as described in the MOA. Planned Projects and Work Items will be reviewed, updated and re-ranked on a regular basis to minimize the impact of Program scope changes. This process will be streamlined and executed as required to minimize delays. Each Project's positive and negative aspects will be studied and the lessons learned used for the forthcoming Projects.

Program scope, schedule, and budget changes will be routinely updated and reported in the monthly program summary reports. All changes requiring PCC approval, involving Program priorities, or altering the Master Plan will be updated and documented at least annually by USACE and made available to all parties through the Program website.

8. Program Schedule

Based on the preliminary scope of work for the Projects included in the Program, a high-level schedule was created for each Project and Work Item. The projects were connected and scheduled based on the projected revenue stream. Projects were scheduled out to twenty years. Any projects that did not fall into that timeframe will be re-evaluated during future Master Plan revisions.

8.1 Five Year District-Wide Section 212 Project Ranking and Schedule

Five Year Gantt Chart			LT10						LT11						LT12						LT13	
			ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
				2021				2022				2023				2024				2025		
			FY21				FY22				FY23				FY24				FY25			
Barkley	Main Power Transformer	$6,900,000	C	///	///	CMP																
Barkley	Turbine/Generator	$115,000,000	C	C	C	C	C	C	C	C	///	///	///	///	///	///	///	///	///	///	///	///
Barkley	Intake Gantry Crane	$17,000,000	C	C	C	C	C	C	C	C	C	CMP										
Center Hill	Turbine/Generator	$68,176,000	///	///	CMP	CMP	CMP															
Old Hickory	Unit #4 Turbine/Generator Rehab	$25,000,000	///	///	///	CMP	CMP															
Wolf Creek	HRAR	$1,380,000	PL	PL	PL	PL	PL	PL														
Cordell Hull	HRAR	$650,000					PL	PL	PL	PL	PL	PL										
Cheatham	HRAR	$650,000							PL	PL	PL	PL	PL	PL								
Wolf Creek	Dissolved Oxygen Investigation	$1,000,000	D	D	D	D																
Wolf Creek	Unit #5 Exciter Repair	$500,000	///	///	CMP																	
Wolf Creek	Head Gate Machinery	$7,850,000	///	///	CMP																	
Center Hill	Head Gate Machinery	$4,565,000	C	///	///	CMP																
Dale Hollow	Head Gate Machinery	$3,585,000	C	C	///	CMP																
Cordell Hull	Excitation	$6,625,000	A	A	C	C	C	C	C	///	///	CMP										
Old Hickory	Excitation	$6,150,000	D	D	D	D	A	C	C	C	C	C	///	///	///	CMP						
Old Hickory	Main Power Transformer	$11,830,000	C	C	C	C	C	C	C	C	///	///	CMP									
Center Hill	HVAC	$2,000,000	D	D	A	A	C	C	C	C	CMP											
Barkley	Intake Trash Rack Installation	$1,346,000				CMP																
Barkley	Powerhouse Roof (Phase 2)	$1,175,000	D	D	A	C	C	C	C	C	CMP											
Barkley	SCADA/Centralized Control	$250,000	C	C	C	C	C	C	C	C	C	C	C	///	CMP							
Center Hill	SCADA	$800,000	C	C	C	C	C	C	C	C	C	C	///	C	CMP							
Cheatham	SCADA	$800,000	C	C	C	C	C	C	C	C	C	///	C	C	CMP							
Dale Hollow	SCADA	$800,000	C	C	C	C	C	C	C	C	C	C	///	C	CMP							
J. Percy Priest	SCADA	$500,000	C	C	C	C	C	C	C	C	C	C	///	C	CMP							
Laurel	SCADA	$500,000	C	C	C	C	C	C	C	C	C	C	C	///	CMP							
J. Percy Priest	Arc Flash Mitigation	$400,000	C	C	C	///	CMP															
Dale Hollow	Power Service Cable Tray Replacement	$473,000	C	CMP																		
Old Hickory	Control Cable & Conduit (Phase 1)	$1,980,000	D	C	A	A	C	C	///													
Old Hickory	Turbine/Generator	$125,000,000	D	D	D	D	D	D	A	A	A	C	C	C	C	C	C	C	///	///	///	
Cheatham	Medium Voltage Cables & Busses	$3,530,000	D	D	D	A	C	C	///	///	///	///	CMP									
Wolf Creek	Main Power Transformer	$16,200,000	D	D	D	D	D	D	D	D	A	A	C	C	C	C	C	C	C	C	///	///
Center Hill	Medium Voltage Cables & Busses	$7,100,000	D	A	A	C	///	C	///	///	CMP											
Wolf Creek	Excitation	$10,650,000					D	D	D	D	D	A	C	C	C	C	C	///	///	///	///	///
Wolf Creek	DC / Preferred AC System	$4,100,000								A	C	C	C	///	CMP							
Wolf Creek	Powerhouse Crane	$3,200,000							D	D	A	A	C	C	C	C	CMP					
Wolf Creek	Turbine/Generator	$200,000,000							D	D	D	D	D	D	D	F	A	A	A	C	C	C
Wolf Creek	Medium Voltage Cables & Busses	$13,300,000														D	D	D	D	A	C	C
Cheatham	Intake Gantry Crane	$10,750,000	PL														D	D	D	D	A	A
Cordell Hull	Powerhouse Crane	$5,900,000																			D	D
J. Percy Priest	DC / Preferred AC System	$2,750,000																			D	D
Cheatham	Excitation	$6,150,000																		D	D	D
Laurel	Excitation	$3,100,000																				D
Center Hill	Station Service Power Systems	$11,250,000	PL																		D	D
Dale Hollow	Excitation	$6,550,000																			D	D
Old Hickory	Station Service Power Systems	$11,000,000	PL																			
Barkley	DC / Preferred AC System	$3,700,000	D	D																		
Old Hickory	DC / Preferred AC System	$3,800,000	D																			

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

8.2 Twenty Year District-Wide Section 212 Project Ranking and Schedule

Medium Range Projects (FY23 - FY30)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
OLD02	Old Hickory	Turbine/Generator	$125,000,000	23
SYS05.05	Wolf Creek	Main Power Transformer	$16,200,000	23
SYS06.05	Wolf Creek	Excitation	$10,650,000	23
WOL22	Wolf Creek	Powerhouse Crane	$3,200,000	23
WOL02	Wolf Creek	Turbine/Generator	$200,000,000	25
WOL04	Wolf Creek	Medium Voltage Cables & Busses	$13,300,000	25
SYS01.03	Cheatham	Intake Gantry Crane	$10,750,000	25
COR22	Cordell Hull	Powerhouse Crane	$5,900,000	26
SYS13.04	J. Percy Priest	DC / Preferred AC System	$2,750,000	26
SYS06.10	Cheatham	Excitation	$6,150,000	26
SYS06.07	Laurel	Excitation	$3,100,000	27
SYS14.09	Center Hill	Station Service Power Systems	$11,250,000	27
SYS06.11	Dale Hollow	Excitation	$6,550,000	27
SYS14.04	Old Hickory	Station Service Power Systems	$11,000,000	27
COR02	Cordell Hull	Turbine/Generator	$175,000,000	29
SYS06.08	J. Percy Priest	Excitation	$3,650,000	29
SYS05.06	Cheatham	Main Power Transformer	$12,250,000	29
CHE22	Cheatham	Powerhouse Crane	$6,700,000	29
SYS05.08	Dale Hollow	Main Power Transformer	$13,950,000	30
DAL04	Dale Hollow	Medium Voltage Cables & Busses	$4,750,000	30

Hydropower Rehabilitation Program

Long Range Projects (FY31 - FY41)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
SYS05.04	Laurel	Main Power Transformer	$6,750,000	31
DAL22	Dale Hollow	Powerhouse Crane	$2,900,000	32
SYS13.05	Barkley	DC / Preferred AC System	$3,700,000	32
CHE02	Cheatham	Turbine/Generator	$200,000,000	33
SYS07.09	Cheatham	Governor	$2,850,000	33
SYS14.08	Barkley	Station Service Power Systems	$12,650,000	33
SYS13.02	Cheatham	DC / Preferred AC System	$3,050,000	34
SYS07.03	Cordell Hull	Governor	$2,850,000	34
SYS13.06	Old Hickory	DC / Preferred AC System	$3,800,000	34
SYS05.07	Center Hill	Main Power Transformer	$21,150,000	35
SYS13.07	Dale Hollow	DC / Preferred AC System	$5,850,000	35
LAU22	Laurel	Powerhouse Crane	$6,950,000	35
DAL02	Dale Hollow	Turbine/Generator + Penstocks/Water Passages	$125,000,000	36
SYS05.10	J. Percy Priest	Main Power Transformer	$6,050,000	36
CEN15	Center Hill	Oil Circuit Breakers (OCBs)	$13,400,000	36
BAR15	Barkley	Oil Circuit Breakers (OCBs)	$19,900,000	38
SYS07.10	Dale Hollow	Governor	$2,950,000	37
COR15	Cordell Hull	Oil Circuit Breakers (OCBs)	$8,800,000	37
SYS07.02	Barkley	Governor	$3,400,000	39
JPP22	J. Percy Priest	Powerhouse Crane	$3,400,000	38
LAU02	Laurel	Turbine/Generator + Penstocks/Water Passages	$50,000,000	39
JPP02	J. Percy Priest	Turbine/Generator + Penstocks/Water Passages	$50,000,000	39
SYS14.05	Cordell Hull	Station Service Power Systems	$14,100,000	39
CHE15	Cheatham	Oil Circuit Breakers (OCBs)	$8,650,000	39
SYS14.11	Cheatham	Station Service Power Systems	$14,750,000	39
SYS13.08	Cordell Hull	DC / Preferred AC System	$3,500,000	40
SYS07.08	Old Hickory	Governor	$3,650,000	40
SYS07.05	Center Hill	Governor	$3,150,000	40
CEN10	Center Hill	Penstocks/Water Passages	$6,600,000	40
SYS05.03	Cordell Hull	Main Power Transformer	$25,650,000	40
OLD04	Old Hickory	Medium Voltage Cables & Busses	$13,200,000	40
SYS07.04	Wolf Creek	Governor	$4,650,000	40
SYS07.07	J. Percy Priest	Governor	$2,100,000	40
SYS07.06	Laurel	Governor	$2,050,000	40
SYS14.06	Dale Hollow	Station Service Power Systems	$6,250,000	40
LAU16	Laurel	Head Gate Machinery	$3,300,000	40
JPP16	J. Percy Priest	Head Gate Machinery	$2,350,000	40
SYS13.09	Laurel	DC / Preferred AC System	$2,550,000	41
SYS06.06	Center Hill	Excitation	$5,450,000	41
SYS13.10	Center Hill	DC / Preferred AC System	$4,250,000	41

9. Nameplate Data and Five Year Performance

LRN Project Nameplate Data and Five Year Performance (FY 2015 – FY 2019)											
Facility				**Generation**	**Forced Outage**		**Scheduled Outage**		**Availability**		
	Number of Units	Nameplate Capacity (MW)	% of LRN Capacity	Net Generation (GWH)	Hours Unavailable	Factor (%)	Hours Unavailable	Factor (%)	Yearly Hours	Hours Available	Factor (%)
Barkley	4	130	14.0%	2,789	9,772	5.57	27,754	15.8	175,296	137,768	78.6
Center Hill	3	156	16.8%	1,600	221	0.13	51,862	29.6	175,296	123,214	70.3
Cheatham	3	36	3.9%	925	1,879	1.43	11,279	8.6	131,472	118,308	90.0
Cordell Hull	3	96.7*	10.4%	2,145	7,614	5.79	10,165	7.7	131,472	113,693	86.5
Dale Hollow	3	54	5.8%	722	577	0.44	4,905	3.7	131,472	125,990	95.8
J. Percy Priest	1	28	3.0%	322	155	0.35	1,499	3.4	43,824	42,169	96.2
Laurel	1	61	6.6%	440	402	0.92	2,328	5.3	43,824	41,093	93.8
Old Hickory	4	100	10.8%	2,316	44,297	25.27	20,900	11.9	175,296	110,098	62.8
Wolf Creek	6	265**	28.6%	5,240	5,991	2.28	19,442	7.4	262,944	237,514	90.3
District Total	**28**	**926.7**	**100%**	**16,499**	**70,907**	**5.58**	**150,132**	**11.8**	**1,270,896**	**1,049,847**	**82.6**

**Cordell Hull Unit #2 - Derated to 30 MW at Unity PF*

***Wolf Creek Unit #2 – Derated to 40 MW at Unity PF*

Barkley Power Plant Development Plan

10. Barkley Power Plant Development Plan

10.1 Overview

Barkley Lock and Dam is the northern-most structure on the Cumberland River, situated some 30.6 miles above the river's confluence with the Ohio River. The project is located in Livingston and Lyon Counties, Kentucky, near the town of Grand Rivers. The reservoir extends 118 miles upstream to Cheatham Lock and Dam (located near Ashland City, TN). Barkley Lock and Dam is a multi-purpose project providing flood control, hydroelectric power, navigation, and recreation. It is a key unit in the comprehensive plan of development on the Cumberland River. Barkley and Kentucky Lakes are connected by a canal large enough to accommodate barge traffic. The canal is located about two miles upstream of the lock and dam, is 1.75 miles long, 400 feet wide, and 9 feet deep at minimum pool. Barkley Lock was placed into operation in 1964 and the powerhouse, with four generating units with 32,500 kilowatt (kW) capacities each, in 1966. Barkley Dam consists of a concrete gravity section and two earthen embankments.

Barkley Power Plant Development Plan

10.2 Hydropower

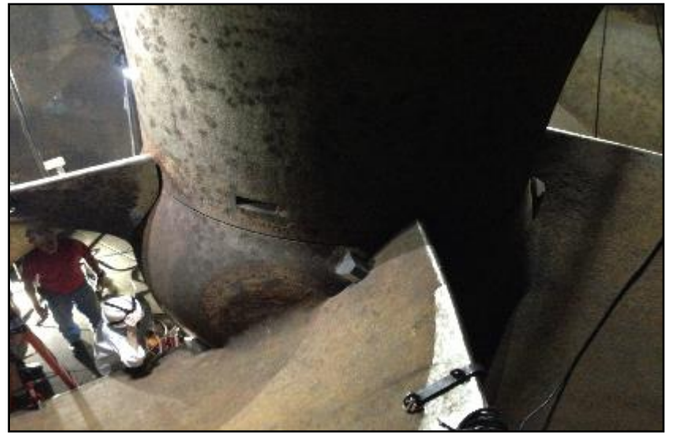
Construction of Barkley Power Plant began in 1957 and was completed in 1966. The power plant is equipped with four vertical shaft Kaplan turbine generating units. Each generator is rated at 32.5 MW. This plant is operated locally and also remotely monitors and has the ability to operate the Sault Ste. Marie Hydroelectric Power Plant, which is located on the St. Marys River on Michigan's Upper Peninsula. Sault Ste. Marie has 5 units in two powerhouses with a total capacity of 18.4 MW.

Barkley Power Plant has a plant rating of 130 MW (3rd highest in Nashville District) and an average annual energy generation of 750 GWhrs (2nd highest in Nashville District).

With the exception of the Unit 1 Generator which underwent a rewind in FY11, the units at Barkley are original, having operated for 52 years.

Plant Characteristics	
Generators / Turbines	
Generator Information	Manufacturer: General Electric Rating: 130 MW - 4 units: 32.5 MW (37.375 MW at 115% overload.
Turbine Runner Rating	Manufacturer: Newport News Type: Kaplan Rating: 58,000 horsepower (hp) at 44 ft head, 65.5 revolutions per minute (rpm) Diameter of Runner: 302 in.
Percent of LRN Capacity	14.1%
Excitation System	
Main	265 kilowatts (kW), 250 volts (V)
Transformers	
General Information	Manufacturer: General Electric Number: 2 (1 for each pair of generators) Type: 3 phase FOA Rating: 13.2/161 kV, 84,000 kilovolt-amp (kVA)
Governors	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Generation Megawatt-hour (MWh)	477,961
Peak Availability	
Factor (%)	76.5%
Forced Outages	
Total No.	4
Hours Unavailable	45.32
Factor (%)	0.13%
Scheduled Outages	
Hours Unavailable	7,714
Factor (%)	22.0%
Availability	
Yearly Hours	35,040
Hours Available	27,278
Factor (%)	77.9%



10.2.1 Component Condition and Operating Constraints

Aside from the Unit 1 Generator that was rewound in 2013 after a catastrophic failure, the turbines and generators are original at Barkley. Similarly, the original mechanical governors are still in service at this power plant. Within the last 10 years, the generator circuit breakers and exciters have been replaced and there is currently an effort underway to replace both of the main power transformers.

In 2015, Unit 3 experienced multiple failures of one of the Kaplan oil head bushings. In order to return the unit to reliable service and eliminate future failures of this bushing, the blades on this unit were blocked in an optimal position and the Kaplan blade tilt function of the turbine runner was thus disabled. This issue will ultimately be resolved with the upcoming Turbine Generator Rehabilitation.

Power Train Conditions								
Unit	Circuit Breakers	Exciters	Generator Rotor	Generator Stator	Governors	Turbines	Transformer Equip#	Transformer
Unit 1	8	10	2.6	10	3.2	4.5	MPT1	5.1
Unit 2	8	10	2.6	1.6	3.2	3.7	MPT2	5.1
Unit 3	8	10	2.6	1.6	3.2	3.2		
Unit 4	8	10	2.6	1.6	3.2	2.2		

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

Barkley Power Plant Development Plan

10.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a twenty-year period.

Ongoing Projects

WBS Code	Power Plant	Project Title	Program Amount	Awarded FY
SYS05.02	Barkley	Main Power Transformer	$6,900,000	18,20
BAR.18	Barkley	SCADA	$250,000	19
BAR02	Barkley	Turbine/Generator	$115,000,000	20
SYS01.02	Barkley	Intake Gantry Crane	$7,950,000	20
BAR.36	Barkley	Intake Trash Racks	$1,346,000	21
BAR.37	Barkley	Powerhouse Roof	$3,466,912	19/21
SYS13.05	Barkley	DC / Preferred AC System (design)	$3,700,000	-

Long Range Projects (FY31 to FY41)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS13.05	Barkley	DC / Preferred AC System	$3,700,000	32
SYS14.08	Barkley	Station Service Power Systems	$12,650,000	33
BAR15	Barkley	Oil Circuit Breakers (OCBs)	$19,900,000	38
SYS07.02	Barkley	Governor	$3,400,000	39

Appropriated Funding Projects

Rank	Project	Identifier	WBS	ROM (FY21 estimate)
8	Barkley	Compressed Air Systems	BAR.24	$152,841
9	Barkley	Switchyard Equipment	BAR.15	$8,446,765
11	Barkley	HVAC	BAR.21	$4,160,824
17	Barkley	Drainage & Unwatering System	BAR.38	$789,163
24	Barkley	Control Cables	BAR.35	$1,332,472
52	Barkley	Unit Control Systems	BAR.08	$151,134
67	Barkley	Oil Systems	BAR.33	$283,592
68	Barkley	Taildeck/Draft Tube Crane	BAR.01	$1,795,330
80	Barkley	Oil Circuit Breakers (OCBs)	BAR.34	$14,264,103
90	Barkley	Communication System	BAR.40	$132,203
114	Barkley	Cooling Water System	BAR.17.01	$2,743,636
117	Barkley	Intake Gates	BAR.16	$2,715,462
119	Barkley	Draft Tube Gates & Slot Fillers	BAR.43	$437,108
131	Barkley	Powerhouse Elevator	BAR.42	$1,110,373
142	Barkley	Intake Bulkheads	BAR.44	$228,901
145	Barkley	Fire Suppression System	BAR.11	$120,184
178	Barkley	Powerhouse Crane	BAR.22	$4,330,873
184	Barkley	Waste Water System	BAR.41	$795,979
186	Barkley	Emergency Diesel Generator	BAR.20	$306,012

10.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Barkley Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	SYS05.02	Barkley	Main Power Transformer	$6,900,000	C	///	///	CMP																
N/A	BAR02	Barkley	Turbine/Generator	$115,000,000	C	C	C	C	C	C	C	C	///	///	///	///	///	///	///	///	///	///	///	///
N/A	SYS01.02	Barkley	Intake Gantry Crane	$17,000,000	C	C	C	C	C	C	C	C	C	CMP										
N/A	BAR.36	Barkley	Intake Trash Rack Installation	$1,346,000				CMP																
N/A	BAR.37	Barkley	Powerhouse Roof (Phase 2)	$1,175,000	D	D	A	C	C	C	C	C	CMP											
N/A	BAR.18	Barkley	SCADA/Centralized Control	$250,000	C	C	C	C	C	C	C	C	C	C	C	///	CMP							
35	SYS13.05	Barkley	DC / Preferred AC System	$3,700,000	D	D																		

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Center Hill Power Plant Development Plan

11. Center Hill Power Plant Development Plan

11.1 Overview

Center Hill is a multipurpose project with power, flood control, and recreation benefits. The dam is a combination of earthen-fill and concrete, approximately 2,160 feet long and 250 feet in height above the streambed. The dam and lake function to control the floodwaters of the Caney Fork River and contribute to the reduction of flood levels at municipal, industrial and agricultural areas along the Cumberland, lower Ohio and Mississippi Rivers. Construction of the dam was initiated in March 1942 and completed in June 1948. The dam has eight tainter gates on the spillway and six sluice gates to aid in control of the pool and provide minimum flow downstream as required. The upper pool is normally maintained at an elevation of 648 feet. TVA's Great Falls dam and hydroelectric powerhouse discharge into Center Hill Lake.

The Center Hill power plant includes three main Francis units and a station service unit that were commissioned in 1950-1951. The power plant has a nominal generating capacity of 156 MW. The plant is operated in "peaking" mode and to maintain minimum flow downstream.

Center Hill Power Plant Development Plan

11.2 Hydropower

Hydropower production at Center Hill was authorized by the Flood Control Act of 1938 and the River and Harbor Act of 1946. Center Hill Power Plant was commissioned in 1950 with two generating units. Unit 3 was completed in 1951. This plant is located on the Caney Fork River approximately 12 miles (20 river miles) from its confluence with the Cumberland River.

Plant Characteristics	
Generators / Turbines	
Generator Information	Manufacturer: General Electric Rating: 156 MW - 3 units: 52 MW
Turbine Runner Rating	Manufacturer: Baldwin Locomotive – OE Voith Hydro - Current Type: Francis (Auto-Venting) Rating: 71,900 hp at 160 ft head, 105.9 rpm Diameter of Runner: 175 in.
Percent of LRN Capacity	15.5%
Excitation System	
Main Pilot	290 kW, 250 V 12kW, 250 V
Transformers	
General Information	Manufacturer: Westinghouse Number: 10 (3 for each generator and 1 spare) Type: Single phase self and forced air cooled Rating: 13.2/161 kV, 15,000 kVA self-cooled, 20,000 kVA forced air cooled
Governors	
General Information	Manufacturer – Woodward Governor Type: Mechanical

The powerhouse has 3 identical Vertical Francis type generating units rated at 52 MW after the recent uprate from the Turbine-Generator Rehabilitation Project. The Plant is dispatched by TVA and has been remotely operated from Cordell Hull since 1972. The switchyard feeds the Southeastern Power Grid.

Fiscal Year 2019 Performance	
Generation	
Generation (MWh)	278,376
Peak Availability	
Factor (%)	49.4%
Forced Outages	
Total No.	6
Hours Unavailable	34
Factor (%)	.10%
Scheduled Outages	
Hours Unavailable	17,640
Factor (%)	50.3%
Availability	
Yearly Hours	35,040
Hours Available	17,367
Factor (%)	49.6%

Center Hill Power Plant Development Plan

11.2.1 Component Condition and Operating Constraints

So long as water quality operations do not impact the project's Congressionally authorized purposes, the Nashville District cooperates to the maximum extent practicable with state water quality standards. Accordingly, this plant monitors dissolved oxygen (DO) levels downstream and water samples are monitored through a gage downstream of the dam. Prior to the Turbine-Generator Rehabilitation, air injection baffles were added from 1999 to 2001 to all runner cones to improve DO levels. In addition, sluicing has been performed historically between September and November, although this period can be extended depending on seasonal weather patterns. Typically one of the six low-level outlet sluice gates has been operated for the purpose of raising DO levels, which amounts to a loss of 1,500 cubic feet per second (cfs) of flow.

In order to increase the DO uptake downstream of the power plant, new turbine runners were designed and constructed with auto-venting technology as part of the Turbine-Generator Rehabilitation project. Auto-venting technology (AVT) utilizes low pressure regions below the runner to draw atmospheric air into the turbine during operation to inject large quantities of air into the discharge. The interaction between the incoming bubbles and the surrounding water drives the aeration performance by influencing the pressures at the air injection location, the resulting air flows, the DO uptake efficiency, and the turbine performance.

Testing of the new AVT runners show, when operated independently, the AVTs are capable of providing 6 milligrams per liter DO through nearly the entire low-DO season without any supplement from the sluices. Early results of the AVT have been very positive with zero non-turbine releases required in calendar year 2020 for water quality purposes.

Power Train Conditions						
Unit	Circuit Breakers	Exciters	Generator Rotor	Generator Stator	Governors	Turbines
Unit 1	8	10	10	10	3	10
Unit 2	8	10	10	10	3	10
Unit 3	8	10	10	10	3	10

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

Transformer Equip#	Transformer
MPT-1A	5.0
MPT-1B	5.0
MPT-1C	5.0
MPT-2A	5.0
MPT-2B	5.0
MPT-2C	5.0
MPT-3A	5.0
MPT-3B	5.0
MPT-3C	5.0
Spare MPT	-
44KV Trans	-

Center Hill Power Plant Development Plan

11.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a twenty-year period.

Ongoing Projects

WBS Code	Power Plant	Project Title	Program Amount	Awarded FY
CEN02	Center Hill	Turbine/Generator	$68,176,000	14
SYS16.3	Center Hill	Head Gate Machinery	$4,565,000	18
CEN.18	Center Hill	SCADA	$800,000	18
CEN.21	Center Hill	HVAC	$2,000,000	19,21
CEN04	Center Hill	Medium Voltage Cables & Busses (Design)	$7,100,000	-
SYS14.09	Center Hill	Station Service Power Systems (Design	$11,250,000	-

Short Range Projects (FY21 - FY22)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
CEN04	Center Hill	Medium Voltage Cables & Busses	$7,100,000	21

Medium Range Projects (FY23 - FY30)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS14.09	Center Hill	Station Service Power Systems	$11,250,000	27

Long Range Projects (FY31 to FY41)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS05.07	Center Hill	Main Power Transformer	$21,150,000	35
CEN15	Center Hill	Oil Circuit Breakers (OCBs)	$13,400,000	36
SYS07.05	Center Hill	Governor	$3,150,000	40
CEN10	Center Hill	Penstocks/Water Passages	$6,600,000	40
SYS06.06	Center Hill	Excitation	$5,450,000	41
SYS13.10	Center Hill	DC / Preferred AC System	$4,250,000	41

Appropriated Funding Projects

Rank	Project	Identifier	WBS	ROM (FY21 estimate)
13	Center Hill	Switchyard Equipment	CEN.15	$6,117,524
14	Center Hill	Powerhouse Roof	CEN.37	$1,551,846
36	Center Hill	Intake Gates	CEN.16	$2,598,377
41	Center Hill	Taildeck/Draft Tube Crane	CEN.01	$1,795,330
48	Center Hill	Intake Bulkheads	CEN.44	$313,570
65	Center Hill	Oil Circuit Breakers (OCBs)	CEN.34	$9,906,854
75	Center Hill	Communication System	CEN.40	$132,203
79	Center Hill	Oil Systems	CEN.33	$283,592
91	Center Hill	Cooling Water System	CEN.17.01	$3,585,721
99	Center Hill	Unit Control Systems	CEN.08	$151,134
110	Center Hill	Compressed Air Systems	CEN.24	$152,841
132	Center Hill	Waste Water System	CEN.41	$2,986,901
149	Center Hill	Intake Trash Racks	CEN.36	$4,059,372
163	Center Hill	Fire Suppression System	CEN.11	$120,184
170	Center Hill	Draft Tube Gates	CEN.43	$500,807
172	Center Hill	Excitation	CEN.06	$5,241,533
176	Center Hill	DC / Preferred AC System	CEN.13	$3,812,338
187	Center Hill	Drainage & Unwatering System	CEN.38	$789,163
188	Center Hill	HVAC	CEN.21	$3,013,904
189	Center Hill	Powerhouse Elevator	CEN.42	$726,484
190	Center Hill	Station Service Generator	CEN.20	$2,072,732

Center Hill Power Plant Development Plan

11.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Center Hill Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	CEN02	Center Hill	Turbine/Generator	$68,176,000	///	///	CMP	CMP	CMP															
N/A	SYS16.3	Center Hill	Head Gate Machinery	$4,565,000	C	///	///	CMP																
N/A	CEN.21	Center Hill	HVAC	$2,000,000	D	D	A	A	C	C	C	C	CMP											
N/A	CEN.18	Center Hill	SCADA	$800,000	C	C	C	C	C	C	C	C	C	C	///	C	CMP							
3	CEN04	Center Hill	Medium Voltage Cables & Busses	$7,100,000	D	A	A	C	///	C	///	///	CMP											
17	SYS14.09	Center Hill	Station Service Power Systems	$11,250,000	PL																		D	D

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Cheatham Power Plant Development Plan

12. Cheatham Power Plant Development Plan

12.1 Overview

The Cheatham Project is located in Cheatham County, Tennessee on the Cumberland River at mile 148.7, about 42 miles downstream from Nashville, Tennessee, and about 9 miles downstream from Ashland City, Tennessee. The project was originally authorized for construction by the River and Harbor Act of 1946 (Public Law 525, 79th Congress, 2nd Session), as a navigation unit in the comprehensive plan of development for the Cumberland River Basin. An additional authorization in 1952 included a power plant to produce hydroelectric power as a project purpose.

