

JOINT
PUBLIC NOTICE

CHARLESTON DISTRICT, CORPS OF ENGINEERS
69A Hagood Avenue
Charleston, South Carolina 29403-5107
and the
S.C. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT
1362 McMillan Avenue, Suite 400
Charleston, South Carolina 29405

REGULATORY DIVISION
Refer to: P/N #2005-1W-093-P

December 16, 2005

Pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), Sections 401 and 404 of the Clean Water Act (33 U.S.C. 1344), and the South Carolina Coastal Zone Management Act (48-39-10 et.seq.) an application has been submitted to the Department of the Army and the S.C. Department of Health and Environmental Control by

COOSAW FARMS, LLC
c/o Bill Sanford
12-B RUTLEDGE AVENUE
CHARLESTON, SC 29401

for a permit to excavate, place fill material and install water control structures in 3 managed impoundments located adjacent to

WIMBEE CREEK AND SOUTH WIMBEE CREEK

at locations near the Briars and Dale Community in Beaufort County, South Carolina.

In order to give all interested parties an opportunity to express their views

NOTICE

is hereby given that written statements regarding the proposed work will be received by both of the above mentioned offices until

12 O'CLOCK NOON, MONDAY, 16 JANUARY 2006

from those interested in the activity and whose interests may be affected by the proposed work.

The proposed work at project site #1 consists of constructing 750' and 180' long interior earthen dikes and the installation of a water control structure within an existing managed tidal impoundment. Also proposed is the excavation of a 750' long interior ditch that will entail the removal of 55 cubic yards of material and will impact approximately 0.03 acres of wetlands.

At project site #2 the proposed work consists of the construction of an 1165' long dike with water control structure and the excavation of an 800' long interior ditch. The excavation of the ditch will entail the removal of 59 cubic yards of material and will impact approximately 0.04 acres of wetlands.

At project site #3 the proposed work consists of the construction of 280', 375' and 550' long interior dikes with 1 water control structure.

A total of approximately 10,000 cubic yards of material will be excavated from areas adjacent to the proposed new dikes for their construction. Approximately 2 acres of wetlands will be impacted by the excavation of the borrow ditches and approximately 2 acres impacted by new dike construction. Material excavated for the construction of interior ditches will be placed on existing embankments when possible and the remainder will be side cast in a manner so that no discernable change to existing ground elevations will occur. The interior ditching work is being accomplished to facilitate water management and manipulations. All work will be performed within existing intact functional impoundments. The purpose of this work is to improve the ability to manage water levels within the existing impoundments. In-turn, this will provide a more effectively managed wetland as high quality habitat for wetland dependent wildlife. An Impoundment Management Plan developed for the 3 projects is attached to this public notice as information.

NOTE: Plans depicting the work described in this notice are available and will be provided, upon receipt of a written request, to anyone that is interested in obtaining a copy of the plans for the specific project. The request must identify the project of interest by public notice number and a self-addressed stamped envelope must also be provided for mailing the drawings to you. Your request for drawings should be addressed to the

**U.S. Army Corps of Engineers
ATTN: REGULATORY DIVISION
69A Hagood Avenue
Charleston, South Carolina 29403-5107**

The District Engineer has concluded that the discharges associated with this project, both direct and indirect, should be reviewed by the South Carolina Department of Health and Environmental Control in accordance with provisions of Section 401 of the Clean Water Act. As such, this notice constitutes a request, on behalf of the applicant, for certification that this project will comply with applicable effluent limitations and water quality standards. The work shown on this application must also be certified as consistent with applicable provisions the Coastal Zone Management Program (15 CFR 930). The District Engineer will not process this application to a conclusion until such certifications are received. The applicant is hereby advised that supplemental information may be required by the State to facilitate the review.

This notice initiates the Essential Fish Habitat (EFH) consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act. Implementation of the proposed project would impact approximately 4 acres of managed impounded wetlands associated with estuarine substrates and emergent wetlands utilized by various life stages of species comprising the red drum, shrimp, and snapper-grouper management complexes. Our initial determination is that the proposed action would not have a substantial individual or cumulative adverse impact on EFH or fisheries managed by the South Atlantic Fishery Management Council and the National Marine Fisheries Service (NMFS). Our final determination relative to project impacts and the need for mitigation measures is subject to review by and coordination with the NMFS.

The District Engineer has consulted the most recently available information and has determined that the project will have no effect on any Federally endangered, threatened, or proposed species and will not result in the destruction or adverse modification of designated or proposed critical habitat. This public notice serves as a request to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for any additional information they may have on whether any listed or proposed endangered or threatened species or designated or

proposed critical habitat may be present in the area which would be affected by the activity, pursuant to Section 7(c) of the Endangered Species Act of 1973 (as amended).

The District Engineer has consulted the latest published version of the National Register of Historic Places for the presence or absence of registered properties, or properties listed as being eligible for inclusion therein, and this worksite is not included as a registered property or property listed as being eligible for inclusion in the Register. Consultation of the National Register constitutes the extent of cultural resource investigations by the District Engineer, and he is otherwise unaware of the presence of such resources. Presently unknown archaeological, scientific, prehistorical, or historical data may be lost or destroyed by the work to be accomplished under the requested permit.

