US Army Corps of Engineers®

Letter Report and Integrated Environmental Assessment
Santee Cooper Partnership Invasive Aquatic Plant Control

for

Lakes Moultrie and Marion
Berkeley, Calhoun, Clarendon, Orangeburg,
and Sumter Counties, South Carolina

August 2024

U.S. Army Corps of Engineers
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1 EXECUTIVE SUMMARY

This Integrated Letter Report and Programmatic Environmental Assessment presents the results of environmental and economic impact evaluations performed by the US Army Corps of Engineers, Charleston District, to determine if the Federal government should participate in an ongoing State-managed program for the control and treatment of invasive aquatic plants on the Santee Cooper Lake System, in Berkeley, Calhoun, Clarendon, Orangeburg, and Sumter Counties, South Carolina.

Without treatment, aquatic invasive plant infestations will continue and expand in Lake Marion and Lake Moultrie. Such infestations cause impacts to the water resource--related infrastructure and activities (Federal and non-Federal) within the lakes, including infrastructure related to US Army Corps of Engineers authorized purposes, impacts to water supply and treatment facilities, boating and marine infrastructure, and recreation, tourism, and waterfront property.

This letter report analyzes two alternatives related to the current aquatic invasive plant control program which is implemented by the South Carolina Public Service Authority (Santee Cooper) and is developed collaboratively with the South Carolina Aquatic Plant Management Council. Alternative 1 is the No Action Alternative. Alternative 2 is the Aquatic Invasive Plant Control Cost Share Program, wherein the Federal government would cost share (50 percent) in the program with Santee Cooper. Federal participation would expand the current program increasing the likelihood of preventing the spread of aquatic invasive species and reducing associated impacts.

The US Army Corps of Engineers has determined that there is Federal interest in partnering with Santee Cooper to continue and expand the control of aquatic invasive plant species. The projected annual costs are estimated at roughly $1,600,000, with the government cost-share of $800,000. The potential costs of infestation and associated impacts exceeds the estimated annual costs associated with treatment. Therefore, Alternative 2 is the Selected Alternative and would allow Santee Cooper to nearly double the current treatment area.

Santee Cooper Estimated Costs	**Total**
Biological Control	
A. Payroll	$48,959.01
B. Materials	$128,435.54
C. Utilities	$10,272.50
D. Automotive	$340.28
Chemical Control	
A. Payroll	$101,816.67
B. Materials	$954,575.61
C. Contract Services	$328,676.00
D. Automotive	$11,430.64
Total Santee Cooper Costs	$1,584,506.25
50% Cost Share Federal Government Cost	$792,253.12

Federal participation would support an existing program that is State-approved and already in operation in accordance with all applicable laws, regulations and permits. The addition of Federal participation would simply alleviate budget concerns and have no additional direct effects to the environment. The indirect environmental effects of the proposed action would continue to be beneficial. Federal participation in this ongoing program is without anticipated controversy and because Federal participation can be terminated at any time, there is minimal risk to it entering this partnership.

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2 INTRODUCTION

This Integrated Letter Report and Programmatic Environmental Assessment (LR/PEA) presents the results of environmental and economic impact evaluations performed by the US Army Corps of Engineers, Charleston District, (USACE) to determine if the Federal government should participate in an ongoing State-managed program for the control and treatment of invasive aquatic plants on the Santee Cooper Lake System, in Berkeley, Calhoun, Clarendon, Orangeburg, and Sumter Counties, South Carolina. This report documents the environmental, planning, and economic considerations used to develop and support the concluding recommendations. It also documents the coordination and evaluations performed to comply with Title 33 Code of Federal Regulations (CFR) Part 230, Procedures for Implementing the National Environmental Policy Act (NEPA) (Engineer Regulation (ER) 200-2-2, Procedures for Implementing NEPA); and the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA, Title 40 CFR Part 1500-1508.

2.1 Authority and Guidance

This report was prepared pursuant to Section 104 of the River and Harbor Act (RHA) of 1958, Public Law 85-500, 72 Stat. 297 (1958), as amended by Section 1039(d) of the Water Resources Reform and Development Act (WRRDA) of 2014 (Public Law 113-121), Section 1178 of the Water Infrastructure Improvements for the Nation Act (WIIN Act) of 2016 (Public Law 114-322), and by Section 1170 of the Water Resources Development Act of 2018 (Public Law 115-270), Section 505 of the Water Resources Development Act of 2020 (Public Law 116-260), and by Section 8305(b) of the Water Resources Development Act of 2022 (Public Law 117-263), codified as amended at 33 U.S.C. § 610.

The project would be implemented under the authority of Section 104 of the RHA of 1958, as amended. Other USACE Policy and Guidance is listed below:

- U.S. Department of Army, Office of the Assistant Secretary Civil Works, Policy Memo., U.S. Army Corps of Engineers Invasive Species Policy (21 Feb 2023).
- Section 103(c)(6) of WRDA 1986
- Executive Order 13751, Safeguarding the Nation from the Impacts of Invasive Species
- Engineer Regulation (ER) 1105-2-103 Chapter 6

2.2 Study Area

Lake Marion and Lake Moultrie, also known as The Santee Cooper Lakes, are recognized as South Carolina's largest freshwater resource. The lake system spans 160,000 acres and includes 15,000 acres of federally managed land and water at the Santee National Wildlife Refuge and

an additional 18,250 acres designated as Wildlife Management Areas managed by South Carolina Department of Natural Resources. The general map of the lakes is illustrated in Figure 1.

These water bodies support a variety of uses and the rate of use is increasing as the population and economy in the region grow. Lake Marion and Lake Moultrie supply municipal drinking water intakes, industrial and commercial intakes, agricultural intakes, and hydroelectric power generation needs. In addition to these surface water withdrawals, the lakes provide navigation and recreational activities including boating, swimming, fishing, and hunting. Nearly all these activities require the availability of a clean, unobstructed water supply.

Lake Marion -- Located within the coastal plain of South Carolina and bordered by Berkeley, Orangeburg, Calhoun, Sumter, and Clarendon Counties, Lake Marion is South Carolina's largest lake, providing 100,000 acres of surface water.

Lake Moultrie – Located within the coastal plain of South Carolina in Berkeley County, Lake Moultrie is South Carolina's third largest lake spanning 60,000 surface acres.

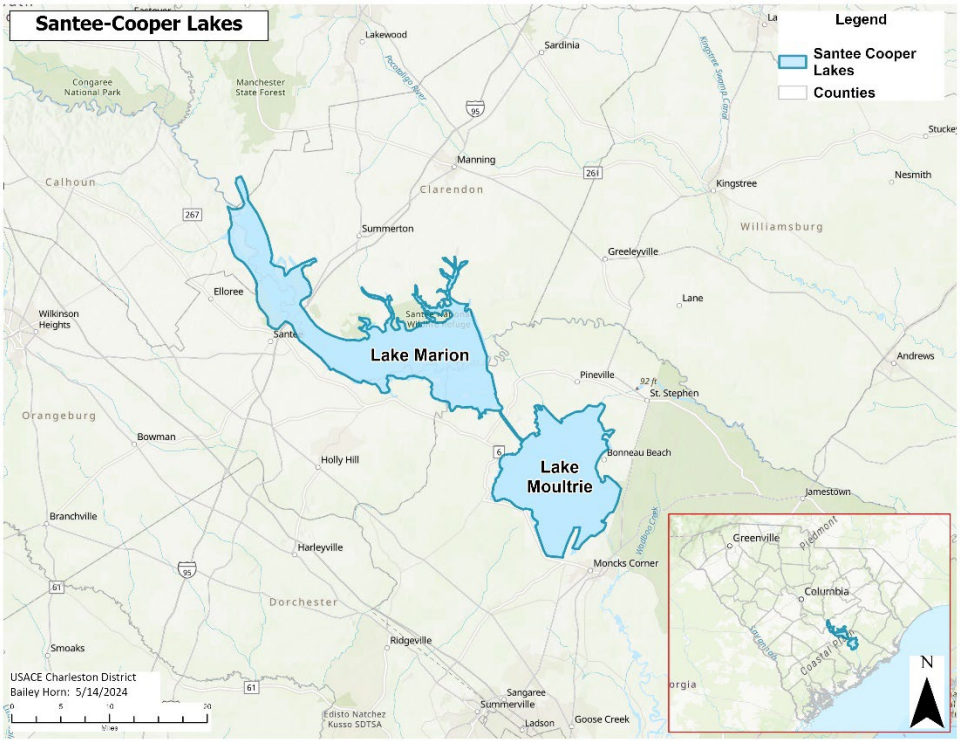

Figure 1. Map of Santee Cooper Lakes

2.3 Purpose and Need

The purpose of seeking Federal investment in the on-going State-managed aquatic invasive species (AIS) program is to increase the effectiveness of future invasive aquatic plant control measures by expanding the treatment area on The Santee Cooper Lakes. The risk of the spread of aquatic invasive species is high, and the introduction and establishment of AIS has the potential to cause damage and increased operation and maintenance costs to water-related infrastructure, recreation, and the ecosystem. Additional investment in the program is needed to ensure the continued reduction in negative impacts of invasive aquatic plants on the lakes' ecosystem, reducing the opportunity of invasive plants spread both downstream and by vessel, and surrounding infrastructure.

3 BACKGROUND

As a public service provider, the South Carolina Public Service Authority (Santee Cooper) is responsible for operating and maintaining the Santee Cooper Hydroelectric Project No. 199. The project includes Lake Marion, with a surface area of 100,000 acres, and Lake Moultrie, with a surface area of 60,000 acres.

Lakes Marion and Moultrie are located in an area of South Carolina that is categorized as humid subtropical. This favorable climate and the shallow, nutrient-rich water found in the reservoirs lend themselves to the proliferation of invasive non-native aquatic plants once these species are introduced.

Invasive non-native plants are typically introduced by human activities and are often unintentional. These types of plants can also be moved by migrating wildlife, however, the aquarium trade, water garden industry and recreational activities are the largest contributors to invasive non-native plant introductions. Both reservoirs have experienced severe infestations of invasive non-native aquatic plants since impoundment of the system in 1941. Excessive growth of unintentionally introduced invasive non-native species has negatively impacted the intended uses of these waterbodies for decades.

Large-scale aquatic plant management in South Carolina began in the 1940's with Santee Cooper's efforts to control alligatorweed (*Alternantherea philoxeroides*) in Lake Marion. The U.S. Rivers and Harbors Act of 1958 gave the USACE authority to administer a 30% state/70% federal cost sharing program to assist states with the control of nuisance aquatic plants in public waters. Under this program, the USACE and Santee Cooper participated in a cooperative program for Lake Marion from 1960 to 1967. The focus shifted in 1967 and USACE partnered with S.C. Department of Agriculture to treat other infested waters in the state.

Additional invasive non-native species have been inadvertently introduced to the Santee Cooper system, and Santee Cooper has continued control efforts over the past six decades. These efforts have focused on alligatorweed (*Alternanthera philoxeroides*), water primrose (*Ludwigia*

hexapetala), Brazilian elodea (*Egeria densa*), hydrilla (*Hydrilla verticillate*), common reed (*Phragmites australis*), water hyacinth (*Eichhornia crassipes*), and crested floating heart (*Nymphoides cristata*). More recently, in 2017, giant salvinia (*Salvinia molesta*) was discovered on Lake Marion, and, due to its rapid reproduction and growth capabilities, this plant has infested most back water areas and shorelines of Lake Marion and Lake Moultrie, despite Santee Cooper's efforts to eradicate it. An additional new invasive, Eurasian watermilfoil (*Myriophyllum spicatum*) was found near the Potato Creek arm of Lake Marion in 2022 and is continuing to expand its range within the Santee Cooper project's reservoirs.