The principal features of this project consist of a navigation lock, a dam with a spillway controlled by seven tainter gates, and a powerhouse. Construction of the lock was initiated on April 6, 1950 and completed on June 15, 1953. Temporary miter gates were installed during construction so the lock could be opened to navigation on December 12, 1952. Construction of the dam started on July 17, 1952 and was completed on October 1954.

The project is responsible for maintaining the water level downstream for navigation purposes and for the water intake for a downstream located fossil power plant, but there are no minimum flow requirements imposed. The plant operates as “run of the river” with little freeboard. Since there is not enough storage capacity for the water that comes to the site, including that from Old Hickory and JPP, spilling operations are extensive. Spilling is performed anywhere from two to nine months per year, depending on the level of annual rainfall.

Cheatham Power Plant Development Plan

12.2 Hydropower

Cheatham Power Plant is located near Ashland City, TN at river mile 148.7 on the Cumberland River. JPP and Cheatham plants are remotely operated from Old Hickory and TVA does the dispatching for this power plant.

The power plant extends 306 feet from the end of the dam into the left bank. The power plant is a conventional indoor type consisting of three (3) 12,000 kW generators, powered by adjustable blade (See operating constraints), propeller-type hydraulic turbines each rated at 20,000 HP. at full gate capacity when operating at the normal speed of 60 RPM under the normal head of 22 feet. Each generator is rated at 13,333 kVA, 12,000 kW, 90% power factor (PF), 3 phase, 60 cycle. Accessory power plant equipment consists of two outdoor gantry cranes mounted on the intake and draft tube decks and used to operate the intake and draft tube gates and bulkheads, and an overhead traveling crane used in the installation and maintenance of the units.

The design head is 22 feet and the units are shut down when the head falls below 8 feet due to the drop in efficiency. With the current equipment, one unit will generate 12 MW with a discharge of 6,400 cfs. This plant also provides a limited amount of synchronous condensing operation for voltage control.

Plant Characteristics	
Generators / Turbines	
Generator Information	Manufacturer: Westinghouse Rating: 36 MW - 3 units: 12 MW
Turbine Runner Rating	Manufacturer: Newport News Type: Kaplan Rating: 20,000 hp at 22 ft head, 60 rpm Diameter of Runner: 274 in.
Percent of LRN Capacity	3.9%
Excitation System	
Main Pilot	170 kW, 250 V 12kW, 250 V
Transformers	
General Information	Manufacturer: Legnano Electric Number: 3 Type: Three phase self and forced air cooled Rating: 13.2/69 kV, 12,000 kVA self-cooled, 16,000 kVA forced air cooled
Governors	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Generation (MWh)	173,121
Peak Availability	
Factor (%)	96.4%
Forced Outages	
Total No.	12
Hours Unavailable	26.4
Factor (%)	.10%
Scheduled Outages	
Hours Unavailable	2305
Factor (%)	8.8%
Availability	
Yearly Hours	26,280
Hours Available	23,947
Factor (%)	91.1%

12.2.1 Component Condition and Operating Constraints

Dating back to the original installation of the units at Cheatham, the turbines experienced issues with the control of the turbine blades. This was due to a design flaw in the blade servo piston rod that resulted in frequent breakage at the point of entry into the spider. Problems persisted with multiple breakages of this rod on all of the units until eventually the adjustable blade operation of these turbine was disabled by welding the blades in place and removing the Kaplan oil head and piping from the units. Since that time, the units have operated reliably, but repairs due to cavitation damage on the turbine blades have been much more common than is typically experienced due to the inability to adjust the blade angle for the given operating conditions of the unit.

Another significant operational concern at this power plant is the large volume of debris that comes from the lake, and especially so during large rain events. At one time, a problematic debris removal system was added, but it was later replaced with a floating boom that was added to help direct the flow of trash away from the intakes. While the amount of debris that builds up on the intakes is reduced due to the addition of the trash boom, significant volumes of debris still get past the boom and build up on the intake trash racks. Over time, excessive build-up of this debris on the intake trash racks can damage the trash racks and eventually impact generation of the units. The project measures differential pressures across intake trash racks to monitor debris impacts. Without yearly removal of the debris, the differential pressure across the trash racks would become excessive and generation would be diminished.

Power Train Conditions								
Unit	Circuit Breakers	Exciters	Generator Rotor	Generator Stator	Governors	Turbines	Transformer Equip#	Transformer
Unit 1	8	2.1	2.6	1.6	2	2.2	MPT-1	5.2
Unit 2	8	2.1	2.6	1.6	2	2.8	MPT-2	5.2
Unit 3	8	2.1	2.6	1.6	2	2.8	MPT-3	5.2

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

Cheatham Power Plant Development Plan

12.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a 20-year period.

Ongoing Projects				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Awarded FY**
CHE.18	Cheatham	SCADA	$800,000	18
PGM01.108	Cheatham	HRAR	$650,000	22
CHE04	Cheatham	Medium Voltage Cables & Busses (Design)	$3,530,000	-

Short Range Projects (FY21 - FY22)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
CHE04	Cheatham	Medium Voltage Cables & Busses	$3,530,000	21

Medium Range Projects (FY23 - FY30)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
SYS01.03	Cheatham	Intake Gantry Crane	$10,750,000	25
SYS06.10	Cheatham	Excitation	$6,150,000	26
SYS05.06	Cheatham	Main Power Transformer	$12,250,000	29
CHE22	Cheatham	Powerhouse Crane	$6,700,000	29

Long Range Projects (FY31 to FY41)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
CHE02	Cheatham	Turbine/Generator	$200,000,000	33
SYS07.09	Cheatham	Governor	$2,850,000	33
SYS13.02	Cheatham	DC / Preferred AC System	$3,050,000	34
CHE15	Cheatham	Oil Circuit Breakers (OCBs)	$8,650,000	39
SYS14.11	Cheatham	Station Service Power Systems	$14,750,000	39

Appropriated Funding Projects				
Rank	**Project**	**Identifier**	**WBS**	**ROM (FY21 estimate)**
10	Cheatham	Cooling Water System	CHE.17.01	$3,585,721
18	Cheatham	Taildeck/Draft Tube Crane	CHE.01	$2,244,163
20	Cheatham	Oil Systems	OLD.33	$283,592
30	Cheatham	Waste Water System	CHE.41	$1,101,074
46	Cheatham	Control Cables	CHE.35	$1,077,318
49	Cheatham	Drainage & Unwatering System	CHE.38	$789,163
61	Cheatham	Switchyard Equipment	CHE.15	$5,914,544
78	Cheatham	Oil Circuit Breakers (OCBs)	CHE.34	$6,281,421
85	Cheatham	Intake Gates	CHE.16	$6,514,502
89	Cheatham	Intake Trash Racks	CHE.36	$3,610,595
93	Cheatham	Emergency Diesel Generator	CHE.20	$306,012
98	Cheatham	Unit Control Systems	CHE.08	$151,134
120	Cheatham	Powerhouse Elevator	CHE.42	$832,780
121	Cheatham	Powerhouse Roof	CHE.37	$2,731,097
160	Cheatham	Compressed Air Systems	CHE.24	$152,841
165	Cheatham	Fire Suppression System	CHE.11	$120,184
168	Cheatham	Communication System	CHE.40	$132,203
175	Cheatham	HVAC	CHE.21	$3,129,823
185	Cheatham	Intake Bulkheads	CHE.44	$318,176
191	Cheatham	Draft Tube Gates & Slot Fillers	CHE.43	$437,108

Cheatham Power Plant Development Plan

12.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Cheatham Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	PGM01.108	Cheatham	HRAR	$650,000							PL	PL	PL	PL	PL	PL								
N/A	CHE.18	Cheatham	SCADA	$800,000	C	C	C	C	C	C	C	C	C	///	C	C	CMP							
1	CHE04	Cheatham	Medium Voltage Cables & Busses	$3,530,000	D	D	D	A	C	C	///	///	///	///	CMP									
10	SYS01.03	Cheatham	Intake Gantry Crane	$10,750,000	PL														D	D	D	D	A	A
15	SYS06.10	Cheatham	Excitation	$6,150,000																		D	D	D

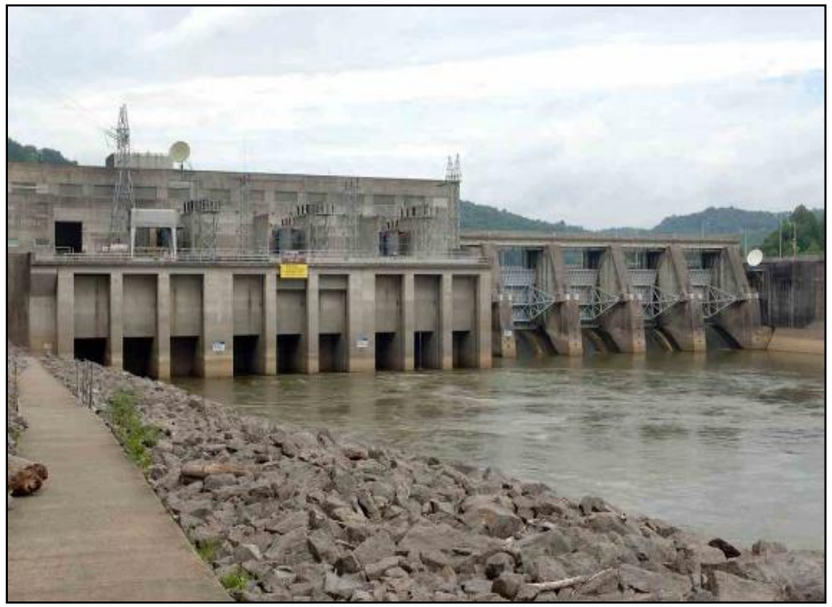
Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Cordell Hull Power Plant Development Plan

13. Cordell Hull Power Plant Development Plan

13.1 Overview

Cordell Hull Dam is located on the Cumberland River at mile 313.5 in Smith County, 5 miles upstream from Carthage, Tennessee. It is a multipurpose project with power, navigation, and recreation benefits, providing the State and Federal government with collateral advantages, including conservation. The dam is a combination earthen-fill and concrete, about 1,306 feet long and 87 feet in height above the streambed. The left bank earthen embankment is flanked by the lock, which is sited adjacent to the concrete spillway.



The powerhouse occupies the present river channel between the spillway and the right bank bluff. Three hydroelectric power units in the powerhouse are capable of generating 100,000kW.

Under normal conditions, target pool levels for winter and summer are at elevations 501 and 504, respectively. Winter drawdown allowances are two feet; summer allowances are one foot. Natural valley storage loss is compensated through surcharge storage between elevations 504 and 508, for use only during the occurrence of a flood. The power plant is operated essentially as a run-of-river type with pondage, but no regulating storage, using all inflow available to the site for power production, except that required for lockage of vessels and the excess that must be passed through the spillway during flood periods.

Project construction began with the first stage cofferdam in May 1963. Lock and dam construction was accomplished between July 1964 and October 1966. Channel dredging was completed between October 1966 and February 1968. The power plant was constructed between September 1969 and September 1973.

Cordell Hull Power Plant Development Plan

13.2 Hydropower

The Cordell Hull Power Plant was commissioned in 1973. The plant is staffed 24 hours per day and remotely operates Center Hill and Dale Hollow. There is one radial transmission line going to Carthage. Carthage relies entirely on the plant's switchyard. Power can be fed to Carthage from Cordell Hull or other places via the switchyard. The Cordell Hull plant provides the brown start for a nearby fossil fuel steam plant located in Gallatin. There is also a line to West Cookeville.

This three unit plant operates as a "run of the river" type mainly for energy generation. Under normal conditions Cordell Hull has sufficient capacity to generate without spilling all of the water that is discharged from the upstream plants. April and May are the rainy months in which most of the spilling occurs and during this time there are greater amounts of trash and debris in the river. Spilling is performed as necessary to get rid of the trash buildup. The units are shut down when the headwater level drops to 499 feet or when the power output falls below 12 MW to prevent cavitation. The three units can generate in overload at the same time for only one or two hours, since the tailwater level rises quickly.

Synchronous condensing is performed less frequently than in the past, generally only late in the summer for voltage control.

Plant Characteristics	
Generators / Turbines	
Generator Information	Manufacturer: General Electric Rating: 96.7 MW - 2 units: 33.3 MW - Unit 2: derated to 30 MW
Turbine Runner Rating	Manufacturer: Baldwin Lima Hamilton Type: Kaplan Rating: 58,200 HP at 44 ft head, 65.5 rpm Diameter of Runner: 290 in.
Percent of LRN Capacity	10.8%
Excitation System	
Main	280 kW, 250 V
Transformers	
General Information	Manufacturer: Legnano Electric Number: 3 Type: Three phase forced oil and water cooled Rating: 13.2/161 kV, 42,700 kVA
Governors	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Generation (MWh)	543,060
Peak Availability	
Factor (%)	99.3%
Forced Outages	
Total No.	9
Hours Unavailable	103
Factor (%)	.39%
Scheduled Outages	
Hours Unavailable	1424
Factor (%)	5.4%
Availability	
Yearly Hours	26,280
Hours Available	24,754
Factor (%)	94.1%

Cordell Hull Power Plant Development Plan

13.2.1 Component Condition and Operating Constraints

The units at Cordell Hull are original, having operated for 45 years. The generator circuit breakers were replaced in 2013. All other main powertrain components at this power plant such as exciters, governors, and transformers are original. There is currently an effort underway to replace the excitation system on each of the units.

In 2015, Unit 2 experienced issues with the hub of the turbine runner. Oil was being lost from around one of the blades of the runner. After further investigation, it was determined that the blade trunnion wear ring on that particular blade was cracked. Since the replacement of the wear ring requires a full unit and turbine runner disassembly, a temporary repair was made to the runner by removing the wear ring and installing a modified seal on that blade. Kaplan operation on that unit is now normally disabled except for times of the year when it is necessary to make one-time changes to the blade angle due to changing heads. While this repair has kept the unit operational since that time, the repair was not meant to be permanent. Turbine runner has experienced noticeably more cavitation damage since this repair was made due to the inability to have optimized blade angles at all times. This issue will ultimately be resolved with the upcoming Turbine/Generator rehab.

In May 2020, Unit #2 experienced its 5th coil failure since the unit was commissioned. After performing calculations to evaluate the effects on the unit from having these coils bypassed, it was determined that the unit should be derated to 35MVA to minimize the potential of additional failures from excessive heating of the winding due to circulating currents. HDC noted that, with five coils failed and bypassed in the machine, a rewind likely should be considered sooner rather than later.

Power Train Conditions								
Unit	Circuit Breakers	Exciters	Generator Rotor	Generator Stator	Governors	Turbines	Transformer Equip#	Transformer
Unit 1	8	2.1	5.2	1.6	3.3	1	MPT-1	7.9
Unit 2	8	2.1	5.2	1.6	3.3	4.3	MPT-2	7.9
Unit 3	8	2.1	5.2	1.6	3.3	4.0	MPT-3	7.9

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

13.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a twenty-year period.

Ongoing Projects				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Awarded FY**
SYS06.04	Cordell Hull	Excitation	$6,625,000	20
PGM01.106	Cordell Hull	HRAR	$650,000	22

Medium Range Projects (FY23 - FY30)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
COR22	Cordell Hull	Powerhouse Crane	$5,900,000	26
COR02	Cordell Hull	Turbine/Generator	$175,000,000	29

Long Range Projects (FY31 to FY41)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
SYS07.03	Cordell Hull	Governor	$2,850,000	34
COR15	Cordell Hull	Oil Circuit Breakers (OCBs)	$8,800,000	37
SYS14.05	Cordell Hull	Station Service Power Systems	$14,100,000	39
SYS13.08	Cordell Hull	DC / Preferred AC System	$3,500,000	40
SYS05.03	Cordell Hull	Main Power Transformer	$25,650,000	40

Appropriated Funding Projects				
Rank	**Project**	**Identifier**	**WBS**	**ROM (FY21 estimate)**
1	Cordell Hull	Centralized Control	COR.18	$1,200,000
4	Cordell Hull	Oil Systems	COR.33	$283,592
7	Cordell Hull	Intake Gantry Crane	COR.01	$11,371,109
15	Cordell Hull	HVAC	COR.21	$3,129,823
29	Cordell Hull	Intake Gates	COR.16	$6,589,520
31	Cordell Hull	Drainage & Unwatering System	COR.38	$789,163
33	Cordell Hull	Cooling Water System	COR.17.01	$2,758,247
38	Cordell Hull	Compressed Air Systems	COR.24	$152,841
39	Cordell Hull	Powerhouse Elevator	COR.42	$832,780
40	Cordell Hull	Unit #2 Repair	COR.09	$18,447,313
47	Cordell Hull	Taildeck/Draft Tube Crane	COR.01	$2,244,163
58	Cordell Hull	Communication System	COR.40	$132,203
59	Cordell Hull	Control Cables	COR.35	$1,131,615
66	Cordell Hull	Switchyard Equipment	COR.15	$5,536,721
77	Cordell Hull	Oil Circuit Breakers (OCBs)	COR.34	$6,388,981
82	Cordell Hull	Powerhouse Crane	COR.22	$5,630,135
87	Cordell Hull	Unit Control Systems	COR.08	$151,134
115	Cordell Hull	Main Power Transformer	COR.05	$17,261,486
122	Cordell Hull	Intake Bulkheads	COR.44	$165,962
125	Cordell Hull	Medium Voltage Cables & Busses	COR.04	$2,558,825
130	Cordell Hull	Intake Trash Racks	COR.36	$4,814,127
133	Cordell Hull	Waste Water System	COR.41	$1,101,074
140	Cordell Hull	Fire Suppression System	COR.11	$120,184
151	Cordell Hull	Draft Tube Gates & Slot Fillers	BAR.43	$327,831
152	Cordell Hull	Powerhouse Roof	COR.37	$2,080,339
192	Cordell Hull	Emergency Diesel Generator	COR.20	$235,394

Cordell Hull Power Plant Development Plan

13.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Cordell Hull Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	PGM01.106	Cordell Hull	HRAR	$650,000					PL	PL	PL	PL	PL	PL										
N/A	SYS06.04	Cordell Hull	Excitation	$6,625,000	A	A	C	C	C	C	C	///	///	CMP										
11	COR22	Cordell Hull	Powerhouse Crane	$5,900,000																			D	D

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Dale Hollow Power Plant Development Plan

14. Dale Hollow Power Plant Development Plan

14.1 Overview

Dale Hollow Dam is located on the Obey River, 7.3 miles above its confluence with the Cumberland River (mile 380.9) in Clay County, Tennessee, about three miles east of Celina, Tennessee. The dam is a gravity type concrete structure comprised of a spillway, right and left bank non-overflow, and power intake sections. The powerhouse accommodates three main hydroelectric power units and one station service unit. The concrete dam is 1,717 feet long and 200 feet in height. There are six spillway gates with a discharge capacity of 166,000 cfs and four sluice gates with a discharge capacity of 6,200 cfs. Minimum pool is at elevation 631, and full pool for flood regulation is at elevation 663 feet.

Dale Hollow Power Plant Development Plan

14.2 Hydropower

Dale Hollow Power Plant houses three identical units that were commissioned between 1948 and 1953 (Units 1 and 2 in 1948-49 and Unit 3 in 1953).

TVA is the entity in charge of dispatching for this plant. Five 69 kV lines feed the distribution system directly. It is the main power source for the five neighboring towns and its reliability is of utmost importance. Dale Hollow is remotely operated from Cordell Hull. Dale Hollow has the third smallest plant capacity of the Nashville District hydroelectric plants.

The 0.75 kW house unit has a discharge capacity of approximately 100 cfs. An opportunity exists to upgrade the house unit, which would provide the required constant flow of 25 cfs to the fish hatchery downstream as well as improve the condition of the house unit.

Hazardous materials were used during the plant's construction. Most of the cable trays contain asbestos. There is asbestos in wiring and insulation, and there is PCB (polychlorinated biphenyl) in instrument transformers and HV equipment bushings. This issue should be considered during any planned upgrades.

The units at Dale Hollow are original, having operated for approximately 70 years.

Plant Characteristics	
Generators / Turbines	
Generator Information	Manufacturer: Westinghouse Rating: 54W • 3 units: 18 MW
Turbine Runner Rating	Manufacturer: S. Morgan Smith Type: Francis Rating: 25,000 HP at 140 ft head, 163.6 rpm Diameter of Runner: 111 in.
Percent of LRN Capacity	5.9%
Excitation System	
Main Pilot	150 kW, 250 V 5 kW, 250 V
Transformers	
General Information	Manufacturer: General Electric Number: 3 Type: Three phase self and forced air cooled Rating: 13.2/69 kV, 18,000 kVA self-cooled, 24,000 kVA forced air cooled
Governors	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Generation (MWh)	210,818
Peak Availability	
Factor (%)	99.99%
Forced Outages	
Total No.	3
Hours Unavailable	8
Factor (%)	.03%
Scheduled Outages	
Hours Unavailable	457
Factor (%)	1.74%
Availability	
Yearly Hours	26,280
Hours Available	25,815
Factor (%)	98.2%

14.2.1 Component Condition and Operating Constraints

So long as water quality operations do not impact the project's Congressionally authorized purposes, the Nashville District cooperates to the maximum extent practicable with state water quality standards. Accordingly, Dale Hollow monitors DO levels downstream.DO monitoring has been done since 2000. Air injection baffles were installed on the turbine runners of all units to help control this issue.

Power Train Conditions								
Unit	Circuit Breakers	Exciters	Generator Rotor	Generator Stator	Governors	Turbines	Transformer Equip#	Transformer
Unit 1	10	2.1	5.3	1.6	3	4	MPT-1	4.1
Unit 2	10	2.1	5.3	1.6	3	4	MPT-2	4.1
Unit 3	10	2.1	5.3	1.6	3	4	MPT-3	4.1

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

Dale Hollow Power Plant Development Plan

14.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a 20-year period.

Ongoing Projects

WBS Code	Power Plant	Project Title	Program Amount	Awarded FY
SYS16.4	Dale Hollow	Head Gate Machinery	$3,585,000	18
DAL.18	Dale Hollow	SCADA	$800,000	18
DAL.35.1	Dale Hollow	Power Service Cable Trays	$400,000	20

Medium Range Projects (FY23 - FY30)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS06.11	Dale Hollow	Excitation	$6,550,000	27
SYS05.08	Dale Hollow	Main Power Transformer	$13,950,000	30
DAL04	Dale Hollow	Medium Voltage Cables & Busses	$4,750,000	30

Long Range Projects (FY31 to FY41)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
DAL22	Dale Hollow	Powerhouse Crane	$2,900,000	32
DAL02	Dale Hollow	Turbine/Generator + Penstocks/Water Passages	$125,000,000	36
SYS13.07	Dale Hollow	DC / Preferred AC System	$5,850,000	35
SYS07.10	Dale Hollow	Governor	$2,950,000	37
SYS14.06	Dale Hollow	Station Service Power Systems	$6,250,000	40

Appropriated Funding Projects

Rank	Project	Identifier	WBS	ROM (FY21 estimate)
5	Dale Hollow	Cooling Water System	DAL.17.01	$3,585,721
21	Dale Hollow	Control Cables	DAL.35	$1,180,595
22	Dale Hollow	HVAC	DAL.21	$3,129,823
32	Dale Hollow	Station Service Generator	DAL.20	$2,156,057
34	Dale Hollow	Switchyard Equipment	DAL.15	$5,275,460
35	Dale Hollow	Communication System	DAL.40	$132,203
37	Dale Hollow	Intake Gates	DAL.16	$795,262
55	Dale Hollow	Unit Control Systems	DAL.08	$151,134
107	Dale Hollow	Station Service Power Systems	DAL.14	$6,787,093
134	Dale Hollow	Intake Bulkheads	DAL.44	$130,184
135	Dale Hollow	Waste Water System	DAL.41	$846,980
141	Dale Hollow	Compressed Air Systems	DAL.24	$152,841
157	Dale Hollow	Intake Trash Racks	DAL.36	$2,005,886
158	Dale Hollow	Taildeck/Draft Tube Crane	DAL.01	$1,318,835
167	Dale Hollow	Fire Suppression System	DAL.11	$120,184
169	Dale Hollow	Oil Circuit Breakers (OCBs)	DAL.34	$13,071,748
177	Dale Hollow	Oil Systems	DAL.33	$283,592
179	Dale Hollow	Draft Tube Gates	DAL.43	$312,771
193	Dale Hollow	Drainage & Unwatering System	DAL.38	$789,163
194	Dale Hollow	Powerhouse Elevator	DAL.42	$854,133
195	Dale Hollow	Powerhouse Roof	DAL.37	$1,643,731

14.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Dale Hollow Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	SYS16.4	Dale Hollow	Head Gate Machinery	$3,585,000	C	C	///	CMP																
N/A	DAL.18	Dale Hollow	SCADA	$800,000	C	C	C	C	C	C	C	C	C	C	///	C	CMP							
N/A	DAL.35.1	Dale Hollow	Power Service Cable Tray Replacement	$473,000	C	CMP																		
18	SYS06.11	Dale Hollow	Excitation	$6,550,000																			D	D

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

J. Percy Priest Power Plant Development Plan

15. J. Percy Priest Power Plant Development Plan

15.1 Overview

The J. Percy Priest project is located in Davidson County, Tennessee on the Stones River, 6.8 river miles above its confluence with the Cumberland River. It is situated approximately 14 miles above the capital city of Nashville. The dam is a combination rolled earthen-fill and concrete gravity dam with a maximum height of 130 feet above streambed and controls a drainage area of 892 square miles. The total crest length of the dam is 2,716 feet, with 664 feet of this being the concrete dam. It was commissioned in 1969 and the original authorized purposes of the project are flood control, recreation and power generation. The lake is one of the major recreation destinations in the Nashville area.

J. Percy Priest Power Plant Development Plan

15.2 Hydropower

J. Percy Priest Dam is located at mile 6.8 on the Stones River, a tributary of the Cumberland River. This single unit plant is used for peaking power or more if there is water available. It is remotely operated from Old Hickory and TVA performs the dispatching.

This is the Nashville District's smallest capacity hydroelectric plant in the Cumberland River basin and its average annual generation of 70 GWhrs is the second lowest next to Laurel. The lake is shallow and to maintain adequate lake levels in the summer the plant is operated minimally during the summer in drier years.

The plant does not have synchronous condensing capabilities, and there is not enough room in the powerhouse to install the required equipment.

Due to a high concentration of sulfur and magnesium in the water column, and the drastic stratification in the summer, the unit at JPP is rarely operated in the summer months (May-Oct) and all water is typically passed through the spillway gates and/or the fixed cone valve.

Except for the generator at JPP which was rewound in 1997, the unit is original, having operated for 48 years.

Plant Characteristics	
Generator / Turbine	
Generator Information	Manufacturer: Allis Chalmers Rating: 28MW - 1 unit: 28 MW
Turbine Runner Rating	Manufacturer: Allis Chalmers Type: Fixed Blade Propeller Rating: 42,700 HP at 78 ft head, 128.6 rpm Diameter of Runner: 180 in.
Percent of LRN Capacity	3%
Excitation System	
Main	200 kW, 250 V
Transformer	
General Information	Manufacturer: Westinghouse Number: 1 Type: Three phase forced air cooled Rating: 13.2/69 kV, 36,000 kVA
Governor	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Net Generation (MWh)	91,081
Peak Availability	
Factor (%)	100%
Forced Outages	
Total No.	6
Hours Unavailable	83
Factor (%)	.95%
Scheduled Outages	
Hours Unavailable	0
Factor (%)	0%
Availability	
Yearly Hours	8,760
Hours Available	8,676
Factor (%)	99.0%

J. Percy Priest Power Plant Development Plan

15.2.1 Component Condition and Operating Constraints

The Stones River water contains sulfur and magnesium which causes complaints from downstream stakeholders due to the strong odor produced. When JPP is operating, at least one unit must be in operation at Old Hickory to mix the JPP outflow and Cumberland River water to control the magnesium levels.

In 1985 water mixing pumps were installed to help bring the DO levels up, but the pumps kept breaking loose and were soon taken out of service due to a poor pump anchorage design. A fixed cone valve has since been installed to improve DO levels downstream of the dam.

Hazardous materials were used during the plant's construction. Some of them have been abated, but there is still asbestos insulation on the cooling water system and the service water piping. Asbestos is also present in the resistor banks for the exciter and powerhouse crane and some of the wiring insulation. No PCB (polychlorinated biphenyl) was reported. This issue should be considered during any planned upgrades.

Power Train Conditions								
Unit	Circuit Breaker	Exciter	Generator Rotor	Generator Stator	Governor	Turbine	Transformer Equip#	Transformer
Unit 1	10	4.2	6	6.5	6.1	6.0	MPT-1	4.9

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

J. Percy Priest Power Plant Development Plan

15.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a 20-year period.