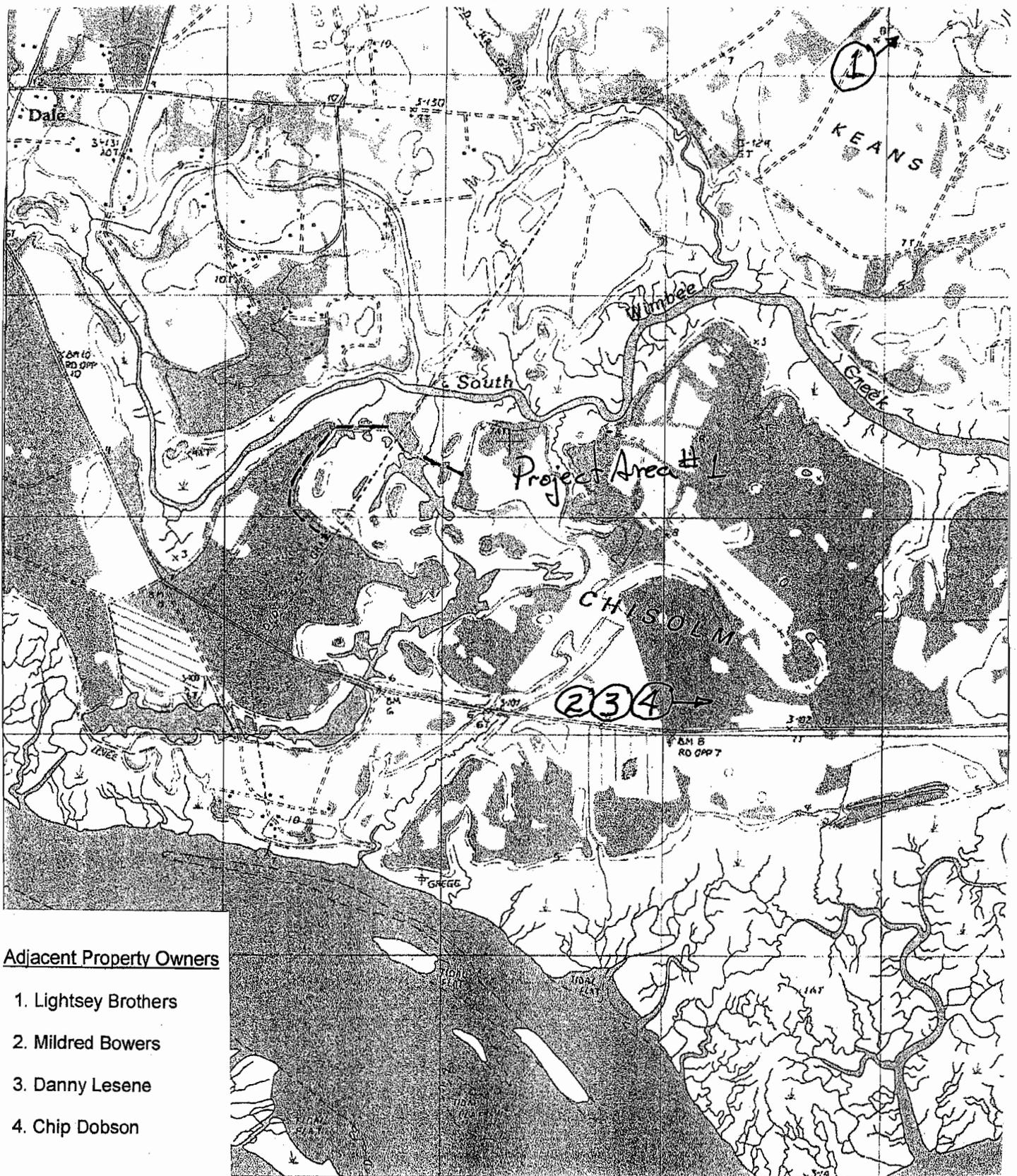
Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for a public hearing shall state, with particularity, the reasons for holding a public hearing.

The decision whether to issue a permit will be based on an evaluation of the probable impact including cumulative impacts of the activity on the public interest and will include application of the guidelines promulgated by the Administrator, Environmental Protection Agency (EPA), under authority of Section 404(b) of the Clean Water Act and, as appropriate, the criteria established under authority of Section 102 of the Marine Protection, Research and Sanctuaries Act of 1972, as amended. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the project must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the project will be considered including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production and, in general, the needs and welfare of the people. A permit will be granted unless the District Engineer determines that it would be contrary to the public interest. In cases of conflicting property rights, the Corps of Engineers cannot undertake to adjudicate rival claims.

The Corps of Engineers is soliciting comments from the public; Federal, state, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of this activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition or deny a permit for this project. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the activity.

If there are any questions concerning this public notice, please contact me at 843-329-8044 or toll free at 1-866-329-8187.