These plants grow prolifically and convert diverse native plant communities into non-native monocultures. This in turn results in a decrease in abundance and diversity of native plant species which provide habitat for native fauna. In particular, Largemouth Bass and the sunfish family of fishes experience impacts to reproduction due to decreased suitable habitat for nest building. In addition to negatively impacting habitat, invasive species can obstruct navigable waterways, restrict water flow, obstruct water intakes, degrade water quality, provide breeding habitat for mosquitoes and other pests, and interfere with all types of recreation. Additionally, invasive plants have led to disruptions in operations at USACE's St. Stephen hydroelectric and fish lift facility. Lack of management related to these types of plants can seriously impair or eliminate beneficial use of subject/compromised waters.

3.1 Description of Current Problem Species

The following is a list of the currently encountered non-native plants, however, this list evolves as additional invasive plants are discovered.

<u>Floating invasive species:</u>

- Giant salvina is a free-floating aquatic fern with leaves ½ to 1 ½ inches long that exhibits variation in form and structure depending on habitat conditions such as space and nutrient availability. Young plants have smaller leaves that lie flat on the water surface. As plants mature and aggregate into mats, leaves are folded and compressed into upright chains. Giant salvinia grows rapidly to cover the surface of lakes and streams and under ideal growing conditions can double its mass and coverage in 5-7 days[1]. It spreads aggressively by vegetative fragments.

- Water Hyacinth is a perennial free-floating plant with long dark roots. Leaves are formed in rosettes; petioles to 12 inches or more, spongy, usually inflated, or bulbous, especially near base; leaf blades rounded or broadly elliptic, glossy green to 6 inches wide. Flowers are showy spike above rosette, to 12 inches long; lavender-blue with a yellow blotch, to 2 inches wide, with 6 petals and 6 stamens. Plant varies in size from a few inches to over three feet tall. Water hyacinth spreads rapidly by producing stolons

[1] Giant Salvinia | U.S. Department of the Interior (doi.gov)

or "daughter" plants.

- Crested Floating Heart is rooted in the substrate and produces leaves and flowers that float on the surface of the water. Leaves form at the terminus of long floating stems and are heart-shaped; the upper surface is green, usually with a red margin, and the underside is smooth and reddish. Leaves may be up to 8 inches long and 6 inches wide. Flowers are white with yellow throats, five petaled, and have a distinct erect fold of petal tissue along the midvein of the upper surface of each petal lobe, up to 1 inch across. Crested floating heart can reproduce from stem and leaf fragment as well as spiky ramets, which float through the water column and eventually sink to the bottom where they can root and sprout to form new plants. A single founder plant can produce as many as 500 ramets over six months and 40% are likely to sprout.

<u>Submerged invasive species</u>:

- Hydrilla is rooted with long stems that branch at the surface where growth becomes horizontal and dense mats form. Small, pointed leaves are arranged in whorls of 4 to 8. Leaves have serrated margins and may have one or more sharp teeth under the midrib. Flowers are attached by threadlike stalks attached at leaf axils near the stem tips and are solitary, tiny, white, and float on the surface. Hydrilla can reproduce through fragmentation as well as subterranean turions (tubers); which are yellowish, potato-like, attached to the root tips in the hydrosoil. A single tuber can grow to produce more than 600 new tubers per square foot.

- Brazilian Elodea is a rooted or free floating submersed perennial aquatic plant with small leaves (1 ½ inches long and 1/8 inches wide), leaves are lance-shaped with minute teeth along the edges and arranged in whorls around the stem. Can grow nine to 15 feet tall and upon reaching the surface of the water, the leafy branches create dense mats. Flowers are small, about one inch wide, and white with three petals. They grow on short stalks above the water and bloom in spring and summer. Seeds production is not known to occur in the Unites States populations, and it spreads primarily by vegetative fragmentation.

- Eurasion Water-Milfoil is a rooted plant with smooth, slender stems 6 to 20 feet long, reddish-brown to whitish-pink; branching several times near the surface. Leaves are olive-green, less than 2 inches long, soft, deeply divided, and feather like. Leaf whorls are arranged along the stems in whorls of 3 to 6 (usually 4) leaves; whorl nodes are about 3/8 inches apart. Flowers on an emersed spike held erect above the water. Flowers are reddish; arranged in 4-flowered whorls along the spike. Spreads prolifically by stem fragments that are produced both naturally (when stem sections detach from the plant at abscission sites) and as a result of mechanical breakage (when plants come into contact with boat motors and intense wave action.

Grasses invasive species (Common Reed)

- Common Reed is a very large grass with thick rhizomes, stiff stems, erect to 16 feet tall. Leaf blades are blue green and alternate along the top half of the stem, flat, strap-like, smooth, tapering to long tip, to 2 feet long, to more than 1 inch wide. Flowers in bush panicles, usually purple or golden in color. Spreads by seed which is dispersed by wind and water; and vegetatively through rhizomes and transport of rhizome fragments.

Shoreline and Wetland invasive species (Alligatorweed and Water Primrose)

- Alligatorweed is a rooted perennial plant with smooth hollow stems that sprawl onto the water's surface and up onto banks. Stems have nodes from which other stems and roots grow. Leaves are opposite and elliptic with smooth margins. Flowers are distinctive white, papery clusters of several flowers that grown on a stalk than can be 2 inches long. Spreads easily by fragmentation.

- Water Primrose is a rooted perennial plant with spongy, branched stems that forms creeping aquatic mats on water surfaces. Leaves are sword shaped or "willow-like" and are spaced alternately along the plant stem. Leaves may be up to 6 inches long, and covered on both sides by small, soft hairs. Young water primrose plants have leaves that are more ovular in shape. The stems are reddish and tend to root freely at the nodes. Bright yellow flowers, each with five petals about 1-2 inches wide. Spreads vegetatively via stolons that stretch out on land and water surfaces and can also reproduce via small plant fragments.

3.2 Regional Response

In June 2009, a USACE policy memorandum established USACE invasive species policy which complemented the National Invasive Species Act, various executive orders, and the National Invasive Species Management Plan. As such, this policy is applied to all civil works project planning and operations, as well as to the regulatory program and Engineer Research and Development Center (ERDC) projects. Under this policy, measures to either prevent or reduce establishment of invasive and non-native species is a component of Operations and Maintenance (O&M) at all USACE project sites, as well as a part of planning and operations of civil work projects.

In 1980, Governor Richard W. Riley was informed of the severity and importance of South Carolina's aquatic plant problem by several state agencies and the South Carolina Aquatic Plant Management Society. In response to this information, Governor Riley issued Executive Order 80-38 on October 10, 1980 (later amended by Executive Order 82-40) which created the South Carolina Aquatic Plant Management Council (the Council) for the purpose of providing statewide coordination of aquatic plant management efforts in public waters.

The Council is composed of one representative from each of the following agencies and/or agency departments:

- S.C. Department of Natural Resources' (SCDNR) Land, Water, and Conservation Division
- S.C. Department of Health and Environmental Control's (SCDHEC) Bureau of Environmental Quality Control
- SCDNR's Division of Wildlife and Freshwater Fisheries
- S.C. Department of Agriculture
- SCDHEC's Office of Coastal Resources Management
- S.C. Public Service Authority (Santee Cooper)
- SCDNR's Land, Water, and Conservation Division, Conservation Program
- S.C. Department of Parks, Recreation and Tourism
- Clemson University Department of Fertilizer and Pesticide Control
- South Carolina Governor's Office

The representative from the Land, Water, and Conservation Division's Aquatic Nuisance Species Program of the SCDNR serves as Chairman of the Council. The Council provides valuable interagency coordination and serves as the principal advisory body to SCDNR on all aspects of aquatic plant management and research. Furthermore, the Council establishes management policies, approves all management plans, and advises SCDNR regarding research priorities.

3.3 Existing Santee Cooper Aquatic Plant Management Program

As previously stated, Santee Cooper already has a robust aquatic plant management program that focuses on reducing invasive aquatic plant species found within Lake Marion and Lake Moultrie that uses Integrated Pest management (IPM) principles. Santee Cooper currently utilizes annual boat surveys and multispectral data collected by satellite to monitor aquatic plant populations on Lake Marion and Lake Moultrie. Lake users also report nuisance and invasive species to Santee Cooper's lake management team through website forms, email, and phone calls.

Santee Cooper's aquatic plant management program currently uses biological control, chemical control, and educational outreach. The treatments focus on the shoreline and shallow water areas of the lakes suitable for invasive aquatic plant growth. These areas are estimated at 450 miles of shoreline and 88,000 acres of area within the lakes (Kirk & Henderson, 2006).

3.3.1 Biological Control

Santee Cooper employs sterile triploid grass carp and salvinia weevils (*Crypobagous salviniae*) to control invasive and noxious aquatic plant species. Beginning in 1989, SCDNR and Santee Cooper

have worked together to stock and maintain sterile triploid grass carp in the Santee Cooper Lakes to help control the growth of hydrilla. Per the South Carolina Aquatic Management Plan (SCDNR, 2023), the carp population in 2022 was around 34,000. Annual surveys of hydrilla, native vegetation and triploid grass carp occur to ensure the appropriate population of triploid grass carp is maintained.

In 2020, the salvinia weevil was released into the Santee Cooper system in an attempt to slow the growth and spread of giant salvinia. Salvinia weevil is monophophagous and only feeds on giant salvinia. The weevil is reared and released by hand to targeted areas with the greatest salvinia growth.

3.3.2 Chemical Control

Santee Cooper applies aquatic herbicides as concentrated liquids, granules, or pellets. All aquatic herbicides used have been approved by the Environmental Protection Agency (EPA) and are registered and labelled for aquatic uses. Additionally, all treatments are applied when plants are actively growing. All aquatic herbicides are mixed and applied per their specific label instructions. Chemical specific application rates and active ingredients are listed in Table 1. These aquatic herbicides and rates are based on current science and may change as new products or treatment methods are developed.

Table 1. Chemical specific application rates by targeted plant species.

Plant Species	Active Ingredients	Rate	Surfactant
Giant Salvina	Carfentrazone/Penoxsulam/Flumioxazin	4 oz/4 oz/4oz ac	MSO[1] 1%
	Metsulfuron/Flumi/MSO	0.5 gal/ ac	N/A
	Fluridone	30 ppb (150 ppb max per year)	N/A
	Carfentrazone/Penoxsulam	8 oz/ac / 4 oz/ac	MSO 1%
	Diquat/ Flumioxazin	1 gal Diquat/ 8 oz. Flumi per acre	MSO 1 %
	Diquat	1-2 gal/ ac	MSO 1%
Primrose/ Alligatorweed	Glyphosate/ Triclopyr	0.5 gal. / 0.5 gal. per acre	MSO 1 %
	Glyphosate/ Florpyrauxifen-benzyl	0.5 gal / 3 PDU per acre	MSO 1%
	Imazamox/Flumioxazin	32 oz / 4 oz per acre	MSO 1%
	Imazapyr/ Glyphosate	16oz/32oz per acre	MSO 1%
	Imazamox/Florpyrauxifen-benzyl	24 oz/ac / 3 PDU/ac	MSO 1%
Waterwillow*	2,4-Dichlorophenoxyacetic acid/Triclopyr	1 gal/ac	Tactic 24oz 100

	Triclopyr / Glyphosate	0.5 gal/ac / 0.5 gal/ac	gal tank mix
	Florpyrauxifen-benzyl/ Imazamox	3 PDU / 24 oz ac	MSO 1%
	Tricloypr	0.5-1.5 gal/ac	MSO 1%
Crested Floating Heart	Florpyrauxifen-benzyl	3 PDU per ac/ft	MSO 1%
	Florpyrauxifen-benzyl	3 PDU per ac	MSO 1%
Water Hyacinth	Triclopyr	0.5 gal.- 1 gal. /ac	Tactic 24oz 100 gal tank mix or MSO 1 %
	Diquat	1-2 gal per surface acre	
Giant Cutgrass*	Triclopyr/ Glyphosate	0.5 gal/ ac / 0.5 gal/ ac	Tactic 24oz 100 gal tank mix or MSO 1 % (SePRO only tests with non ionic)
	Imazapyr/ Glyphosate	0.5 gal/ac / 0.5 gal/ac	Tactic 24oz 100 gal tank mix or MSO 1 %
Algae	Chelated Copper/Surfactant	0.6-2.5 gal/ac-ft	
Eel Grass*	Diquat / Chelated Copper - Surfactant	1 gal per surface acre /	

[1] Methylated Seed Oil (MSO)
*These treatments are limited to areas where access and navigation are severely impacted, or large monocultures exist.