Ongoing Projects				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Awarded FY**
JPP.18	J. Percy Priest	SCADA	$500,000	18
JPP.14.1	J. Percy Priest	Arc Flash Mitigation	$473,000	20

Medium Range Projects (FY23 - FY30)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
SYS13.04	J. Percy Priest	DC / Preferred AC System	$2,750,000	26
SYS06.08	J. Percy Priest	Excitation	$3,650,000	29

Long Range Projects (FY31 to FY41)				
WBS Code	**Power Plant**	**Project Title**	**Program Amount**	**Award FY**
SYS05.10	J. Percy Priest	Main Power Transformer	$6,050,000	36
JPP22	J. Percy Priest	Powerhouse Crane	$3,400,000	38
JPP02	J. Percy Priest	Turbine/Generator + Penstocks/Water Passages	$50,000,000	39
SYS07.07	J. Percy Priest	Governor	$2,100,000	40
JPP16	J. Percy Priest	Head Gate Machinery	$2,350,000	40

Appropriated Funding Projects				
Rank	**Project**	**Identifier**	**WBS**	**ROM (FY21 estimate)**
42	J. Percy Priest	Unit Control Systems	JPP.08	$151,134
45	J. Percy Priest	Station Service Power Systems	JPP.14	$533,596
53	J. Percy Priest	Compressed Air Systems	JPP.24	$152,841
60	J. Percy Priest	Control Cables	JPP.35	$1,160,189
76	J. Percy Priest	Switchyard Equipment	JPP.15	$2,783,684
81	J. Percy Priest	Oil Systems	JPP.33	$283,592
83	J. Percy Priest	Drainage & Unwatering System	JPP.38	$789,163
86	J. Percy Priest	Intake Gates	JPP.16	$962,626
94	J. Percy Priest	Waste Water System	JPP.41	$366,367
104	J. Percy Priest	Governor	JPP.07	$387,995
108	J. Percy Priest	HVAC	JPP.21	$2,638,632
118	J. Percy Priest	Cooling Water System	JPP.17.01	$3,585,721
126	J. Percy Priest	Head Gate Machinery	JPP.01	$1,678,968
139	J. Percy Priest	Powerhouse Roof	JPP.37	$1,793,543
143	J. Percy Priest	Communication System	JPP.40	$132,203
147	J. Percy Priest	Fire Suppression System	JPP.11	$120,184
150	J. Percy Priest	Intake Trash Racks	JPP.36	$1,604,709
159	J. Percy Priest	Powerhouse Crane	JPP.22	$2,156,616
164	J. Percy Priest	Penstocks/Water Passages	JPP.10	$1,229,788
171	J. Percy Priest	Intake Bulkheads	JPP.44	$276,104
180	J. Percy Priest	Draft Tube Gates	JPP.43	$932,355

J. Percy Priest Power Plant Development Plan

15.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

J. Percy Priest Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	JPP.18	J. Percy Priest	SCADA	$500,000	C	C	C	C	C	C	C	C	C	C	///	C	CMP							
N/A	JPP.14.1	J. Percy Priest	Arc Flash Mitigation	$400,000	C	C	C	///	CMP															
13	SYS13.04	J. Percy Priest	DC / Preferred AC System	$2,750,000																			D	D

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Laurel Power Plant Development Plan

16. Laurel Power Plant Development Plan

16.1 Overview

Laurel Dam is located on the Laurel River, 2.3 miles above its confluence with the Cumberland River, and 21 river miles west of Corbin, Kentucky. It lies on the border of Laurel and Whitley Counties in Eastern Kentucky. The project is an integral unit of the coordinated plan for development of the water resources of the Cumberland River Basin, providing flood control, power, and recreation.

The reservoir was impounded between September 1973 and July 1974. Laurel Dam is a compacted rockfill structure with a central impervious core and is approximately 1420 feet long and 300 feet high. The sandstone for the rockfill and clay for the core were obtained from areas very near the dam site. The axis of the structure is arched upstream. The crest width is 40 feet, and with the opening of the 1988 spillway bridge, provides for access of a state highway. The upstream and downstream slopes of the dam are 1V and 2H except below the upstream berm at elevation 870, which is 1V to 2.5H. The bottom width of the embankment at its maximum height is 1730 feet. The 17-foot diameter concrete lined penstock runs through the right abutment and was used for diversion during construction of the embankment. This was converted to power usage for the one unit, 61MW capacity power plant immediately downstream of the dam. The 750 foot long, uncontrolled spillway on the left bank discharges into a natural side channel.

Construction of the project was divided into four major contracts. The first, involving construction of the portals and tunnels, started April 1966 and was completed in 1967. The second, consisting of foundation excavation, began in March 1968 and was completed in June 1969. The third, encompassing foundation treatment and construction of the embankment, spillway and power intake structure began in August 1969 and was completed in September 1972. The final contractor was awarded in June 1973 for the construction of the powerhouse. It was completed in January 1978. The pool of record at Laurel occurred in March 1975, when the upper pool elevation reached 1022.47.

Laurel Power Plant Development Plan

16.2 Hydropower

The Laurel Project is located on the Laurel River in Laurel County, KY, 2.3 miles above its confluence with Cumberland River. The lake was impounded in 1974 and the plant was commissioned in 1977. The power produced at the site is delivered to Eastern Kentucky Power Co. Operation is controlled remotely from Wolf Creek via SCADA. The plant normally operates in peaking mode.

Plant Characteristics	
Generator / Turbine	
Generator Information	Manufacturer: General Electric Rating: 61MW - 1 unit: 61 MW
Turbine Runner Rating	Manufacturer: Allis Chalmers Type: Francis Rating: 98,000 HP at 237 ft head, 144 rpm Diameter of Runner: 155 in.
Percent of LRN Capacity	6.6%
Excitation System	
Static	245 kW, 250V
Transformer	
General Information	Manufacturer: General Electric Number: 1 Type: Three phase self-cooled and forced air cooled Rating: 13.2/161 kV, 58,500/78,000/87,300 kVA
Governor	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Generation (MWh)	128,944
Peak Availability	
Factor (%)	99.9%
Forced Outages	
Total No.	4
Hours Unavailable	39
Factor (%)	.44%
Scheduled Outages	
Hours Unavailable	192
Factor (%)	2.2%
Availability	
Yearly Hours	8,760
Hours Available	8,529
Factor (%)	97.4%

16.2.1 Component Condition and Operating Constraints

In 2004, the main generator at Laurel Power Plant was removed from service at 0700 hours for a complete inspection. As the top and bottom covers over the stator and field poles were removed for cleaning and inspection a piece of metal originating from a field pole lamination was found. Upon further inspection, a total of four pole laminations were broken and several were loose on both the top and bottom. The chosen repair for this issue was to weld the pole laminations in place to prevent further damage to the poles. In addition to the damage to the field poles, the stator frame foundation's second concrete placement was found to be significantly damaged. Observation of the operation of the unit had shown that below 45MW the unit was experiencing significant vibration during operation. In order to prevent further damage to the unit, the minimum loading was increased from 35MW to 45MW. Since that time, the unit has been monitored closely including the Turbine/Generator assessment that was completed by MWH in 2012. No further damage of significance has been observed since the increase to the minimum loading of the unit.

Power Train Conditions								
Unit	Circuit Breaker	Exciter	Generator Rotor	Generator Stator	Governor	Turbine	Transformer Equip#	Transformer
Unit 1	10	2.1	5.3	2.8	7.3	5.0	MPT-1	7.7

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

Laurel Power Plant Development Plan

16.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a 20-year period.

Ongoing Projects

WBS Code	Power Plant	Project Title	Program Amount	Awarded FY
LAU.18	Laurel	SCADA	$500,000	18

Medium Range Projects (FY23 - FY30)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS06.07	Laurel	Excitation	$3,100,000	27

Long Range Projects (FY31 to FY41)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS05.04	Laurel	Main Power Transformer	$6,750,000	31
LAU22	Laurel	Powerhouse Crane	$6,950,000	35
LAU02	Laurel	Turbine/Generator + Penstocks/Water Passages	$50,000,000	39
SYS07.06	Laurel	Governor	$2,050,000	40
LAU16	Laurel	Head Gate Machinery	$3,300,000	40
SYS13.09	Laurel	DC / Preferred AC System	$2,550,000	41

Appropriated Funding Projects

Rank	Project	Identifier	WBS	ROM (FY21 estimate)
28	Laurel	Communication System	LAU.40	$132,203
43	Laurel	Waste Water System	LAU.41	$366,367
51	Laurel	Security System	LAU.45	$701,836
57	Laurel	Station Service Power Systems	LAU.14	$404,539
70	Laurel	Switchyard Equipment	LAU.15	$3,834,506
73	Laurel	Cooling Water System	LAU.17.01	$1,195,240
74	Laurel	Unit Control Systems	LAU.08	$151,134
105	Laurel	Governor	LAU.07	$387,995
106	Laurel	Control Cables	LAU.35	$1,160,189
112	Laurel	Oil Circuit Breakers (OCBs)	LAU.34	$4,083,870
116	Laurel	Head Gate Machinery	LAU.01	$1,678,968
123	Laurel	Oil Systems	LAU.33	$283,592
127	Laurel	DC / Preferred AC System	LAU.13	$1,651,441
136	Laurel	Drainage & Unwatering System	LAU.38	$789,163
137	Laurel	HVAC	LAU.21	$1,043,274
148	Laurel	Compressed Air Systems	LAU.24	$152,841
155	Laurel	Intake Gates	LAU.16	$364,964
156	Laurel	Intake Trash Racks	LAU.36	$1,337,257
166	Laurel	Fire Suppression System	LAU.11	$120,184
181	Laurel	Draft Tube Gates	LAU.43	$443,836
182	Laurel	Intake Bulkheads	LAU.44	$61,454
183	Laurel	Powerhouse Roof	LAU.37	$821,044

16.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Laurel Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	LAU.18	Laurel	SCADA	$500,000	C	C	C	C	C	C	C	C	C	C	C	///	CMP							
16	SYS06.07	Laurel	Excitation	$3,100,000																				D

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Old Hickory Power Plant Development Plan

17. Old Hickory Power Plant Development Plan

17.1 Overview

The Old Hickory Project is located in Sumner and Davidson Counties northeast of Nashville, Tennessee. The dam is a combination concrete gravity and rolled earthen-fill structure. The concrete dam consists of a spillway section adjacent to the powerhouse and a concrete portion built into the right abutment. The powerhouse houses four hydroelectric power units. The lock consists of a concrete chamber with upper and lower guide and guard walls and is between the spillway and left earthen embankment. The Old Hickory Project is operated for navigation, generation of hydroelectric power, and recreation. Under normal operation, the pool varies between elevations 442 and 445. Surcharge storage, for use only during the occurrence of a flood to compensate for loss in natural valley storage, is held between elevations 445 and 450. The earthen embankment section is approximately 2,800 linear feet of impervious rolled earthen-fill topped with a bituminous roadway surface 35 feet wide. The embankment terminates at a junction with the lock land wall at the operation building.

The lock consists of a concrete lock chamber 84 feet wide and 400 feet long with a 60-foot lift. Concrete upper and lower guide and guard walls, upper and lower lock miter gates, hydraulic operating system, lock lighting and grounding system, brick control shelters and galleries complete the lock. A concrete spillway portion of the dam is about 350 feet long and includes a conventional ogee section and stilling basin. It is topped with 6 tainter gates, 41 by 45 feet each, and a service bridge.

Construction of the lock and dam began in January 1952 and was completed in May 1954. Construction of the power plant began in March 1954 and was completed in May 1958.

Old Hickory Power Plant Development Plan

17.2 Hydropower

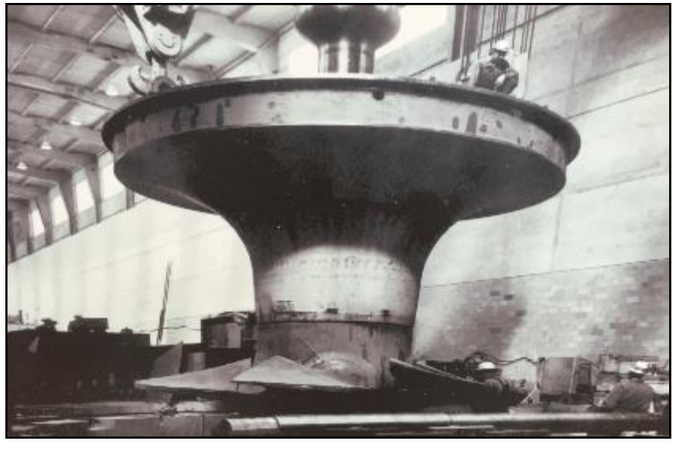
Old Hickory Power Plant is located in Hendersonville, TN at river mile 216.2 on the Cumberland River. The power plant was commissioned in 1957. This four unit plant is a "run of the river" type with each of the units consisting of 25MW generators powered by adjustable blade, Kaplan turbines that are rated at 45,000 HP at full gate capacity when operating at the normal speed of 75 rpm at a normal head of 45 feet. At times when there's enough water available, the units at Old Hickory are often operated at beyond their rated load.

The power plant extends 380 feet from the end of the dam into the left bank. Accessory power plant equipment consists of two outdoor gantry cranes mounted on the intake and draft tube decks and used to operate the intake and draft tube gates and bulkheads, and an overhead traveling crane used in the installation and maintenance of the units.

JPP and Cheatham plants are remotely operated from Old Hickory and TVA performs the dispatching for this power plant.

Plant Characteristics	
Generators / Turbines	
Generator Information	Manufacturer: General Electric Rating: 100 MW - 4 units: 25MW (28.75 MW at 115% overload.
Turbine Runner Rating	Manufacturer: Baldwin-lima-Hamilton Type: Kaplan Rating: 45,000 HP at 45 ft head, 75 rpm Diameter of Runner: 264 in.
Percent of LRN Capacity	10.9%
Excitation System	
Main	300 kW, 250 V
Pilot	17 kW, 250 V
Transformers	
General Information	Manufacturer: Westinghouse Electric Number: 2 (1 for each pair of generators) Type: 3 phase OA/FA/FOA Rating: 13.2/69 kV, 43,200 self-cooled, 57,600 kVA forced air cooled, 72,000 kVA forced oil cooled
Governors	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Generation (MWh)	403,742
Peak Availability	
Factor (%)	48.2%
Forced Outages	
Total No.	5
Hours Unavailable	9,077
Factor (%)	25.9%
Scheduled Outages	
Hours Unavailable	9,005
Factor (%)	25.7%
Availability	
Yearly Hours	35,040
Hours Available	16,958
Factor (%)	48.4%



17.2.1 Component Condition and Operating Constraints

The Old Hickory powerhouse structural concrete has experienced movement since original construction and has caused misalignment of Unit 4 that is being addressed with the Unit 4 Rehabilitation contract that is currently ongoing.

As far back as 1968, there are reports that Unit 4 was misaligned. In 1968 this unit was plumbed and realigned by shimming the lower bearing bracket. The discharge ring was ground down in 1980 and again in 2009 to provide adequate running clearances to stop the runner from striking the discharge ring. In July 2013, the unit would not start, indicating another possible blade strike. After grinding the turbine discharge ring in 1980 and 2009, another startup failure in 2013 indicated that a more detailed investigation was warranted. Thus, prior to the rehabilitation of Unit 4, a structural investigation was performed and the results from the findings from that investigation were incorporated into the plans and specifications for that contract.

Continued issues with the runner contacting the discharge ring is evidence that attempting to fix this problem by grinding the liner was not effective. Because of this, the approach of the Unit 4 Rehabilitation contract has been to re-center the discharge ring to be concentric with the turbine guide bearing and the rest of the unit above it.

There has also been evidence from unit inspections that this movement has also caused misalignment issues with Units 2 and 3. Both of these units have experienced issues with the runner blade tip clearances that have necessitated the grinding of the discharge ring. It is anticipated that additional remediation will be required (much like what is being done on Unit 4) to address these issues with the other units in the power plant during the Turbine-Generator Rehabilitation contract.

Power Train Conditions						
Unit	Circuit Breakers	Exciters	Generator Rotor	Generator Stator	Governors	Turbines
Unit 1	10	2.1	5.8	3.7	6.1	3.5
Unit 2	10	2.1	5.8	3.2	6.1	3.0
Unit 3	10	2.1	5.8	3.2	6.1	2.3
Unit 4	10	2.1	5.8	1.6	6.1	0.7

Transformer Equip#	Transformer
MPT-1	7.7
MPT-2	7.7

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

Old Hickory Power Plant Development Plan

17.3 Capital Improvement Plan

The following tables identify capital improvement projects allowing systematic evaluation of all potential projects over a 20-year period.

Ongoing Projects

WBS Code	Power Plant	Project Title	Program Amount	Awarded FY
OLD02R	Old Hickory	Unit #4 Turbine/Generator Rehab	$25,000,000	17
SYS05.09	Old Hickory	Main Power Transformer	$11,830,000	20, 22
OLD.35	Old Hickory	Switchyard Control Cable & Conduit (Phase 1 Design))	$1,980,000	21
SYS06.09	Old Hickory	Excitation (Design)	$6,150,000	-
OLD02	Old Hickory	Turbine/Generator (Design)	$125,000,000	-

Short Range Projects (FY21 - FY22)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS05.09	Old Hickory	Main Power Transformer	$11,830,000	20, 22
OLD.35	Old Hickory	Switchyard Control Cable & Conduit (Phase 1)	$1,980,000	21
SYS06.09	Old Hickory	Excitation	$6,150,000	22
OLD02	Old Hickory	Turbine/Generator	$125,000,000	22

Medium Range Projects (FY23 - FY30)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
OLD02	Old Hickory	Turbine/Generator	$125,000,000	23
SYS14.04	Old Hickory	Station Service Power Systems	$11,000,000	27

Long Range Projects (FY31 to FY41)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS13.06	Old Hickory	DC / Preferred AC System	$3,800,000	34
SYS07.08	Old Hickory	Governor	$3,650,000	40
OLD04	Old Hickory	Medium Voltage Cables & Busses	$13,200,000	40

Appropriated Funding Projects

Rank	Project	Identifier	WBS	ROM (FY21 estimate)
2	Old Hickory	Centralized Control	OLD.18	$1,700,000
12	Old Hickory	Control Cables	OLD.35	$1,168,444
16	Old Hickory	Intake Gantry Crane	OLD.01	$14,916,924
26	Old Hickory	Switchyard Equipment	OLD.15	$7,709,206
27	Old Hickory	Oil Circuit Breakers (OCBs)	OLD.34	$8,998,393
44	Old Hickory	Drainage & Unwatering System	OLD.38	$789,163
54	Old Hickory	Unit Control Systems	OLD.08	$151,134
62	Old Hickory	Communication System	OLD.40	$132,203
64	Old Hickory	Oil Systems	OLD.33	$283,592
71	Old Hickory	Intake Gates	OLD.16	$6,051,893
72	Old Hickory	Powerhouse Elevator	OLD.42	$854,133
84	Old Hickory	Waste Water System	OLD.41	$1,468,099
88	Old Hickory	Intake Trash Racks	OLD.36	$4,814,126
95	Old Hickory	HVAC	OLD.21	$4,160,824
100	Old Hickory	Intake Bulkheads	OLD.44	$319,111
111	Old Hickory	Medium Voltage Cables & Busses	OLD.04	$8,751,327
124	Old Hickory	Taildeck/Draft Tube Crane	OLD.01	$1,294,710
138	Old Hickory	Powerhouse Crane	OLD.22	$4,746,741
146	Old Hickory	Fire Suppression System	OLD.11	$120,184
153	Old Hickory	Draft Tube Gates & Slot Fillers	OLD.43	$327,831
161	Old Hickory	Powerhouse Roof	OLD.37	$8,532,784
174	Old Hickory	Compressed Air Systems	OLD.24	$152,841

Old Hickory Power Plant Development Plan

17.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Old Hickory Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	OLD02R	Old Hickory	Unit #4 Turbine/Generator Rehab	$25,000,000	///	///	///	CMP	CMP															
N/A	SYS06.09	Old Hickory	Excitation	$6,150,000	D	D	D	D	A	C	C	C	C	C	///	///	///	CMP						
N/A	SYS05.09	Old Hickory	Main Power Transformer	$11,830,000	C	C	C	C	C	C	C	C	///	///	CMP									
N/A	OLD.35	Old Hickory	Control Cable & Conduit (Phase 1)	$1,980,000	D	C	A	A	C	C	///													
0	OLD02	Old Hickory	Turbine/Generator	$125,000,000	D	D	D	D	D	D	A	A	A	C	C	C	C	C	C	C	C	///	///	///
20	SYS14.04	Old Hickory	Station Service Power Systems	$11,000,000	PL																			
41	SYS13.06	Old Hickory	DC / Preferred AC System	$3,800,000	D																			

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Wolf Creek Power Plant Development Plan

18. Wolf Creek Power Plant Development Plan

18.1 Overview

Wolf Creek Dam is a high hazard potential dam located at river mile 460.9 on the Cumberland River in Russell County, Kentucky, approximately twelve miles north of Albany, Kentucky. The dam consists of an embankment, concrete gravity dam, spillway, hydropower plant, and outlet works. The embankment is a rolled earthfill structure 3,940 feet long, the top of which is 222 feet above the streambed. The top of the embankment width is 35 feet, and the base has a maximum width of 1,100 feet. The embankment contains 10,016,500 cubic yards of earth. The concrete gravity dam has a top length of 1,796 feet and consists of 1,380,000 cubic yards of concrete. The spillway is a controlled ogee type incorporated into the concrete gravity dam. The crest elevation is 723 feet, with a gross length of crest measuring 590 feet. The spillway is surmounted by 10 tainter gates 37 feet high by 50 feet wide with a top elevation of 760 feet when in the closed position. The design discharge is 553,000 cubic feet per second with a pool surcharge of 43.7 feet. The hydropower plant contains 6 hydropower turbines rated at 45MW each for a total capacity of 270MW. The outlet works consist of six gated sluices, 4 feet high by 6 feet wide with hydraulically operated slide gates in tandem. The discharge capacity with the pool at spillway crest is 9,800 cfs.

Wolf Creek Power Plant Development Plan

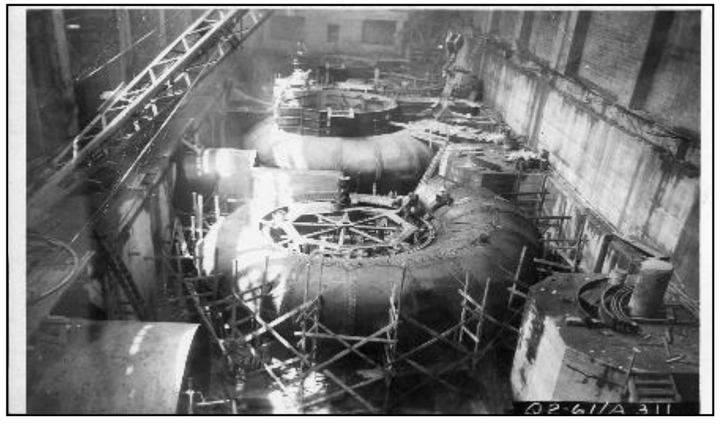
18.2 Hydropower

Hydropower production at Wolf Creek was authorized by the Flood Control Act of 1938 and the River and Harbor Act of 1946. Wolf Creek Power Plant was commissioned with six units from 1951 to 1952. This plant is located on the Cumberland River at river mile 460.9 near Jamestown, Ky.

Five of the six identical vertical Francis type generating units in the power plant are rated at 45 MW with the capability to operate continuously at 115% of the nameplate rating as the availability of water allows. Unit 3 has experienced enough coil failures to require a derate to a maximum output of 40 MW at unity power factor to limit the risk of further damage to the unit. See the following section for more information. The Plant is dispatched by TVA and remotely operates Laurel Power Plant. The switchyard feeds the Southeastern Power Grid.

Wolf Creek Power Plant is the highest energy generating plant and also has the largest installed capacity in the District.

Except for the Unit 4 and 6 generators, which were rewound in 2008, the units at Wolf Creek are original, having operated for 67 years.



Plant Characteristics	
Generators / Turbines	
Generator Information	Manufacturer: General Electric Rating: 270 MW - 5 units: 45MW (51.75 MW at 115% overload. 1 unit: 40MW Maximum
Turbine Runner Rating	Manufacturer: Baldwin-lima-Hamilton Type: Francis Rating: 62,500 HP at 160 ft head, 105.9 rpm Diameter of Runner: 175 in.
Percent of LRN Capacity	29.3%
Excitation System	
Main	290 kW, 250 V
Pilot	12 kW, 250 V
Transformers	
General Information	Manufacturer: Westinghouse Electric Number: 10 (1 for each pair of generators and a spare) Type: 1 phase OA/FA Rating: 13.2/173 kV, 30,000 self-cooled, 37,500 kVA forced air cooled.
Governors	
General Information	Manufacturer – Woodward Governor Type: Mechanical

Fiscal Year 2019 Performance	
Generation	
Generation (MWh)	1,343,148
Peak Availability	
Factor (%)	74.0%
Forced Outages	
Total No.	1
Hours Unavailable	4,396
Factor (%)	8.4%
Scheduled Outages	
Hours Unavailable	9,724
Factor (%)	18.5%
Availability	
Yearly Hours	52,560
Hours Available	38,442
Factor (%)	73.1%

18.2.1 Component Condition and Operating Constraints

So long as water quality operations do not impact the project's Congressionally authorized purposes, the Nashville District cooperates to the maximum extent practicable with state water quality standards. Accordingly, this plant monitors dissolved oxygen (DO) levels downstream. Low DO levels are mainly due to the deep location of the turbine water intakes in the lake. Currently, the plant deals with this issue by releasing water through one or two sluice gates located at the downstream toe of the dam, into a hydraulic jump (there are six sluice gates at the bottom of the spillway, but no more than two are used at one time). This oxygenates the river water but represents a significant loss of energy (the water flow released through one sluice gate is close to half of the rated discharge of one turbine).

In June 2020, Unit 3 at Wolf Creek experienced a differential relay operation. Upon inspection of the unit, B Phase Coils 352 and 357 as well as C Phase Coil 356 were damaged during the event. Repair work was completed with the failed coils being cut out by the Wolf Creek Power Plant maintenance staff. To date, four coils have been cut out of Unit 3 with three coils being cut out of B Phase (352, 357 and 358) and one coil being cut out of C Phase (356). Calculations were performed by the LRN Hydropower Section and HDC based on EPRI EL-4983 "Synchronous Machine Operation With Cutout Coils" along with the data from the original generator tests for Wolf Creek. Results of the calculations resulted in a derate to 40MVA (40 MW at 1.0 PF) to reduce the risk of additional failures prior to the rehabilitation of this unit.

Power Train Conditions						
Unit	Circuit Breakers	Exciters	Generator Rotor	Generator Stator	Governors	Turbines
Unit 1	10	1.7	4.5	1.6	6.1	3.8
Unit 2	10	1.7	2.6	1.6	6.1	3.8
Unit 3	10	1.7	2.6	1.6	6.1	3.8
Unit 4	10	1.7	2.6	10	6.1	3.8
Unit 5	10	1.7	2.6	1.6	6.1	3.8
Unit 6	10	1.7	2.6	10	6.1	3.8

HydroAMP Condition	
Rating Categories	Condition Index
Good	8-10
Fair	6-8
Marginal	3-6
Poor	0-3

Transformer Equip#	Transformer
MPT-1A	4.7
MPT-1B	4.7
MPT-1C	4.7
MPT-2A	4.7
MPT-2B	4.7
MPT-2C	4.7
MPT-3A	4.7
MPT-3B	4.7
MPT-3C	4.7
Spare MPT	-

Wolf Creek Power Plant Development Plan

18.3 Capital Improvement Plan

The following tables identify all capital improvement projects allowing systematic evaluation of all potential projects over a 20-year period.

Ongoing Projects

WBS Code	Power Plant	Project Title	Program Amount	Awarded FY
WOL02.1	Wolf Creek	HRAR	$1,380,000	15/20
SYS16.2	Wolf Creek	Head Gate Machinery	$7,850,000	18
WOL.46	Wolf Creek	Thrust Bearing High Pressure Lift	$2,150,000	18,19
WOL02.2	Wolf Creek	Dissolved Oxygen Investigation	$1,000,000	20
WOL.06.01	Wolf Creek	Unit #5 Exciter Refurbishment	$500,000	20
SYS05.05	Wolf Creek	Main Power Transformer (Design)	$16,200,000	-

Short Range Projects (FY21 - FY22)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
WOL.06.02	Wolf Creek	Unit #3 Exciter Refurbishment	$500,000	21
SYS13.03	Wolf Creek	DC / Preferred AC System	$4,100,000	22
SYS06.05	Wolf Creek	Excitation (Design)	$10,650,000	-

Medium Range Projects (FY23 - FY30)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS05.05	Wolf Creek	Main Power Transformer	$16,200,000	23
SYS06.05	Wolf Creek	Excitation	$10,650,000	23
WOL22	Wolf Creek	Powerhouse Crane	$3,200,000	23
WOL02	Wolf Creek	Turbine/Generator	$200,000,000	25
WOL04	Wolf Creek	Medium Voltage Cables & Busses	$13,300,000	25

Long Range Projects (FY31 to FY41)

WBS Code	Power Plant	Project Title	Program Amount	Award FY
SYS07.04	Wolf Creek	Governor	$4,650,000	40

Appropriated Funding Projects

Rank	Project	Identifier	WBS	ROM (FY21 estimate)
3	Wolf Creek	Centralized Control	WOL.18	$2,300,000
6	Wolf Creek	HVAC	WOL.21	$6,259,647
19	Wolf Creek	Taildeck/Draft Tube Crane	WOL.01	$1,714,485
23	Wolf Creek	Oil Systems	WOL.33	$283,592
50	Wolf Creek	Intake Bulkheads	WOL.44	$230,377
56	Wolf Creek	Station Service Generator	WOL.20	$2,156,057
63	Wolf Creek	Security System	WOL.45	$701,836
69	Wolf Creek	Drainage & Unwatering System	WOL.38	$607,048
92	Wolf Creek	Unit Control Systems	WOL.08	$151,134
96	Wolf Creek	Governor	WOL.07	$2,327,969
97	Wolf Creek	Switchyard Equipment	WOL.15	$9,915,102
101	Wolf Creek	Draft Tube Gates	WOL.43	$997,516
102	Wolf Creek	Powerhouse Roof	WOL.37	$4,377,668
103	Wolf Creek	Control Cables	WOL.35	$627,760
109	Wolf Creek	Cooling Water System	WOL.17.01	$3,875,233
113	Wolf Creek	Oil Circuit Breakers (OCBs)	WOL.34	$15,786,617
128	Wolf Creek	Intake Gates	WOL.16	$6,731,170
129	Wolf Creek	Intake Trash Racks	WOL.36	$8,023,545
144	Wolf Creek	Communication System	WOL.40	$132,203
154	Wolf Creek	Powerhouse Elevator	WOL.42	$1,665,560
162	Wolf Creek	Fire Suppression System	WOL.11	$120,184
173	Wolf Creek	Compressed Air Systems	WOL.24	$152,841
196	Wolf Creek	Waste Water System	WOL.41	$2,202,149

Wolf Creek Power Plant Development Plan

18.4 Five-Year Gantt Chart

The following table shows in detail the current execution strategy for the next five years. This is to be used for planning purposes and will change as the projects are executed.