Dean Herndon
Project Manager
Regulatory Division
U.S. Army Corps of Engineers



Adjacent Property Owners

- 1. Lightsey Brothers
- 2. Mildred Bowers
- 3. Danny Lesene
- 4. Chip Dobson

PROPOSED ACTIVITY: Interior Embankment

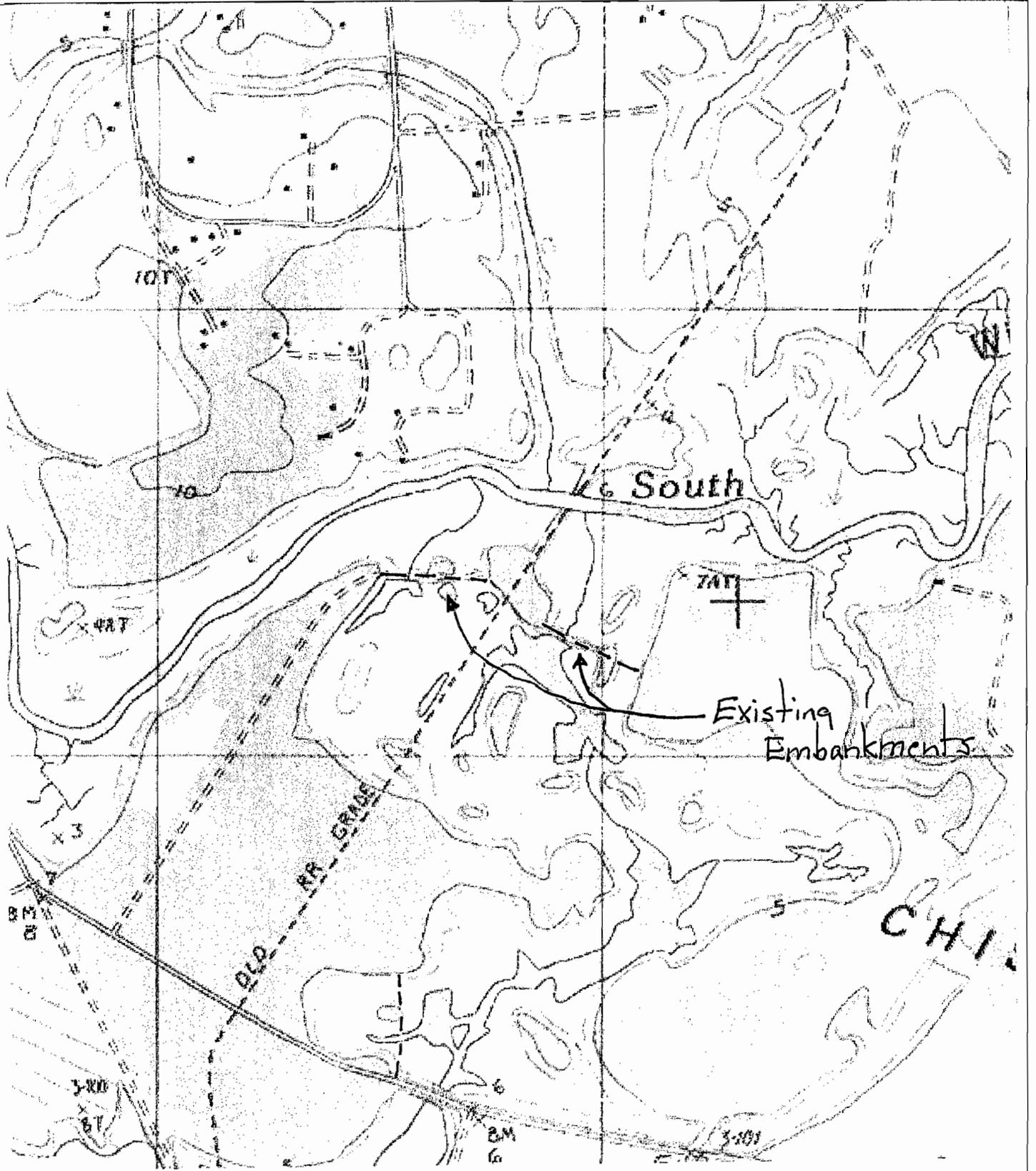
APPLICANT: Coosaw Farms, LLC

COUNTY: Beaufort

DATE: February 15, 2005
REVISED - Nov 14, 2005

STATE: South Carolina

PAGE: 1 OF 10



Project Area #1

PROPOSED ACTIVITY: Interior Embankment

APPLICANT: Coosaw Farms, LLC

COUNTY: Beaufort

DATE: February 8, 2005

REVISED - NOV. 14, 2005

STATE: South Carolina

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Project Area #1

PROPOSED ACTIVITY: Interior Embankment

APPLICANT: Coosaw Farms, LLC

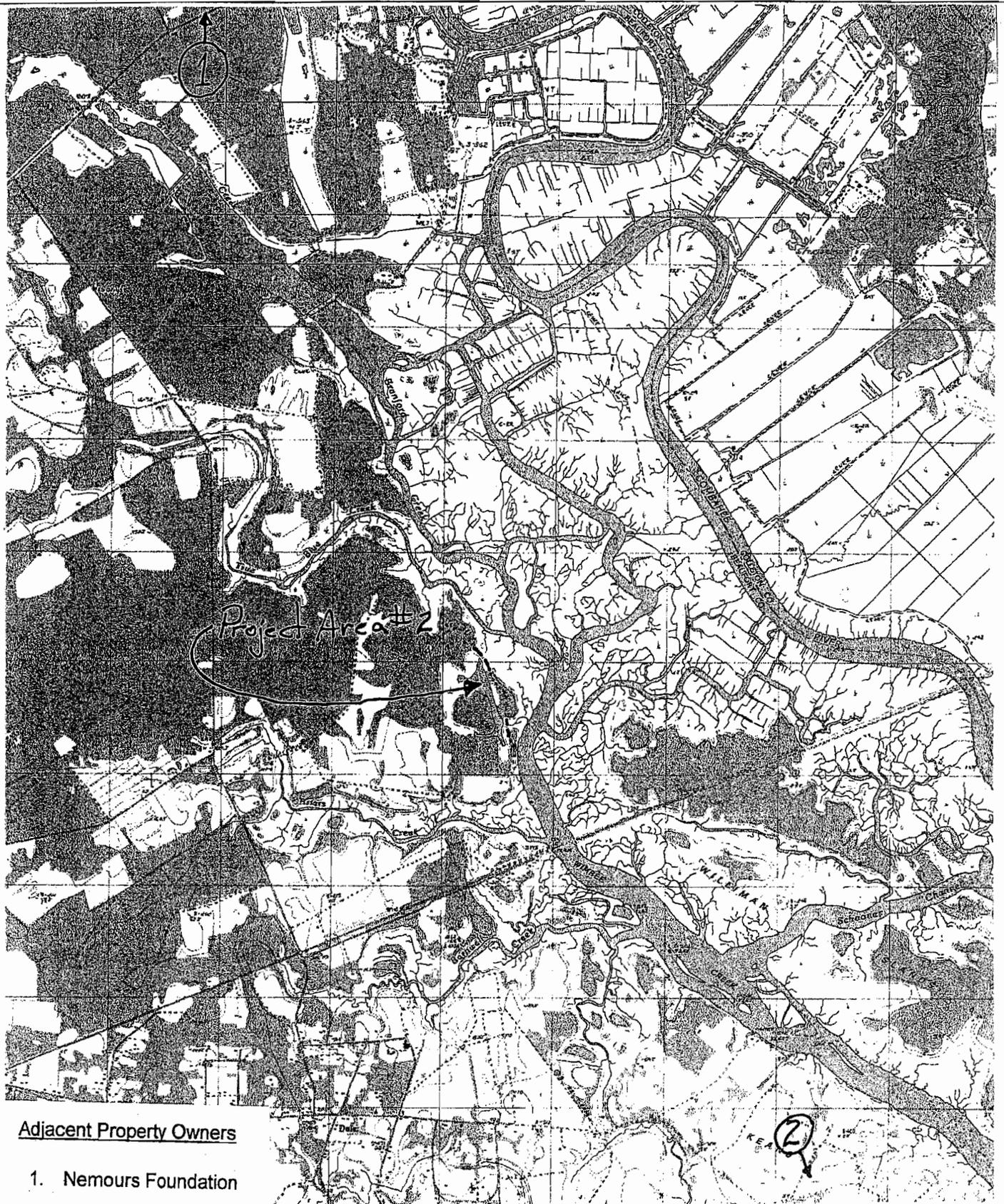
COUNTY: Beaufort

DATE: February 15, 2005

REVISED - Nov. 14, 2005

STATE: South Carolina