3.3.3 Educational Outreach

Santee Cooper works to promote public awareness of the existence and risks associated with aquatic invasive plants. Public outreach includes ad campaigns such as “Stop the Hitchhikers” which is aimed at keeping boats free from AIS. Signs are placed at boat ramps and other strategic places in an effort to reach the key targeted audience.

3.3.4 Current Costs

The average annual cost to implement the program from 2019-2021 was $1,115,000. During this timeframe, 2,500 to 3,500 acres were treated annually. Approximately 7,400 acres were treated in the calendar year 2023.

4 PLAN FORMULATION

Development of this report generally followed USACE’s six-step planning process. The process

provides a flexible, systematic, and rational framework to make determinations and decisions at each step based on constraints, objectives, and assumptions. This allows the interested public and decision-makers to be fully aware of the basic assumptions employed, the data and information analyzed, the areas of risk and uncertainty, and the substantive implications of each plan that is considered.

4.1 Problems

The spread of invasive aquatic plants is causing a multitude of problems within the Santee Cooper Lake system. Non-native aquatic plant species are not as susceptible to the natural population controls that impact native aquatic plant species, and as a result when an invasive non-native plant is introduced, they often outcompete native aquatic plant species. Floating and submerged grasses, and shoreline and wetland invasive species have proliferated in Lakes Marion and Moultrie and often occupy much of the shallow water (<4 ft deep). Fundamentally, the problems can be divided into two categories: Impacts to Infrastructure and Impacts to the Environment. These impacts are summarized in the bullets, below.

Infrastructure Impacts:

- Floating rafts of invasive aquatic plants impede the operation of the St. Stephen Fish Lift, thus impacting the ability of American Shad and Blueback Herring to migrate past the dam and ascend through Lakes Moultrie and Marion to their spawning grounds.
- Floating rafts of aquatic plants can block critical water intake infrastructure associated with St. Stephen Hydroelectric Plant (USACE owned) leading to temporary shutdowns in operations.
- Invasive aquatic plants interfere with boat propellers, swimming, and fishing thus reducing recreational opportunities along waterbodies.

Environmental Impacts:

- Conversion of diverse native plant communities into monocultures that reduces suitable habitat for native flora and fauna.
- Large mats of vegetation can become lodged in the intake grates or turbines and die off. Decomposition of the plants can result in depleted oxygen and liberated nutrients producing algae blooms which deplete dissolved oxygen further and result in large fish kills, similar to the one that occurred in 1991.

4.2 Opportunities

Invasive aquatic plant control is likely to provide a benefit to aquatic species by restoring native vegetation, maintaining suitable habitat, and restoring ecosystem and shoreline function. The project's reduction of invasive aquatic plants would benefit the ecosystem and resident and

transient wildlife, and the public good via more resilient/reliable hydropower generation and water supply, expanded and improved quality of recreational opportunities and thriving aquatic ecosystem.

4.3 Planning Objectives and Constraints

Planning Objectives

The overall federal objective of this project is to reduce the negative impacts of invasive aquatic plants within the project area and reduce the risk of substantial impacts to the ecology and infrastructure and reduce the probability of spread both downstream and by boat/boat trailer.

Planning Constraints

Project constraints are resource, legal, or policy considerations that limit the range or type of actions that could be implemented to meet planning objectives. The following constraints were identified for this evaluation:

- Avoid adverse effects to Threatened and Endangered Species.
- Avoid adverse impacts on water quality.

4.4 Potential Management Measures

4.4.1 Biological Control

Triploid grass carp (*Ctenopharyngodon Idella*) could be stocked to limit hydrilla growth and distribution. Additionally, the program could include stocking of giant salvinia weevils (*Cyrtobagous salviniae*) when the water temperature is above 65^{o} F to ensure weevil survival and reproduction, which has been shown to reduce the presence of giant salvinia.

4.4.2 Chemical Control

The following are chemical treatment options for the control of a variety of aquatic invasive plants in Lakes Marion and Moultrie. Those listed are the most commonly used, however, this is not an exhaustive list. Other treatment options that may better accomplish project goals, if identified, will also be considered.

Ammonium salt of imazamox

Imazamox is available in both liquid and granular forms and is used to control submerged, emergent, and floating leaf plants. It is a selective, systemic herbicide that moves throughout plant tissue and prevents the plant from producing a necessary enzyme, known as acetolactate

synthase (ALS) enzyme, which is not found in animals. Susceptible plants will stop growing soon after treatment, with plant death and decomposition occurring over several weeks.

Imazamox should be applied to plants that are actively growing when used as a post-emergence herbicide. It can also be used during drawdown as a pre-emergent herbicide to prevent plant regrowth.

Imazamox is only moderately persistent, and it degrades aerobically in the soil to a non-herbicidal metabolite which is immobile or moderately mobile. Imazamox also degrades in the water by aqueous photolysis. Hazard to non-target organisms is considered to be minimal. Imazamox is practically nontoxic to avian species, finfish, aquatic invertebrates, and honeybees (EPA 1997).

Liquid imazamox can be applied to the surface of the water using a sprayer or injected below the water surface. When treating emergent or floating plants, imazamox must be used with a spray adjuvant. Spray additives generally consist of surfactants, oils, and fertilizers and enhance the effectiveness of herbicides. USACE only authorizes use of aquatic registered adjuvants which are not petroleum-based, non-toxic, and do not contain metals.

Imazapyr

The active ingredient in Imazapyr is isopropylamine salt of imazapyr. Imazapyr is used for control of emergent vegetation. It is not recommended for control of submersed vegetation. Imazapyr is a systemic herbicide that moves throughout the plant tissue and prevents plants from producing a necessary enzyme, ALS, which is not found in animals. Susceptible plants would stop growing soon after treatment and become reddish at the tips of the plant. Plant death and decomposition would occur gradually over several weeks to months. Imazapyr should be applied to plants that are actively growing. If applied to mature plants, a higher concentration of herbicide and a longer contact time would be required. Imazapyr is broken down in the water by light and has a half-life (the time it takes for half of the active ingredient to degrade) ranging from three to five days.

Three degradation products are created as imazapyr breaks down. These are pyridine hydroxy-dicarboxylic acid, pyridine dicarboxylic acid (quinolinic acid), and nicotinic acid. These degradates persist in water for approximately the same amount of time as imazapyr. Imazapyr doesn't bind to sediments, so leaching through soil into groundwater is likely. Imazapyr is practically non-toxic (the U.S. Environmental Protection Agency's (EPA) lowest toxicity category) to fish, invertebrates, birds, and mammals and it does not bioaccumulate in animal tissues.

There are no restrictions on recreational use of treated water, including swimming and eating fish from treated water bodies. If application occurs within a 0.5-mile of a drinking water intake, then the intake must be shut off for 48 hours following treatment. There is a 120-day irrigation restriction for treated water, but irrigation can begin sooner if the concentration falls below one

part per billion.

Imazapyr could be applied using handguns at two to six pints per acre of herbicide, with one quart methylated seed oil, and an aquatic labeled colorant. All-terrain vehicle (ATV) applications could be made using the same herbicide rates with 100 gallon/acre water in open areas not restricted by docks, marinas, or boat ramps.

Diquat

Diquat is the common name for the chemical 6,7-dihydropyrido[1,2-a:2',1'-c] pyrazinediium. It is commonly formulated as a dibromide salt. Diquat inhibits photosynthesis and oxidizes cell membranes. It is rapidly absorbed by plants, and symptoms appear within hours (Senseman 2007). Diquat is a good choice for submersed weeds, but it is not especially effective on emergent weeds (Helfrich et al., 2009). Diquat is used to control submersed plants in small treatment areas or in areas where dilution may reduce the period of time that plants are exposed to the herbicide. Diquat is generally considered to be a "broad-spectrum" product that kills a wide range of plant species. However, the susceptibility of different submersed species can vary substantially.

Diquat is slow to degrade in the environment, but will rapidly be adsorbed by soil particles (Hofstra et al. 2001, Poovey & Getsinger 2002; World Health Organization, 2004). Diquat can be rapidly inactivated when treating "muddy" or turbid water and the speed of this inactivation can interfere with plant control. In pond studies, diquat was quickly eliminated from the water column and was present at very low levels within 14 days and undetectable after 38 days (Langeland & Warner 1986; Parsons et al., 2007; Robb et al., 2014).

High acute risk to birds is not expected from the use of diquat. Diquat should be applied before plant growth becomes dense and when plants are actively growing. Application of this herbicide can be made by spraying it onto the water surface, by pouring into the water, or using an injection system.

Endothall

Endothall is the common name of the active ingredient endothal acid. Endothall is available in both liquid and granular forms. Two types of endothall are available, dipotassium salt and monoamine salts. Endothall is a contact herbicide that prevents certain plants from making the proteins they need. Factors such as density and size of the plants present, water movement, and water temperature determine how quickly endothall works. Under favorable conditions, plants begin to weaken and die within a few days after application. Endothall disperses with water movement and is broken down by microorganisms into carbon, hydrogen, and oxygen.

For effective control, endothall should be applied when plants are actively growing. Endothall is used primarily to control submersed plants. Most submersed weeds are susceptible to

dipotassium salt formulations. The choice of liquid or granular formulations depends on the size of the area requiring treatment. Granular is more suited to small areas or spot treatments, while liquid is more suitable for large areas. If endothall is applied to a pond or enclosed bay with abundant vegetation, no more than one third to one half of the surface should be treated at one time because excessive decaying vegetation may deplete the oxygen content of the water and kill fish. Untreated areas should not be treated until the vegetation exposed to the initial application decomposes.

Liquid endothall products can be sprayed on the water or injected below the water surface. It may be applied as a concentrate or diluted with water depending on the equipment used. Granular endothall products must be spread as evenly as possible in the area to be treated (State of Connecticut Department of Energy & Environmental Protection 2014).

Glyphosate

Glyphosate is a broad spectrum, systemic herbicide that moves throughout the plant tissue and works by inhibiting an important enzyme needed for multiple plant processes, including growth. Glyphosate is effective only on plants that grow above the water. It would not be effective on plants that are submerged or have most of their foliage under water, nor would it control regrowth from seed. Three salts of glyphosate, which are used as active ingredients in registered pesticide products, collectively constitute the most widely used pesticides by volume. Glyphosate should be applied to plants that are actively growing and after flowers have formed, usually around midsummer. Following treatment, plants will gradually wilt, appear yellow, and die in approximately two to seven days. Occasionally, effects are not seen on the plant the year it is applied, but the plants do not appear the next season.

In water, the concentration of glyphosate is reduced through dispersal by water movement, binding to sediments, and break-down by microorganisms. Glyphosate adsorbs strongly to soil and is readily degraded to carbon dioxide by soil microbes (Sprankle et al., 1975). Glyphosate does not degrade in distilled water but is rapidly adsorbed by suspended sediment and subsequently degraded to Aminomethylphosphonic Acid (Zaranyika & Nyandoro, 1993).

Glyphosate is no more than slightly toxic to birds and is practically nontoxic to fish, aquatic invertebrates and honeybees (Folmar et al., 1979; Howe et al., 2004; Mensah et al., 2015; Takacs et al., 2002). Based on available data, the EPA has determined that the effects of glyphosate on birds, mammals, fish and invertebrates are minimal (EPA 1993). Glyphosate may be applied as a broadcast spray. This application method is effective for most species in large stands. In very small stands, an alternative method of glyphosate application is to wipe the entire plant (wearing personal protective equipment) with a wet rag or using a wick type applicator. When using glyphosate, an appropriate surfactant must be mixed with the product before application to ensure that the glyphosate “sticks” to the plant surfaces, increasing the rate of absorption. Sometimes in very small stands, one can brush cut the plant down and use an eye dropper to place glyphosate into the interior of the cut stem. The herbicide will travel from the cut stem

down into the roots and kill the remaining portion of the plant.