Wolf Creek Five Year Gantt Chart					LT10						LT11						LT12						LT13	
					ST8		ST9		ST10		ST11		ST12		ST13		ST14		ST15		ST16		ST17	
Section 212 Rank	WBS Code	Power Plant	Project Title	Program Amount	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
						2021				2022				2023				2024				2025		
					FY21				FY22				FY23				FY24				FY25			
N/A	WOL02.1	Wolf Creek	HRAR	$1,380,000	PL	PL	PL	PL	PL	PL														
N/A	WOL02.2	Wolf Creek	Dissolved Oxygen Investigation	$1,000,000	D	D	D	D																
N/A	WOL02.1.5	Wolf Creek	Unit #5 Exciter Repair	$500,000	///	///	CMP																	
N/A	SYS16.2	Wolf Creek	Head Gate Machinery	$7,850,000	///	///	CMP																	
2	SYS05.05	Wolf Creek	Main Power Transformer	$16,200,000	D	D	D	D	D	D	D	D	A	A	C	C	C	C	C	C	C	C	///	///
4	SYS06.05	Wolf Creek	Excitation	$10,650,000					D	D	D	D	D	A	C	C	C	C	C	///	///	///	///	///
6	SYS13.03	Wolf Creek	DC / Preferred AC System	$4,100,000								A	C	C	C	///	CMP							
7	WOL22	Wolf Creek	Powerhouse Crane	$3,200,000							D	D	A	A	C	C	C	C	CMP					
8	WOL02	Wolf Creek	Turbine/Generator	$200,000,000							D	D	D	D	D	D	D	F	A	A	A	C	C	C
9	WOL04	Wolf Creek	Medium Voltage Cables & Busses	$13,300,000														D	D	D	D	A	C	C

Gantt Chart Legend			
PL	Planning	Q1	1st Quarter of Fiscal Year (Oct, Nov, Dec)
F	Funding	Q2	2nd Quarter of Fiscal Year (Jan, Feb, Mar)
D	Design	Q3	3rd Quarter of Fiscal Year (Apr, May, Jun)
A	Advertise/ Award	Q4	4th Quarter of Fiscal Year (Jul, Aug, Sep)
C	Construction		
///	Outage		
CMP	Closeout/Complete		

Appendix A: Section 212 Program Information

1. Section 212 Funding Process

1.1. Sub-Agreement Process

The following figure illustrates the process for Sub-Agreement development, review and approval.

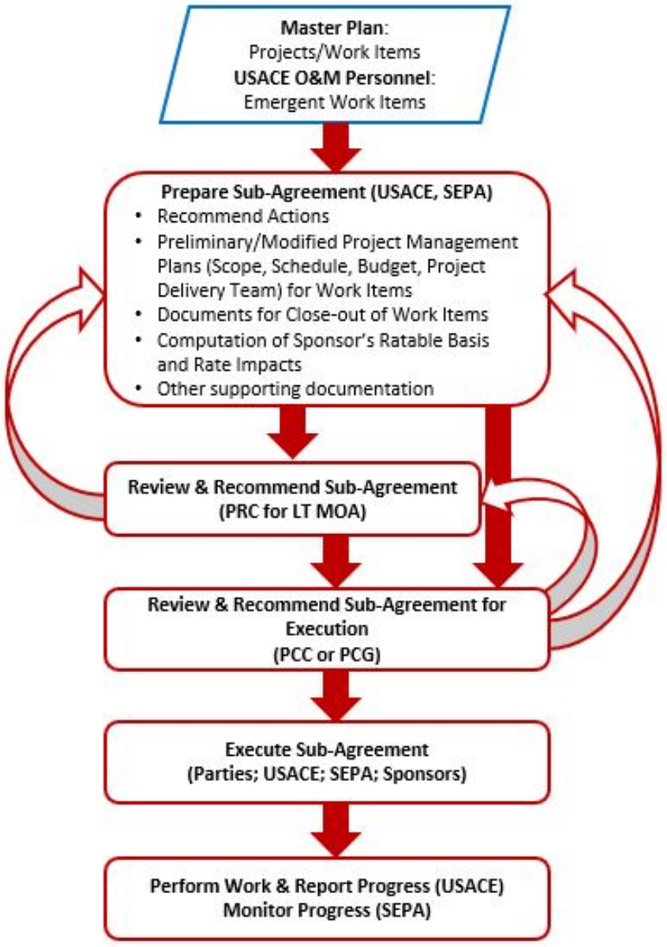


Figure 4: Sub-Agreement Process

1.2. Balloting Process

The following figure illustrates the process for Ballot development, review and approval.

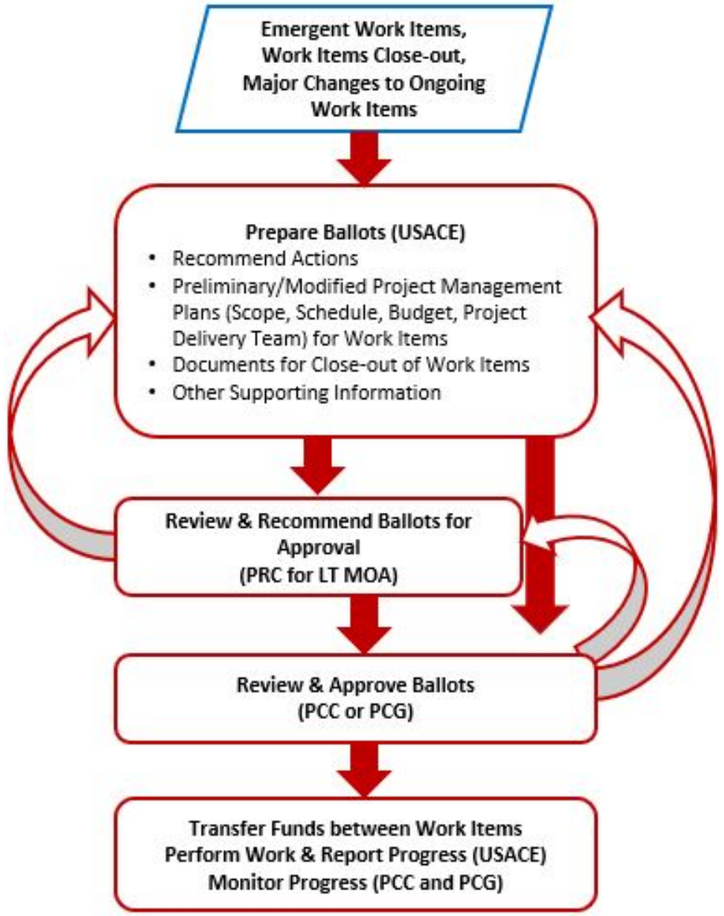


Figure 5: Balloting Process

1.3. Gateway and Document Approval Process

The following figure illustrates the process for development and approval of program and project gateways and program level documents.

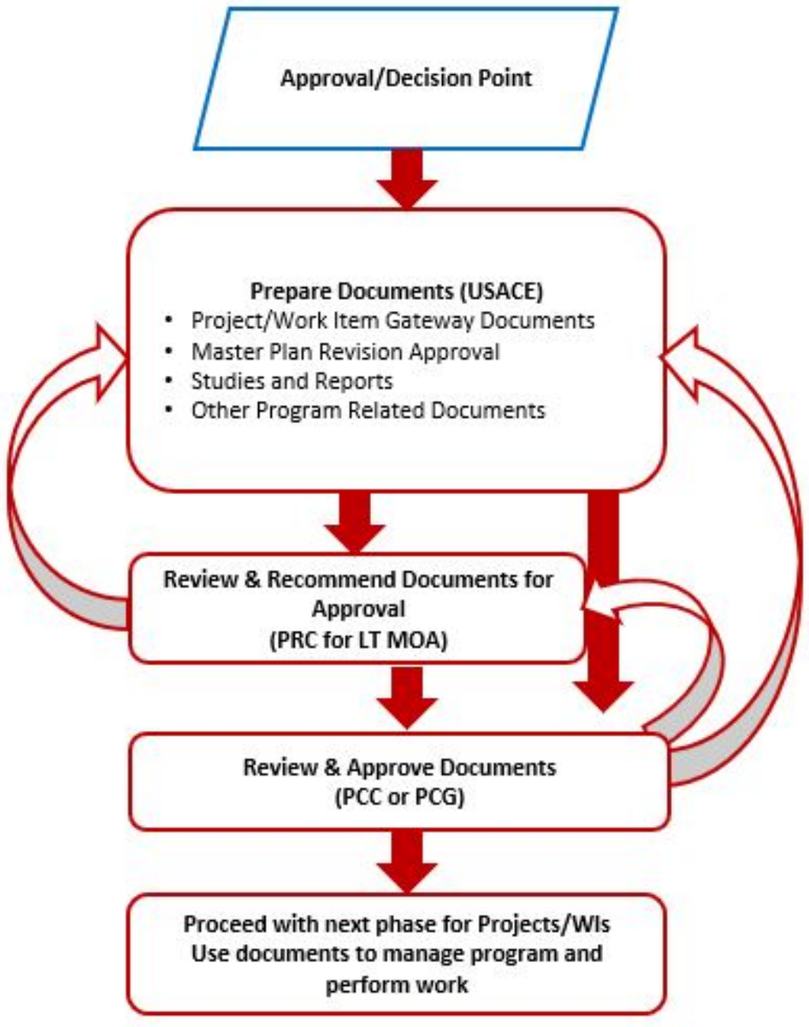


Figure 6: Gateway/Document Approval Process

Appendix A – Section 212 Program Information

2. Program Life Cycle

Figure 7 below shows the Program life cycle. The individual Project life cycles (Figure 10) begin with the creation of Project Management Plans (PMP) and fall between the Program Planning and Delivery of Program Benefits. Each Project is additionally broken down into Work Items. Each Work Item will be described (i.e., scope, milestones, schedule, and budget) in a Sub-Agreement and will be authorized individually.

As the Program moves forward, changes in revenue, cost, or other factors may alter the Program from the original plan. The Projects/Work Item approval process will control the flow of work according to these changing conditions to minimize risk. This cyclical and iterative process is represented by the green arrows in Figure 7, which connects Project delivery to the authorization of future Projects. Program closure marks the completion of all desired Projects. Program implementation and delivery will be managed by USACE and the status communicated to the PCC (Long Term MOA) and/or the PCG (Short Term MOA).

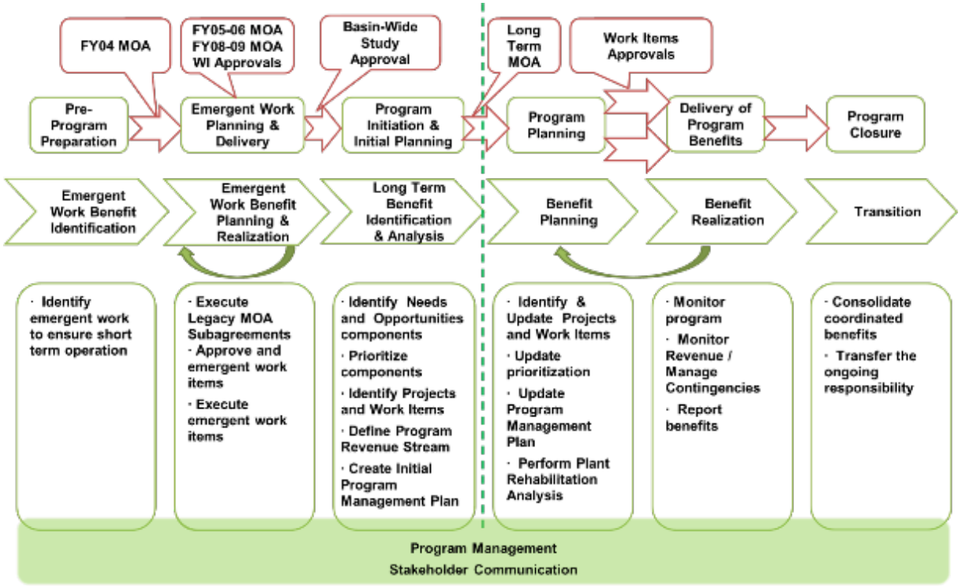


Figure 7: Recommended Program Life Cycle

3. Program Delivery Team

The Program Delivery Team will be made up of USACE Nashville District resources, and a shared resource pool including the USACE Hydroelectric Design Center and appropriate consulting services. The Section 212 Program Manager will provide Section 212 Program leadership to support the LRN Hydropower Rehabilitation Program.

The Section 212 Program Manager will be responsible for Program implementation, administration, and delivery, and for updating and maintaining the Master Plan in accordance with changes approved by the PCC or PCG and as described in the following sections. The organizational structure for the Program is shown below. This structure is dynamic and it will change based on the active projects.

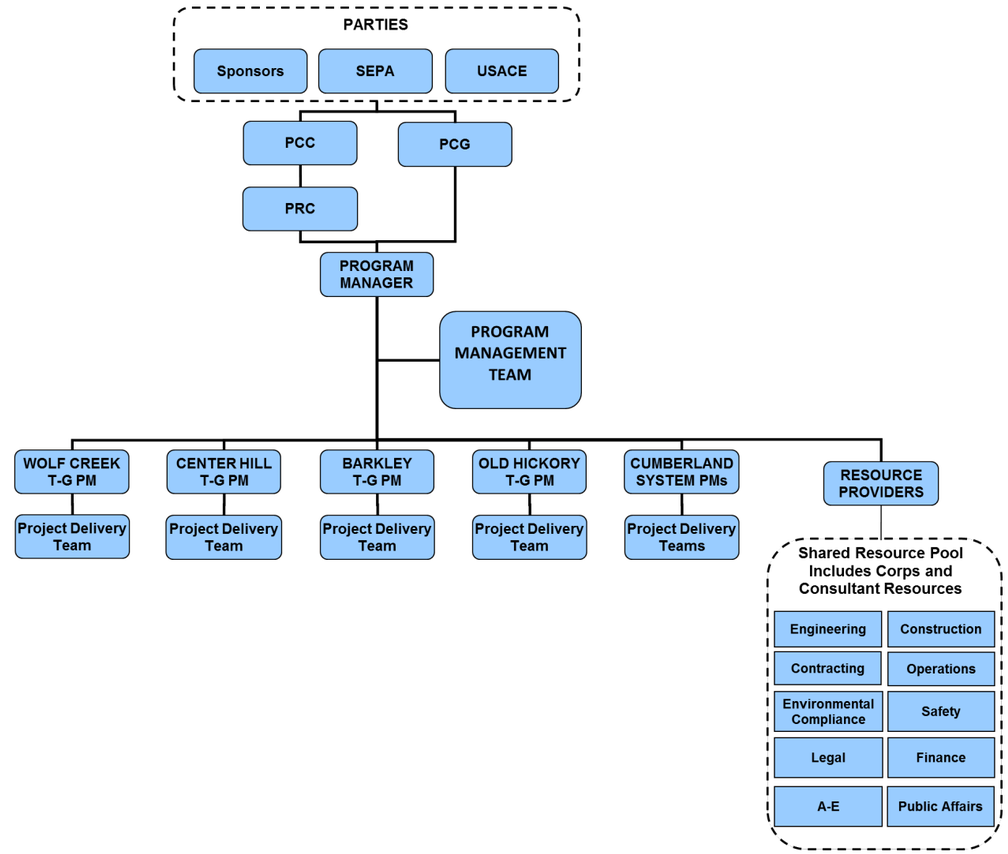


Figure 8: Organizational Structure

3.1. Roles and Responsibilities – Parties

The legal descriptions of the roles and responsibilities are defined in the governing MOA(s) and summarized here for information. If there are discrepancies between the governing MOA(s) and this document, the MOA(s) takes precedent.

3.1.1. Department of the Army

The Department of the Army (Army), through the Corps, shall meet with representatives of SEPA and of the Sponsors as members of the PCC, PCG and PRC to approve and prioritize Work Items to be funded by the Sponsors and to oversee progress and performance in completing such Work Items, all in accordance with the features of this Master Plan.

The Army, through the Corps, shall provide Work Item expenditure and placement in service projections to SEPA for purposes of rate impact analysis. The Corps shall include these estimates in each Sub-Agreement. The Corps shall update these estimates at other times as requested by the Sponsors or SEPA.

The Army, through the Corps, shall perform and complete Work Items as set out in Sub-Agreements. The Corps shall administer all funds advanced in accordance with Sub-Agreements and said funds shall be expended only on the Work Items as set out in accordance with Sub-Agreements and the terms of the governing MOA. Prior to the execution of any Sub-Agreement, the Corps shall provide SEPA with a Treasury account number into which the Corps may receive funds provided by the Sponsors to SEPA pursuant to the governing MOA. Prior to the execution of any Sub-Agreement, the Corps shall also provide SEPA with a Treasury account number into which the Corps may receive funds provided by the Sponsors to SEPA for deposit into the Reserve Fund pursuant to the governing MOA.

The Army, through the Corps, shall comply with all other obligations of the Corps as set forth in the applicable MOA(s) and Sub-Agreements.

The Army, through the Corps, shall cooperate with any advisors or consultants performing under contracts with SEPA in order to help assure that those advisors or consultants have access to the information from the Corps that is necessary for those advisors or consultants to provide effective assistance to the Sponsor representatives in carrying out their PCC or PCG responsibilities.

3.1.2. Southeastern Power Administration

SEPA, through its representatives on the PCC, PCG and the PRC, shall assist the Sponsors and the Corps in prioritizing the Work Items that the Corps will perform at the facilities to be funded by the Sponsors and overseeing the progress and performance of the Corps in completing said Work Items, all in accordance with the features of this Master Plan.

SEPA shall develop rate impacts based upon the Corps' Work Item expenditure and placement in service projections. Rate impacts will be provided to the Corps for inclusion in each Sub-Agreement or at other times as requested by the Sponsors or the Corps.

SEPA shall take appropriate action to provide credit to the Sponsors in the form of Section 212 Allowances for designated funds the Sponsors provide through payments for SEPA power that are to be applied by SEPA toward Work Item Funding Requirements or Reserve Fund obligations. All credits provided by SEPA pursuant to each MOA shall be pursuant to SEPA authorities.

SEPA shall ensure funds collected from billings are processed and deposited as determined by the U.S. Treasury.

At the end of each month on behalf of the Sponsors, SEPA shall cause to be transferred to the Corps all funds collected pursuant to the applicable MOA.

Upon requests from the Corps, SEPA shall provide the Corps with the current balance of all funds deposited on the Corps' behalf.

By not later than November 30 of each calendar year during the term of applicable MOAs, the Administrator of SEPA shall provide the Sponsors with an accounting report specifying the amounts and timing of all funds provided to the Corps under each MOA during the preceding Federal governmental fiscal year.

At the request of a majority of the Sponsor representatives on the PCC or PCG, SEPA shall assign a SEPA employee and/or contract with appropriate, qualified advisors or consultants to provide assistance to the Sponsor representatives in carrying out their responsibilities, in accordance with a scope of work and amounts of annual funding as developed and specified by the Sponsor representatives on the PCC or PCG. SEPA shall fund these services under such contracts through existing authorities.

In the event of termination or cancellation of the contract among SEPA, TVA, and TVPPA dated October 1, 1997, SEPA will put forth every effort to secure alternative arrangements for the services provided under the aforementioned contract by TVA which are necessary and required to facilitate delivery of Cumberland System power to the Sponsors. In the event SEPA is unable to establish such alternative arrangements, the governing MOA(s) shall be subject to cancellation or renegotiation.

3.1.3. Sponsors

The Sponsors, through the PCC or PCG, through their representatives on the PRC, and through any subsequently established Committee(s) under executed MOAs, shall assist the Corps and SEPA in identifying and prioritizing the Work Items the Corps will perform at the facilities to be funded by the Sponsors and overseeing the progress and performance of the Corps in completing said Work Items, all in accordance with the features of the Master Plan.

Notwithstanding any provision of the governing MOA(s) that might be interpreted to the contrary, none of the Sponsors shall be an agent of SEPA or the Corps.

Notwithstanding any provision of the governing MOA(s) that might be interpreted to the contrary, the Sponsors shall not be required to provide funding in excess of (i) the total of all Funding Requirements established in Sub-Agreements entered into pursuant to the governing MOA(s), plus (ii) funds to be deposited into the Reserve Fund in accordance with the governing MOA(s) and with a cumulative limit defined in each governing MOA.

Subject to the limitations of amounts established in applicable Funding Requirements and amounts available in the Reserve Fund, as applicable; and except for any damages and related costs occasioned by work performed under the governing MOA(s) and related Sub-Agreements and due to the negligence and/or misconduct of the United States or its contractors; and only to the extent such funding is available through Section 212 Funds for which Section 212 Allowances have been credited to the Sponsors; the Sponsors shall be responsible for funding all costs incurred by the Corps pursuant to Sub-Agreements, including costs resulting from (1) Qualified Reserve Fund Expenditures, (2) the performance of Work Items, and (3) termination of Work Items in accordance with the governing MOA(s). In the event of termination of a Work Item, subject to limitation to the amount available in the applicable Funding Requirement to fund such Work Item, the Sponsors shall fund all costs incurred by the Corps for closing out the Work Item or transferring any associated ongoing contracts, provided that the Corps shall take reasonable steps to mitigate costs associated with Work Item termination, including but not limited to considering the seeking of additional funds through appropriations and reporting such costs to SEPA.

3.2. Roles and Responsibilities – Committees

The legal descriptions of the roles and responsibilities of the committees are defined in the governing MOA(s) and summarized here for information. If there are discrepancies between the governing MOA(s) and this document, the MOA(s) takes precedent.

3.2.1. Program Coordination Committee (PCC)

The Corps, twenty-four Sponsors, and SEPA have formed a Program Coordination Committee (PCC) to administer and oversee the performance of the L-T MOA. SEPA has two (2) members on the PCC, who shall be designated in a written notice by SEPA to the other Parties. Each Sponsor has one (1) member on the PCC, who shall be designated in a written notice by such Sponsor to the other Parties. The Corps has appointed a Section 212 Program Manager to be a member of the PCC and to be the Corps' authorized representative and point of contact for reporting work progress, expenditures, and variances in scope, schedule, or cost to perform the work under this MOA. The Corps may further appoint a second member to the PCC. Both members shall be designated in a written notice by the Corps to the other Parties.

A Party may change its designated PCC member(s) at any time upon written notice to the other Parties. By written notice to the other Parties, each Party shall designate an alternate for its PCC member(s) to serve with full participation and voting rights when the regular PCC member is unable to attend a meeting. By unanimous agreement of the PCC members, the PCC may include additional members as appropriate.

The PCC shall prepare any proposed amendments to the governing MOA(s) for consideration by the Parties. To become effective, any amendment to the governing MOA(s) must be approved by the PCC and signed by all Parties.

The PCC shall be authorized to take such other actions as it deems necessary or appropriate for the administration of the governing MOA(s), including but not limited to review and approval of (a) recommendations from the PRC, (b) Work Items, (c) Sub-Agreements, (d) amendments to the Master Plan, and (e) preparation of proposed amendments to the governing MOA(s).

Operating Guidelines for conducting the PCC's responsibilities under the governing MOA(s) and Sub-Agreements are set forth in the governing MOA(s). The Operating Guidelines may be modified from time to time upon approval by the PCC, and such modification may not require a formal amendment of the governing MOA(s).

All actions taken by the PCC shall require unanimous agreement of all PCC members.

3.2.2. Program Coordination Group (PCG)

Upon execution of an appropriate MOA, the Corps, TVA, TVPPA, and SEPA shall form a Program Coordination Group (PCG) to administer and oversee such rehabilitation, non-routine maintenance and modernization activities that may be funded under the governing MOA(s) to which these entities are party. SEPA shall have two (2) members on the PCG, who shall be designated in a written notice by SEPA to the other Parties. TVA and TVPPA shall each have one (1) member on the PCG, who shall be designated in a written notice by such Sponsor to the other Parties. The Corps shall appoint a Section 212 Program Manager to be a member of the PCG and to be the Corps' authorized representative and point of contact for reporting work progress, expenditures, and variances in scope, schedule, or cost to perform the work under this MOA. The Corps may further appoint a second member to the PCG. Both members shall be designated in a written notice by the Corps to the other Parties.

A Party may change its designated PCG member(s) at any time upon written notice to the other Parties. By written notice to the other Parties, each Party shall designate an alternate for its PCG member(s) to serve with full participation and voting rights when the regular PCG member is unable to attend a meeting. By unanimous agreement of the PCG members, the PCG may include additional members as appropriate.

The PCG shall oversee and coordinate rehabilitation, non-routing maintenance, and modernization activities funded under the governing MOA(s) to which the members are party, including, but not limited to: (i) evaluating defined needs, priorities, and proposed Work Items; (ii) tracking project and program progress and performance; (iii) overseeing governance of the program; and (iv) approving changes to the Master Plan as necessary. The PCG shall evaluate information provided by the Corps regarding needs of the Facilities and identify, prioritize, and recommend Work Items to the Parties for the Corps to perform under Sub-Agreements, all in a manner consistent with the Master Plan described in Article III of the governing MOA(s). Consistent with the Master Plan described in Article III of the governing MOA(s) and sound engineering practice, the PCG shall prioritize Work Items to be performed at the Facilities on the basis of availability of units, the potential for outage, ease of maintenance, efficiency of contracting and work practices, previous maintenance, rehabilitation or modernization work at the facility, and such other factors as the PCG may deem relevant.

The PCG shall be authorized to take such other actions as it deems necessary or appropriate for the administration of the governing MOA(s), including but not limited to review of and providing recommendations to the Parties regarding (a) Work Items, (b) Sub-Agreements, and (c) amendments to the Master Plan.

Operating Guidelines for conducting the PCG's responsibilities under the governing MOA(s) and Sub-Agreements are set forth in the governing MOA(s). The Operating Guidelines may be modified from time to time upon approval by the PCG, and such modifications may not require a formal amendment of the governing MOA(s).

All actions taken by the PCG shall require unanimous agreement of all PCG members. Although the PCG may recommend Work Items and Sub-Agreements for execution under the governing MOA(s), only the Corps, SEPA, TVA and TVPPA are authorized to execute Sub-Agreements for Work Items.

3.2.3. Program Review Committee (PRC)

The Corps, twenty-four Sponsors, and SEPA have formed a Project Review Committee (PRC) under the L-T MOA to assist the PCC in matters including, but not limited to: (i) defining needs, priorities, and Work Items; (ii) tracking project and program progress and performance; (iii) overseeing governance of the program; and (iv) recommending changes to the Master Plan as necessary. The PRC shall evaluate needs of the Facilities and identify, prioritize, and recommend to the PCC Work Items for the Corps to perform under Sub-Agreements, all in a manner consistent with the Master Plan. Consistent with the Master Plan and sound engineering practice, the PRC shall prioritize Work Items to be performed at the Facilities on the basis of availability of units, the potential for outage, ease of maintenance, efficiency of contracting and work practices, previous maintenance, rehabilitation or modernization work at the facility, and such other factors as the PCC may deem relevant.

The PRC shall consider and recommend to the PCC the Funding Requirement for each Work Item to be included in a L-T MOA Sub-Agreement. All Sub-Agreements related materials including ballots for determining approvals must be reviewed and approved by the PRC prior to submission to the PCC.

The PRC shall prepare and recommend any proposed changes or revisions to the governing MOA(s), the Master Plan, Sub-Agreements, Work Items, or other related program items for consideration by the PCC.

All recommendations by the PRC to the PCC shall include dissenting and differing views, if any.

The PRC shall have no more than five (5) members and shall consist of one (1) member appointed by the Corps, one (1) member appointed by SEPA, and up to three (3) members appointed by the Sponsors. A majority vote of the members of the PRC is required for the PRC to take action. Any member of the PCC may attend meetings of the PRC in a non-voting capacity.

The Nashville District Engineer shall appoint the Corps' member of the PRC.

SEPA shall select its member of the PRC in accordance with its own guidelines.

The Sponsors' members on the PRC may include one (1) member appointed by the Tennessee Valley Authority.

The PRC members may be changed by their respective Party (ies) at any time upon written notice to the other Parties.

3.3. Roles and Responsibilities – USACE Management Team

3.3.1. Hydropower Program Manager

The Chief, Hydropower Section (Chief, OPS-H), Operations Division, Nashville District serves as the Hydropower Program Manager (HYD PgM) for the Cumberland River Basin Hydropower Program. The Chief, OPS-H is the Hydropower Business Line (BL) manager for the District. The Program includes both the operations & maintenance as well as capital improvements. The Chief, OPS-H reports to Corps management to ensure that the Corps' assets are being rehabilitated in a way consistent with Corps' practices, and that the rehabilitation goals are aligned with the Corps' mission. The Chief, OPS-H has ultimate responsibility for prioritization of Work Items in sub agreements and ballots.

The Chief, OPS-H is responsible for monitoring and upward reporting within LRN of the condition and operation of hydropower facilities and plans to maintain or repair these facilities. Responsibilities as the Hydropower BL manager include District utilization of the USACE Hydropower Asset Management/Operational Condition Assessment system (HydroAMP) and implementation of the annual strategy resulting from the USACE Hydropower Modernization Initiative (HMI) ranking and prioritization tool (Asset Investment Program - AIP).