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Adjacent Property Owners

1. Nemours Foundation
2. Lightsey Brothers

PROJECT AREA #2

PROPOSED ACTIVITY: Interior Embankment

APPLICANT: Coosaw Farms, LLC

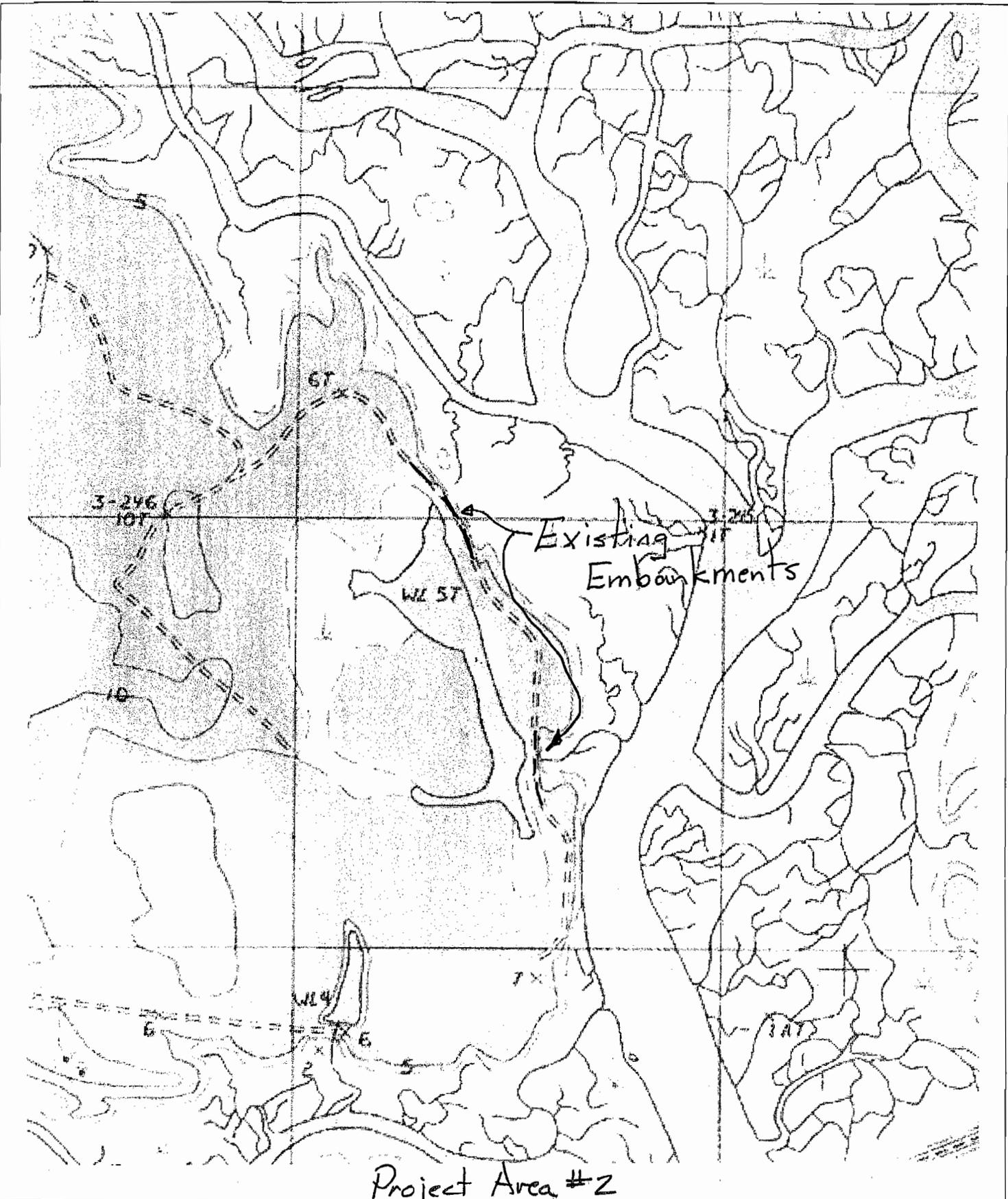
COUNTY: Beaufort

DATE: February 8, 2005

REVISED - NOV. 14, 2005

STATE: South Carolina

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Project Area #2

PROPOSED ACTIVITY: Interior Embankment

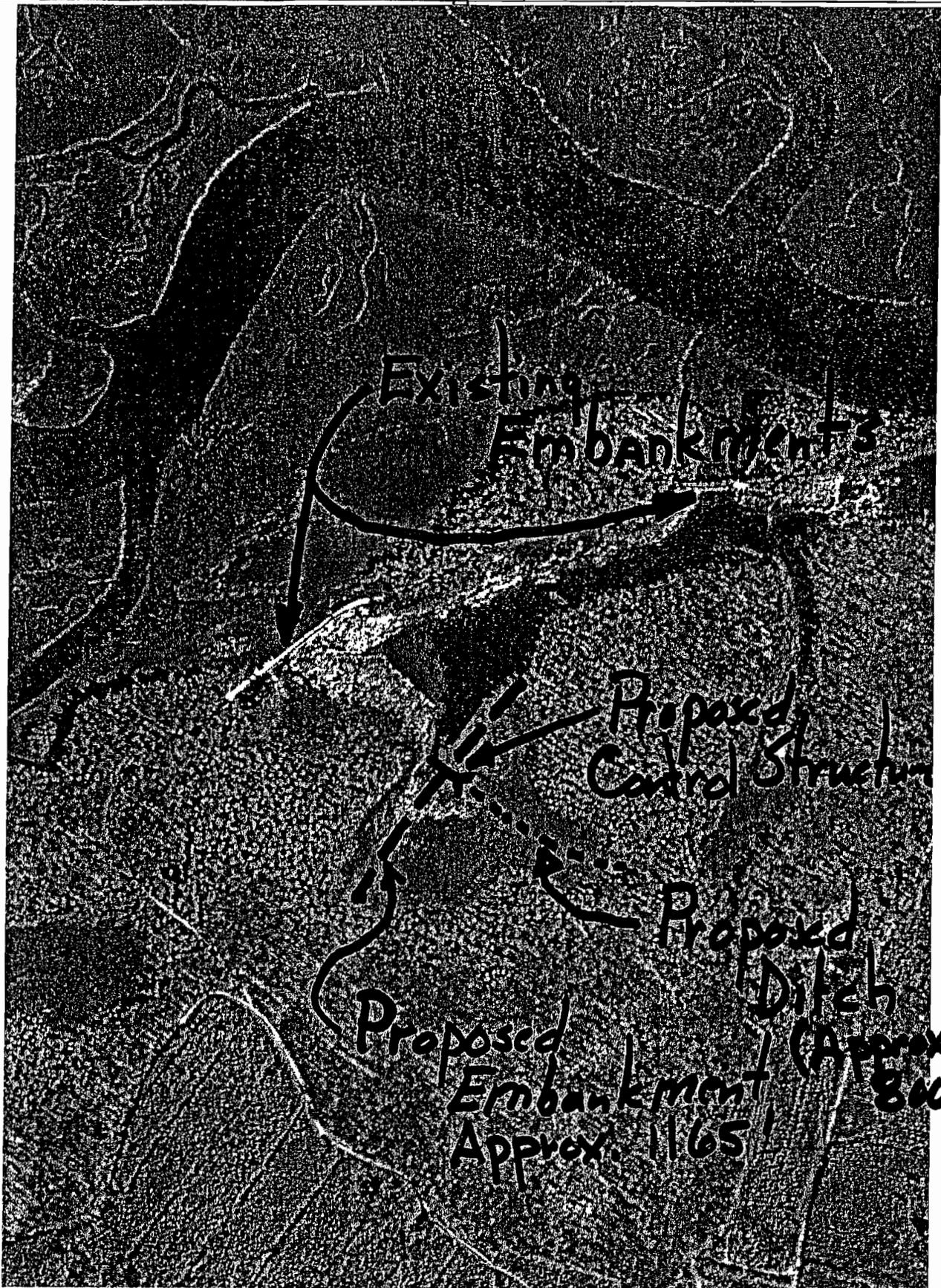
APPLICANT: Coosaw Farms, LLC

COUNTY: Beaufort

DATE: February 8, 2005
REVISED - NOV. 14, 2005

STATE: South Carolina

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PROPOSED ACTIVITY: Interior Embankment
Project AREA #2
COUNTY: Beaufort
STATE: South Carolina

APPLICANT: Coosaw Farms, LLC
DATE: February 8, 2005
REVISED - NOV. 14, 2005
PAGE: 6 of 10