Fluridone

Fluridone is a selective systemic herbicide for management of aquatic vegetation in freshwater ponds, lakes, reservoirs, drainage canals and irrigation canals. Fluridone is absorbed from water by plant shoots and from the hydrosoil by the roots of aquatic vascular plants. For in-water treatments, it is important to maintain the specified concentration in contact with the target plants for a minimum of 45 days. Rapid water movement or any condition which results in rapid dilution in treated water will reduce its effectiveness. In susceptible plants, fluridone inhibits the formation of carotene. In the absence of carotene, chlorophyll is rapidly degraded by sunlight. Herbicidal symptoms of fluridone appear in seven to ten days and appear as white (chlorotic) or pink growing points. Under optimum conditions, 30 to 90 days are required before the desired level of aquatic plant management is achieved. Species susceptibility may vary depending on time of year, stage of growth, and water movement. Fluridone should be applied prior to initiation of weed growth or when weeds begin active growth. Application to mature target plants may require an application rate at the higher end of the specified rate range and may take longer to control.

Fluridone has low toxicity to animals (USDA, 2008) with no restrictions on swimming or drinking in treated water bodies. Fluridone breaks down in the environment over days or weeks with the major degradation product being N-methyl formamide (EPA, 2004). The half-life of fluridone in soils and sediments has been estimated at nine months. Fluridone degradation in soils and saturated sediments has been correlated with temperature and clay content, while fluridone degradation in water is largely dependent on UV light exposure (Paranjape et al,. 2014). Fluridone transport through the soil, vadose zone, and aquifer is limited by its strong absorbance to organic matter (Wickham et al., 2020).

Penoxsulam

Penoxsulam is a systemic herbicide that moves throughout the plant tissues and prevents plants from producing a necessary enzyme, acetolactate synthase (ALS), which is not found in animals. Susceptible plants will stop growing soon after treatment and become reddish at the tips of the plant. Plant death and decomposition will occur gradually over several weeks to months. Penoxsulam should be applied to plants that are actively growing; mature plants require a higher concentration of herbicide and a longer contact time. Penoxsulam must remain in contact with plants for around 60 days. A supplemental “bump” treatment may be needed to maintain the herbicide concentration for the required contact time. Because of this long contact period, penoxsulam is likely to be used for larger-scale or whole-lake treatments and should not be used where rapid dilution can occur such as spot treatments or moving water.

Toxicity tests conducted with rainbow trout, water fleas (Daphnia sp.), and Ramshorn snail indicate that penoxsulam is not toxic for these species. Additionally, penoxsulam is not toxic to

birds, including waterfowl such as mallards. There are no restrictions on swimming, eating fish from treated water bodies, or using water for drinking water. Before treated water can be used for irrigation, the concentration must be below 30 parts per billion (ppb) for turf grass or rice, and below one ppb for food crops (Wisconsin DNR, 2012).

Penoxsulam is broken down in the water by light and microbes and has a half-life ranging from about 12-38 days. Shallow clear-water lakes will have faster degradation than in turbid, shaded, or deep lakes. As penoxsulam breaks down, twelve degradation products are created. Six of these are more persistent in the environment than penoxsulam itself: BSTCA (half-life 67-770 days), 2-amino-TCA, 5-OH-penoxsulam, SFA, sulfonamide, and 5,8-di-OH. Penoxsulam doesn't bind to sediments, so leaching through soil into groundwater is likely. Three of the more persistent degradates have been tested for mobility and are also mobile through the soil (Wisconsin DNR, 2012).

Florpyrauxifen-Benzyl

Florpyrauxifen-Benzyl is a systemic herbicide. It is a WSSA Group 4 herbicide, meaning that the mechanism of action is by mimicking the plant growth hormone auxin and causing excessive elongation of plant cells, ultimately killing the plant. Affected plants may show atypical growth patterns, and leaf and shoot tissue may become fragile. While initial effects will become apparent within a few days after treatment, it will take two to three weeks for the full plant decomposition process to occur. Florpyrauxifen-benzyl should be applied to plants that are actively growing; mature plants may require a higher concentration of herbicide and a longer contact time compared to smaller, less established plants. Florpyrauxifen-benzyl has relatively short contact exposure time (CET) requirements (typically 12 to 24 hours). The short CET may be advantageous for localized treatments of submersed aquatic plants, however, the target species efficacy compared to the size of the treatment area is not yet known.

Florpyrauxifen-benzyl is practically nontoxic to freshwater fish and invertebrates, birds, bees, reptiles, amphibians and mammals. Florpyrauxifen-benzyl will temporarily bioaccumulate in freshwater organisms but is expelled and/or metabolized within one to three days after exposure to high (greater than 150 ppb) concentrations. There are no risks of concern to human health since no adverse short- or long-term effects, including a lack of carcinogenicity or mutagenicity, were observed in the submitted toxicological studies for Florpyrauxifen-benzyl regardless of the route of exposure. There are no drinking water or recreational use restrictions, including swimming and fishing, and no restrictions on irrigating turf. There is a short waiting period (dependent on application rate) for other non-agricultural irrigation purposes. Treated water should not be used for livestock drinking water or for agricultural irrigation (Wisconsin DNR, 2022).

Florpyrauxifen-benzyl is short-lived, with a half-life of four to six days in aerobic aquatic environments and two days in anaerobic aquatic environments. Florpyrauxifen-benzyl in water is subject to rapid breakdown by light, with a reported photolytic half-life of approximately two

hours in surface water when exposed to sunlight. In addition, the herbicide can convert partially to an acid form via breakdown by water at high pH (greater than 9) and higher water temperatures (greater than 25^{o}C). Microbial activity in the water and sediment can also enhance degradation. Florpyrauxifen-benzyl has a high soil adsorption coefficient (KOC) and low volatility, which allows for rapid plant uptake resulting in short exposure time requirements. Florpyrauxifen-benzyl degrades quickly in sediment (2 to 15 days) (Wisconsin DNR, 2022).

Flumioxazin

Flumioxazin is a broad-spectrum contact herbicide. It is a WSSA Group 14 herbicide, meaning the mechanism of action is by inhibiting protoporphyrinogen oxidase, which blocks production of heme and chlorophyll. Treated plants respond quickly to treatment and rapidly decompose. For larger treatments or in dense vegetation, split treatments about two weeks apart are recommended to prevent fish suffocation from low oxygen due to decaying plants. The efficacy is dependent on both light intensity and water pH; herbicide efficacy decreases with increasing pH and decreasing light intensity. Flumioxazin needs to be applied to young plants early in the spring as they begin to grow. Flumioxazin should not be used in flowing waters such as rivers or streams.

Flumioxazin is slightly to moderately toxic to freshwater fish on a short-term basis, with possible effects on larval growth below the maximum label rate of 400 ppb. Flumioxazin is moderately toxic to freshwater invertebrates, with possible impacts below the maximum label rate. Flumioxazin is practically non-toxic to birds and small mammals on a short-term basis. The potential for bioaccumulation is low since degradation in water is rapid (Wisconsin (DNR 2022).

Flumioxazin is broken down rapidly by water, light, and microbes. The half-life is dependent on the pH of the water, and ranges from approximately four days at pH 5 to 18 minutes at pH 9. Flumioxazin degrades into APF (6-amino-7-fluoro-4-(2-propynyl)-1,4,-benzoxazin-3(2H)-one) and THPA (3.4.5.6-tetrahydrophthalic acid). Flumioxazin has a low potential to leach into groundwater due to the very quick hydrolysis and photolysis. APF and THPA have a high potential to leach through soil and could be persistent (Wisconsin DNR, 2022).

Carfentrazone-Ethyl

Carfentrazone-Ethyl is a contact herbicide labeled for the control of floating-leaf vegetation using surface applications and for control of submerged vegetation using subsurface applications. It is a WSSA Group 14 herbicide which interferes with the chlorophyll biosynthetic pathway. The herbicide causes membrane disruption and plant tissue necrosis. After application, affected plants will show signs of injury within a few hours and will decompose in subsequent weeks. Environmental conditions like temperature and pH may affect the activity of the herbicide; herbicide symptoms are accelerated under warm conditions.

Carfentrazone-Ethyl is moderately toxic to freshwater fish and moderately toxic to practically non-toxic to freshwater invertebrates. Carfentrazone-ethyl is practically non-toxic to birds on a short-

and medium-term exposure basis. There is no restriction on the use of treated water for recreation. Carfentrazone-ethyl should not be applied directly to water within ¼ of a mile of an active potable water intake (Wisconsin DNR, 2022).

Although carfentrazone-ethyl breaks down rapidly in the environment, its degradates are persistent. The herbicide is broken down by water and light to carfentrazone-choloropropionic acid, which is then further degraded to carfentrazone-cinnamic, -propionic, -benzioc and 3-(hydroxymethyl) -carfentrazone-benzoic acids. The half-life typically ranges from approximately three hours to nine days but can be longer (over 34 days) in acidic waters. While low levels of chemical residue may occur in surface water and groundwater, risk concerns to non-target organisms are not expected. If applied into water, carfentrazone-ethyl is expected to adsorb to suspended solids and sediment (Wisconsin DNR, 2022).

4.5 Alternatives

For this LR/PEA, Section 104 of the RHA of 1958 (33 U.S.C. 610), as amended, serves as a guide for determining the range of alternatives to be considered. When an action is taken pursuant to a specific statute, the statutory objectives of the project serve as a guide by which to determine the reasonableness of objectives outlined in the NEPA document. This LR/ PEA has been prepared to ascertain Federal interest in supporting and expanding Santee Cooper's Aquatic Invasive Plant Control Program to reduce impacts caused by the spread of aquatic invasive species at Lake Marion and Lake Moultrie. This alternatives analysis, therefore, focuses on identification of measures/alternatives that can be implemented under such a program. NEPA does not require an agency to consider all alternatives; rather, only "reasonable alternatives" need to be explored and objectively evaluated. The result of preliminary screening is that one action alternative – Cost Sharing Aquatic Invasive Plants Control – and the No Action alternative were carried forward for evaluation.

4.5.1 Alternatives Considered but Eliminated

USACE considered, but ultimately screened out an alternative that would only involve either chemical or biological control. An integrated pest management program, using all available methods, is the most effect way of managing invasive species while maintaining environmental balance. Using just one method could ultimately result in a less effective program with more environmental impacts. Therefore, a stand-alone alternative was screened out.

4.5.2 Alternative 1: No Action – No Change to Current Practice

Under the No Action Alternative, the Federal government would not share costs with Santee Cooper to control invasive aquatic plants. Under the no action alternative, Santee Cooper would continue control operations to the level that current funding allows, which is only a small portion of the affected area. With limited treatment, invasive aquatic plants would have greater effects on native wildlife habitat by forming dense stands in previously un-vegetated or sparsely vegetated

aquatic environments. Dense stands of invasive aquatic plants outcompete native plants resulting in monocultures which limit native animal species preferred foraging, spawning, nesting, and rearing habitat. These large stands obstruct navigable waterways, restrict water flow, obstruct water intakes and other infrastructure, degrade water quality, and confine or restrict recreational activities including boating, swimming, fishing, and hunting. As previously mentioned, fish kills are another potential result if plants go untreated.

4.5.3 Alternative 2: Cost Share Aquatic Invasive Plant Control Program (Proposed Action)

Alternative 2 consists of the Federal government and Santee Cooper sharing in the cost of the aquatic invasive plant control program at Lakes Marion and Moultrie. By sharing the costs, Santee Cooper would treat up to double the acreage they currently treat. This alternative would include the use of the aquatic-labeled herbicides (listed above and described in Table 1 above) and biological control methods including the continued use of giant salvinia weevil and triploid grass carp.