The Chief, OPS-H coordinates with the Section 212 PgM (defined below) to identify and prioritize Work Items eligible for funding under the Section 212 program. Goals include maximizing revenue and minimizing cost by the coordination of outage schedules and the exchange of lessons learned, etc.

3.3.2. Section 212 Program Manager

The Section 212 Program Manager (Section 212 PgM) is a member of the PCC, PCG and PRC, appointed by the LRN District Commander, and is the Corps' authorized representative and point of contact for monitoring work progress, expenditures, and variances in scope, schedule, or cost. The Section 212 PgM will be committed to the Program full time. The Section 212 PgM will support the Chief, OPS-H in developing Work Item prioritization, and by preparing Sub-Agreements and Ballots, as well as the management of the Work Items after they are approved for funding. The Section 212 PgM is responsible for day-to-day administration of the Program. The Section 212 PgM is the main point of contact between the Corps (Nashville District), and the power customers and representatives of SEPA, and will provide liaison with these groups and others who may enter into a Memorandum of Agreement with the Nashville District for Section 212 activities.

The Section 212 PgM reports to the USACE management to ensure that the Corps' assets are being rehabilitated in a way consistent with the Corps' practices, and that the rehabilitation goals are aligned with the Corps' mission. The Section 212 PgM reports to the Program Coordination Committee to ensure that the funds provided by the Sponsors are expended according to authorized scopes of work, funding schedules, and budget.

The Section 212 PgM coordinates with the Chief, Project Delivery Section (Chief, PPPM-MD), and Chief, OPS-H, in the selection of Project Managers for Section 212 Projects, and provides support and guidance to the individual Project Managers to ensure consistent practices throughout the Section 212 Program and proper coordination between related Projects. Goals include workload leveling, maximizing revenue and minimizing cost by the coordination of outage schedules and the exchange of lessons learned, etc.

The Section 212 PgM Mgr. will ensure that all Project Managers prepare all documents required by the terms of the applicable MOA(s). This includes the monthly Project Manager Progress reports, final completion reports, and other documents required by the applicable MOA(s).

3.3.3. Section 212 Assistant Program Manager

The Section 212 Assistant Program Manager (Section 212 APgM) will support the Section 212 PgM in day-to-day Program Management Activities and will act as the Section 212 PgM's designee in matters related to the Program. The Section 212 APgM will be committed to the Program as required to accomplish Program goals and activities.

3.3.4. Project Managers

Project Managers (PM) will be assigned to Projects and Work Items as the Work Items are authorized and funded. For Section 212-funded projects, the assignments will be made by the Section 212 PgM from nominees provided by the Chief, OPS-H and the Chief, PPPM-MD. For every Section 212-funded project, the Project Managers shall create and maintain Project Management Plans in accordance with USACE's Project Management Business Process (PMBP), prepare monthly Project Manager Progress Reports, support the Chief, OPS-H and Section 212 PgM in preparing Sub-Agreements and Ballots, and manage the Work Items after they are approved for funding. Project Managers are responsible for providing other documents required by the Long-Term Memorandum of Agreement, and for reporting on their projects at monthly Project Review meetings. All projects shall be managed in accordance with USACE Project Management Business Practices.

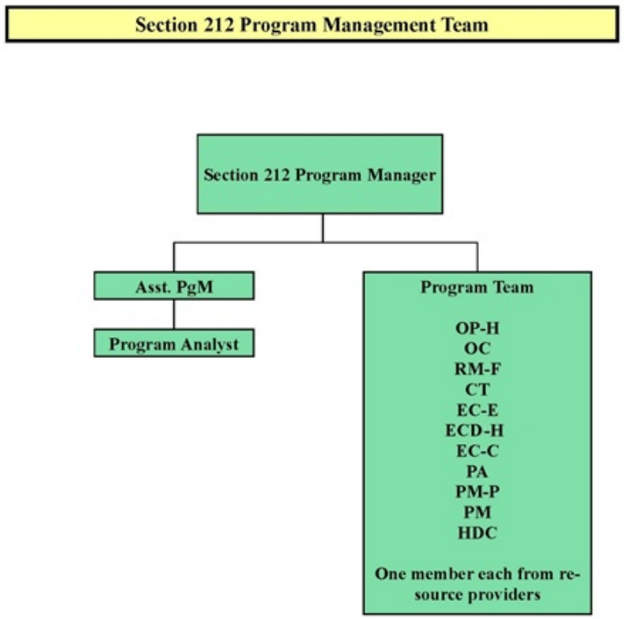
3.3.5. Contract Actions

Depending on the contract action, responsibility for any initiating contract actions could be the responsibility of the Chief, OPS-H, Section 212 PgM, or any of the individual Project Managers. For Section 212-funded work, Contracting Division shall have a member on the PDT to provide guidance and assistance in acquisition planning.

3.3.6. Program Team

The Section 212 Program Management Team (PgMT) will operate under the leadership of the Section 212 PgM to review and resource projects that are proposed for customer-funding. The Team will be comprised of resource providers in the Nashville District and HDC and meet as necessary to consider upcoming work. The purpose of the meetings is to consider the scope of work for each project, appropriate level of staffing and review, and a preliminary acquisition strategy. Following this meeting, the Section 212 PgM will select a PM for each project from candidates supplied by the Chief, Project Delivery Branch and Chief, Hydropower Section, and the PM will assemble the PDT. USACE will utilize their Nashville District and HDC resources as required for the execution of the Program. If additional resources are required, the Nashville District will utilize regional Indefinite Delivery/Indefinite Quantity (IDIQ) Contracts in place for program management and design support throughout the life of the program. Individual Section 212-funded projects will have PDTs that will be comprised of a PM, LRN team members from appropriate engineering disciplines, Contracting, Office of Counsel, Hydropower, and other LRN members as required to execute the project.

Appendix A – Section 212 Program Information



In accordance with the Nashville District Cumberland River System Hydropower Rehabilitation Program Master Plan, the Section 212 Program Manager is responsible for the day-to-day administration of the Section 212 Program and execution of work items in accordance with authorized scopes of work, funding schedules and budget. The Program Team operates in an advisory capacity under the Program Manager's leadership to coordinate the effective and efficient use of District resources to accomplish Program rehabilitation goals.

Figure 9: Section 212 Program Management Team

4. Project Framework

The Cumberland River Basin Customer-Funded Hydropower Rehabilitation Program consists of Projects that will follow a project life cycle as shown in Figure 10.

For each Project there are a minimum of two Work Items resulting in a minimum of two PCC approval points unless otherwise authorized. Each Work Item approval requires a submittal to the PCC. Based on the submitted information, overall Program performance and available funding, the Committee can authorize or postpone the execution of the next WI of the Project. More turbine-generator overhaul Projects and other complex Projects may have interim approvals for additional Work Items to mitigate funding and scheduling risks, and to coordinate Projects within the Program.

A PM will be assigned to each Project. This PM will manage all Work Items within a Project. For system-wide projects funded by Section 212, a PM will be assigned by the Section 212 PgM, in consultation with the Chief, OPS-H, for each project. The Chief, OP-H will assign PM for system-wide projects paid from appropriated funds, unless those projects are integral to Section 212 projects or involve work that is more substantial than normal maintenance. Under these circumstances, the PM assignment will be coordinated with the Section 212 PgM. Some PM may have more than one Project and/or Task Management activities assigned to them. Each PM, together with the PDT, must prepare a Project Management Plan (PMP) for every Project regardless of funding source, and manage and control the Project using the PMP.

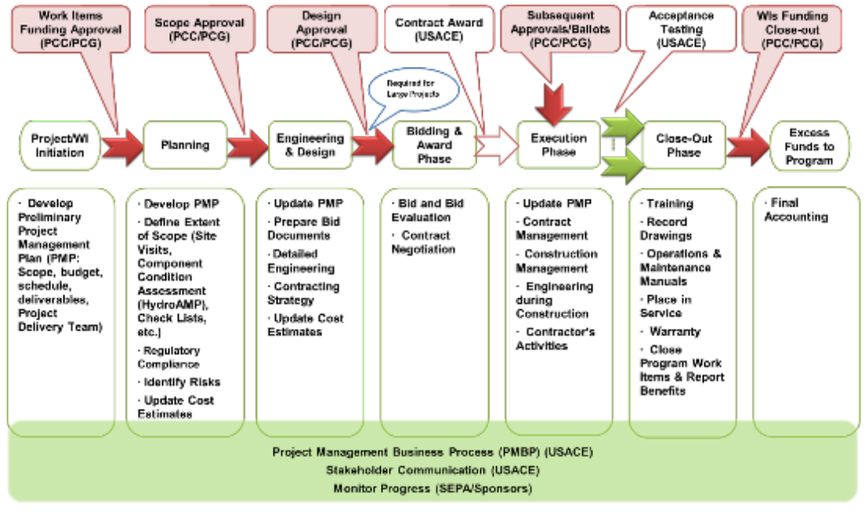


Figure 10: Project Life Cycle

5. Contracting and Acquisition

The PgMT will provide each PM with a recommended preliminary acquisition strategy based on a review of the scope of work and understanding of requirements and project intent. Detailed Project and Work Item specific contracting and acquisition strategies will be developed for each individual Project or Work Item in their respective PMPs. Acquisition strategies will be developed in consultation with PDT members to determine the most effective and efficient contracting vehicle for the Project or Work Item. Contracting Division shall have input into each acquisition regardless of the strategy implemented.

Work Items and subprojects will be grouped into Projects, and requirements will be added to achieve the following results:

Savings from Economy of Scale – Example: turbine-generator upgrades to be contracted out by plant (not by unit), etc. Options in contracting for additional work could also be used.

Standardization of Equipment and Spare Parts – Combine and execute Projects system-wide. Examples: Generator Circuit Breakers; Excitation Systems; Governors; etc.

Standardization of Documentation and O&M Manuals – Specify common on-line database driven O&M manuals.

Personnel Training Requirements – Training will be recorded and available as webcast videos for inclusion in the O&M Manuals.

6. Environmental Compliance

Sufficient analysis, coordination, and documentation shall be accomplished to comply with applicable environmental laws, statutes, and Executive Orders, and to provide a basis for obtaining the necessary permits for program implementation; such as the following:

6.1. Coordination

Projects implemented under the applicable MOA(s) will be accomplished with the involvement of multiple Federal, state and local agencies, tribes and the public. Provisions contained in, but not limited to, the National Environmental Policy Act of 1969, Fish and Wildlife Coordination Act of 1958, Fish and Wildlife Conservation Act of 1980, Clean Water Act of 1972, Endangered Species Act of 1973, National Historic Preservation Act of 1966, and Water Resources Development Act of 1996 may require this involvement during program implementation.

6.2. National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. §§ 4321, et seq.) guides the civil works planning process, serving to focus the critical evaluation of the cost of today's activities in terms of tomorrow's resources. Provisions for complying with NEPA are found in the Council of Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 C.F.R. Parts 1500-1508) and USACE Environmental Quality Procedures for Implementing NEPA (ER 200-2-2, 4 March 1988, codified at 33 C.F.R. Part 230). NEPA requires that decision making should proceed with full awareness of the environmental consequences that follow from a major Federal action, which significantly affects the environment. It also contains requirements to coordinate with Federal, state and local agencies and the public as well as consideration/compliance with other environmental laws and regulations, many of which require additional coordination.

6.3. Fish and Wildlife Coordination Act

In accordance with the provisions of the Fish and Wildlife Coordination Act (16 U.S.C. §§ 661, et seq., as amended), the Corps is required to consult with the U.S. Fish and Wildlife Service to seek their views and recommendations on measures to protect, conserve and mitigate for damages to fish and wildlife resources.

6.4. Endangered Species Act

In accordance with Section 7(a) (2) of the Endangered Species Act (16 U.S.C. §§ 1531, et seq., as amended), no Federal actions will jeopardize the continued existence or modify designated critical habitat of federally listed species. During program implementation, the U.S. Fish and Wildlife Service will be consulted to determine if federally listed species reside in the project area. If informal consultation with the Fish and Wildlife Service determines that the Federal action is "not likely to adversely affect" listed species, then no further action is required. If a proposed action is "likely to adversely affect" a federally listed species or its critical habitat, additional consultation will occur and measures will be developed to avoid or minimize adverse impacts.

6.5. National Historic Preservation Act

Section 106 of the National Historic Preservation Act (16 U.S.C. § 470f) requires Federal agencies to take into account the effects of an undertaking on historic properties, which are districts, sites, buildings, structures, or objects that are included in or eligible for inclusion in the National Register of Historic Places. In addition, Section 110 of the NHPA (16 U.S.C. § 470h-2(a)) requires Federal agencies to assume responsibility for the preservation of historic properties which are owned or controlled by the agency. ER 1130-2-540 and EP 1130-2-540 direct consideration and management of cultural resources and historic properties for Corps projects and lands.

The Nashville District's Locks, Dams and Powerhouses in the Cumberland River Basin Project form a discontinuous historic district. The Cumberland River Basin Project is significant for its engineering and architectural values and forms a good representation of federal flood control-power development of the early post World War II era. When an undertaking has the potential to alter the integrity of location, design, setting, materials, workmanship, feeling or association, the

undertaking may result in an adverse effect. The Corps must consult with the State Historic Preservation Officer (SHPO), tribes and other consulting parties prior to an undertaking to determine if the actions will result in an adverse effect. Consultation will seek to identify ways to avoid or minimize the adverse effect or develop measures to mitigate the adverse effect.

If major modification to an existing project will result in significant impacts, a Historic Properties Feature Design Memorandum may be required and would provide a management tool to guide the proper treatment of the historic property throughout construction and initial operational phases. Alternative treatments may include the preparation of a Historic American Building Survey or Historic American Engineering Record or recording features to state specifications as determined through consultation with the SHPO.

7. Communications Plan

7.1. General

This section of the Master Plan establishes the general policies and procedures for written correspondence, information exchange via meetings and teleconferences and collaboration websites for USACE, SEPA and the Sponsors. USACE will follow Army Regulation 25-50 Preparing and Managing Correspondence for internal and other formal communication.

Acceptable methods of formal communications are: Teleconference Calls; Meetings; Virtual Meetings; E-mail; and data exchange via a Collaboration Web Site.

E-mails, telephone calls and meetings used for coordination or exchange of draft documents are considered to be informal communications.

The USACE Section 212 PgM will be responsible for coordinating PCC, PRC and PCG (if applicable) meetings with the appropriate group of attendees. These meetings may be accomplished in person, via teleconference/web meeting, or video teleconference. PCC, PRC or PCG meetings that are held in-person shall be at a facility arranged by the host party (i.e., the Corps in Nashville, TVA in Chattanooga, etc.). The need for a meeting may be determined by members of the committees/group as conditions warrant. Further, the Section 212 PgM will be responsible for production of minutes for meetings, electronic routing of minutes to members for review and comment, electronic routing of corrected minutes, and storage of final copies of meeting minutes as agreed by members.

7.2. Communications Channels & Paths

This section of the Master Plan illustrates the communication channels and paths for conduct of the Program. Figure 11 shows the communication flow path for formal correspondence, and to a large degree for communications in Program control and coordination.

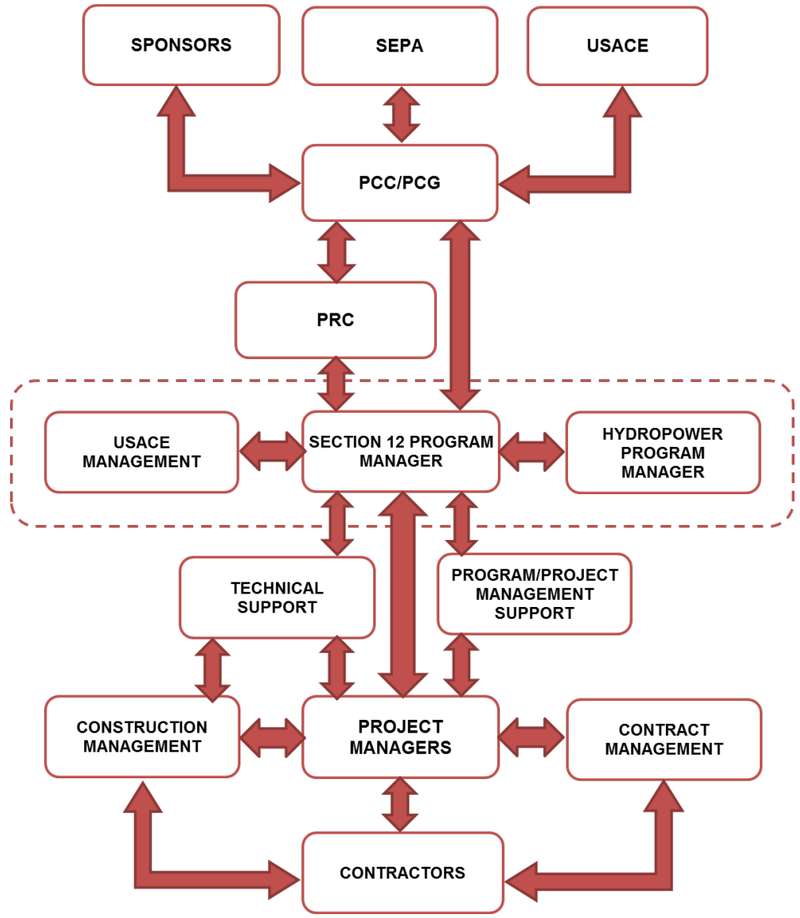


Figure 11: Communication Flow

7.3. Performance Reporting

Performance reporting will comply with requirements of the governing MOA and will include the following:

Monthly Program Performance Report. The performance report will include:

Reporting Period

Individual Project Status for Active Projects. The status will be provided by individual Work Items and will have description of work activities and work progress accomplished since the last report; an accounting of all costs charged to the Work Item during the previous period; an explanation of significant variances on cost to date, including recovery plans where appropriate; schedule status, including any anticipated delays and/or revisions; a discussion of any forecasted cost impacts required by proposed schedule revisions or scope of work changes; an accounting of the funding authorizations for each Work Item; a short description of planned activities for the following period; and any other significant information pertaining to Work Item performance and progress and any item as required to comply with the intent of the governing MOA.

Program Cost Performance: utilizing the Corps of Engineers Financial Management System (CEFMS), which includes accrued cost information, an update on the total actual cost will be provided.

Program Schedule Performance: milestone status will be provided

Earned Value Management (EVM): Cost Performance Index (CPI) and Schedule Performance Index (SPI) will be generated for the active Projects and the Program

Approved Change Requests

Updated Risk Register

Benefits Realization

Program Forecasts

Portfolio Reports for Program and Plants. These reports will be generated annually, on or before December 31 and will include the status of all active Projects, total Program funding to date, total expenses to date, and funding reserve to date.

Project-Specific Reports. These reports will be generated annually, on or before December 31 and will include more detailed Project information, the status of all planned Work Items, initial and current budget, expenditures to date, and Project contingency status;

Work Items Reports. These reports will be generated annually, on or before December 31 and will provide information for each Work Item within a Project, and include: Work Item number, description of activities and accomplishments, summary of expenditures, cost variances and recovery plans, schedule status and potential cost impacts of schedule changes, record of funding authorizations, and planned activities.

Final Completion Report. USACE will provide a final completion report for each Project within 60 days of completion of each Project. Depending on the complexity of the Projects or the contracting strategy, USACE may produce a final completion report for individual Work Items.

Lessons Learned Documents. These documents will be generated for each Project to identify Program and Project successes and failures. The lessons learned communication will include recommendations to improve future performance within the Program. The different aspects could be technical, managerial and process.

Annual Stakeholder Report. An annual stakeholders report will be prepared after the end of each fiscal year by the Program Manager. Using current year SEPA revenue data, the PM will update the 5-Year plans. Program accomplishments through all possible funding sources will be summarized. The PM will identify any changes in system reliability, breakdowns, or other prioritization adjustments needed. The plan will be prepared during the second quarter of the fiscal year (first quarter of the calendar year) and will be submitted to the Sponsors for approval.

The Section 212 PgM, in partnership with the Chief, OPS-H and Chief, Project Delivery Section, will be responsible for ensuring the completion of reports required by governing agreements and this Master Plan.

Information Distribution

Document / Information	Originator	Recipient	Frequency	Comment
Project/Work Item Status Updates	Project Managers	Program Manager	Monthly (within 1 week of end of month)	Includes: actual and accrued cost; physical percent complete; change log; risk log; other pertinent information.
Funding Status Updates	SEPA	Program Manager PCC/PCG	Monthly	

Document/ Information	Originator	Recipient	Frequency	Comment
Program Progress Report	Program Manager	PCC/PCG	Monthly - At scheduled meetings	
Identify Work Items / Change Requests	Program Manager	PRC/PCG	As required	Following change management process
Work Items/ Change Request Approval Ballots	PRC/PCG	PCC/PCG	As required	
Coordination Teleconference Calls	Program Manager	PRC and/or PCG	As Required or Requested	
Coordination Meetings	Program Manager	PRC and/or PCG	Monthly	Virtual
Coordination Teleconference Calls	Program Manager	PCC and/or PCG	Monthly	
Coordination Meetings	Program Manager	PCC and/or PCG	Annual	Attempt to coordinate with Team Cumberland meetings
Information Requests	All	All	As Requested	

7.4. Program Management Information Systems and Processes

USACE will use the Project Management Business Process (PMBP) and CEFMS to track project and program progress and financial expenditures and obligations. Project and Program working electronic documents shall be maintained on the Nashville District's projects server. Electronic copies of reports and project information provided to the customers shall be provided via a SharePoint site.

Item	Update	Description	Responsibility
WI Planned Value (PV)	On WI Approval (Sub-Agreement) or Modification (Ballot)	Planned cost value as a function of time.	Project Manager
WI Base Line Schedule	On WI Approval (Sub-Agreement) or Modification (Ballot)	WI high level schedule. The base line will be created on WI approval and updated when WI is modified	Project Manager
Budget at Completion (BCA)	On WI Approval (Sub-Agreement) or Modification (Ballot)	The total planned cost value (at the end of the project).	Project Manager
WI Actual Cost (AC)	Monthly	Actual costs will be extracted from CEFMS	Program Analyst
WI Schedule	Monthly	WI high level schedule status, dependent on detailed schedule provided by Contractor, HDC or A/E	Project Manager
WI Percent Complete (PC)	Monthly	Physical percent complete	Project Manager
WI Earned Value (EV)	Monthly	Using Percent Complete to express earned value in cost terms EV=PC*PV	Project Manager
WI Cost Performance Index (CPI)	Monthly	CPI=EV/AC, with goal of CPI≥1	Project Manager
WI Schedule Performance Index (SPI)	Monthly	SPI=EV/PV, with goal of SPI≥1	Project Manager

Appendix A – Section 212 Program Information

Item	Update	Description	Responsibility
WI Estimate to Complete (ETC)	Monthly	Cost and duration estimates for the remaining work.	Project Manager
WI Estimate at Completion (EAC)	Monthly	EAC=AC+ETC	Project Manager
Program Cost Performance Index (PgCPI)	Annually	$PgCPI=\sum EV_{fo}/\sum AC_{fo}$, where $\sum EV_{fo}$ – Earned Value sum for all finished and ongoing Work Items $\sum AC_{fo}$ – Actual Cost sum for all finished and ongoing Work Items.	Program Manager
Program Schedule Performance Index (PgSPI) to date	Annually	$PgSPI=\sum EV_{fo}/\sum PV_{fo}$, $\sum EV_{fo}$ – Earned Value sum for all finished and ongoing Work Items $\sum PV_{fo}$ – Planned Value sum for all finished and ongoing Work Items	Program Manager
Program Estimate at Completion (PgEAC)	Annually	$PgEAC=\sum EAC_{fo}+\sum PV_{ns}$, $\sum EAC_{fo}$ – Estimate at Completion sum for all finished and ongoing Work Items $\sum PV_{ns}$ – Planned values for Work Items that have not started yet	Program Manager

Earned Value Management (EVM) will be used in the development of the Program, Project and Work Item Reports described above.

To facilitate distribution and storage of electronic copies of documents, an MS SharePoint-based collaboration site will be used. The collaboration site will be hosted by USACE. The Section 212 PgM will coordinate document updates, changes and administration of this site using information developed by Section 212 PMs and information provided by the Chief, OP-H regarding appropriated funds projects and overall system conditions reporting.

8. Change Management Plan

8.1. Project Change Management

Minor scope, schedule or cost changes will be processed by the assigned PMs in accordance with the Corps' PMBP. Each Project will have Project contingency funds to be managed by the PM in the event of unexpected conditions or costs that may be within the scope of the contingency funding. More significant change requests will be elevated to the Section 212 PgM and reported and approved through LRN's Change Management Process. The threshold defining minor and major changes shall be defined in the PMP. Major changes will be reported to PCC/PRC/PCG and will require a formal approval through a new Sub-Agreement or reallocation of previously authorized funds as described in the governing MOA and following the balloting process. The PMP shall be revised to reflect major changes in scope, schedule or budget.

All Project scope/schedule/cost changes will be included in the monthly progress report.

8.2. Program Change Management

The Section 212 PgM will monitor the performance of the Section 212 Program and manage the Section 212 Program contingency to minimize change impact to the Program.

Projects funded from other sources (appropriations) will be reported as the funding becomes available and the Section 212 Program budget will be adjusted accordingly. Previously authorized customer funding for such work will be allocated to other Work Items based on priority rankings. The balloting process will be used for this purpose.

Emergency work will be funded through a new Sub-Agreement or reallocation of previously authorized funds as described in the governing MOA(s) and following the balloting process. The need for emergency projects will be included in the monthly progress report.

The Program will be re-evaluated annually during the second quarter of the fiscal year (first quarter of the calendar year), based on past progress, current needs and priorities and future expectations of relevant factors to maintain a more detailed 5-year rolling plan. Applicable Program cost

estimates will also be updated at this time. The updated plan will be made available to all parties through the Program SharePoint web site.

9. Quality Control Plan and Objectives

The objective of the quality control plan is to ensure that work continually meets the technical criteria, industry standards, and relevant laws and policies as the Program moves forward – all while remaining on schedule and within budget. Within each PMP, technical and functional objectives will be defined that outline the criteria for assessing Project quality.

Quality control is a part of every process, and relies on accurate, timely data communicated and stored in the information tools. It is important to note that quality control is a continuous process throughout the Program and will be reviewed before approving any gateways or closing out any Projects. Program and Project gateways will help control the flow of work. Projects within the Program will be reviewed by qualified staff, based on project type. All Section 212-funded work will have formal QA performed and documented, regardless of contracting vehicle used to execute the work.

Independent technical reviews will be utilized for all technical work, focusing on safety, functionality, operability, constructability, economics and environmental concerns. Engineering assumptions and cost estimates will be reviewed by a technical team to ensure they are reasonable and accurate. HDC will be the primary review agency for technical work and shall perform all Agency Technical Reviews (ATR). The Nashville District will conduct District Quality Control (DQC).

Performance tracking and reporting, risk management, change management, and communication plans are all tools for quality control. As the Project progresses, any "lessons learned" (positive and negative) will be documented and used as appropriate to adapt the Program plan for increased efficiency. These lessons learned will be prepared by the PDT, documented by the PM, and provided to the Section 212 PgM at the conclusion of each project.

Projects and Work Items will be executed following the USACE's Quality Control System and PMBP.

10. Safety and Occupation Health Plan

All aspects of this Program shall be in compliance with the EM 385-1-1 USACE Safety and Health Requirements Manual and other applicable Federal, state and local codes, regulations, and standards. Where apparent conflicting safety and occupational health standards are set forth in these requirements and regulations, the more stringent shall apply.

For construction contracts, contractors will submit an Accident Prevention Plan and Activity Hazard Analysis as identified in the contract specifications; in accordance with the latest version of EM 385-1-1 (including interim changes) that is in effect on the date of solicitation.

For service, supply, and research and development contracting actions, compliance with the EM 385-1-1 shall be a contract requirement for such activities unless technical representatives (in coordination with safety and health professionals) advise that special precautions are not appropriate due to extremely limited scope of services.

Safety and Occupational Health (SOH) requirements will be integrated into the Section 212 Project Management Plan through SOH Plan development, PDT involvement, independent SOH technical reviews, and safety and health testing assessment requirements.

11. Risk Management Plan

With such a vast Program, a risk management plan is essential to ensure that Program objectives are successfully met. Risk management identifies potential Program risks, assesses the severity of the risk, and creates a mitigation strategy for the identified risks throughout the Program life cycle. Risks include setbacks in budget (exceeding cost estimates or falling short of projected revenue), schedule (from unplanned events, natural or otherwise), and scope. Maintaining an up-to-date record of work completed, cost incurred, and remaining budget, will minimize risk when used alongside Program and Project gateways.

Monthly reporting and reviews will aid identification and minimization of potential problems. Program and Project contingencies will be used to manage financial risk from cost and revenue uncertainties. PMs will work with their respective PDTs to identify potential risks in each project, and to plan contingency actions to mitigate scope, cost or schedule risks. Detailed risk registers will be included in each PMP.

12. Value Management Plan

Value Management (VM) is a process used to maximize the value of the Program by balancing resources and quality. VM is continuously applied during the Program by updating cost and revenue information in conjunction with quality control and assessment. Potential savings from grouping similar work to save on design of installation costs will be re-evaluated as the Program moves forward.

Projects and Work Items will be executed following the USACE's VM System.

13. Fiscal Management & Contingencies

The PM can change the distribution between Project activities without the approval of the Program Manager as long as the scope or overall cost of the Project is not changed. PMs will assist the PgM in the preparation of monthly schedules of obligations and expenditures.

The Program will maintain the following levels of contingencies:

Project contingencies. The Project contingencies will include overall Project contingency; and contingency for high probability risk items. These contingencies will be included in the Work Items budgets. The PM will be responsible for identifying risks, overruns and for requesting the release of the contingency amounts for changes to project costs that exceed the minor changes. The PgMT will be responsible for the authorization and release of Project contingency funds.