Adjacent Property Owners

1. Lightsey Brothers
2. Mildred Bowers
3. Danny Lesene
4. Chip Dobson

Project Area #3

PROPOSED ACTIVITY: Interior Embankment

APPLICANT: Coosaw Farms, LLC

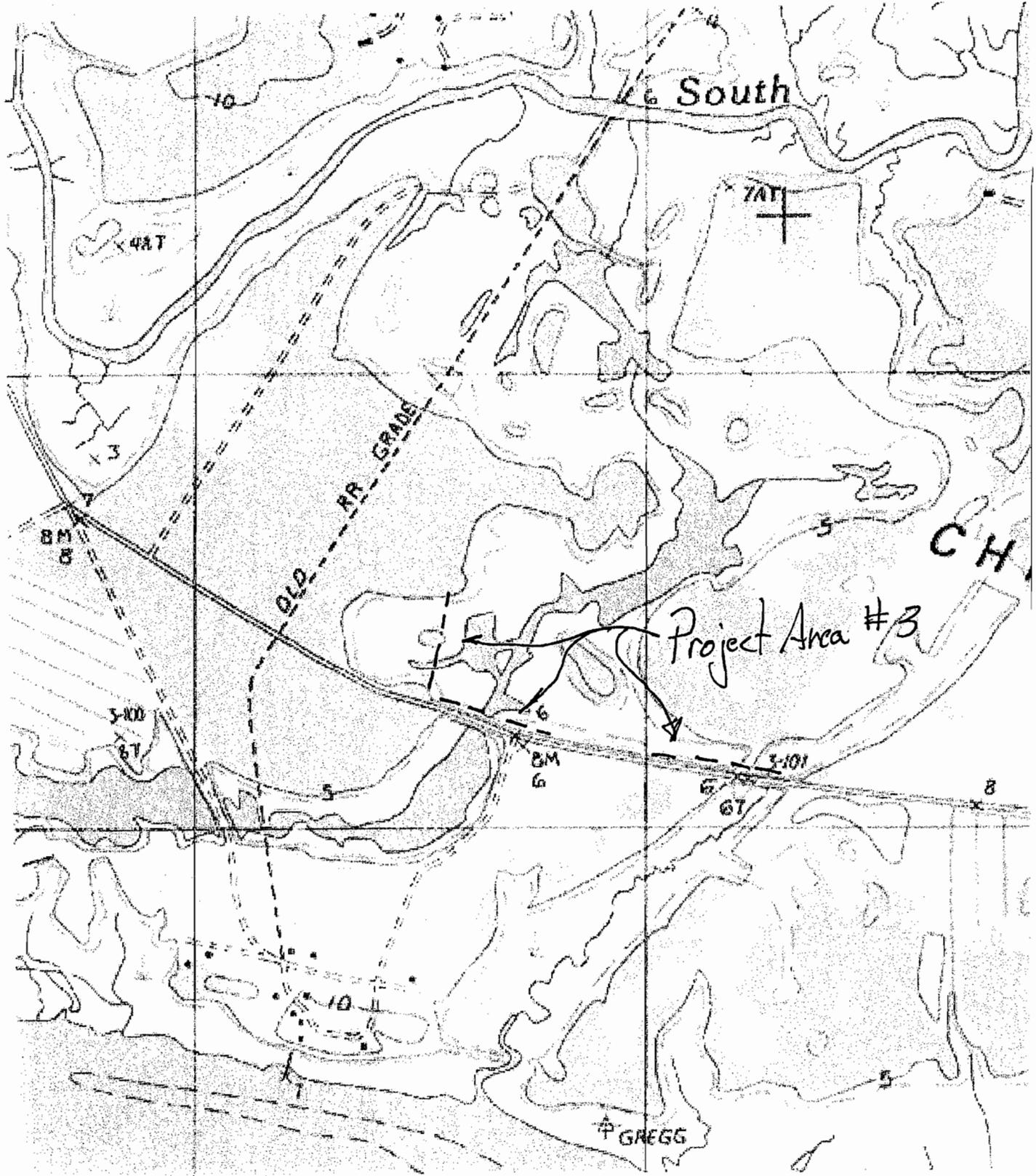
COUNTY: Beaufort

DATE: February 15, 2005

REVISED - NOV. 4, 2005

STATE: South Carolina

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Project Area #3

PROPOSED ACTIVITY: Interior Embankment

APPLICANT: Coosaw Farms, LLC

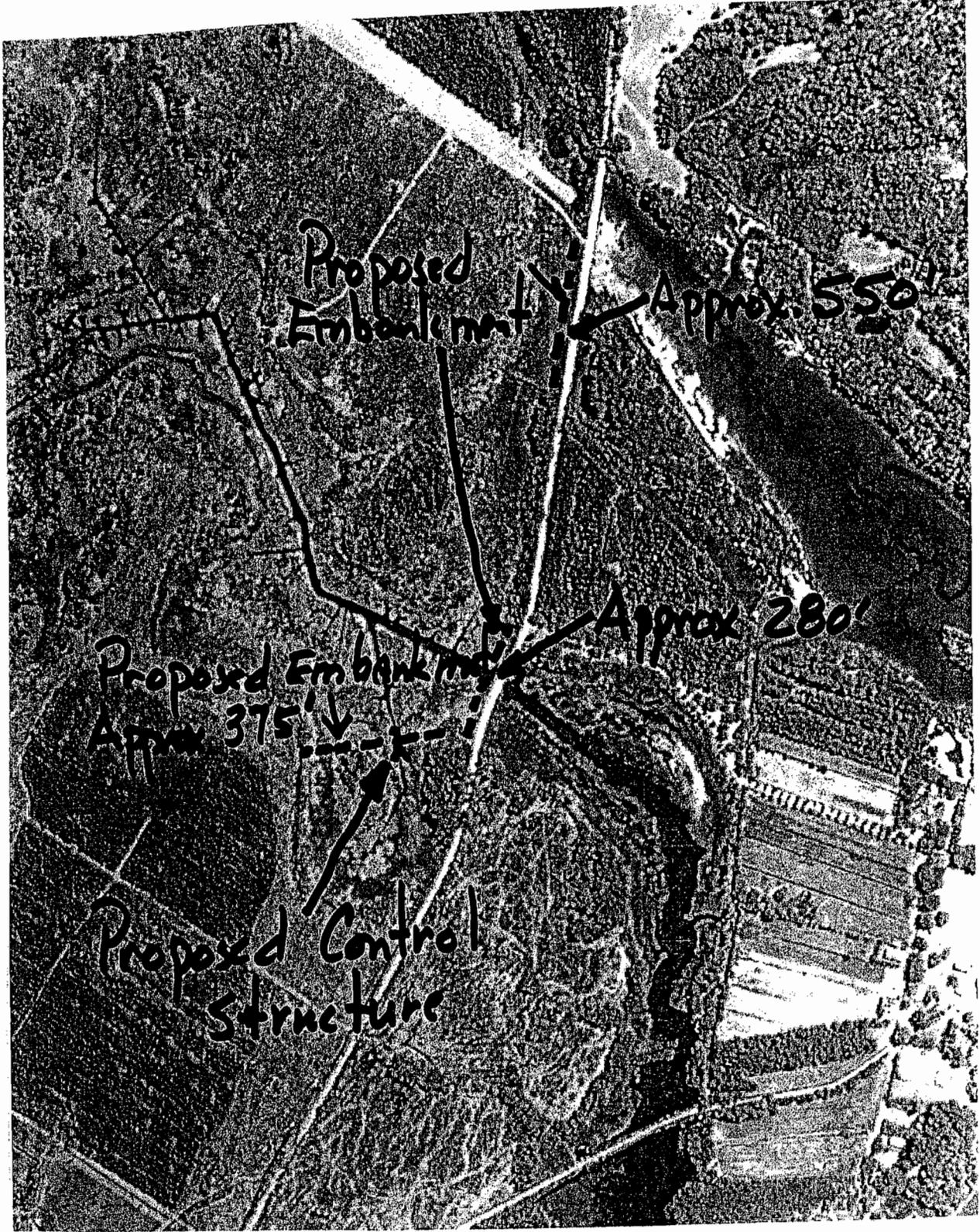
COUNTY: Beaufort

DATE: February 15, 2005

STATE: South Carolina

REVISED - NOV. 14, 2005

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Project Area #3

PROPOSED ACTIVITY: Interior Embankment

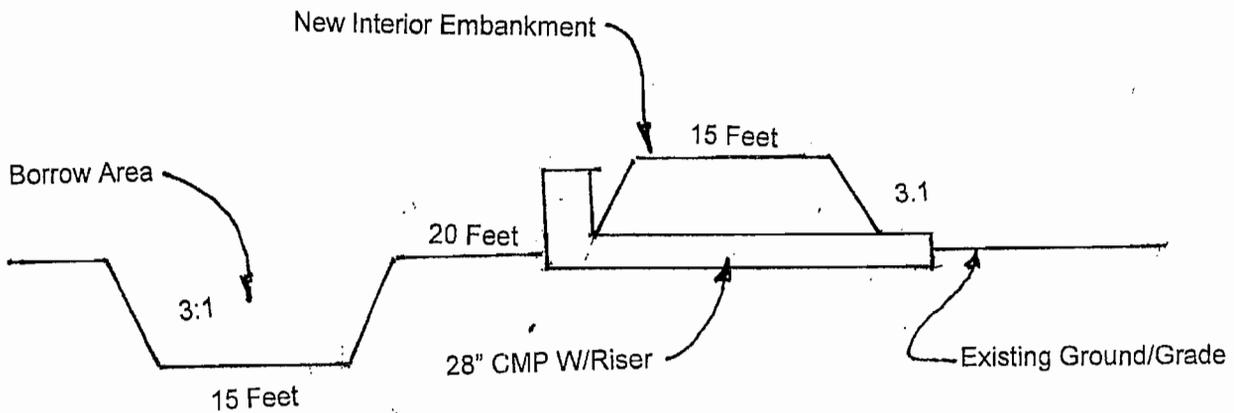
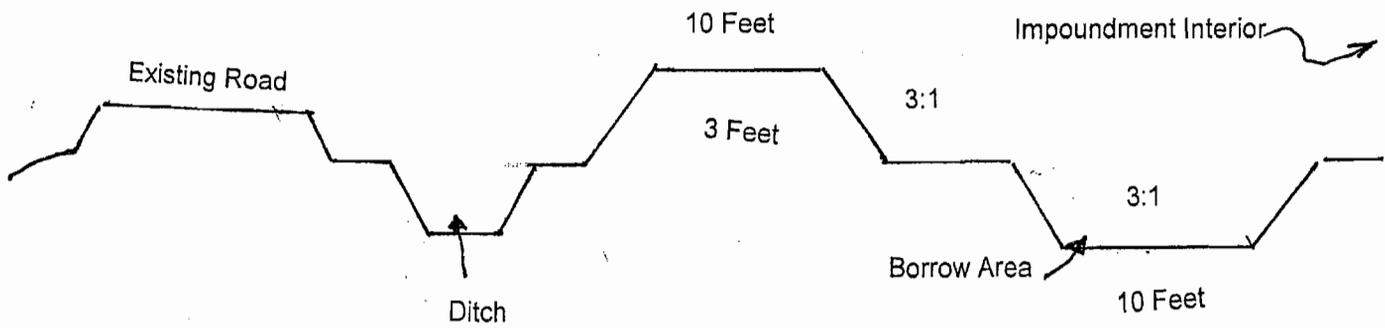
APPLICANT: Coosaw Farms, LLC

COUNTY: Beaufort

DATE: February 15, 2005
REVISED - NOV. 14, 2005

STATE: South Carolina

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TYPICAL SECTION (Not to Scale)

Note: All proposed work is within an existing intact impoundment.