Long-term benefits of invasive aquatic plant treatment include improved shoreline/shallow water habitat at the project site. This would in turn provide ideal foraging, spawning, nesting, and rearing habitat to the benefit of transient and resident fish and wildlife species. Widespread treatment and control of these invasive species would lower the risk of clogs and damage to water intakes, hydropower operations, and the fish lift. Finally, recreational activities such as boating, swimming, fishing, which support the local economy, would not be impaired.

Using Federal funding, Santee Cooper would assume the following obligations:

1. Santee Cooper would continue to perform control activities in cooperation with SCDNR. Statements of Work (SOW) would be submitted annually by Santee Cooper. The SOW would detail treatment locations, timeline, and methodologies.
2. Control methods would fall within that which are outlined in this LR/PEA, including any listed minimization measures. Should there be a desire to use treatment options not detailed here, supplemental NEPA analysis would be required.

5 ECONOMIC IMPACTS ASSESSMENT

This Section captures the average annual equivalent (AAEQ) cost in addition to examining the economic impacts of the proposed action. Engineer Regulation 1105-2-103, Chapter 6, cites the general authority for aquatic ecosystem restoration provided by 33 U.S.C. §2213 (c)(7) and allows USACE participation in the Santee Cooper Partnership because it falls into the broad category described as; “general authority for USACE to restore degraded aquatic ecosystems.” This ER (6-5)(a) also directs that “economic, social, and environmental benefits, impacts and costs are to be identified, measured, and/or qualitatively characterized using the four Principle & Guideline

accounts as described in section 5.2 below.

5.1 Economic Considerations

5.1.1 Infestation Impacts

This section does not attempt to provide the total economic costs of aquatic invasive species presence in the Santee Cooper Lake system. Such an effort would greatly exceed the scope of this report. Instead, it focuses on describing the known impacts to the water resource--related infrastructure and activities (Federal and non-Federal) within Lake Marion and Lake Moultrie that are most likely to be affected by AIS, including infrastructure related to USACE authorized purposes. Other impacts presented in the sections below include water supply and treatment facilities, boating and marine infrastructure, recreation, tourism, and waterfront property.

Hydropower Facilities

There are three hydroelectric facilities within the study area. Jefferies Hydroelectric Station, located at the Pinopolis Dam on Lake Moultrie, is owned and operated by Santee Cooper and is capable of producing 140 megawatts (MW) of electricity. Santee Powerhouse, located directly downstream from Santee Dam, is owned and operated by Santee Cooper and capable of producing 1.8 MW. USACE owns and operates the St. Stephen Powerhouse that is located on the Cooper River Rediversion Canal and can produce 84 MW of electricity and service nearly 40,000 homes. The general location of these facilities is illustrated in Figure 2.

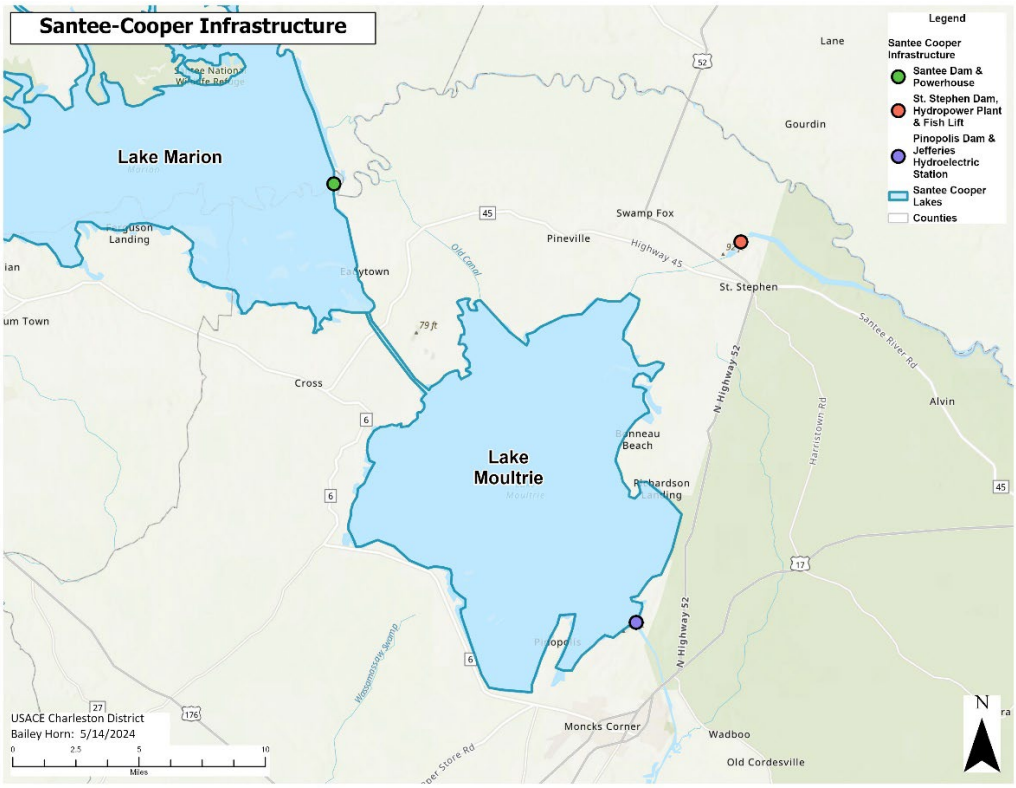

Figure 2. Map of Santee Cooper Infrastructure

Hydropower outages, and thus foregone economic benefits, are likely if intake blockages occur more frequently if the Federal Government does not participate and restricts/constrains the treatment area for the lakes invasive aquatic plant control. The costs associated with outages are borne by both consumers and producers in the power market. These costs are a function of the magnitude of infestation, the cost of response measures, and the extent of impact vulnerabilities and also result in a reduction in transfer payments by the Southeastern Power Administration to the US Treasury.

The aquatic weed hydrilla is attributed with causing one of the greatest single impacts from an invasive species in the state. Following a storm in 1991, large rafts of hydrilla were dislodged and floated into the water intake canal and impinged on the debris screens of the St. Stephen Powerhouse. The power plant was shut down for weeks while hydrilla was removed from the screens. The monetary impact from that incident alone was estimated at $4 million in lost electric power generation and associated costs (SCDNR, 2008).

St. Stephen Fish Lift

In 1976, USACE was authorized to construct the Cooper River Rediversion Project (CRRP) to divert water from Lake Moultrie and the Cooper River to the Santee River. The CRRP involved the

construction of a canal beginning at Lake Moultrie, the St. Stephen Dam, and the St. Stephen Powerhouse. To ensure continued fish passage, USACE also constructed a fish lift, or fish lock, at St. Stephen Dam. The lock is operated by SCDNR during the spawning season and up to 750,000 fish pass through the lock per year. AIS can cause adverse issues with the operation and proper function of the fish lift and impede fish passage. Debris from invasive species is removed weekly from the fish lift during fish passage season by USACE and SCDNR staff. In addition to this effort, a vacuum truck is required on average three times per year to more thoroughly remove water hyacinth and giant salvinia matted up around the exit chamber of the fish lift. Each of these instances, cost USACE roughly $10,000 to remove the debris to allow the fish lift to operate effectively. If this removal did not occur and an outage should occur during peak spawning, the impact to the species that rely on the lift to reach spawning waters would be devastating.

Water Supply and Treatment Facilities

Santee Cooper owns and operates two water treatment systems. These systems are located on Lake Marion and Lake Moultrie. Together, they have the capacity to treat and distribute 48 million gallons of water per day. These water systems distribute clean drinking water to multiple counties and municipalities. Hydrilla and other invasive species can clog water intake pipes reducing the reliability and quality of drinking water for thousands of people and businesses throughout a multi-county region.

Recreation, Tourism, and Waterfront Property Values

In some areas where dense infestations grow adjacent to the shoreline and docks, recreational use (i.e., boating, fishing, and swimming) has been impaired. Largemouth Bass and the sunfish family of fishes experience impacts to reproduction due to decreased suitable habitat for nest building. One study suggests that invasive aquatic plants can reduce property values and associated property taxes, as well as the impact from economic activity attributed to tourism (Olden & Tamayo, 2014).

5.1.2 Costs of Recommended Plan

Table 2 shows the actual costs associated with the Aquatic Invasive Plant control program for October 2022-September 2023.

Table 2: Santee Cooper Actual Expenditures for Fiscal Year 2023

Santee Cooper Budget Estimates	Total
Biological Control	
A. Payroll*	$48,959.01
B. Materials	$128,435.54
C. Utilities	$10,272.50

D. Automotive**	$340.28
Chemical Control	
A. Payroll*	$101,816.67
B. Materials	$954,575.61
C. Contract Services	$328,676.00
D. Automotive*	$11,430.64
Grand Total	$1,584,506.25

*Santee Cooper Staff: Environmental Specialists, Administrative Support, and Manager
**Automotive charges are for fleet usage.

Proposed Action Project Costs

Expenses incurred by Santee Cooper from the date the scope of work is signed by the Charleston District Commander through December 31, 2024 will be reimbursed as per the Agreement. The total project costs for calendar year 2024 are estimated to be $1,600,000. The final total contributions of the Federal Government will therefore not exceed $800,000 for 2024. In subsequent years, Santee Cooper will provide an annual workplan, which will outline estimated annual costs. The federal government will review and approve the workplan and reimburse up to half the costs. Reimbursement is subject to the availability of funds.

5.2 Plan Evaluation and Selection

Consistent with the USACE planning process, projects must be formulated to consider four criteria described in the Principle and Guidelines (P&G) Report (U.S. Water Resources Council, 1983) for completeness, effectiveness, efficiency, and acceptability, which are described below.

The Alternatives were evaluated to determine if they met the four planning criteria described in the P&G. The No Action alternative does not meet any of the criteria, nor does it meet the planning objective or solve the identified problem of non-native invasive species infestation at Lakes Marion and Moultrie. Alternative 2, Cost Share Aquatic Invasive Plant Control, is evaluated against the P&G criteria below:

- **Completeness.** Alternative 2 is the most complete solution available to control aquatic invasive plants. It includes every potential measure. Together these measures address all planning objectives, without violating any planning constraints, creating powerful preventive actions, monitoring, educational opportunities, planning for contingencies, and preparing for quick response to potential infestations. While this alternative cannot completely eradicate aquatic invasive plants, it is the most comprehensive solution available.
- **Effectiveness.** Alternative 2 includes a combination of different methods to control a

complete infestation of aquatic invasive plants. This alternative is a broad solution that will do more to control and prevent infestations than any other alternatives considered.

- **Efficiency.** Based on the current level of knowledge, if aquatic invasive plants are not treated, they will eventually outcompete much of the native, desired vegetation. The proposed action will help avoid unnecessary costs that could arise from a severe infestation. The costs of the cost-share partnership detailed above would be a small fraction of the costs associated with O&M costs resulting from a severe infestation.
- **Acceptability.** Alternative 2 is accepted by federal and state resource agencies, as well as the South Carolina Aquatic Plant Management Council as an appropriate and meaningful treatment for invasive aquatic plants present within these lakes. Only EPA registered chemicals will be used, reducing environmental impacts. While the program will not eradicate all invasive species, it is accepted as the most complete and effective treatment available.

Based on the information evaluated in this LR/PEA, USACE has determined that there is Federal interest in partnering with Santee Cooper to continue and expand the control of aquatic invasive plant species. As described in Section 5, the potential costs of infestation exceed the estimated annual costs of the cost-sharing program, thus demonstrating an economic benefit in investing in controlling these invasive species. Therefore, Alternative 2, Cost Share Aquatic Invasive Plant Control, is the recommended plan.

6 EXISTING CONDITIONS

This section provides general information about the environmental conditions within the approximately 160,000-acre study area. The background environmental information provided is limited due to a general lack of impacts associated with the existing inspection stations as well as any anticipated changes to the watercraft inspection station sites or their operation.