Emergent Work Item(s). The Emergent Work Item(s) will be used to hold funds not allocated to other Work Items, to accept funds from closed out Work Items executed under budget, and to provide a Program level funding reserve for emergent work and significant project overruns. The release and acceptance of funds from the Emergent Work Item(s) will follow the standard Program Sub-Agreement and Balloting processes and will require Authorization from the applicable MOA signatories.

Reserve Fund. A legal reserve fund will be set up as defined in the MOA(s).

14. Program Closeout Plan

Program closeout may only occur after all included Projects and Work Items are closed out. Each Project closeout must be documented, including drawings, reports, and operation and maintenance plan manuals. Project closeouts require a final inspection, all payments must be made, and USACE must receive a release of claims from all contractors performing work using Program funds. After all Projects are closed out, a Program summary will be compiled, stored with all of the final Program and Project information (including actual schedule with cost, revenue, and work completed), and the Program may be closed.

Appendix B: Project Ranking

Section 212 Project Ranking

SEC 212 Funding Rank	Work Item ID	Plant/System	Project Name	Start FY	Finish FY	Program Amount ($)	MOA/SA
0	OLD02	Old Hickory	Turbine/Generator	1Q21	3Q29	$ 125,000,000	ST 6-10
1	CHE04	Cheatham	Medium Voltage Cables & Busses	2Q20	3Q23	$ 3,530,000	LT 9-10
2	SYS05.05	Wolf Creek	Main Power Transformer	2Q20	1Q26	$ 16,200,000	LT 9-10
3	CEN04	Center Hill	Medium Voltage Cables & Busses	2Q20	1Q23	$ 7,100,000	LT 9-10
4	SYS06.05	Wolf Creek	Excitation	1Q22	1Q26	$ 10,650,000	LT10-11
5	PgM 1.008	Program	Program Management Year 7	3Q22	4Q23	$ 1,100,000	LT 10
6	SYS13.03	Wolf Creek	DC / Preferred AC System	4Q22	1Q24	$ 4,100,000	LT11
7	WOL22	Wolf Creek	Powerhouse Crane	3Q22	3Q24	$ 3,200,000	LT11
8	WOL02	Wolf Creek	Turbine/Generator	3Q22	3Q33	$ 200,000,000	ST 11-18
9	WOL04	Wolf Creek	Medium Voltage Cables & Busses	2Q24	4Q26	$ 13,300,000	LT 11-12
10	SYS01.03	Cheatham	Intake Gantry Crane	3Q24	2Q28	$ 10,750,000	LT 11-12
11	COR22	Cordell Hull	Powerhouse Crane	3Q25	3Q28	$ 5,900,000	LT 12-13
12	COR02	Cordell Hull	Turbine/Generator	1Q27	1Q35	$ 175,000,000	ST 19-25
13	SYS13.04	J. Percy Priest	DC / Preferred AC System	3Q25	2Q28	$ 2,750,000	LT 12-13
14	PgM 1.009	Program	Program Management Year 8	1Q24	2Q25	$ 1,100,000	LT 11
15	SYS06.10	Cheatham	Excitation	2Q25	3Q28	$ 6,150,000	LT 12-13
16	SYS06.07	Laurel	Excitation	4Q25	4Q28	$ 3,100,000	LT 12-13
17	SYS14.09	Center Hill	Station Service Power Systems	3Q25	1Q29	$ 11,250,000	LT 12-13
18	SYS06.11	Dale Hollow	Excitation	3Q25	1Q29	$ 6,550,000	LT 13-14
19	PgM 1.010	Program	Program Management Year 9	3Q25	4Q26	$ 1,100,000	LT 12
20	PgM 1.011	Program	Program Management Year 10	1Q27	2Q28	$ 1,050,000	LT 13
21	SYS14.04	Old Hickory	Station Service Power Systems	1Q26	4Q29	$ 11,000,000	LT 14
22	SYS06.08	J. Percy Priest	Excitation	1Q28	1Q31	$ 3,650,000	LT 14-15
23	SYS05.06	Cheatham	Main Power Transformer	1Q28	2Q32	$ 12,250,000	LT 14-15
24	CHE22	Cheatham	Powerhouse Crane	2Q28	2Q31	$ 6,700,000	LT 14-15
25	CHE02	Cheatham	Turbine/Generator	2Q30	1Q39	$ 200,000,000	ST 26-33
26	SYS05.08	Dale Hollow	Main Power Transformer	3Q28	2Q33	$ 13,950,000	LT 14-16
27	DAL04	Dale Hollow	Medium Voltage Cables & Busses	3Q28	2Q32	$ 4,750,000	LT 14, LT 16
28	DAL22	Dale Hollow	Powerhouse Crane	3Q31	3Q34	$ 2,900,000	LT 15-16
29	PgM 1.012	Program	Program Management Year 11	3Q28	4Q29	$ 1,200,000	LT 14
30	DAL02	Dale Hollow	Turbine/Generator	2Q34	4Q41	$ 125,000,000	ST 34-38
31	SYS05.04	Laurel	Main Power Transformer	1Q30	1Q34	$ 6,750,000	LT 15-16
32	LAU22	Laurel	Powerhouse Crane	1Q33	4Q36	$ 6,950,000	LT 15, LT 17
33	LAU02	Laurel	Turbine/Generator	1Q37	3Q42	$ 50,000,000	ST 39-40

Appendix B – Project Ranking

SEC 212 Funding Rank	Work Item ID	Plant/System	Project Name	Start FY	Finish FY	Program Amount ($)	MOA/SA
34	PgM 1.013	Program	Program Management Year 12	1Q30	2Q31	$ 1,200,000	LT 15
35	SYS13.05	Barkley	DC / Preferred AC System	3Q31	2Q34	$ 3,700,000	LT 16-17
36	SYS07.09	Cheatham	Governor	3Q31	1Q35	$ 2,850,000	LT 16-17
37	SYS14.08	Barkley	Station Service Power Systems	3Q31	1Q35	$ 12,650,000	LT 16-18
38	SYS13.02	Cheatham	DC / Preferred AC System	1Q33	3Q35	$ 3,050,000	LT 17-18
39	SYS07.03	Cordell Hull	Governor	1Q33	3Q36	$ 2,850,000	LT 17-18
40	PgM 1.014	Program	Program Management Year 13	3Q31	4Q32	$ 1,200,000	LT 16
41	SYS13.06	Old Hickory	DC / Preferred AC System	1Q33	3Q35	$ 3,800,000	LT 17-18
42	SYS05.07	Center Hill	Main Power Transformer	3Q33	4Q37	$ 21,150,000	LT 17-19
43	PgM 1.015	Program	Program Management Year 14	1Q33	2Q34	$ 1,300,000	LT 17
44	SYS13.07	Dale Hollow	DC / Preferred AC System	3Q34	1Q37	$ 5,850,000	LT 18-19
45	SYS05.10	J. Percy Priest	Main Power Transformer	3Q34	3Q38	$ 6,050,000	LT 18-19
46	PgM 1.016	Program	Program Management Year 15	3Q34	4Q35	$ 1,300,000	LT 18
47	CEN15	Center Hill	Oil Circuit Breakers (OCBs)	1Q35	1Q39	$ 13,400,000	LT 19-20
48	BAR15	Barkley	Oil Circuit Breakers (OCBs)	4Q36	4Q40	$ 19,900,000	LT 19-21
49	PgM 1.017	Program	Program Management Year 16	1Q36	2Q37	$ 1,300,000	LT 19
50	SYS07.10	Dale Hollow	Governor	1Q36	3Q39	$ 2,950,000	LT 20-21
51	COR15	Cordell Hull	Oil Circuit Breakers (OCBs)	3Q37	3Q41	$ 8,800,000	LT 21
52	SYS07.02	Barkley	Governor	3Q37	1Q41	$ 3,400,000	LT 20-21
53	JPP22	J. Percy Priest	Powerhouse Crane	3Q37	3Q40	$ 3,400,000	ST 41
54	JPP02	J. Percy Priest	Turbine/Generator and Penstocks/Water Passages	4Q37	2Q43	$ 50,000,000	ST 41-43
55	SYS14.05	Cordell Hull	Station Service Power Systems	3Q37	1Q41	$ 14,100,000	ST 43-44
56	CHE15	Cheatham	Oil Circuit Breakers (OCBs)	3Q37	3Q41	$ 8,650,000	ST 43-44
57	SYS14.11	Cheatham	Station Service Power Systems	3Q37	1Q41	$ 14,750,000	ST 43-45
58	SYS13.08	Cordell Hull	DC / Preferred AC System	4Q38	2Q42	$ 3,500,000	LT 21-22
59	SYS07.08	Old Hickory	Governor	1Q39	4Q42	$ 3,650,000	LT 21-22
60	PgM 1.018	Program	Program Management Year 17	3Q37	4Q38	$ 1,400,000	LT 20
61	PgM 1.019	Program	Program Management Year 18	1Q39	2Q40	$ 1,400,000	LT 21
62	SYS07.05	Center Hill	Governor	1Q39	3Q42	$ 3,150,000	ST 43
63	CEN10	Center Hill	Penstocks/Water Passages	1Q39	4Q41	$ 6,600,000	LT 22
64	SYS05.03	Cordell Hull	Main Power Transformer	1Q39	2Q43	$ 25,650,000	ST 43, ST 45
65	OLD04	Old Hickory	Medium Voltage Cables & Busses	2Q39	1Q42	$ 13,200,000	ST 45-46
66	SYS07.04	Wolf Creek	Governor	2Q39	2Q43	$ 4,650,000	LT 22
67	SYS07.07	J. Percy Priest	Governor	2Q39	3Q42	$ 2,100,000	LT 22
68	SYS07.06	Laurel	Governor	2Q39	3Q42	$ 2,050,000	LT 22
69	SYS14.06	Dale Hollow	Station Service Power Systems	2Q39	4Q42	$ 6,250,000	ST 46
70	LAU16	Laurel	Head Gate Machinery	3Q39	2Q42	$ 3,300,000	ST 46-47
71	JPP16	J. Percy Priest	Head Gate Machinery	3Q39	2Q42	$ 2,350,000	LT 22

Appendix B – Project Ranking

SEC 212 Funding Rank	Work Item ID	Plant/System	Project Name	Start FY	Finish FY	Program Amount ($)	MOA/SA
72	PgM 1.020	Program	Program Management Year 19	3Q40	4Q41	$ 1,400,000	LT 22
73	SYS13.09	Laurel	DC / Preferred AC System	4Q39	2Q42	$ 2,550,000	ST 46
74	SYS06.06	Center Hill	Excitation	4Q39	1Q43	$ 5,450,000	ST 46
75	SYS13.10	Center Hill	DC / Preferred AC System	1Q40	3Q42	$ 4,250,000	ST 46-47
76	PgM 1.021	Program	Program Management Year 20	1Q42	4Q43	$ 2,000,000	ST 47

Appendix B – Project Ranking

Appropriated Funding Project Ranking

Appropriated Funding Rank	Plant	Identifier	WBS	ROM (FY21 estimate)
1	Cordell Hull	Centralized Control	COR.18	$1,200,000
2	Old Hickory	Centralized Control	OLD.18	$1,700,000
3	Wolf Creek	Centralized Control	WOL.18	$2,300,000
4	Cordell Hull	Oil Systems	COR.33	$283,592
5	Dale Hollow	Cooling Water System	DAL.17.01	$3,585,721
6	Wolf Creek	HVAC	WOL.21	$6,259,647
7	Cordell Hull	Intake Gantry Crane	COR.01	$11,371,109
8	Barkley	Compressed Air Systems	BAR.24	$152,841
9	Barkley	Switchyard Equipment	BAR.15	$8,446,765
10	Cheatham	Cooling Water System	CHE.17.01	$3,585,721
11	Barkley	HVAC	BAR.21	$4,160,824
12	Old Hickory	Control Cables	OLD.35	$1,168,444
13	Center Hill	Switchyard Equipment	CEN.15	$6,117,524
14	Center Hill	Powerhouse Roof	CEN.37	$1,551,846
15	Cordell Hull	HVAC	COR.21	$3,129,823
16	Old Hickory	Intake Gantry Crane	OLD.01	$14,916,924
17	Barkley	Drainage & Unwatering System	BAR.38	$789,163
18	Cheatham	Taildeck/Draft Tube Crane	CHE.01	$2,244,163
19	Wolf Creek	Taildeck/Draft Tube Crane	WOL.01	$1,714,485
20	Cheatham	Oil Systems	OLD.33	$283,592
21	Dale Hollow	Control Cables	DAL.35	$1,180,595
22	Dale Hollow	HVAC	DAL.21	$3,129,823
23	Wolf Creek	Oil Systems	WOL.33	$283,592
24	Barkley	Control Cables	BAR.35	$1,332,472
25	Barkley	Powerhouse Roof	BAR.37	$3,466,912
26	Old Hickory	Switchyard Equipment	OLD.15	$7,709,206
27	Old Hickory	Oil Circuit Breakers (OCBs)	OLD.34	$8,998,393
28	Laurel	Communication System	LAU.40	$132,203
29	Cordell Hull	Intake Gates	COR.16	$6,589,520
30	Cheatham	Waste Water System	CHE.41	$1,101,074
31	Cordell Hull	Drainage & Unwatering System	COR.38	$789,163
32	Dale Hollow	Station Service Generator	DAL.20	$2,156,057
33	Cordell Hull	Cooling Water System	COR.17.01	$2,758,247
34	Dale Hollow	Switchyard Equipment	DAL.15	$5,275,460
35	Dale Hollow	Communication System	DAL.40	$132,203
36	Center Hill	Intake Gates	CEN.16	$2,598,377

Appendix B – Project Ranking

Appropriated Funding Rank	Plant	Identifier	WBS	ROM (FY21 estimate)
37	Dale Hollow	Intake Gates	DAL.16	$795,262
38	Cordell Hull	Compressed Air Systems	COR.24	$152,841
39	Cordell Hull	Powerhouse Elevator	COR.42	$832,780
40	Cordell Hull	Unit #2 Repair	COR.09	$18,447,313
41	Center Hill	Taildeck/Draft Tube Crane	CEN.01	$1,795,330
42	J. Percy Priest	Unit Control Systems	JPP.08	$151,134
43	Laurel	Waste Water System	LAU.41	$366,367
44	Old Hickory	Drainage & Unwatering System	OLD.38	$789,163
45	J. Percy Priest	Station Service Power Systems	JPP.14	$533,596
46	Cheatham	Control Cables	CHE.35	$1,077,318
47	Cordell Hull	Taildeck/Draft Tube Crane	COR.01	$2,244,163
48	Center Hill	Intake Bulkheads	CEN.44	$313,570
49	Cheatham	Drainage & Unwatering System	CHE.38	$789,163
50	Wolf Creek	Intake Bulkheads	WOL.44	$230,377
51	Laurel	Security System	LAU.45	$701,836
52	Barkley	Unit Control Systems	BAR.08	$151,134
53	J. Percy Priest	Compressed Air Systems	JPP.24	$152,841
54	Old Hickory	Unit Control Systems	OLD.08	$151,134
55	Dale Hollow	Unit Control Systems	DAL.08	$151,134
56	Wolf Creek	Station Service Generator	WOL.20	$2,156,057
57	Laurel	Station Service Power Systems	LAU.14	$404,539
58	Cordell Hull	Communication System	COR.40	$132,203
59	Cordell Hull	Control Cables	COR.35	$1,131,615
60	J. Percy Priest	Control Cables	JPP.35	$1,160,189
61	Cheatham	Switchyard Equipment	CHE.15	$5,914,544
62	Old Hickory	Communication System	OLD.40	$132,203
63	Wolf Creek	Security System	WOL.45	$701,836
64	Old Hickory	Oil Systems	OLD.33	$283,592
65	Center Hill	Oil Circuit Breakers (OCBs)	CEN.34	$9,906,854
66	Cordell Hull	Switchyard Equipment	COR.15	$5,536,721
67	Barkley	Oil Systems	BAR.33	$283,592
68	Barkley	Taildeck/Draft Tube Crane	BAR.01	$1,795,330
69	Wolf Creek	Drainage & Unwatering System	WOL.38	$607,048
70	Laurel	Switchyard Equipment	LAU.15	$3,834,506
71	Old Hickory	Intake Gates	OLD.16	$6,051,893
72	Old Hickory	Powerhouse Elevator	OLD.42	$854,133
73	Laurel	Cooling Water System	LAU.17.01	$1,195,240

Appendix B – Project Ranking

Appropriated Funding Rank	Plant	Identifier	WBS	ROM (FY21 estimate)
74	Laurel	Unit Control Systems	LAU.08	$151,134
75	Center Hill	Communication System	CEN.40	$132,203
76	J. Percy Priest	Switchyard Equipment	JPP.15	$2,783,684
77	Cordell Hull	Oil Circuit Breakers (OCBs)	COR.34	$6,388,981
78	Cheatham	Oil Circuit Breakers (OCBs)	CHE.34	$6,281,421
79	Center Hill	Oil Systems	CEN.33	$283,592
80	Barkley	Oil Circuit Breakers (OCBs)	BAR.34	$14,264,103
81	J. Percy Priest	Oil Systems	JPP.33	$283,592
82	Cordell Hull	Powerhouse Crane	COR.22	$5,630,135
83	J. Percy Priest	Drainage & Unwatering System	JPP.38	$789,163
84	Old Hickory	Waste Water System	OLD.41	$1,468,099
85	Cheatham	Intake Gates	CHE.16	$6,514,502
86	J. Percy Priest	Intake Gates	JPP.16	$962,626
87	Cordell Hull	Unit Control Systems	COR.08	$151,134
88	Old Hickory	Intake Trash Racks	OLD.36	$4,814,126
89	Cheatham	Intake Trash Racks	CHE.36	$3,610,595
90	Barkley	Communication System	BAR.40	$132,203
91	Center Hill	Cooling Water System	CEN.17.01	$3,585,721
92	Wolf Creek	Unit Control Systems	WOL.08	$151,134
93	Cheatham	Emergency Diesel Generator	CHE.20	$306,012
94	J. Percy Priest	Waste Water System	JPP.41	$366,367
95	Old Hickory	HVAC	OLD.21	$4,160,824
96	Wolf Creek	Governor	WOL.07	$2,327,969
97	Wolf Creek	Switchyard Equipment	WOL.15	$9,915,102
98	Cheatham	Unit Control Systems	CHE.08	$151,134
99	Center Hill	Unit Control Systems	CEN.08	$151,134
100	Old Hickory	Intake Bulkheads	OLD.44	$319,111
101	Wolf Creek	Draft Tube Gates	WOL.43	$997,516
102	Wolf Creek	Powerhouse Roof	WOL.37	$4,377,668
103	Wolf Creek	Control Cables	WOL.35	$627,760
104	J. Percy Priest	Governor	JPP.07	$387,995
105	Laurel	Governor	LAU.07	$387,995
106	Laurel	Control Cables	LAU.35	$1,160,189
107	Dale Hollow	Station Service Power Systems	DAL.14	$6,787,093
108	J. Percy Priest	HVAC	JPP.21	$2,638,632
109	Wolf Creek	Cooling Water System	WOL.17.01	$3,875,233
110	Center Hill	Compressed Air Systems	CEN.24	$152,841

Appendix B – Project Ranking

Appropriated Funding Rank	Plant	Identifier	WBS	ROM (FY21 estimate)
111	Old Hickory	Medium Voltage Cables & Busses	OLD.04	$8,751,327
112	Laurel	Oil Circuit Breakers (OCBs)	LAU.34	$4,083,870
113	Wolf Creek	Oil Circuit Breakers (OCBs)	WOL.34	$15,786,617
114	Barkley	Cooling Water System	BAR.17.01	$2,743,636
115	Cordell Hull	Main Power Transformer	COR.05	$17,261,486
116	Laurel	Head Gate Machinery	LAU.01	$1,678,968
117	Barkley	Intake Gates	BAR.16	$2,715,462
118	J. Percy Priest	Cooling Water System	JPP.17.01	$3,585,721
119	Barkley	Draft Tube Gates & Slot Fillers	BAR.43	$437,108
120	Cheatham	Powerhouse Elevator	CHE.42	$832,780
121	Cheatham	Powerhouse Roof	CHE.37	$2,731,097
122	Cordell Hull	Intake Bulkheads	COR.44	$165,962
123	Laurel	Oil Systems	LAU.33	$283,592
124	Old Hickory	Taildeck/Draft Tube Crane	OLD.01	$1,294,710
125	Cordell Hull	Medium Voltage Cables & Busses	COR.04	$2,558,825
126	J. Percy Priest	Head Gate Machinery	JPP.01	$1,678,968
127	Laurel	DC / Preferred AC System	LAU.13	$1,651,441
128	Wolf Creek	Intake Gates	WOL.16	$6,731,170
129	Wolf Creek	Intake Trash Racks	WOL.36	$8,023,545
130	Cordell Hull	Intake Trash Racks	COR.36	$4,814,127
131	Barkley	Powerhouse Elevator	BAR.42	$1,110,373
132	Center Hill	Waste Water System	CEN.41	$2,986,901
133	Cordell Hull	Waste Water System	COR.41	$1,101,074
134	Dale Hollow	Intake Bulkheads	DAL.44	$130,184
135	Dale Hollow	Waste Water System	DAL.41	$846,980
136	Laurel	Drainage & Unwatering System	LAU.38	$789,163
137	Laurel	HVAC	LAU.21	$1,043,274
138	Old Hickory	Powerhouse Crane	OLD.22	$4,746,741
139	J. Percy Priest	Powerhouse Roof	JPP.37	$1,793,543
140	Cordell Hull	Fire Suppression System	COR.11	$120,184
141	Dale Hollow	Compressed Air Systems	DAL.24	$152,841
142	Barkley	Intake Bulkheads	BAR.44	$228,901
143	J. Percy Priest	Communication System	JPP.40	$132,203
144	Wolf Creek	Communication System	WOL.40	$132,203
145	Barkley	Fire Suppression System	BAR.11	$120,184
146	Old Hickory	Fire Suppression System	OLD.11	$120,184
147	J. Percy Priest	Fire Suppression System	JPP.11	$120,184

Appendix B – Project Ranking

Appropriated Funding Rank	Plant	Identifier	WBS	ROM (FY21 estimate)
148	Laurel	Compressed Air Systems	LAU.24	$152,841
149	Center Hill	Intake Trash Racks	CEN.36	$4,059,372
150	J. Percy Priest	Intake Trash Racks	JPP.36	$1,604,709
151	Cordell Hull	Draft Tube Gates & Slot Fillers	BAR.43	$327,831
152	Cordell Hull	Powerhouse Roof	COR.37	$2,080,339
153	Old Hickory	Draft Tube Gates & Slot Fillers	OLD.43	$327,831
154	Wolf Creek	Powerhouse Elevator	WOL.42	$1,665,560
155	Laurel	Intake Gates	LAU.16	$364,964
156	Laurel	Intake Trash Racks	LAU.36	$1,337,257
157	Dale Hollow	Intake Trash Racks	DAL.36	$2,005,886
158	Dale Hollow	Taildeck/Draft Tube Crane	DAL.01	$1,318,835
159	J. Percy Priest	Powerhouse Crane	JPP.22	$2,156,616
160	Cheatham	Compressed Air Systems	CHE.24	$152,841
161	Old Hickory	Powerhouse Roof	OLD.37	$8,532,784
162	Wolf Creek	Fire Suppression System	WOL.11	$120,184
163	Center Hill	Fire Suppression System	CEN.11	$120,184
164	J. Percy Priest	Penstocks/Water Passages	JPP.10	$1,229,788
165	Cheatham	Fire Suppression System	CHE.11	$120,184
166	Laurel	Fire Suppression System	LAU.11	$120,184
167	Dale Hollow	Fire Suppression System	DAL.11	$120,184
168	Cheatham	Communication System	CHE.40	$132,203
169	Dale Hollow	Oil Circuit Breakers (OCBs)	DAL.34	$13,071,748
170	Center Hill	Draft Tube Gates	CEN.43	$500,807
171	J. Percy Priest	Intake Bulkheads	JPP.44	$276,104
172	Center Hill	Excitation	CEN.06	$5,241,533
173	Wolf Creek	Compressed Air Systems	WOL.24	$152,841
174	Old Hickory	Compressed Air Systems	OLD.24	$152,841
175	Cheatham	HVAC	CHE.21	$3,129,823
176	Center Hill	DC / Preferred AC System	CEN.13	$3,812,338
177	Dale Hollow	Oil Systems	DAL.33	$283,592
178	Barkley	Powerhouse Crane	BAR.22	$4,330,873
179	Dale Hollow	Draft Tube Gates	DAL.43	$312,771
180	J. Percy Priest	Draft Tube Gates	JPP.43	$932,355
181	Laurel	Draft Tube Gates	LAU.43	$443,836
182	Laurel	Intake Bulkheads	LAU.44	$61,454
183	Laurel	Powerhouse Roof	LAU.37	$821,044

Appropriated Funding Rank	Plant	Identifier	WBS	ROM (FY21 estimate)
184	Barkley	Waste Water System	BAR.41	$795,979
185	Cheatham	Intake Bulkheads	CHE.44	$318,176
186	Barkley	Emergency Diesel Generator	BAR.20	$306,012
187	Center Hill	Drainage & Unwatering System	CEN.38	$789,163
188	Center Hill	HVAC	CEN.21	$3,013,904
189	Center Hill	Powerhouse Elevator	CEN.42	$726,484
190	Center Hill	Station Service Generator	CEN.20	$2,072,732
191	Cheatham	Draft Tube Gates & Slot Fillers	CHE.43	$437,108
192	Cordell Hull	Emergency Diesel Generator	COR.20	$235,394
193	Dale Hollow	Drainage & Unwatering System	DAL.38	$789,163
194	Dale Hollow	Powerhouse Elevator	DAL.42	$854,133
195	Dale Hollow	Powerhouse Roof	DAL.37	$1,643,731
196	Wolf Creek	Waste Water System	WOL.41	$2,202,149

Appendix C – Previously Funded Projects

Appendix C: Previously Funded Projects

Section 212 Project History

Hydropower Master Plan – Section 212 Funded Completed Projects List						
Work Item ID	**Plant/System**	**Project Name**	**Funding Source**	**Program Amount ($)**	**MOA/SA**	**Status**
SYS07.02	Barkley	Turbine Governors	Section 212	$236,149.48	LT 1, Ballot 2	Complete
PgM01.002	Program	Program Management Year 1	Section 212	$1,073,385.73	LT 3, Ballot 2	Complete
BAR04.1	Barkley	Medium Voltage Cables & Busses-Planning	Section 212	$98,003.15	LT 3	Complete
SYS13.1	System	DC Systems-Planning	Section 212	$144,686.81	LT 3	Complete
SYS14.1	System	Station Service Power Systems-Planning	Section 212	$130,071.08	LT 3	Complete
SYS06.1	System	Excitation Equipment-Planning	Section 212	$70,531.17	LT 3	Complete
SYS06.2	Barkley	Excitation	Section 212	$4,752,685.37	LT 3, Ballot 8	Complete
WOL33.2	Wolf Creek	Unwatering Pumps	Section 212	$392,542.78	LT 3	Complete
SYS01.4	Cordell Hull	Intake Draft Tube Lifting Equipment	Section 212	$23,869.90	LT 3	Complete
SYS01.5	Cheatham	Intake Draft Tube Lifting Equipment	Section 212	$25,702.36	LT 3	Complete
BAR02.1.1	Barkley	Rehabilitation Coordination Memorandum	Section 212	$57,591.58	LT 3	Complete
WOL26.1	Wolf Creek	Evacuation/Water Depression Controls	Section 212	$165,705.41	LT 3	Complete
BAR04.2	Barkley	Medium Voltage Cables & Busses	Section 212	$4,099,788.38	LT 5	Complete
PgM01.003	Program	Program Management Year 2	Section 212	$1,067,187.79	LT 5	Complete
SYS30.02	System	System-Wide Transformer Bushings Replacement	Section 212	$550,000.00	LT 3 & 5, Ballot 5	Complete
1	Wolf Creek	Rewind Generator Unit #6	Section 212	$3,546,566.88	Legacy 04	Complete
2, 11	Center Hill	Rehabilitate and Repair Powerhouse Crane	Section 212	$1,498,301.90	Legacy 04 & 05-06	Complete
1	System	Needs/Opportunities & Evaluation Ranking Study	Section 212	$825,243.20	Legacy 05-06	Complete
3	Dale Hollow	Replace Head Gate Hoist Wire Ropes	Section 212	$201,371.52	Legacy 05-06	Complete
4	Wolf Creek	Replace Generator Air Coolers and Piping	Section 212	$532,670.88	Legacy 05-06	Complete
6	Wolf Creek	Thrust Bearing Hi-Pressure Lift System Units 4 & 6	Section 212	$119,844.10	Legacy 05-06	Complete
7	Barkley	Replace Transformer Cooling System	Section 212	$279,993.68	Legacy 05-06	Complete
8	Old Hickory	Replace Generator Cooling Water Piping	Section 212	$297,783.11	Legacy 05-06	Complete
9	Center Hill	Replace Generator #2 Air Coolers	Section 212	$152,880.88	Legacy 05-06	Complete
10	Center Hill	Replace Generator #2 Thrust Bearing	Section 212	$64,508.00	Legacy 05-06	Complete
12	System	MWH Program Management Support	Section 212	$290,508.83	Legacy 05-06	Complete
13	Dale Hollow	Emergency Repair of Head Gate Machinery	Section 212	$185,323.68	Legacy 05-06	Complete
2	Old Hickory	Rehabilitate Powerhouse Crane	Section 212	$2,124,820.41	Legacy 05-06	Complete
14, 1	Barkley	Rehabilitate Powerhouse Crane	Section 212	$3,783,181.45	Legacy 05-06, 08-09	Complete
2	Old Hickory	Generator #4 Rewind – PED	Section 212	$173,070.14	Legacy 08-09	Complete
6	Center Hill	Turbine-Generator Rehab Unit #2	Section 212	$1,644,992.97	Legacy 08-09	Complete
14	Barkley	Unit #1 Rewind	Section 212	$4,287,619.47	Legacy 08-09	Complete
7	System	System Wide Circuit Breakers PED	Section 212	$84,573.11	Legacy 08-09	Complete
9-17	System	System Wide Circuit Breakers Procurement and Installation	Section 212	$7,281,305.74	Legacy 08-09	Complete