PROPOSED ACTIVITY: Interior Embankment

APPLICANT: Coosaw Farms, LLC

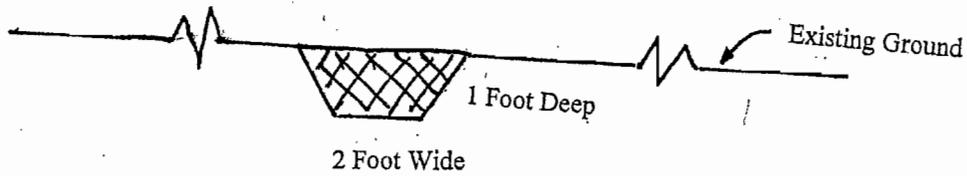
COUNTY: Beaufort

DATE: February 15, 2005

REVISED - NOV. 14, 2005

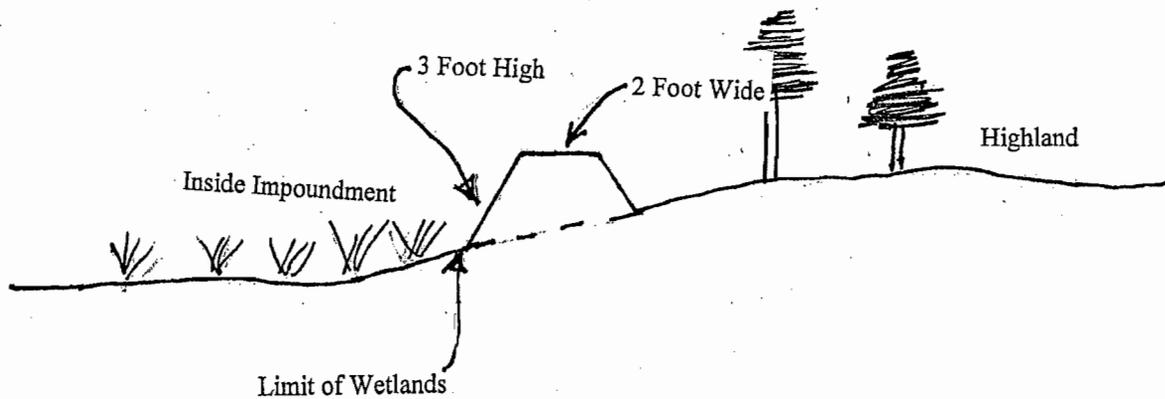
STATE: South Carolina

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Typical Ditch Section

Not to Scale



Typical Upland Embankment Section

Not To Scale

PROPOSED ACTIVITY: Interior Embankment

APPLICANT: Coosaw Farms, LLC

COUNTY: Beaufort

DATE: February 15, 2005
REVISED - Nov. 14, 2005

STATE: South Carolina

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Coosaw Farms, LLC

Supporting Information

For

Application for

Federal & State Permits

Prepared by

Newkirk Environmental, Inc.

Dated February 2005
Revised November 2005

I. Site Location and Description: The Coosaw Farms, LLC project site is located on Chisolm Island near Dale, Beaufort County, SC. The site can be accessed off State Highway #237. If site visits are desired, arrangements must be made through Newkirk Environmental, Inc.