6.1 Water Quality

The South Carolina Department of Health and Environmental Control (SCDHEC) tests the waters to protect the health of consumers of fish and shellfish, and for recreation. Specific monitoring criteria include bacteria, dissolved oxygen, pH, nutrients, and temperature. The state uses these criteria to designate the use of the water bodies. Classifications include drinking water, recreation, fishing, propagation of fish, shellfish, game and other aquatic life, wild river, scenic river, and coastal fishing. Both Lake Marion and Lake Moultrie are part of the larger Santee River Watershed. SCDHEC has issued a fish consumption advisory for both lakes, specifically due to mercury (SCDHEC, 2023). There are numerous monitoring stations on both lakes. All monitoring stations fully support recreational uses, specifically, swimming. However, both lakes have elevated phosphorus and reduced dissolved oxygen and therefore are not considered to fully support or meet the aquatic life use (aquatic life protection) as designed by SCDHEC (SCDHEC, 2022).

Water quality, and in particular dissolved oxygen, is impacted by dense mats of invasive aquatic plants. Dissolved oxygen is impacted by reduced light penetration and photosynthesis, reduced gas exchange at the surface of the water, and decomposition of dying plant material. The impacts are localized to the immediate area of the matted plants, but some mats of giant salvinia may be several hundred acres.

6.2 Wetland and Native Aquatic Vegetation

Wetland acreage totals more than 172,730 acres within and adjacent to the project boundary (Santee Cooper, 2004). Among these are riverine (396 acres), lacustrine (131,112 acres), and palustrine (41,222 acres) wetlands (Cowardin et al., 1979; Santee Cooper, 2004). Riverine and lacustrine systems are largely composed of open water habitats that generally lack vegetation, with the exception of aquatic beds and littoral emergent wetlands present within Lakes Marion and Moultrie. Palustrine wetlands within and adjacent to the project boundary are composed of forested (31,937 acres), scrub-shrub (4,960 acres), unconsolidated shore (67 acres), unconsolidated bottom (434 acres), aquatic bed (266 acres), and emergent (3,558 acres) wetland subclasses. Distinct wetland communities in the project area include calcareous wetlands, non-alluvial, and floodplain wetlands.

The majority of palustrine wetlands occur at the upstream end of Lake Marion and in the Santee River floodplain. In addition, lacustrine emergent and aquatic bed wetland habitats can be found along islands and within the littoral zone of both lakes. These wetland types provide habitat, forage, and cover opportunities for various species of plants and wildlife including waterfowl and fish. Survey results in 2023 by Santee Cooper documented about 24.219 acres of native aquatic

species colonizing the littoral zones of Lake Marion (Santee Cooper, 2023).

Sparkleberry Swamp on upper Lake Marion is part of the 1,600-acre Upper Santee Swamp system. When Lakes Marion and Moultrie were created in 1941 by damming the Santee River, Sparkleberry Swamp transformed into a flooded forest. The result of the high water and pristine swamp is an ecosystem teeming with more than 150 bird species, including at one time the largest colony of yellow-crowned night herons in the eastern United States. The National Audubon Society recognizes Sparkleberry Swamp as an Important Bird Area.

6.3 Fisheries

The dams creating Lakes Marion and Moultrie are the first dams upstream from the ocean on the Santee River. As a result of the dams and the way the lakes were created, habitat in the lakes ranges from shallow, vegetated flooded areas to deep, open water of the main river basin. There are over 50 species of fish found within the lakes, including seven species of diadromous fish (Normandeau Associates, Inc., 2002). The South Carolina Department of Natural Resources (SCDNR) has conducted winter gill net sampling on the Santee Cooper lakes annually since 1984. The main purpose of the surveying is to monitor striped bass populations; however, other species are monitored as well. During the 2022-23 winter survey, 20 species were collected (SCDNR, 2023). The five most abundant species were gizzard shad, blue catfish, white perch, channel catfish, and striped bass.

As previously mentioned, several diadromous fish are present in the lakes, including American eel, shortnose sturgeon, American shad, hickory shad, and blueback herring. There are three dams present on the lake system, two of which include operations to allow fish passage; Pinopolis Dam (Cooper River) and St. Stephen Dam (Santee River), both of which include operations to allow fish passage during the spawning season (February through mid-May). Both fish and boats pass through the locks at the Pinopolis Dam, however, St. Stephen has a dedicated fish lock, also known as the St. Stephen Fish Lift. In 2023, the St. Stephen Fish Lift operated for 89 days between January 30 and May 3, 2023 and resulted in 583,813 fish passages, of which 93% were American shad (SCDNR, 2023).

6.4 Wildlife and Terrestrial Resources

Alligators, snakes, turtles, and frogs are common throughout Lakes Marion and Moultrie. Since all amphibians require water for breeding, most species exist at least seasonally in shoreline wetlands. Many terrestrial reptiles reside in or near shoreline habitats throughout the Project, in particular American Alligators are ubiquitous in shallow-water, near-shore habitat.

Waterfowl, wading birds, shore birds, gulls and terns, raptors, and perching birds use Lakes Marion and Moultrie for nesting, feeding, and resting on both a full-time and migratory basis. Bald eagle (*Haliaeetus leucocephalus*) osprey (*Pandion haliaetus*), and common loon (*Gavia*

immer) are noteworthy migratory species using Lakes Marion and Moultrie.

6.5 Threatened and Endangered Species

The Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. §§ 1531 – 1543) was passed to conserve the ecosystems upon which endangered and threatened species depend, and to conserve and recover those species. An endangered species is defined by the ESA as any species in danger of extinction throughout all or a significant portion of its range. A threatened species is likely to become endangered within the foreseeable future throughout all or a significant part of its range. Critical habitats, essential to the conservation of listed species, also can be designated under the ESA. The ESA establishes programs to conserve and recover endangered and threatened species and makes their conservation a priority for federal agencies. Section 7 of the ESA requires federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) Protected Resources Division (PRD) when their proposed actions may affect endangered or threatened species or their critical habitats.

The USFWS' Information for Planning and Consultation (IPaC) tool was accessed on September 27, 2023, and identified the following ESA-listed species as occurring or possibly occurring in the project Area (Table 3). Critical habitat for the Atlantic sturgeon (Carolina Distinct Population) is present within the project area.

Table 3. Federally listed species potentially occurring in Study Area

CATEGORY	COMMON NAME	SCIENTIFIC NAME	Status	Suitable Habitat in Project Area
Birds	Red-cockaded woodpecker	*Picoides borealis*	E	N
	American wood stork	*Mycteria americana*	T	Y
Fish	Atlantic sturgeon*	*Acipenser oxyrinchus**	E	Y
	Shortnose sturgeon*	*Acipenser brevirostrum**	E	Y
Mammals	Northern long-eared bat	*Myotis septentrionalis*	E	N
	West Indian manatee	*Trichechus manatus*	T	Y
Plants	American chaffseed	*Schwalbea americana*	E	N
	Canby's dropwort	*Oxypolis canbyi*	E	Y
	Pondberry	*Lindera melissifolia*	E	N

NOTES:
* Species under the jurisdiction of NMFS Fisheries, all others are under USFWS only.
E - Federally Endangered, T - Federally Threatened

Species that may be present within the project area (surface water and immediate shoreline) are discussed in detail below.

American wood stork

The wood stork is a long-legged water bird species that uses freshwater and estuarine wetlands as feeding, nesting, and roosting sites. The stork constructs nests in trees, typically cypress, that are

in or near standing water. In South Carolina, storks typically nest from March through August. In 2022, a record number of nests were counted in the state. A total of 3,928 nests were seen (SCDNR, 2022). Though there is an abundance of potentially suitable habitat in the Santee Cooper project area, no wood storks are currently known to permanently reside within the project and no nesting or colony locations have been identified as of the date of issuance for this plan. Staff at the Santee National Wildlife Refuge (SNWR), which is located on the norther shores of Lake Marion within and adjacent to the project boundary, have occasionally observed transient wood storks visiting the NWR in the past, and future visits and/or residence at the NWR is possible as the species' recovery continues, and its range expands.

Canby's dropwort

Canby's dropwort was listed as an endangered species in 1986. This species is native to the coastal plain and is found in natural ponds primarily composed of pond cypress, grass-sedge dominated bays, wet pine savannahs, shallow pineland ponds, and cypress-pine swamps (USFWS, 1990). There are six known populations in South Carolina, five of which are protected (USFWS, 2022). At this time, there is no critical habitat designated. There are no known populations of Canby's dropwort within the Santee Cooper project boundary, though one population has been identified in the nearby Santee National Wildlife Refuge (Santee Cooper, 2023).

Sturgeon species

Atlantic and shortnose sturgeon migrate to freshwater annually for purposes of spawning. Both species have been documented using upstream portions of the Cooper River and Santee River for spawning (Cooke, 1998). The project area, consisting primarily of Lake Marion and Lake Moultrie, is bound downstream by two dams—the Pinopolis Dam which intersects Lake Moultrie and the Cooper River, and the St. Stephens Dam intersecting Lake Moultrie and Santee River. These two dams serve as major barriers to both species of fish from moving upstream, as very few instances of movement upstream of these barriers has been documented in several decades. For instance, from 1985 to 2003, the fish lift at St. Stephens Dam recorded only six sturgeon being moved upstream into Lake Moultrie from Santee River (Collins et al. 2003). Similarly, the navigational lock at Pinopolis Dam does not effectively pass sturgeon (Cooke et al. 2002, Timko et al. 2003), though a few instances have been recorded.

Shortnose and Atlantic sturgeon have been documented in both Lake Moultrie and Lake Marion, within the project area where potential direct effects could occur. However, existing information suggests very few sturgeon utilize Lake Moultrie. Collins and Smith (1997) documented two Atlantic sturgeon in Lake Moultrie, though they were just above the St. Stephens Dam, and both were found dead. Shortnose sturgeon have also been documented in Lake Moultrie only in very few instances, as Collins et al. (2003) found only one of fourteen sturgeon were documented in the lake, and only one other sturgeon was known from 1980 until the end of their study period. In contrast, Lake Marion may harbor upwards of 200-300 individual sturgeon (Post & Holbrook, 2016). Telemetry data show that shortnose sturgeon in Lake Marion primarily utilize four distinct

geographic areas, including: (1) a former oxbow in the upper reaches of Lake Marion, (2) the transition zone where the Upper Santee River channel (Congaree and Wateree Rivers) enters Lake Marion, (3) the Upper Santee River, and (4) the Congaree River near Columbia, South Carolina (Collins et al., 2003). Collins et al. (2003) showed most of the sturgeon are in the upper portion of area 3 (near Columbia) from March through May. In summer months (June – August), fish spent their time in area 3. Towards the end of summer, all but one fish migrated back into the reservoir, and in the fall and winter, the fish were located primarily in area 1. Fish overwintered in these areas and migrated back to area 3 when spring arrived.

West Indian Manatee

Manatees (Trichechus manatus) inhabit both saltwater and freshwater habitats and can be found in shallow (usually <20 feet), slow-moving rivers, estuaries, saltwater bays, canals, and coastal areas (USFWS, 2001) throughout their range. In South Carolina, manatees occupy fresh, brackish, and marine habitats and move freely between salinity extremes. Manatees will move up rivers until the water is too shallow for passage or is blocked by a dam. Manatees are thermally stressed at water temperatures below 18ºC (64.4ºF) (Garrott et al., 1995). For this reason, manatees are only seen in South Carolina in summer months and no critical habitat has been designated. Manatees have managed to enter the lake system by passing through the lock at Pinopolis Dam.

6.6 Cultural and Historic Resources

A "historic property" is defined at 54 U.S.C. §300308 in the National Historic Preservation Act (54 U.S.C. §300101 et seq.) (NHPA) as any prehistoric or historic district, sites, building, structure, artifacts, or object included on, or eligible for inclusion on, the National Register. Several Federal laws and regulations protect these resources, including the NHPA, the Archaeological and Historic Preservation Act of 1974 (54 U.S.C. §§312501-312508), and the Archaeological Resources Protection Act of 1979 (16 U.S.C. §§470aa-470mm). These Federal laws, specifically Section 106 of the NHPA, require Federal agencies to consider the effects of their actions on cultural resources and historic properties, including districts, sites, buildings, structures and objects included or eligible for inclusion in the NRHP.