Appendix C – Previously Funded Projects

Work Item ID	Plant/System	Project Name	Funding Source	Program Amount ($)	MOA/SA	Status
19	Old Hickory	Unit #4 Turbine-Generator PED	Section 212	$1,683,013.17	Legacy 08-09	Complete
20	Center Hill	Penstocks/Water Passages PED	Section 212	$85,138.52	Legacy 08-09	Complete
21	Center Hill	Medium Voltage Cables and Busses PED	Section 212	$189,310.51	Legacy 08-09	Complete
22	System	System-Wide Turbine Governors PED	Section 212	$477,440.41	Legacy 08-09	Complete
23	System	System-Wide Main Power Transformers	Section 212	$241,757.49	Legacy 08-09	Complete
24	Laurel	Unit #1 Assessment	Section 212	$228,772.75	Legacy 08-09	Complete
25	System	System-Wide Switchyards Condition Assessment	Section 212	$118,320.35	Legacy 08-09	Complete
26	System	System-Wide Program Start-Up Support	Section 212	$879,827.76	Legacy 08-09	Complete

Hydropower Master Plan - Active Project List						
Work Item ID	**Plant/System**	**Project Name**	**Funding Source**	**Program Amount ($)**	**MOA/SA**	**Status**
BAR02	Barkley	Major Hydropower Rehabilitation E&D	Section 212	$1,831,000.00	ST 1	Active
BAR02	Barkley	Major Hydropower Rehabilitation Acquisition	Section 212	$113,169,000.00	ST 1-5	Active
1		Reserve Fund	Section 212	$5,000,000.00	LT 1	Active
2		Emergent Work	Section 212	$73,850.52	LT 1	Active
SYS13	System	DC / Preferred AC System - E&D	Section 212	$575,000.00	LT 3, Ballot 1	Active
4		PCG Reserve Fund	Section 212	$10,000,000.00	ST 2	Active
1		Reserve Fund	Section 212	$5,000,000.00	LT 2	Active
2		Emergent Work	Section 212	$286,171.78	LT 3	Active
CEN02.2	Center Hill	Equipment Vendor Eng & Model Test	Section 212	$800,000.00	LT 3	Active
WOL33.1	Wolf Creek	Thrust Bearing Hi-Pressure Lift System Units 1,2,3 & 5	Section 212	$2,150,000.00	LT 3	Active - Closeout
WOL10.1	Wolf Creek	Penstock/Water Passages - PED	Section 212	$149,000.00	LT 3	Active - Closeout
OLD02.1.1	Old Hickory	Rehabilitation Coordination Memorandum	Section 212	$722,900.00	LT 3, Ballot 6 & 13	Active - Closeout
WOL02.1	Wolf Creek	Rehabilitation Coordination Memorandum	Section 212	$1,380,000.00	LT 3	Active
CEN02	Center Hill	Turbine Generator Rehabilitation	Section 212	$67,376,000.00	LT 1-4, Ballot 3, Ballot 13	Active
2		Emergent Work	Section 212	$275,561.29	LT 4	Active
SYS14	System	Station Service Power Systems-Engineering & Design	Section 212	$1,816,000.00	LT 4	Active
2		Emergent Work	Section 212	$1,959,582.41	LT 5	Active
SYS16.2	Wolf Creek	System-Wide Headworks/Intake Controls and Wiring Replacement	Section 212	$7,850,000.00	LT 5 & 7, Ballot 11	Active
SYS16.3	Center Hill	System-Wide Headworks/Intake Controls and Wiring Replacement	Section 212	$4,565,000.00	LT 5 & 7, Ballot 11	Active
SYS16.4	Dale Hollow	System-Wide Headworks/Intake Controls and Wiring Replacement	Section 212	$3,585,000.00	LT 5 & 7, Ballot 11	Active
OLD02R	Old Hickory	Old Hickory Unit #4 Repair	Section 212	$25,000,000.00	LT 4 & 6, Ballot 7	Active
SYS14.03	Wolf Creek	Station Service Power Systems Rehabilitation	Section 212	$7,400,000.00	LT 6-7	Active - Closeout
WOL10.2	Wolf Creek	Penstock/Water Passages Repair Work	Section 212	$5,350,000.00	LT 6 & 3, Ballot 13	Active - Closeout
PgM01.004	Program	Program Management Year 3	Section 212	$1,100,000.00	LT 6	Active
SYS05.02	Barkley	Main Power Transformers	Section 212	$6,900,000.00	LT 7 & 5, Ballot 14	Active
SYS14.02	Dale Hollow	Station Service Power Systems Engineering Design	Section 212	$650,000.00	LT 7	Active - Closeout
PgM01.108	Cheatham	Hydropower Rehabilitation Analysis Report	Section 212	$650,000.00	LT 7	Active
Pgm01.106	Cordell Hull	Hydropower Rehabilitation Analysis Report	Section 212	$650,000.00	LT 7	Active

Appendix C – Previously Funded Projects

Hydropower Master Plan - Active Project List						
Work Item ID	**Plant/System**	**Project Name**	**Funding Source**	**Program Amount ($)**	**MOA/SA**	**Status**
SYS13.02	Cheatham	DC Systems E&D	Section 212	$600,000.00	LT 7	Active - Closeout
SYS06.04	Cordell Hull	Excitation E&D and Acquisition	Section 212	$6,625,000.00	LT 7	Active
PgM01.005	Program	Program Management Year 4	Section 212	$1,100,000.00	LT 7	Active
OLD02.01	Old Hickory	Major Hydropower Rehabilitation E&D	Section 212	$2,200,000.00	LT 7	Active
2		Emergent Work	Section 212	$25,000.00	LT 7	Active
OLD02	Old Hickory	Major Hydropower Rehabilitation Acquisition	Section 212	$20,920,000.00	LT 8-9	Active
SYS05.09	Old Hickory	Main Power Transformers	Section 212	$11,180,000.00	LT 8	Active
PgM01.006	Program	Program Management Year 5	Section 212	$1,100,000.00	LT 8	Active
SYS01.02	Barkley	Intake Draft Tube Lifting Equipment	Section 212	$112,465.75	LT 8	Active
SYS01.03	Cheatham	Intake Draft Tube Lifting Equipment	Section 212	$181,314.48	LT 8	Active
SYS01.04	Old Hickory	Intake Draft Tube Lifting Equipment	Section 212	$175,000.00	LT 8	Active
SYS01.05	Cordell Hull	Intake Draft Tube Lifting Equipment	Section 212	$181,219.77	LT 8	Active
SYS13.04	Old Hickory	DC Systems E&D	Section 212	$650,000.00	LT 8	Active
SYS06.09	Old Hickory	Excitation Replacement	Section 212	$6,150,000.00	LT 8-9	Active
2		Emergent Work	Section 212	$6,000,000.00	LT 8	Active
PgM01.007	Program	Program Management Year 6	Section 212	$1,100,000.00	LT 9	Active
55	Wolf Creek	Turbine Performance Test	Section 212	$115,000.00	LT 3, Ballot 10	Active - Closeout
60	Wolf Creek	Unit 5 Exciter Repair	Section 212	$500,000.00	LT 5, Ballot 15	Active
5		Emergent Work	Section 212	$1,588,003.34	Legacy 05-06, SA 1	Active
1		Emergent Work	Section 212	$1,000,000.00	Legacy 05-06, SA 2	Active
5		Emergent Work	Section 212	$173,748.41	Legacy 08-09, SA 1	Active
8		Emergent Work	Section 212	$4,122,615.03	Legacy 08-09, SA 2	Active
18		Emergent Work	Section 212	$5,587,492.31	Legacy 08-09, SA 3	Active
55	Wolf Creek	Dissolved Oxygen Investigation - Planning Study	Section 212	$85,000.00	Legacy 08-09, SA 1, Ballot 19	Active
56	Old Hickory	OCB Bushing Replacement	Section 212	$165,000.00	Legacy 08-09, SA 1, Ballot 21	Active - Closeout
57	Wolf Creek	Dissolved Oxygen Investigation - PED	Section 212	$1,000,000.00	Legacy 05-06, SA 1, Ballot 22	Active

Appendix C – Previously Funded Projects

Appropriated Funded Project History

Hydropower Master Plan – Prior Appropriated Funded Project List			
Plant	**Project Name**	**Fiscal Year (FY)**	**Funding Source**
Barkley	Replace Diesel Generator	FY06	O&M
Barkley	Amplidynes	FY09	ARRA
Barkley	Backup Generator	FY09	ARRA
Barkley	CO2 System	FY09	ARRA
Barkley	Coupling Capacitor Volt Transformer	FY09	ARRA
Barkley	Digital Line Relays	FY09	ARRA
Barkley	Elevator	FY09	ARRA
Barkley	Generator Neutral Transformer	FY09	ARRA
Barkley	Manlift	FY09	ARRA
Barkley	Spillway Gate Chains	FY09	ARRA
Barkley	Station Power Cables	FY09	ARRA
Barkley	Thrust Bearing Oil Coolers	FY09	ARRA
Barkley	Unit 1 Rewind	FY11	O&M
Barkley	Cooling Water System	FY15	O&M
Barkley	Headgate Seals and Rehab	FY15	O&M
Barkley	Repair Monolith Leaks	FY17	O&M
Barkley	Unit Intake Cleaning	FY17	O&M
Barkley	Repair Powerplant Roof	FY18	O&M
Barkley	SCADA Upgrade	FY18	O&M
Barkley	Station Pumps	FY18	O&M
Barkley	Design/Purchase Trash Screens	FY19	O&M
Barkley	Replace Storm Damaged Powerhouse Roof	FY19	O&M
Barkley	Unit Intake Cleaning	FY19	O&M
Barkley	Intake Gantry Crane Power Feeder	FY08	O&M
Center Hill	CO2 System	FY09	ARRA
Center Hill	Control Cables	FY09	ARRA
Center Hill	Generator Cooler Piping U2	FY09	ARRA
Center Hill	Generator Coolers U1	FY09	ARRA
Center Hill	Generator Coolers with Piping U3	FY09	ARRA
Center Hill	Main Power Cables	FY09	ARRA
Center Hill	Manlift	FY09	ARRA
Center Hill	Slot Repair	FY09	ARRA
Center Hill	Sluice Repair	FY09	ARRA
Center Hill	Station Power Cables	FY09	ARRA
Center Hill	Headgate 3 Repair and Repaint	FY13	O&M
Center Hill	Arc Flash	FY16	O&M
Center Hill	Governor Air Compressors (Purchase)	FY16	O&M
Center Hill	NRWP Replace Governor Air Compressors	FY16	O&M
Center Hill	Turbine Generator Relays	FY16	O&M
Center Hill	SCADA Upgrade (Design)	FY17	O&M

Appendix C – Previously Funded Projects

Hydropower Master Plan – Prior Appropriated Funded Project List			
Plant	**Project Name**	**Fiscal Year (FY)**	**Funding Source**
Center Hill	HVAC (Ventilation)	FY18	O&M
Center Hill	SCADA Upgrade	FY18	O&M
Center Hill	Repair Water Leaks in Switchyard Cable Vault and Replace Dc System Cabling	FY09	ARRA
Cheatham	Draft Tube Slot Fillers	FY14	O&M
Cheatham	Oil Coolers	FY15	O&M
Cheatham	1600 Amp Breaker	FY16	O&M
Cheatham	600 Amp Breaker	FY16	O&M
Cheatham	NRWP Replace Generator Thrust Bearing Coolers	FY16	O&M
Cheatham	SCADA Upgrade (Design)	FY17	O&M
Cheatham	Unit Intake Cleaning	FY17	O&M
Cheatham	SCADA Upgrade	FY18	O&M
Cheatham	Unit Intake Cleaning	FY18	O&M
Cheatham	Unit Intake Cleaning	FY19	O&M
Cheatham	Unit Intake Cleaning	FY20	O&M
Cheatham	Replace SCADA System Battery	FY09	ARRA
Cordell Hull	CO2 System	FY09	O&M
Cordell Hull	Station Service Power Cables (COR/P To COR/R)	FY13	O&M
Cordell Hull	Cooling Water System	FY14	O&M
Cordell Hull	Powerhouse Roof	FY14	O&M
Cordell Hull	480v Circuit Breaker	FY18	O&M
Cordell Hull	Unit Intake Cleaning	FY19	O&M
Cordell Hull	HVAC (For Control Room)	FY13	O&M
Dale Hollow	CO2 System	FY09	ARRA
Dale Hollow	Concrete Repair	FY09	ARRA
Dale Hollow	Manlift	FY09	ARRA
Dale Hollow	Powerhouse Crane Rehab	FY09	ARRA
Dale Hollow	Sluice Repair	FY09	ARRA
Dale Hollow	Station Power Cables	FY09	ARRA
Dale Hollow	Arc Flash	FY15	O&M
Dale Hollow	Security System	FY15	O&M
Dale Hollow	SCADA Upgrade (Design)	FY17	O&M
Dale Hollow	Elevator	FY18	O&M
Dale Hollow	SCADA Upgrade	FY18	O&M
JPP	CO2 System	FY09	ARRA
JPP	Powerhouse Crane	FY09	ARRA
JPP	Station Service Power Cables	FY09	ARRA
JPP	SCADA Upgrade (Design)	FY17	O&M
JPP	Arc Flash Mitigation	FY20	O&M
JPP	SCADA Upgrade	FY18	O&M
Laurel	CO2 System	FY09	ARRA
Laurel	Powerplant Roof	FY09	ARRA

Appendix C – Previously Funded Projects

Hydropower Master Plan – Prior Appropriated Funded Project List			
Plant	**Project Name**	**Fiscal Year (FY)**	**Funding Source**
Laurel	Sewer System	FY12	O&M
Laurel	Station Service Diesel Generator	FY13	O&M
Laurel	Station Service Transformer	FY15	O&M
Laurel	Battery Switchboard	FY16	O&M
Laurel	SCADA Upgrade (Design)	FY17	O&M
Old Hickory	Spillway Gate Rehab	FY05	O&M
Old Hickory	CO2 System	FY09	ARRA
Old Hickory	HVAC	FY09	ARRA
Old Hickory	Manlift	FY09	ARRA
Old Hickory	SCADA Upgrade	FY09	ARRA
Old Hickory	Spillway Gate Repair and Coating	FY09	ARRA
Old Hickory	Toe Drain Repair	FY09	ARRA
Old Hickory	Governor Air Compressors	FY13	O&M
Old Hickory	Cooling Water Piping	FY14	O&M
Old Hickory	Draft Tube Bulkheads and Slot Fillers	FY14	O&M
Old Hickory	Main Power Transformers and Oil Leak	FY16	O&M
Old Hickory	Unit Intake Cleaning	FY17	O&M
Old Hickory	Phase One Plans and Specs For 69kv Switchyard Rehab	FY19	O&M
Old Hickory	Unit Intake Cleaning	FY19	O&M
Old Hickory	Conduct Concrete Growth Study	FY14	O&M
Wolf Creek	Major Rehab MRER	FY05	O&M
Wolf Creek	Powerhouse Crane Rehab	FY05	O&M
Wolf Creek	Orifice Gates	FY07	O&M
Wolf Creek	Switchyard Lighting Arrestors Install	FY08	O&M
Wolf Creek	CO2 System	FY09	ARRA
Wolf Creek	Concrete Repair	FY09	ARRA
Wolf Creek	Cooling Water System	FY09	ARRA
Wolf Creek	Manlift	FY09	ARRA
Wolf Creek	Mobile Crane	FY09	ARRA
Wolf Creek	Repair Pylon Elevator	FY09	ARRA
Wolf Creek	Sewage Facilities	FY09	ARRA
Wolf Creek	Sluice Repair	FY09	ARRA
Wolf Creek	Spillway Gate Machinery	FY17	O&M
Wolf Creek	Cable Tray Replacement	FY18	O&M
Wolf Creek	Cable Tunnel Leak Repair	FY18	O&M
Wolf Creek	Hydropower Analysis for Operational Data	FY20	O&M

Appendix D – Project and Work Item Naming

Appendix D: Project and Work Item Naming

WBS Breakdown

Plant Code		Project Type		Work Item #
CEN	.	02	.	1

Work Item #	Description
1 and up	Consecutive number assigned to each Work Item within a project

Project Type	Equipment/ Description
1	Intake Lifting Equipment (may include draft tube lifting equipment)
2	Generator / Turbine Upgrades
3	Generator Circuit Breaker
4	Medium Voltage Cables and Buses
5	Main Power Transformers
6	Excitation Equipment
7	Turbine Governor
8	Unit Control System
9	Hydraulic Turbine Repairs
10	Penstock / Water Passages
11	CO2 System
12	Unit Protection Systems and Instrumentation
13	DC System
14	Station Service Power Systems
15	Switchyard Equipment
16	Head / Intake Gates
17	Cooling Water System
18	SCADA System
19	Draft Tube Stop Logs Lifting Equipment
20	Emergency Generator or House Hydroelectric Unit
21	HVAC
22	Powerhouse Crane
23	Spillway Gates and Equipment
24	Compressed Air System
25	Neutral Circuit Breakers
26	Synchronous Condensing
27	Turbine Grease System
28	Reservoir Level Instrumentation
29	Switchyard Work
30	Studies
32	Vibration & Air Gap Monitoring
33	Oil Systems
34	OCBs
35	Control Cables
36	Trash Racks
37	Powerhouse Roof
38	Drainage and Unwatering System
39	Raw Water System
40	Communication System
41	Waste Water System
42	Powerhouse Elevator
43	Draft Tube Gates
44	Intake Bulkheads
45	Security System
46	Turbine-Generator Bearings
98	Legal Reserve
99	Emergent Work and Reserve
100	Items Funded by Legacy MOAs

Plant Code	Description
BAR	Barkley
CEN	Center Hill
CHE	Cheatham
COR	Cordell Hull
DAL	Dale Hollow
JPP	J. Percy Priest
LAU	Laurel
OLD	Old Hickory
SYS	System Projects (More than one plant)
WOL	Wolf Creek

Appendix E – Proposed Five Year Outage Schedule

Appendix E: Proposed Five Year Outage Schedule

The following outage schedules are shown for information only and are subject to change

2021

LRN CY 2021 Hydro Unit Master Outage Schedule

Hydropower Plant	Unit #	Avail MW	4-Jan-21	11-Jan-21	18-Jan-21	25-Jan-21	1-Feb-21	8-Feb-21	15-Feb-21	22-Feb-21	1-Mar-21	8-Mar-21	15-Mar-21	22-Mar-21	29-Mar-21	5-Apr-21	12-Apr-21	19-Apr-21	26-Apr-21	3-May-21	10-May-21	17-May-21	24-May-21	31-May-21	7-Jun-21	14-Jun-21	21-Jun-21	28-Jun-21	5-Jul-21	12-Jul-21	19-Jul-21	26-Jul-21	2-Aug-21	9-Aug-21	16-Aug-21	23-Aug-21	30-Aug-21	6-Sep-21	13-Sep-21	20-Sep-21	27-Sep-21	4-Oct-21	11-Oct-21	18-Oct-21	25-Oct-21	1-Nov-21	8-Nov-21	15-Nov-21	22-Nov-21	29-Nov-21	6-Dec-21	13-Dec-21	20-Dec-21	27-Dec-21	3-Jan-22
Barkley	1	35.0	35	Transfo	PI	Transformer Installation																		35	35	35	35	35	35	35	35	Debris/Trash Rac			35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	2	35.0	35	CI	Transformer Installation																			35	35	35	35	35	35	35	35	Debris/Trash Rac			35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	3	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	Tra	PI	Transformer Installatio n								Deb	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	4	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	Transformer Installation										Deb	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Center Hill	1	52.0	Unit #1 Rehab								M-Th 700-1700		Headworks			45	45	45	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	45	MV Cable R			45	45	45	45	45	45	45	45	45	45	45	45	45
	2	52.0	45	45	45	45	45	45	45	45	Feeders			45	45	45	45	Headworks						52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	MV Cable R			45	45	45	45	45	45	45	45	45	45	45	45	45
	3	52.0	45	45	45	45	45	45	45	45	M-Th 700-1700			45	45	45	45	45	45	45	52	Headworks			52	52	52	52	52	52	52	52	52	52	52	52	Wa	52	45	45	45	45	45	45	45	MV Cable R			45	45	45	45	45	45	45	45	45	45	45	45	45
Cheatham	1	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	Debris Remov		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	2	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	CI-X/Debris		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	3	12.0	12	12	12	12	12	12	12	12	12	12	PI	12	12	12	12	12	12	12	12	12	12	12	12	Debris Remov		12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Cordell Hull	1	33.3	33	PI	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	2	30.0	30	Deb	30	30	30	30	30	Turbine		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	CI/Xfmr		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	3	33.3	33	Deb	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	PI	33	33	33	33	33	33	33	33	33	33	33
Dale Hollow	1	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	PI	18	18	18	18	18	18	18	18	18	18	0	0	0	0	0	0	0	0	0	16	16	16	16	16	16	16
	2	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	Hea	18	18	18	18	18	Thurst Bearing Oil Coo			16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	3	18.0	16	16	16	CI/Xfmr & Thrust Bearing (								16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	Hea	18	18	18	18	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
J. Percy Priest	1	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0	0	CI/Xfmr		0	0	0	0	0	MC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	30	30	30	30
Laurel	1	61.0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	CI			61	61	61	61	61	61	61	61	61	61
Old Hickory	1	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Debris R		25	25	25	25	25	25	25	CI		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	2	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	OCB Bus		25	25	PI	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	3	25.0	25	25	25	25	480	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Debris R		25	25	25	PI	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	4	25.0	Old Hickory Unit #4 Rehab																			25	25	25	25	25	25	25	25	25	25	25	25	25	25	OCB Bus		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Wolf Creek	1	45.0	45	45	45	45	Xfm	45	45	45	45	45	45	45	PI	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	Xm	50	50	45	45	45	45	45	45	45	45	Monolit			45	45	45	45	45	45	45	45
	2	45.0	45	45	45	45	Xfm	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	CI/Xfmr	50	45	45	45	45	45	45	Monolit	0	0	M-Th 7			45	45	45	45	45	45	45	45
	3	40.0	40	40	Headworks				40	40	40	Exciter Repairs																																			M-Th 7	Exciter Repairs			Monolit	Exciter Repairs											
	4	45.0	45	45	Headworks				PI / Misc W			45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	Monolit	45	45	0	0	M-Th 7	Monolit	45	45									
	5	45.0	Headwo	Exci	CI	Exciter Repairs								45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	Monolit	45	45	Monolit	M-Th 7	45	45					
	6	45.0	Headwo	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	M-Th 7	45	45	45	Monolit	45	45					
Weekly Available MW		938.6	751	585	641	641	510	625	665	635	545	580	568	686	641	686	737	737	692	692	801	801	771	771	771	787	769	769	755	773	773	703	753	728	735	775	748	845	772	727	780	780	747	690	629	584	645	645	690	781	781	736	736	871	871
Weekly Available MW (w/o LAU)		877.6	690	524	580	580	449	564	604	574	484	519	507	625	580	625	676	676	631	631	740	740	710	710	710	726	708	708	694	712	712	642	692	667	674	714	687	784	711	666	719	719	686	629	629	584	584	645	690	720	670	625	625	760	760
28 Units in District	# Units Avail		24	19	21	21	17	20	21	20	18	19	18	22	21	22	23	23	22	22	24	24	23	23	23	21	20	20	21	22	22	20	22	21	21	23	22	24	23	22	24	24	23	22	21	20	21	21	22	25	25	24	24	27	27
	# Units UnAvail		4	9	7	7	11	8	7	8	10	9	10	6	7	6	5	5	6	6	4	4	5	5	5	7	8	8	7	6	6	8	6	7	7	5	6	4	5	6	4	4	5	6	7	8	7	7	6	3	3	4	4	1	1

OUTAGE SCHEDULE LEGEND: SEPA Outage Restriction | O&M Unit Inspection Outages | O&M Specific Work - Maint | Section 212 Contract Work | Expected Water Quality Issues | Expected Hydrologic Limitations

Future Changes are Noted as Follows:	
From	To
	Change in Inspection Dates
	Change
	Change
	Simultaneous Work

*** PI & CI inspection will return to service on Thursday of the scheduled week***

*** NOTES***
1. All dates are projections
2. Must make sure manpower is available for shared plants
3. Availabity of assets for testing
4. No interference with Contracts as much as possible
5. PRC-005 schedule maintenance

Project	Unit #	Reason Out of Service / Maintenance
Barkley	1,3	Partial Unit Inspection
Barkley	2	Complete Unit Inspection
Barkley	1,2,3,4	Transformer Installation
Barkley	1,2,3,4	Debris Removal / Trash Rack Install
Center Hill	1	Turbine Generator Rehab
Center Hill	1,2,3	Headworks - Intake Gate Hoist Machinery
Center Hill	1,2,3	Medium Voltage Cables & Busses
Center Hill	3	Turbine Bearing Oil Sump Inspection
Center Hill	3	Unit Warranty Inspection
Cheatham	1,2,3	Debris Removal
Cheatham	2	Complete Unit & Transformer Inspection
Cheatham	3	Partial Unit Inspection
Cordell Hull	1,2,3	Debris Removal
Cordell Hull	2	Turbine Shaft Packing Replacement
Cordell Hull	2	Complete Unit & Transformer Inspection
Cordell Hull	1,3	Partial Unit Inspection
Dale Hollow	1,2,3	Headworks
Dale Hollow	1	Partial Unit Inspection
Dale Hollow	3	Complete Unit & Transformer Inspection
Dale Hollow	2,3	Thrust Bearing Oil Cooler Installation
Dale Hollow	1,2,3	Dissolved Oxygen Levels - NMT 2 Units Max

Project	Unit #	Reason Out of Service / Maintenance
J. Percy Priest	Plant	Water Quality - No Generation
J. Percy Priest	Plant	Expected Hydrologic Limitations
J. Percy Priest	Plant	Complete Unit & Transformer Inspection
J. Percy Priest	Plant	MCC Install (Arc Flash Hazard Mitigation)
Laurel	Plant	Complete Unit Inspection
Old Hickory	1	Complete Unit Inspection
Old Hickory	1,2,3,4	OCB Bushing Work
Old Hickory	1,2,3,4	Debris Removal
Old Hickory	2,3	Partial Unit Inspection
Old Hickory	3	480V Board Replacement
Old Hickory	4	Turbine Generator Rehab
Wolf Creek	2	Transformer Inspection
Wolf Creek	2,5	Complete Unit Inspection
Wolf Creek	1,4	Partial Unit Inspection
Wolf Creek	3,4,5,6	Headworks
Wolf Creek	1,2	Main Transformer PT Leak Repair
Wolf Creek	1,2,3,4,5,6	Monolith Repair Project
Wolf Creek	3,5	Exciter Repairs
Wolf Creek	4	Governor Work & Headcover Sampling
Wolf Creek	2,4,6	DO Degradation - 4-unit (175 MW) max

Appendix E – Proposed Five Year Outage Schedule

2022

LRN CY 2022 Hydro Unit Master Outage Schedule

Hydropower Plant	Unit #	Avail MW	1/3/2022	1/10/2022	1/17/2022	1/24/2022	1/31/2022	2/7/2022	2/14/2022	2/21/2022	2/28/2022	3/7/2022	3/14/2022	3/21/2022	3/28/2022	4/4/2022	4/11/2022	4/18/2022	4/25/2022	5/2/2022	5/9/2022	5/16/2022	5/23/2022	5/30/2022	6/6/2022	6/13/2022	6/20/2022	6/27/2022	7/4/2022	7/11/2022	7/18/2022	7/25/2022	8/1/2022	8/8/2022	8/15/2022	8/22/2022	8/29/2022	9/5/2022	9/12/2022	9/19/2022	9/26/2022	10/3/2022	10/10/2022	10/17/2022	10/24/2022	10/31/2022	11/7/2022	11/14/2022	11/21/2022	11/28/2022	12/5/2022	12/12/2022	12/19/2022	12/26/2022	1/2/2023
Barkley	1	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	CI	35	35	35	35	35	35	35	35	35	35	35
	2	35.0	35	35	35	35	35	35	35	35	35	35	PI	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	3	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	CI	35	35	35
	4	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	PI	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	Unit 4 Rehab											
Center Hill	1	52.0	45	45	45	45	45	45	45	45	45	Wa	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	MV Cable R	45	45	45	45	45	45	45	45	45	45	45	45
	2	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52	52	52	52	52	52	52	MV Cable R	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	3	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	MV Cable R	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Cheatham	1	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	MV Cable Replacement																					PI	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	2	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	Debris R	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	MV Cable Replacemen				
	3	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	Debris R	12	12	12	12	12	12	12	12	MV Cable Replacement																			CI	12	12	12	12	12	12
Cordell Hull	1	33.3	Excitation Replacement								PI	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	2	30.0	30	30	30	30	30	30	30	30	30	Excitation Replacement									30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	3	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	Excitation Replacement								CI/Xfmr	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Dale Hollow	1	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	CI/Xfmr & Thrust Bearing (							0	0	0	0	0	0	0	0	16	16	16	16	16	16
	2	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	3	18.0	16	16	16	16	16	16	16	16	16	16	16	PI	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
J. Percy Priest	1	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	30	30
Laurel	1	61.0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Old Hickory	1	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Switchyard Cable					PI	Replacement					25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Transformer R				25	25	25	25
	2	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Switchyard Cable Replacemen					CI						25	25	25	25	25	25	25	25	25	25	25	25	25	25	Transformer R				25	25	25	25
	3	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Switchyard Cable Replacement											25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Transformer R						
	4	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Switchyard Cable Replacement											25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Transformer R						
Wolf Creek	1	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	CI			45	45	45	45	45	45	45	45	45	45	45	45	45	45
	2	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	0	0	0	0	0	0	45	45	45	45	45	45
	3	40.0	Exciter Repairs						40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	PI	40	40	40	40	40	40	40	40	40	40	40	40	40
	4	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	CI/Xfmr	50	50	50	45	45	45	45	0	0	0	0	0	0	45	45	45	45	45	45	45
	5	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	6	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	45	PI	0	0	0	45	45	45	45	45	45	45
Weekly Available MW		938.6	838	838	838	838	838	838	878	878	878	836	846	865	881	869	875	840	875	875	918	794	764	788	788	788	736	736	736	821	821	821	871	853	851	851	851	808	808	853	768	693	648	728	683	683	633	633	814	779	779	814	814	814
Weekly Available MW (w/o LAU)		877.6	777	777	777	777	777	777	817	817	817	775	785	804	820	808	814	779	814	814	857	733	703	727	727	727	675	675	675	760	760	760	760	810	792	790	790	790	747	747	792	707	632	587	667	622	622	572	572	753	718	718	753	753	753
28 Units in District	# Units Avail		26	26	26	26	26	26	27	27	27	26	26	26	27	26	26	25	26	26	20	19	21	21	21	20	20	20	22	22	22	22	25	24	24	24	24	24	24	25	23	21	20	22	21	21	19	19	24	23	23	24	24	24
	# Units UnAvail		2	2	2	2	2	2	1	1	1	2	2	2	1	2	2	3	2	2	2	8	9	7	7	7	8	8	8	6	6	6	6	3	4	4	4	4	4	4	3	5	7	8	6	7	7	9	9	4	5	5	4	4	4