II. Project Description and Need: The proposed work involves constructing interior embankments within two (2) different existing intact managed impoundments. The work, in waters of the United States, including wetlands, involves borrowing material from within the impounded area and constructing interior embankments. Each embankment will be approximately three (3) feet in height and 39 feet wide at their base. A water control structure will be installed in each new interior embankment to manage water levels within the new created compartments. Additionally, the applicant intends to construct an embankment just above the limit of wetlands to insure that containment of water within the impounded area and that the adjacent uplands are not affected by impoundment water management activities. Drainage ditches will be excavated within the new compartments of the impoundments to facilitate water management and manipulations. An n Impoundment Management Plan is attached. The excavated material will be placed on the existing embankment or side cast in the interior of the impoundment with no discernable change in existing elevations.

III. Description of Impacts: In order to accomplish the above stated project, the applicant proposes to affect approximately 4.0-acres of wetlands within the impoundments by constructing interior embankments (2.0-acres) and excavating (2.0-acres) within the existing impoundment to obtain material to construct the proposed embankments. Excavation of ditches (approximately 2 feet wide by 1 foot deep) will also occur within the impoundments to facilitate water management and manipulations. The ditch at Project Area #1 will be approximately 750 feet long and the ditch at Project Area #2 will be approximately 800 feet long. A total of 114 cubic yards of material will

be excavated (55 at Project Area #1 and 59 at Project Area #2) and deposited on highland where possible or scattered throughout the interior of the impounded area with no discernable changes in bottom elevations. Approximately 0.07-acres of wetlands will be affected by ditch excavation (0.04-acres in Project Area #2 and 0.03-acres in Project Area #1)

IV. Project Purpose: For clarity purposes, the project purpose statement has been divided into “basis project purpose” and “overall project purpose”. This approach is consistent with the evaluation of alternatives required by the 404(b)(1) Guidelines and may assist the COE in conducting their analysis of alternatives. It is clearly recognized that while the COE may consider our stated “basis” and “overall” purpose, it must determine these issues without undue deference to our views.

- The **overall purpose** of the proposed project is to improve the ability to management water levels within the existing impoundments.
- The **basic purpose** of the work is to construct interior embankment to better management water levels.

It is understood that the “basic purpose” statement is used to determine “water dependency” for alternative analysis purposes. Beyond that, the project purpose, as stated in the “overall purpose” paragraph clearly defines the applicant’s intend for this undertaking.

VI. Alternative Analysis: In considering alternatives one must take in to account the purpose and intent of the project. Given a project purpose of managing water levels within an existing impoundment, constructing a new interior embankment is the only practicable manner to affect that desired purpose. The site(s) selected are the points were it is deemed best from a management standpoint to provide the ability to manage/manipulate water levels in an effective fashion and to prevent the flooding of the

adjacent public road. Based thereon, less damaging alternatives do not exist that will provide the applicant with a means to manage water levels in the fashion desired.

VII. Mitigation: Since the work involves impacts within an existing impoundment and since the overall purpose of the work is to enhance the quality of the areas through better management thereby improving and/or enhancing the quality and functions of the interior wetland areas, the work itself is a mitigative feature and additional mitigation is not believed warranted.

VIII. Endangered Species: Newkirk Environmental, Inc. conducted a threatened and endangered species assessment on the referenced property and found no suitable habitat for threatened and endangered species on-site. Species that were identified and potentially in the area were:

Common Name	Scientific Name	Status	Occurrence
West Indian manatee	<i>Trichechus manatus</i>	E	Known
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	Known
Red-cockaded woodpecker	<i>Picoides borealis</i>	E	Known
Wood Stork	<i>Mycteria americana</i>	E	Known
Piping plover	<i>Charadrius melodus</i>	T, CH	Known
Pondberry	<i>Lindera melissiflora</i>	E	Known
Canby's dropwort	<i>Oxypolis canbyi</i>	E	Known
Chaff-seed	<i>Schwalbea americana</i>	E	Known

Newkirk Environmental, Inc. has also reviewed existing current data from the South Carolina Department of Natural Resources (SCDNR) to locate recorded occurrences of threatened and endangered species within or near the subject tract. SCDNR has no documentation or any rare, threatened or endangered species within or immediately adjacent to the referenced tract. Based upon the lack of suitable habitat for any of the listed species and existing records, it is the opinion of Newkirk Environmental, Inc. that the proposed use of this property is not likely to cause any adverse impact to any federally listed threatened and endangered species.

IX. Cultural Resources/Historic Properties: A review of available information indicates that the project site is not located near any site(s) listed on the National Register for Historic Places. There are no known archeological sites on the property to be developed.

X. Cumulative Impacts: The construction of the proposed interior embankment(s) are not likely to cause or contribute to other similar activities given the nature of the action and the limited number of impoundments in the area.

XI. Summary: The proposed impacts to wetlands associated with this project represent the least damaging and most practicable alternative for accomplishing the project purpose when considering the cumulative effects, both adverse and beneficial, of the overall project. Impacts to 404 jurisdictional wetlands represent a relatively minor impact. Given the information provided above, it appears the impacts are unavoidable, minimal and necessary to accomplish the project's purpose.

IMPOUNDMENT MANAGEMENT PLAN FOR COOSAW FARMS

GENERAL HABITAT MANAGEMENT PRINCIPLES

Wetland plant species distribution and abundance within coastal wetlands are determined by numerous physical and chemical factors including degree of tidal influence, water depth, water quality, soil texture, soil pH, soil moisture and soil organic content. Depending upon the lack of tidal influence or degree of tidal influence, water depth and water quality have been identified as the principal factors responsible for plant community composition. Therefore, the most important techniques employed in coastal habitat management for waterfowl involve: (1) the manipulation of water levels to provide varying amounts of soil moisture and flooding potential, and (2) the manipulation of water quality with regard to total freshness or amount of salinity. Manipulating these two factors allows the manager to favor the establishment and growth of preferred plant species, i.e., food and cover plants attractive to waterfowl. The manager is manipulating water levels and water quality to retard the growth of undesirable competing vegetation and promote the establishment and growth of preferred plant species. In most cases, the manager is attempting to replace later stages of plant succession with early stages of plant succession.

To summarize, it is necessary to have the capability to manipulate the physical and chemical factors affecting plant community distribution, composition and growth to achieve success in managing coastal habitats for waterfowl. While all physical and chemical factors affecting plant succession are important, the management of water levels and salinity are the two factors more readily controlled to effect improvement in the various habitats on the subject property.

It is important for the wetland manager to determine the types of wetlands being managed on the subject property. Wetland types are determined by the physical and chemical factors such as those previously mentioned. The impoundments at Coosaw Farms are influenced by a tidal range of 4.5' to 6.5' depending upon moon phase and wind direction. Tidewater salinities should normally range between 10 ppt to 15 ppt. During extended drought, tidewaters may increase in salinity to a level of 20 ppt or higher.