Several cultural resource investigations have been done for the overall Santee Cooper project, which includes both of the lakes. In 2003, cultural resource surveys of the project were completed by Mead and Hunt (2003) and Brockington and Associates (Baluha & Bailey, 2003). Terracon prepared a Historic Properties Management Plan (HPMP) for Santee Cooper in 2023. The HPMP was prepared to satisfy requirements of a 2008 Programmatic Agreement between Santee Cooper, the South Carolina State Historic Preservation Office (SHPO), and the Federal Energy Regulatory Commission (FERC). The HPMP noted that in all, there are 137 archaeological sites and six Revolutionary War sites within the project boundaries. Of these, one site, Scott's Lake/Santee Indian Mound/Fort Watson (38CR1/39/1002) is a National Historic Landmark (NHL), while two sites the Eutaw Springs Battlefield (38CR218/219, SHPO No. 0011) and the old Santee Canal (38BK102/621, SHPO No. 136-0011), are listed in the National Register of Historic Places (NRHP). There are also 15 sites that were recommended for additional work or as being potentially eligible for the NRHP, and 110 archaeological sites and five Revolutionary War sites that have not been

evaluated for inclusion in the NRHP (Green & Dorn, 2023).

6.7 Aesthetics and Visual Resources

Aesthetics or visual resources are the natural and cultural features of the landscape that can be seen and that contribute to the public's appreciative enjoyment of the environment. The aesthetic quality of an area is a subjective measure of one's perception of how pleasing an area is. The lakes provide beautiful views, including areas of undeveloped and undisturbed cypress swamps.

6.8 Recreation

Recreational opportunities within the project area include boating, skiing, swimming, canoeing, camping, fishing, hunting, birdwatching, and hiking. There are 62 public boating access sites, as well as numerous permitted swimming areas scattered throughout the project. Consumptive and non-consumptive wildlife recreation is available throughout the project including on 15,000 acres of federally managed land and water at the Santee National Wildlife Refuge and an additional 18,250 acres designated as Wildlife Management Areas managed by South Carolina Department of Natural Resources.

7 ENVIRONMENTAL CONSQUENCES

In addition to the economic and ecosystem effects described in Section 4 and 5, USACE considers the environmental and social consequences of its actions when making decisions.
This section discusses effects anticipated to occur over a wide range of environmental resources and social considerations as a result of the proposed action. The proposed action is intended to reduce the risk of invasive species infestations and, as a result, avoid or delay the adverse economic, environmental, and social consequences of such infestations.

Federal participation in the program would be dependent on Santee Cooper continuing to fund and implement the program and Congress specifically appropriating funds for the program. The No Action alternative represents a continuation of Santee Cooper's current program, in which USACE would not provide cost-share funds, thus potentially limiting the acreages treated. This section describes those potential effects.

7.1 Water Quality

7.1.1 Alternative 1: No Action

All pesticides used by Santee Cooper are approved by the Environmental Protection Agency (EPA) for aquatic use and will be applied according to their labels. The EPA requires rigid testing of each active chemical prior to approval and has developed several risk assessments to evaluate the potential for the product to cause harm to the environment, humans, and wildlife (EPA, 2024). Adverse impacts to water quality would be short-term and minor and mainly due to water quality degradation from the use of herbicides to control invasive species. The current program uses an integrated approach to manage aquatic invasive plant populations in such a way as to minimize adverse impacts to water quality.

Treatment activities have the potential to decrease dissolved oxygen (DO) in the immediate vicinity of the treatment areas. Aquatic plants generate DO, and the die-off and subsequent decomposition of plants can contribute to lower DO levels, especially in the summer months when DO is naturally lower due to warmer temperatures. Large-scale loss of plants is not expected due to the targeted approach of treatments; therefore, the proposed action is anticipated to have minimal impacts on DO.

7.1.2 Alternative 2: Proposed Action

Aquatic Invasive plant control cost shared with Santee Cooper could treat up to double the acreages as under the No Action Alternative. The proposed action would result in similar impacts as the No Action Alternative, but these effects may potentially be spread over a greater number of locations. The Proposed Action Alternative would have a minor effect on water quality.

7.2 Wetlands and Native Aquatic Vegetation

7.2.1 Alternative 1: No Action

One of the main goals of the Santee Cooper invasive plant management program is to promote and maintain native aquatic plant populations. As non-native aquatic vegetation became established in the project area, it has been to the detriment of native plants, as they are easily outcompeted by the more aggressively growing non-native species.

The integrated control program is intended to maintain control of invasive aquatic species while having minimal impact on wetlands and native vegetation. As previously mentioned, the South Carolina Aquatic Plant Management Council establishes management policies and objectives and approves all management plans, including Santee Cooper's. Santee Cooper's management plan is prepared and then approved by this council. This process allows for adaptive management and input from the public to ensure the right control methods are used.

Annually, priority areas are identified to be treated and herbicides will be applied when targeted plants are actively growing and applied in such a manner that is targeted to minimize impacts to native plants. Additionally, the biological control methods utilized are intended to reduce the targeted species and reduce the need for less selective means, such as herbicide application.

As a result of the integrated and adaptive management approach to treatment, adverse impacts to wetlands and native vegetation are expected to be minor and short-term with the goal to benefit and restore native wetland communities and plants.

7.2.2 Alternative 2: Proposed Action

Invasive aquatic plant invasions can have long-term detrimental impacts on wetland ecosystems. Targeted plants can out compete native plants and lead to loss of native plant biodiversity. Aquatic Invasive plant control cost shared with Santee Cooper could treat up to double the acreages as under the No Action Alternative. The impacts to wetlands and native vegetation are the same as discussed under Alternative 1 with the exception that there would be more beneficial,

moderate impacts over the long-term as more control would occur and allow native species to reestablish.

7.3 Fisheries

7.3.1 Alternative 1: No Action

Santee Cooper would continue their current program to control invasive aquatic plants. Direct impacts to fish are not expected as EPA approved herbicides undergo rigorous evaluation prior to receiving an aquatic use label. Fish may experience indirect impacts from this program as habitat, in the form of invasive aquatic vegetation, could be reduced. Invasive plants are well established at the project and due to the abundance of the seed and tuber bank in the hydrosoil, Santee Cooper does not view eradication of invasive aquatic plants as a realistic management objective. Eradication would require a level of biological and chemical control that would nearly eliminate native aquatic vegetation and would be harmful to fish in the project area that rely on the habitat provided by aquatic vegetation.

Santee Cooper's integrated control program aims to reduce the acreage of non-native aquatic vegetation while promoting native aquatic vegetation to provide the necessary habitat to sustain the popular fisheries at the Project. As a result, impacts to fisheries are expected to be minor.

7.3.2 Alternative 2: Proposed Action

Aquatic Invasive plant control cost shared with Santee Cooper could treat up to double the acreages as under the No Action Alternative. The impacts to fisheries are the same as discussed under Alternative 1.

7.4 Wildlife and Terrestrial Resources

7.4.1 Alternative 1: No Action

Santee Cooper would continue their current program to control invasive aquatic plants. Insects, birds, reptiles, amphibians, and mammals inhabit or interact with both native and non-native aquatic vegetation at the project site. These animals may temporarily vacate the area during the application of aquatic herbicides due to the noise and disturbance from the application airboat. However, this is a short-term disturbance, and the animals may immediately return to the area when the disturbance has ceased. Direct impacts to these animals are not expected, as all pesticides used by Santee Cooper are approved by the EPA for aquatic use and will be applied according to their labels.

7.4.2 Alternative 2: Proposed Action

No new ground disturbance would occur from the proposed action and treatment areas are limited to the aquatic environment or immediate shoreline. All chemical treatment applications would be done according to their labels and in such a way to minimize impacts to terrestrial resources.

7.5 Threatened and Endangered Species

7.5.1 Alternative 1: No Action

Santee Cooper would continue their current program to control invasive aquatic plants. As discussed in Section 6.5, the following species may be found within the project area: American wood stork, Canby's dropwort, Atlantic sturgeon, shortnose sturgeon, and West Indian manatee.

American wood stork

No wood stork nesting or roosting sites have been identified within the project area. The swamps and shallow flooded areas provide foraging habitat. The treatment of invasive aquatic species may occur in areas where foraging habitat exists, however, the treatment would not impact the foraging habitat as these areas would still provide habitat for small fish, frogs, and other food for the wood stork. **Therefore, the current program would have no effect on this species.**

Canby's dropwort

There are no known occurrences of the species within the project area. Santee Cooper prepared a Rare Wetland Plant Protection Plan that will be distributed to all staff involved in the aquatic invasive plant control program. If the species is encountered, a minimum 50-foot buffer is implemented to avoid impacts to the species. **Therefore, the current program may affect, but is not likely to adversely affect this species.**

Sturgeon species

Shortnose and Atlantic sturgeon have been documented in Lake Moultrie and Lake Marion, though existing information on sturgeon in Lake Moultrie suggests very few sturgeon utilize the lake. Telemetry data show that shortnose sturgeon in Lake Marion primarily utilize four distinct geographic areas, including: (1) a former oxbow in the upper reaches of Lake Marion, (2) the transition zone where the Upper Santee River channel (Congaree and Wateree Rivers) enters Lake Marion, (3) the Upper Santee River, and (4) the Congaree River near Columbia, South Carolina (Collins et al., 2003). The greatest likelihood of overlap between sturgeon and chemical and biological control methods proposed here are in areas of Lake Marion are in area 1. The extent of herbicide applications as proposed are as far into area 1 as Pack's Landing and the flooded timber between Pack's Landing and the river channel. Aquatic vegetation spraying in this area is focused on giant salvinia, water hyacinth, giant cutgrass, alligator weed, water primrose, and crested floating heart. Chemical methods here are focused on surface applications since significant water flow reduces the efficacy of submersed application. These applications usually occur along a shoreline or in shallow water flooded cypress and tupelo stands. Sturgeons are typically found in areas of deeper water with greater flow rates (Fernandes et al., 2010; measured average depth of 6.4 m) and are relatively sensitive to low dissolved oxygen (Stoklosa et al., 2018). They are also known to spend time foraging in sandy, muddy bottoms of rivers for insects, crustaceans, worms and mollusks, as well as taking refuge from warm water in deep holes (NOAA, 2023). Given that many of the areas where aquatic plant control methods (both chemical and biological) are applied do not overlap with areas typically occupied by shortnose sturgeon (see Collins et al., 2003 for telemetry points in upper Lake Marion), there is little reason to expect anything more than insignificant effects.

Copper has been shown to have sublethal effects to fish (Baldwin et al., 2003; De Boeck, van der Ven, Hattink, & Blust, 2006). However, a study conducted by the New York State Department of Environmental Conservation's Aquatic Toxicant Research Unit, demonstrated that chelated copper herbicides are less toxic to fish (Wagner et al., 2017).

Likewise, neither grass carp nor giant salvinia weevil habitat is expected to overlap with that of sturgeons, and grass carp have previously been shown to have no detectable negative effects on the littoral fish assemblage of upper Lake Marion (Killgore et al., 1998).

Based on the above, **the project as exists may affect, but is not likely to adversely affect listed sturgeon nor their critical habitat.**

West Indian manatee

Few occurrences of manatee have been documented in the lakes. In 2021, a study was published that showed the presence of glyphosate in manatee plasma in nearly half of the population sampled (Mariá et al., 2021). The study showed that chronic exposure to glyphosate can impact manatees. Few occurrences of manatee have been documented in the lakes, though there is the potential for their presence. **Therefore, the current program may affect, but is not likely to adversely affect this species.**

7.5.2 Alternative 2: Proposed Action

Aquatic Invasive plant control cost shared with Santee Cooper could treat up to double the acreages as under the No Action Alternative. The impacts to listed species are the same as discussed under Alternative 1 with the exception that to minimize potential effects to sturgeon species, chelated copper treatments will not be applied in area 1, or north of the I-95 bridge. Therefore, **the project as proposed will have no effect to listed sturgeon nor their critical habitat.**

7.6 Cultural and Historic Resources

7.6.1 Alternative 1: No Action

Currently all treatments occur below the high watermark and no treatment or staging of equipment occurs on or near known sites. Santee Cooper will continue to follow the HPMP and treatment is proposed on or near a historic property, a site-specific analysis and consultation would occur.