OUTAGE SCHEDULE LEGEND: SEPA Outage Restriction | O&M Unit Inspection Outages | O&M Specific Work - Maint | Section 212 Contract Work | Expected Water Quality Issues | Expected Hydrologic Limitations

Future Changes are Noted as Follows:		
From	To	
	Change in Inspection Dates	
	Change	
	Change	
	Simultaneous Work	

*** PI & CI inspection will return to service on Thursday of the scheduled week***

*** NOTES***

1. All dates are projections
2. Must make sure manpower is available for shared plants
3. Availabity of assets for testing
4. No interference with Contracts as much as possible
5. PRC-005 schedule maintenance

Project	Unit #	Reason Out of Service / Maintenance
Barkley	1,3	Complete Unit Inspection
Barkley	2,4	Partial Unit Inspection
Barkley	4	Unit 4 Rehab
Center Hill	1	Unit Warranty Inspection
Center Hill	1,2,3	Medium Voltage Cables & Busses
Cheatham	1,2,3	Medium Voltage Cables & Busses
Cheatham	1,2,3	Debris Removal
Cheatham	1	Partial Unit Inspection
Cheatham	3	Complete Unit Inspection
Cordell Hull	1,2,3	Excitation Replacement
Cordell Hull	1	Partial Unit Inspection
Cordell Hull	3	Complete Unit & Transformer Inspection
Dale Hollow	1	Complete Unit & Transformer Inspection
Dale Hollow	1	Dissolved Oxygen Levels - NMT 2 Units Max

Project	Unit #	Reason Out of Service / Maintenance
Dale Hollow	1	Thrust Bearing Oil Coolers
Dale Hollow	3	Partial Unit Inspection
J. Percy Priest	Plant	Water Quality - No Generation
J. Percy Priest	Plant	Expected Hydrologic Limitations
Old Hickory	Plant	Switchyard Cable Replacement
Old Hickory	1,2,3,4	Transformer Replacement
Old Hickory	1	Partial Unit Inspection
Old Hickory	2	Complete Unit Inspection
Wolf Creek	1	Complete Unit Inspection
Wolf Creek	3,6	Partial Unit Inspection
Wolf Creek	4	Complete Unit & Transformer Inspection
Wolf Creek	2,4,6	DO Degradation - 4-unit (175 MW) max

Appendix E – Proposed Five Year Outage Schedule

2023

LRN CY 2023 Hydro Unit Master Outage Schedule

Hydropower Plant	Unit #	Avail MW	1/2/2023	1/9/2023	1/16/2023	1/23/2023	1/30/2023	2/6/2023	2/13/2023	2/20/2023	2/27/2023	3/6/2023	3/13/2023	3/20/2023	3/27/2023	4/3/2023	4/10/2023	4/17/2023	4/24/2023	5/1/2023	5/8/2023	5/15/2023	5/22/2023	5/29/2023	6/5/2023	6/12/2023	6/19/2023	6/26/2023	7/3/2023	7/10/2023	7/17/2023	7/24/2023	7/31/2023	8/7/2023	8/14/2023	8/21/2023	8/28/2023	9/4/2023	9/11/2023	9/18/2023	9/25/2023	10/2/2023	10/9/2023	10/16/2023	10/23/2023	10/30/2023	11/6/2023	11/13/2023	11/20/2023	11/27/2023	12/4/2023	12/11/2023	12/18/2023	12/25/2023	1/1/2024
Barkley	1	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	2	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	CI	35	35	35	35
	3	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	Xfmr	Unit 3 Rehab														
	4	35.0	Unit 4 Rehab																																			SC/	Xfmr	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Center Hill	1	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	CI/Xfmr	45	45	45	45	45	45	45	45	45
	2	52.0	45	45	45	45	45	45	45	45	45	45	45	PI	45	45	45	45	45	SCAI	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	3	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Cheatham	1	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	CI/Xfmr	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	2	12.0	MV Cable Replacement								SC	PI	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	3	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Cordell Hull	1	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	CI/Xfmr	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	2	30.0	30	30	30	30	30	30	30	30	30	30	30	30	PI	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	3	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Dale Hollow	1	18.0	16	16	16	16	16	16	16	16	16	16	16	16	SC	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	0	0	0	0	0	0	16	16	0	0	0	0	0	0	0	16	16	16	16	16
	2	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	CI/Xfmr		16	16	16	16	16	16	16	16	16	16	16	16
	3	18.0	16	16	16	16	16	16	16	16	16	16	PI	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
J. Percy Priest	1	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0	0	0	SCAI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	PI	0	0	0	0	0	0	30	30	30	30	30	30
Laurel	1	61.0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	CI	SC/	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Old Hickory	1	25.0	25	25	25	25	25	25	25	25	CI		Transfo		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	Excitation												25	25	25	25	25
	2	25.0	25	25	25	25	25	25	25	25	Transformer R				25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	3	25.0	25	25	25	25	25	25	25	25	25	25	25	25	Transfo	CI	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	4	25.0	25	25	25	25	25	25	25	25	25	25	25	25	Transformer R		Excitation																																																
Wolf Creek	1	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	DC/AC S	50	50	50	50	50	50	50	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	2	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	DC/AC S	50	50	50	50	50	45	45	45	PI	0	0	0	0	0	0	0	45	45	45	45	45	45
	3	40.0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	DC/AC S	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	4	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	DC/AC S	50	50	45	45	45	45	45	0	0	0	0	0	0	PI	45	45	45	45	45	45
	5	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	DC/AC &	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	6	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	DC/AC S	45	45	45	45	45	45	45	0	0	0	0	45	45	45	45	45	45	45
Weekly Available MW		938.6	864	864	864	864	864	864	864	864	814	814	810	781	796	810	832	832	857	812	891	891	873	873	873	873	873	873	823	823	790	790	833	833	805	805	805	805	699	664	770	760	760	670	670	670	670	670	670	816	841	876	876	876	876
Weekly Available MW (w/o LAU)		877.6	803	803	803	803	803	803	803	803	753	753	749	720	735	749	771	771	796	751	830	830	812	812	812	812	812	812	762	762	729	729	772	772	744	744	744	744	699	664	709	699	699	609	609	609	609	609	609	755	780	815	815	815	815
28 Units in District	# Units Avail		26	26	26	26	26	26	26	26	24	24	24	24	24	24	25	25	26	25	25	25	25	25	25	25	25	25	24	24	23	23	24	24	23	23	23	23	22	21	23	23	23	21	21	21	21	21	21	25	26	27	27	27	27
	# Units UnAvail		2	2	2	2	2	2	2	2	4	4	4	4	4	4	3	3	2	3	3	3	3	3	3	3	3	3	4	4	5	5	4	4	5	5	5	5	6	7	5	5	5	7	7	7	7	7	7	3	2	1	1	1	1

OUTAGE SCHEDULE LEGEND: SEPA Outage Restriction | O&M Unit Inspection Outages | O&M Specific Work - Maint | Section 212 Contract Work | Expected Water Quality Issues | Expected Hydrologic Limitations

Future Changes are Noted as Follows:		
From	To	
	Change in Inspection Dates	
	Change	
	Change	
	Simultaneous Work	

*** PI & CI inspection will return to service on Thursday of the scheduled week***

*** NOTES***
1. All dates are projections
2. Must make sure manpower is available for shared plants
3. Availabity of assets for testing
4. No interference with Contracts as much as possible
5. PRC-005 schedule maintenance

Project	Unit #	Reason Out of Service / Maintenance
Barkley	2	Complete Unit Inspection
Barkley	2	SCADA
Barkley	3,4	Transformer Inspection
Barkley	3,4	Unit Rehab
Center Hill	1	Complete Unit & Transformer Inspection
Center Hill	1	SCADA
Center Hill	2	Partial Unit Inspection
Cheatham	1	Complete Unit & Transformer Inspection
Cheatham	2	Medium Voltage Cables & Busses
Cheatham	2	SCADA
Cheatham	2	Partial Unit Inspection
Cordell Hull	1	Complete Unit & Transformer Inspection
Cordell Hull	2	Partial Unit Inspection
Dale Hollow	1	Dissolved Oxygen Levels - NMT 2 Units Max

Project	Unit #	Reason Out of Service / Maintenance
Dale Hollow	1	SCADA
Dale Hollow	2	Complete Unit & Transformer Inspection
Dale Hollow	3	Partial Unit Inspection
J. Percy Priest	Plant	Water Quality - No Generation
J. Percy Priest	Plant	Expected Hydrologic Limitations
J. Percy Priest	Plant	SCADA
Laurel	Plant	Complete Unit Inspection
Laurel	Plant	SCADA
Old Hickory	1,2,3,4	Excitation Replacement
Old Hickory	1,3	Complete Unit Inspection
Wolf Creek	1,2,3,4,5,6	DC / Preferred AC System
Wolf Creek	2,4,6	DO Degradation - 4-unit (175 MW) max
Wolf Creek	2,4	Partial Unit Inspection
Wolf Creek	5	Complete Unit & Transformer Inspection

Appendix E – Proposed Five Year Outage Schedule

2024

LRN CY 2024 Hydro Unit Master Outage Schedule

Hydropower Plant	Unit #	Avail MW	1/1/2024	1/8/2024	1/15/2024	1/22/2024	1/29/2024	2/5/2024	2/12/2024	2/19/2024	2/26/2024	3/4/2024	3/11/2024	3/18/2024	3/25/2024	4/1/2024	4/8/2024	4/15/2024	4/22/2024	4/29/2024	5/6/2024	5/13/2024	5/20/2024	5/27/2024	6/3/2024	6/10/2024	6/17/2024	6/24/2024	7/1/2024	7/8/2024	7/15/2024	7/22/2024	7/29/2024	8/5/2024	8/12/2024	8/19/2024	8/26/2024	9/2/2024	9/9/2024	9/16/2024	9/23/2024	9/30/2024	10/7/2024	10/14/2024	10/21/2024	10/28/2024	11/4/2024	11/11/2024	11/18/2024	11/25/2024	12/2/2024	12/9/2024	12/16/2024	12/23/2024	12/30/2024
Barkley	1	35.0	35	35	35	35	35	35	35	35	35	35	35	35	PI/Xfmr	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	2	35.0	35	35	35	35	35	35	35	35	35	35	35	35	XFN	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	Unit 2 Rehab										
	3	35.0	Unit 3 Rehab																																						35	35	35	35	35	35	35	35	35	35	35	35	35
	4	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	War	35	35	35	35	35	35	35	35	35	35	35	35
Center Hill	1	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	2	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	CI/Xfmr	45	45	45
	3	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	PI	52	52	52	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
Cheatham	1	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	2	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	CI/Xfmr	12	12	12	12	12	12
	3	12.0	12	12	12	12	12	12	12	12	12	PI	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Cordell Hull	1	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	2	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	CI/Xfmr	30	30	30	30	30	30	30	30	30	30
	3	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	PI	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Dale Hollow	1	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	PI	18	18	18	18	18	18	18	18	0	0	0	0	0	0	16	16	0	0	0	0	0	0	0	16	16	16	16
	2	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	3	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	16	16	CI/Xfmr	16	16	16	16	16	16	16	16	16	16	16	16
J. Percy Priest	1	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0	0	0	0	0	0	0	0	0	0	0	0	0	Xfm	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	30	30	30
Laurel	1	61.0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Old Hickory	1	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	2	25.0	25	25	25	25	25	25	25	25	25	25	25	25	PI	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	3	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	4	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	PI	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Wolf Creek	1	45.0	Power Transformer							PI		45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	Excitation Replacement							45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	2	45.0	Power Transformer									45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	Excitation Replacement							45	45	45	45	45	45	45	45	45	45
	3	40.0	40	40	40	40	40	40	40	40	40	Power Transformer									40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
	4	45.0	45	45	45	45	45	45	45	45	45	Power Transformer									50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	0	Excitation Replacement						
	5	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	Power		PI		Transformer					50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	6	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	Power Transformer					CI				50	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	0	0	0	45	45	45	45	45
Weekly Available MW		938.6	786	786	786	786	786	786	786	786	786	779	791	791	696	756	797	797	764	797	828	828	746	773	780	798	798	798	848	848	848	848	848	798	780	830	830	825	785	785	785	750	785	715	715	695	728	728	740	786	786	831	831	831	831
Weekly Available MW (w/o LAU)		877.6	725	725	725	725	725	725	725	725	725	718	730	730	635	695	736	736	703	736	767	767	685	712	719	737	737	737	787	787	787	787	787	737	719	769	769	764	724	724	724	689	724	654	654	634	667	667	679	725	725	770	770	770	770
28 Units in District	# Units Avail		25	25	25	25	25	25	25	25	25	24	25	25	22	24	25	25	24	25	25	25	23	23	23	24	24	24	25	25	25	25	25	24	23	24	24	24	24	24	24	23	24	22	22	22	22	22	23	25	25	26	26	26	26
	# Units UnAvail		3	3	3	3	3	3	3	3	3	4	3	3	6	4	3	3	4	3	3	3	5	5	5	4	4	4	3	3	3	3	3	4	5	4	4	4	4	4	4	5	4	6	6	6	6	6	5	3	3	2	2	2	2

OUTAGE SCHEDULE LEGEND: SEPA Outage Restriction | O&M Unit Inspection Outages | O&M Specific Work - Maint | Section 212 Contract Work | Expected Water Quality Issues | Expected Hydrologic Limitations

Future Changes are Noted as Follows:		
From	To	
	Change in Inspection Dates	
	Change	
	Change	
	Simultaneous Work	

*** PI & CI inspection will return to service on Thursday of the scheduled week***

*** NOTES***

1. All dates are projections
2. Must make sure manpower is available for shared plants
3. Availabity of assets for testing
4. No interference with Contracts as much as possible
5. PRC-005 schedule maintenance

Project	Unit #	Reason Out of Service / Maintenance
Barkley	1	Partial Unit & Transformer Inspection
Barkley	2	Transformer Inspection
Barkley	2,3	Unit Rehab
Barkley	4	Warranty Inspection
Center Hill	2	Complete Unit & Transformer Inspection
Center Hill	3	Partial Unit Inspection
Cheatham	2	Complete Unit & Transformer Inspection
Cheatham	3	Partial Unit Inspection
Cordell Hull	2	Complete Unit & Transformer Inspection
Cordell Hull	3	Partial Unit Inspection
Dale Hollow	1	Dissolved Oxygen Levels - NMT 2 Units Max
Dale Hollow	1	Partial Unit Inspection
Dale Hollow	3	Complete Unit & Transformer Inspection

Project	Unit #	Reason Out of Service / Maintenance
J. Percy Priest	Plant	Water Quality - No Generation
J. Percy Priest	Plant	Expected Hydrologic Limitations
J. Percy Priest	Plant	Complete Transformer Inspection
Old Hickory	2,4	Partial Unit Inspection
Wolf Creek	1,2,3,4,5,6	Main Power Transformer
Wolf Creek	1,2,4	Excitation Replacement
Wolf Creek	2,4,6	DO Degradation - 4-unit (175 MW) max
Wolf Creek	6	Complete Unit Inspection
Wolf Creek	1,5	Partial Unit Inspection

Appendix E – Proposed Five Year Outage Schedule

2025

LRN CY 2025 Hydro Unit Master Outage Schedule

Hydropower Plant	Unit #	Avail MW	1/6/2025	1/13/2025	1/20/2025	1/27/2025	2/3/2025	2/10/2025	2/17/2025	2/24/2025	3/3/2025	3/10/2025	3/17/2025	3/24/2025	3/31/2025	4/7/2025	4/14/2025	4/21/2025	4/28/2025	5/5/2025	5/12/2025	5/19/2025	5/26/2025	6/2/2025	6/9/2025	6/16/2025	6/23/2025	6/30/2025
Barkley	1	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	2	35.0	Unit 2 Rehab																									
	3	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	4	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Center Hill	1	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	PI	52	52	52	52	52	52	52	52
	2	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52
	3	52.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	52	52	52	52	52	52	52	52
Cheatham	1	12.0	12	12	12	12	12	12	12	12	DIV	PI	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	2	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	3	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Cordell Hull	1	33.3	33	33	33	33	33	33	PI	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	2	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	3	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
Dale Hollow	1	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18
	2	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	PI	18	18
	3	18.0	16	16	16	16	16	16	16	16	16	16	16	16	16	16	18	18	18	18	18	18	18	18	18	18	18	18
J. Percy Priest	1	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	0	0	0	0	0	0
Laurel	1	61.0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Old Hickory	1	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	2	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	CI		25	25	25	25	25	25	25
	3	25.0	Unit 3 Rehab																									
	4	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Wolf Creek	1	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50
	2	45.0	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50
	3	40.0	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40		PI	Excitation Replacement		
	4	45.0	Excitation			45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	50	50	50	50	50	50	50	50
	5	45.0	45	45	45	Excitation Replacement									45	45	45	45	45	45	50	50	50	50	50	50	50	50
	6	45.0	45	45	45	45	45	45	45	45	45	45	45	45	Excitation Replacemen					PI				50	50	50	50	50
Weekly Available MW		938.6	806	806	806	806	806	806	773	806	794	794	806	806	806	806	812	812	812	742	828	853	823	833	833	815	833	833
Weekly Available MW (w/o LAU)		877.6	720	720	720	720	720	720	687	720	708	708	720	720	720	720	726	726	726	656	742	767	737	747	747	729	747	747
28 Units in District		# Units Avail	25	25	25	25	25	25	24	25	24	24	25	25	25	25	25	25	25	23	24	25	24	24	24	23	24	24
		# Units UnAvail	3	3	3	3	3	3	4	3	4	4	3	3	3	3	3	3	3	5	4	3	4	4	4	5	4	4

Hydropower Plant	Unit #	Avail MW	7/7/2025	7/14/2025	7/21/2025	7/28/2025	8/4/2025	8/11/2025	8/18/2025	8/25/2025	9/1/2025	9/8/2025	9/15/2025	9/22/2025	9/29/2025	10/6/2025	10/13/2025	10/20/2025	10/27/2025	11/3/2025	11/10/2025	11/17/2025	11/24/2025	12/1/2025	12/8/2025	12/15/2025	12/22/2025	12/29/2025	1/5/2026
Barkley	1	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	Unit 1 Rehab													
	2	35.0														35	35	35	35	35	35	35	35	35	35	35	35	35	35
	3	35.0	35	35	35	35	35	35	35	35	Wa	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
	4	35.0	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35
Center Hill	1	52.0	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	2	52.0	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
	3	52.0	52	52	52	52	52	52	52	52	52	52	45	45	45	45	45	45	CI		45	45	45	45	45	45	45	45	45
Cheatham	1	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	2	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	3	12.0	12	12	12	12	12	12	12	12	12	12	12	12	12	CI/Xfmr		12	12	12	12	12	12	12	12	12	12	12	12
Cordell Hull	1	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
	2	30.0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	3	33.3	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	CI/Xfmr		33	33	33	33	33	33	33
Dale Hollow	1	18.0	18	18	18	18	18	18	0	0	0	0	CI/Xfmr		0	0	0	0	0	0	0	0	0	16	16	16	16	16	16
	2	18.0	18	18	18	18	18	18	18	18	18	18	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	3	18.0	18	18	18	18	18	18	18	18	18	18	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
J. Percy Priest	1	30.0	0	CI		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	30	30	30	30	30
Laurel	1	61.0	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	CI		61	61	61	61	61	61	61	61	61	61
Old Hickory	1	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	2	25.0	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
	3	25.0																											
	4	25.0	25	25	25	25	25	25	25	CI		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Wolf Creek	1	45.0	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	MV Cable R			45	45	45	45	45	45	45	45
	2	45.0	50	50	50	50	50	50	50	50	50	50	45	45	45	MV Cable R			0	0	0	0	0	45	45	45	45	45	45
	3	40.0					40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	MV Cable R			40	40
	4	45.0	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	0	0	0	0	CI		MV	45	45	45	45	45
	5	45.0	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	MV Cab	
	6	45.0	50	50	50	50	50	50	50	50	50	50	45	45	45	45	45	45	45	0	0	0	0	45	45	45	45	45	45
Weekly Available MW		938.6	833	833	833	833	873	873	855	830	795	855	805	805	805	748	748	654	564	580	592	637	670	806	811	811	811	806	806
Weekly Available MW (w/o LAU)		877.6	747	747	747	747	787	787	769	744	709	769	719	719	719	662	662	629	539	494	506	551	584	720	725	725	725	720	720
28 Units in District		# Units Avail	24	24	24	24	25	25	24	23	22	24	24	24	24	22	22	21	19	19	19	20	21	25	25	25	25	25	25
		# Units UnAvail	4	4	4	4	3	3	4	5	6	4	4	4	4	6	6	7	9	9	9	8	7	3	3	3	3	3	3

OUTAGE SCHEDULE LEGEND:	SEPA Outage Restriction	O&M Unit Inspection Outages	O&M Specific Work - Maint	Section 212 Contract Work	Expected Water Quality Issues	Expected Hydrologic Limitations

Future Changes are Noted as Follows:			
From	To		
		Change in Inspection Dates	
		Change	
		Change	
		Simultaneous Work	

*** PI & CI inspection will return to service on Thursday of the scheduled week***

*** NOTES***

1. All dates are projections
2. Must make sure manpower is available for shared plants
3. Availabity of assets for testing
4. No interference with Contracts as much as possible
5. PRC-005 schedule maintenance

Project	Unit #	Reason Out of Service / Maintenance
Barkley	1,2	Unit Rehab
Barkley	3	Warranty Inspection
Center Hill	1	Partial Unit Inspection
Center Hill	3	Complete Unit Inspection
Cheatham	1	Dive & Partial Unit Inspection
Cheatham	3	Complete Unit & Transformer Inspection
Cordell Hull	1	Partial Unit Inspection
Cordell Hull	3	Complete Unit & Transformer Inspection
Dale Hollow	1	Dissolved Oxygen Levels - NMT 2 Units Max
Dale Hollow	1	Complete Unit Inspection
Dale Hollow	2	Partial Unit Inspection

Project	Unit #	Reason Out of Service / Maintenance
J. Percy Priest	Plant	Water Quality - No Generation
J. Percy Priest	Plant	Expected Hydrologic Limitations
J. Percy Priest	Plant	Complete Unit Inspection
Laurel	Plant	Complete Unit Inspection
Old Hickory	3	Unit Rehab
Old Hickory	2,4	Complete Unit Inspection
Wolf Creek	1,2,3,4,5	Medium Voltage Cables & Busses
Wolf Creek	2,4,6	DO Degradation - 4-unit (175 MW) max
Wolf Creek	3,6	Partial Unit Inspection
Wolf Creek	3,4,5,6	Excitation Replacement
Wolf Creek	4	Complete Unit Inspection

Appendix F – Program Contacts

Appendix F: Program Contacts

Name	Title	Organization	Phone	E-mail
Stephanie Hall	Nashville District, Deputy District Engineer	USACE Nashville	615 736-7836	Stephanie.L.Hall@usace.army.mil
Diane Parks	Nashville District, Chief, Operations Division	USACE Nashville	615-736-7273	Diane.E.Parks@usace.army.mil
Ben Rohrbach	Nashville District, Chief, Engineering-Construction Division	USACE Nashville	615-736-7497	Ben.Rohrbach@usace.army.mil
Loren McDonald	Sec. 212 Program Manager; PRC, PCC, & PCG Member	USACE Nashville	615-736-7858	Loren.McDonald@usace.army.mil
David Mistakovich	Chief, Hydropower Section	USACE Nashville	615-736-7974	David.Mistakovich@usace.army.mil
James Roth	Nashville District, Chief Counsel	USACE Nashville	615-736-7692	James.L.Roth@usace.army.mil
Heather Turner	Nashville District, Contracting Division Chief	USACE Nashville	615-736-7939	Heather.D.Turner@usace.army.mil
Myles England	Nashville District, Chief, Resource Management Division	USACE Nashville	615-736-7736	Myles.M.England@usace.army.mil
Ellen Ballantine	Regional Design Manager, Hydroelectric Design Center	USACE HDC	503 808-4236	Ellen.B.Ballantine@usace.army.mil
Robert Iseli	Great Lakes and Ohio River Division	USACE Cincinnati	513-684-2997	Robert.w.Iseli@usace.army.mil
Robert W. Berry	Program Coordination Committee Member	Big Rivers Electric	270-844-6153	Bob.Berry@bigrivers.com
Marlene Parsley	Project Review Committee	Big Rivers Electric	270-844-6155	Marlene.Parsley@bigrivers.com
Jeff Bowman	Program Coordination Committee Member	Cooperative Energy	601-268-2083	jbowman@cooperativeenergy.com
Ron Repsher	Program Coordination Committee Representative	Cooperative Energy	601-268-2083	rrepsher@cooperativeenergy.com
Fernie Williams	Program Coordination Committee Member	East Kentucky Power Cooperative	859-745-9429	fernie.williams@ekpc.coop
Jeff Loven	Program Coordination Committee Member	French Broad	828-649-2051	Jeff.loven@frenchbroademc.com
Thomas Batchelor	Program Coordination Committee Member	Haywood EMC	828-452-2281	tom.batchelor@haywoodemc.com
Chris Heimgartner	Program Coordination Committee Member	Henderson Municipal Power & Light	270-826-2726	cheimgartner@hmpl.net
Brown Thornton	Project Review Committee, Program Coordination Committee	Kentucky Municipals	615-714-7896	bthornton@newgenstrategies.net
George Miller	Program Coordination Committee Member	MDEA	662-624-2688	mill6989@bellsouth.net
Geoffrey Wilson	Program Coordination Committee Member	MEAM	601-362-2252	gwilson@meam.com
Kevin Frizzell	Program Coordination Committee Member	Owensboro Municipal Utilities	270-691- 4298	frizzellkd@omu.org
Tom Lyons	Program Coordination Committee Representative	Owensboro Municipal Utilities	270-691-4233	llyonstt@omc.org
Virgil Hobbs	Administrator; Program Coordination Group & Program Coordination Committee Member	SEPA Office of the Administrator	706-213-3838	Virgil.hobbs@sepa.doe.gov
Samuel Loggins	Assistant Administrator of Finance and Marketing	SEPA Finance and Marketing	706-213-3805	Samuel.Loggins@sepa.doe.gov
Kim Ledbetter	Program Coordination Committee Member	SEPA Finance and Marketing	706-213-3837	kiml@sepa.doe.gov
Herb Nadler	Program Coordination Committee Member	SEPA Power Resources	706-213-3853	herb@sepa.doe.gov
Dixie Cordell	Program Coordination Group Member	SEPA Power Resources	706-213-3851	dixie.cordell@sepa.doe.gov
Dee Smith	Project Review Committee	SEPA Power Resources	706-213-3861	dees@sepa.doe.gov
Bill Hutchison	Project Review Committee, Program Coordination Committee	Southern Illinois Power Coop	618-964-2207	Hutchison@sipower.org
Robert Hites	Program Coordination Committee Member	Town of Waynesville, NC	828-452-2491	rhites@waynesvillenc.gov
Robin Robertson	Program Coordination Group Member	TVA	865-632-6861	rekirsch@tva.gov
Steve Noe	Program Coordination Group Member	TVPPA	423.490.7929	snoe@tvppa.com

Appendix G: Revision Control

Description	Date
Issue for PCC Review Meeting Feb 22 &23,2010	2/18/2010
Issue for Draft MOA Review	3/22/2010
Issue based on Customer Comments Apr 12,10	4/12/2010
USACE internal issue based on internal review meeting	7/16/2010
MOA based update and projects re-run	3/29/2011
Issue based on PCC comments	4/11/2011
Issue based on comments from PCC conference call held 4/13/11	4/18/2011
Issue for submittal with Long Term MOA	4/21/2011
Intermediate Issue for PRC Review	9/07/2012
Revision 1 Long Term MOA	1/31/2013
Revised Project List and 5-Year Plan	04/17/2014
April Revision Approved	7/16/2014
Master Plan Re-write and Re-ranking	10/2/2020
Master Plan Revision Approved; L-T MOA Ballot #17 & S-T MOA Ballot #1	9/17/2021