7.6.2 Alternative 2: Proposed Action

The proposed action would have no adverse effects on cultural resources and historic properties. The project was coordinated with the SHPO, and appropriate tribes listed in Section 8 on June 24, 2024. In an email dated August 6, 2024, the SHPO stated that they have no additional comments or concerns given that the currently proposed action is following all stipulations as outlined within the existing Historic Properties Management Plan.

7.7 Aesthetics and Visual Resources

7.7.1 Alternative 1: No Action
The current program has minimal effects to aesthetic or visual resources present.

7.7.2 Alternative 2: Proposed Action
Aquatic Invasive plant control cost shared with Santee Cooper could treat up to double the acreages as under the No Action Alternative. The proposed action would cause minimal changes to the aesthetic or visual resources present. The treatment of invasive plants would serve to bring the environment back to the natural aesthetic.

7.8 Recreation
7.8.1 Alternative 1: No Action
Recreational activities are varied at the project and include fishing, hunting, swimming, water sports, pleasure boating, kayaking, birding, and more. Floating aquatic invasive species, such as giant salvinia, are often transported by wind and water currents, forming large mats covering the water surface. These floating mats impede swimming, discourage water sports such as skiing and tubing and can foul intakes of watercraft. Moreover, these mats pose challenges for outdoor enthusiasts, making it difficult for them to access areas for fishing or hunting.

Santee Cooper's integrated control program aims to reduce the acreage of hydrilla but not at the expense of native aquatic vegetation. This approach ensures the necessary habitat to sustain hunting and fishing at the project. The goal of the current program is to continue to provide recreational opportunities while balancing habitat for targeted fish sought after by anglers.

7.8.2 Alternative 2: Proposed Action
Aquatic Invasive plant control cost shared with Santee Cooper could treat up to double the acreages as under the No Action Alternative. The proposed action would increase accessibility to these activities by reducing the impacts of invasive aquatic vegetation on navigation. A segment of anglers and hunters may perceive a negative impact of the proposed action, as they associate the presence of hydrilla, a non-native aquatic vegetation, with better hunting and fishing conditions.

8 Public Involvement and Coordination

The Draft LR/PEA and Finding of No Significant Impact (FONSI) was released to the public for a 30-day review and comment period on June 25, 2024. The draft LR/PEA was placed on the Charleston District's external website. Additionally, notification letters were sent to the following:

- **Tribes**
  - Absentee-Shawnee Tribe of Indians of Oklahoma
  - Alabama-Quassarte Tribal Town
  - Catawba Indian Nation
  - Cherokee Nation
  - Chickasaw Nation
  - Delaware Tribe of Indians
  - Eastern Band of the Cherokee Indians
  - Eastern Shawnee Tribe of Oklahoma
  - Kialegee Tribal Town
  - The Muscogee (Creek) Nation
  - Poarch Band of Creek Indians
  - Shawnee Tribe
  - Thlopthlocco Tribal Town
  - Tuscarora Nation
  - United Keetoowah Band of Cherokee Indians in Oklahoma
- **Federal Agencies**
  - Environmental Protection Agency
  - National Marine Fisheries Services
  - U.S. Fish and Wildlife Service
- **State Agencies**
  - SCDHEC Bureau of Air Quality
  - SCDHEC Bureau of Water
  - SCDHEC Ocean and Coastal Resources Management
  - South Carolina Department of Natural Resources (SCDNR)
  - South Carolina Department of Archives and History
  - South Carolina Department of Parks, Recreation, and Tourism

If, after this evaluation, it is concluded that the proposed project would have no significant environmental impacts and an environmental impact statement is not required, the District Commander will sign a Finding of No Significant Impact (FONSI).

8.1 Compliance with Other Environmental Laws

This Section identifies the legal, policy, and regulatory requirements applicable to the proposed action. The implications for each requirement are discussed with respect to the proposed action. Summaries of compliance and coordination activities for each of the laws, policies, or regulations

are also provided. Also included in this Section are additional authorities and guidance related to the proposed action.

8.1.1 Clean Water Act of 1972

The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq., as amended) is more commonly referred to as the Clean Water Act. This act is the primary legislative vehicle for Federal water pollution control programs and the basic structure for regulating discharges of pollutants into waters of the United States. The act was established to restore and maintain the chemical, physical, and biological integrity of the Nation's waters and sets goals to eliminate discharges of pollutants into navigable water, protect fish and wildlife, and prohibit the discharge of toxic pollutants in quantities that could adversely affect the environment. The act has been amended numerous times and given a number of titles and codifications.

Section 402 of the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) program, pertains to discharge of pollutants. Aquatic pesticide application would require approval for use under a NPDES permit. Santee Cooper will continue to operate under SCDHEC's NPDES General Permit for the Application of Pesticides.

8.1.2 National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966 as amended directs Federal agencies to assume responsibility for all cultural resources under their jurisdiction. Section 106 of NHPA requires agencies to consider the potential effect of their actions on properties that are listed, or are eligible for listing, on the National Register of Historic Places (NRHP). The NHPA Section 106 implementing regulations, 36 Code of Federal Regulations (CFR) Part 800, requires that the Federal agency consult with the State Historic Preservation Officer (SHPO), Tribes and interested parties to ensure that all historic properties are adequately identified, evaluated and considered in planning for proposed undertakings.

USACE has determined that the proposed invasive aquatic plant treatment methods, as described, would have no adverse effects to historic properties based on the location and methods used. The project was coordinated with the SHPO, and appropriate tribes listed in Section 8 on June 24, 2024. In an email dated August 6, 2024, the SHPO stated that they have no additional comments or concerns given that the currently proposed action is following all stipulations as outlined within the existing Historic Properties Management Plan.

8.1.3 Fish and Wildlife Coordination Act of 1958

The Fish and Wildlife Coordination Act (FWCA) of 1934, as amended (16 USC 661 et seq.) requires consultation with USFWS when any water body is impounded, diverted, controlled, or modified for any purpose. The USFWS and state agencies charged with administering wildlife resources are to conduct surveys and investigations to determine the potential damage to wildlife and the mitigation measures that should be taken. The USFWS incorporates the concerns and findings of the state agencies and other Federal agencies, including NMFS, into a report that addresses fish and wildlife factors and provides recommendations for mitigating or enhancing impacts to fish and wildlife affected by a Federal project.

The proposed action would not impound, divert, control or modify any body of water and would not involve activities subject to the FWCA.

8.1.4 Migratory Bird Act

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§ 703-712, as amended) prohibits the taking of and commerce in migratory birds (live or dead), any parts of migratory birds, their feathers, or nests. Take is defined in the MBTA to include by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof.

The USFWS Information for Planning and Consultation (IPaC) database indicated that a total of 13 migratory bird species overlap the treatment area. The application of herbicides will occur during the growing season, which coincides with the breeding season of some migratory birds that may be present. USACE's proposal to cost-share the treatment program is not expected to impact (directly or indirectly) any migratory bird species.

8.1.5 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. § 668 et seq.) prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions, primarily for Native American Tribes. Take under this Act includes both direct taking of individuals and take due to disturbance.

Bald and golden eagles are common throughout much of the action area. Nesting, roosting, or foraging eagles may be present near a treatment site during plan implementation. In some locations, eagles that may occupy treatment sites frequently are likely accustomed to the daily human activities and related noise levels such as vehicles, equipment, boat, and foot traffic, while in other areas, eagles may rarely have human interaction.

In the case of a treatment site occurring where eagles have relatively little human interaction, eagles are likely to avoid the immediate treatment site. In addition, suitable roosting and foraging habitat is expected to be available adjacent to the treatment site outside of a range of disturbance. Santee Cooper has a Bald Eagle Protection Plan to protect bald eagles and their habitat. This plan will be followed. Therefore, USACE has determined there would be no disturbance or take of eagles as a result of the proposed action.

8.1.6 Endangered Species Act

The ESA established a national program for the conservation of threatened and endangered fish, wildlife, and plants and the habitat upon which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the USFWS and NMFS if an action may affect a listed species to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their critical habitats. Section 7(c) of the ESA and the Federal regulations on endangered species coordination (50 C.F.R. §402.12) require that Federal agencies prepare biological assessments of the potential effects of major actions on listed species and critical habitat.

USACE has determined that impacts to threatened and endangered species from the proposed partnership would range from "no effect" to "may affect, but not likely to adversely affect." On November 8th 2023, USFWS generated a letter and concurred with USACE's determination of "may affect but is not likely to adversely affect" Canby's Dropwort and the West Indian manatee.

8.1.7 Executive Order 11988, Floodplain Management

This Executive Order outlines the responsibilities of Federal agencies in the role of floodplain management. Each agency must evaluate the potential effects of actions on floodplains and avoid undertaking actions that directly or indirectly induce development in the floodplain or adversely affect natural floodplain values. The proposed action will not affect the floodplain functionality.

8.1.8 Executive Order 11990, Protection of Wetlands

This Executive Order requires, among other things, that federal agencies avoid, to the extent possible, the long-and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. No wetlands would be affected by the proposed project. This project is in compliance with the goals of this Executive Order.

8.1.9 Executive Order 12898, Environmental Justice

Section 112(b)(1) of WRDA 2020, Executive Order (EO) 12898 (1994), Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, EO 14008 (January 2021), Tackling the Climate Crisis at Home and Abroad, and EO 14096 (April 21, 2023), Executive Order on Revitalizing Our Nation's Commitment to Environmental Justice for All, all oblige Federal agencies to consider whether their actions will have disproportionate and adverse human health and environmental effects on low income, minority, disadvantaged, or underserved communities. The proposed action is not expected to disproportionately affect any particular demographic group.

8.1.10 Executive Order 13112, Invasive Species

This executive order requires federal agencies, including the USACE, to meet the National Invasive Species Management Plan (NISMP) goals. This order called upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. Executive Order 13112 also created a coordinating body -- the Invasive Species Council, also referred to as the National Invasive Species Council -- to oversee implementation of the order, encourage proactive planning and action, develop recommendations for international cooperation, and take other steps to improve the Federal response to invasive species. Past efforts at preventing, eradicating, and controlling invasive species demonstrated that collaboration across Federal, State, local, tribal, and territorial government; stakeholders; and the private sector is critical to minimizing the spread of invasive species and that coordinated action is necessary to protect the assets and security of the United States. The purpose and need of the proposed action is to provide assistance in preventing the spread of aquatic invasive species.

8.1.11 Executive Order 13751, Safeguarding the Nation from the Impacts of Invasive Species

This order amends Executive Order 13112 and directs actions to continue coordinated Federal prevention and control efforts related to invasive species, stating that it is the policy of the United States to prevent the introduction, establishment, and spread of invasive species, as well as to eradicate and control populations of invasive species that are established. The order directs Federal agencies to refrain from authorizing, funding, or implementing actions that are likely to cause or promote the introduction, establishment, or spread of invasive species in the United States unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions. The purpose and need of the proposed action is to provide assistance in preventing the spread of aquatic invasive species.

9 Conclusion / Recommendation

Based on the information evaluated in this LR/PEA, USACE has determined that there is Federal interest in partnering with Santee Cooper to continue and expand the control of aquatic invasive plant species. Cost sharing with the federal government allows Santee Cooper to treat nearly double the acres of affected waters and would also substantially reduce the economic impact to the Nation by reducing damages and the need for frequent and costly repairs to infrastructure and lost regional income from recued recreation.

10 References

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