Thus, the marsh plant communities at Coosaw Farms should be managed to promote the germination and growth of certain target plant species beneficial to wintering waterfowl that thrive at salinities between 5 ppt and 15 pt., but may be considerably higher during drought periods. Discounting those impoundments that are influenced more by fresh runoff than by tidewaters, management of all of the various impoundments to be addressed in this management plan would be characterized as tidal brackish or tidal brackish/saline marsh impoundments.

MANAGEMENT OF TIDAL BRACKISH AND BRACKISH/SALINE IMPOUNDMENTS

Tidal brackish marsh impoundments occur along the tidewater zones where salinities average between 10 ppt to 15 ppt year round. Tidal brackish/saline impoundments occur where salinity ranges average >20ppt year round. Water level manipulations and water quality (chiefly salinity) are extremely important in management of brackish impoundments. Most undesirable and competing plants can be controlled through a combination of water level manipulations and flooding with salinities within certain ranges of strength.

Most of the impoundments at Coosaw appear to lie in the intertidal zone and can be effectively flooded during high tides. Exceptions may be upper regions of the impoundments which appear to be higher in elevation and may not be readily flooded except during extremely high tides (6.5' +).

The following management recommendations are made in two sections. The first section addresses the procedure for getting impoundments back into good management condition after several years of plant succession that has resulted in rank stands of undesirable dominant plant species in the emergent zones of an impoundment. The second section addresses the procedure for a typical management approach after the emergent stands of plants have been replaced with more desirable plant species attractive to waterfowl.

Getting The Impoundment In Shape

The following procedure should be attempted to reduce or eliminate the competitive stands of giant cordgrass, smooth cordgrass, cattails, common reed and saltgrass before intensive management can take place. This procedure may have to be used for more than one year to maximize its effect.

1. Drain the impoundment completely in late fall (late October to November).
2. Burn the entire area with a hot cover burn that reduces all emergent vegetation to stubble (mid-February to mid-March).
3. Flood the area as deeply as possible using properly adjusted water control structures (outside doors completely open, riser boards all the way to top of riser). Flooding should take place immediately after burning is complete and should be coordinated with a period of above normal lunar tides.
4. Maintain deep flooding condition on the impoundment through March, April and May. (Deep flooding for the entire growing season will produce the best results.)
5. Drain the impoundment in late May to early June (depending upon the effects of the deep flooding) to a level 10" to 18" below marsh floor.
6. Allow for emergent vegetation to germinate and grow to six inches in height (two weeks). Saltmarsh bulrush will invade some of the higher elevations of the impoundment during this period.
7. Begin flooding regime to start widgeongrass cycle in late June or early July. Flood the marsh floor with 6" to 8" of tidewater in the range of 10 ppt to 15 ppt initially.
8. Continue flooding the impoundment with an additional 4" to 6" of tides twice each month until mid-October. Highest tides will be on the new moon and full moon of each month. Attempt to keep salinities in the low range if possible (5 ppt to 15 ppt). Attempt to keep water levels above the tops of the widgeongrass plants in the open water areas.

Special Note:

Vigorous circulation should be encouraged after initial flooding and continued throughout the growing season. While raising the level of waters inside the impoundment some 8" to 12" per month, allow excess waters flushed into the impoundment to flow over flashboard riser boards to afford circulation. Excess rainwaters can be allowed to flush out of the impoundment over riser boards and increase circulation also. The circulation will reduce temperatures of the impoundment waters and reduce the potential for infestation of the widgeongrass beds by filamentous algae. Remember that salinities will have to be closely monitored during this period of twice-monthly additions of tides. Tidewater salinities may increase markedly during summer due to evaporation and drought. Also, salinities may increase inside the

impoundment due to evaporation. It may be advisable to retain rainfall in the impoundment when salinities inside approach 15 ppt so that high salinities may be reduced by dilution.

9. Drawdown the impoundment using flashboard riser boards removed one at a time in late fall (first of November) so that the average depth across the impoundment would be 10" to 15" by the first week of December to allow for waterfowl utilization of desirable food plants.

Typical Management Scenario For Brackish Marsh Impoundments

Once the impoundment has been managed to reduce undesirable competing plants for a year or more, the following procedure can be followed for production of desirable waterfowl food plants.

1. Gradually lower water levels in the impoundment during late February and March by removing flashboards in risers one at a time. This procedure will allow for germination of saltmarsh bulrush in the higher zones (elevations) of the impoundment and dwarf spikerush in the exposed mud of formerly open water areas. Water levels should be reduced to the perimeter ditches by the end of March.
2. Circulate tidewaters into and out of the impoundment while maintaining water levels in the ditches 4" to 6" below the marsh floor (April through May) to allow the marsh sediments to consolidate. Excessive drying during this period may cause marsh soils to become acid due to the formation of cat clay.
3. Flood the impoundment during the month of June with 6" to 8" of tidewater to begin growth of widgeongrass and dwarf spikerush.
4. Continue adding tidewaters 4" to 6" twice monthly until the end of the growing season in mid-October. Water control structures must be carefully monitored during this period. Remember that salinities over 15 ppt will adversely affect growth and seed production of saltmarsh bulrush.
5. Drawdown the impoundment using flashboard riser boards removed one at a time in late fall (first of November) so that average depths in the impoundment will be 10" to 15" by the first of December to allow for waterfowl utilization of desirable food plants. Various widths of riser boards should be available at each water control structure so water levels can be gradually lowered to the desired depth.

Special Note:

Management of relatively small brackish marsh impoundments (less than 100 acres) by typical management schedules often results in extensive, dense stands of saltmarsh bulrush lacking open water areas, that are not attractive to waterfowl. Flooding to depths of 18" to 24" for an entire growing season will reduce saltmarsh bulrush density, create openings, promote the growth of widgeongrass and dwarf spikerush and thereby enhance waterfowl use. In order to limit the growth of competing vegetation, it is desirable to maintain water salinity in the range of 10 ppt to 20 ppt. Once open water conditions have been achieved, management should be directed toward water manipulation that encourages the growth of widgeongrass and dwarf spikerush as previously described.

Other Notes:

In addition to water level, water salinity may be manipulated to enhance habitat conditions. Narrowleaf

and tropical cattail may be controlled by flooding with salinities of 15 ppt to 20 ppt. However, optimum saltmarsh bulrush growth occurs at <10 ppt and growth is severely restricted by salinities over 20 ppt. Therefore, the achievement of desired objectives requires careful monitoring of water control structures and salinity. Excessive rainfall during the growing season may dilute salinity concentrations. Flashboard risers may be used to remove excess rainwaters during ebb tides. Conversely, retention of rainwater following drought, can offset high salinities that may have developed. In periods of normal weather conditions, salinity should be monitored on a 2 to 4 week routine schedule. However, during periods of above normal rainfall or drought more frequent (weekly) monitoring of salinity is advisable. A hand-held optical refractometer provides fast and accurate estimates in the field.

Prolonged growing season droughts can interfere with typical brackish marsh management. Summer flooding may be delayed for extended periods because of high tidewater salinities during droughts. Soil salinities can increase as a result of evaporative concentration of soluble salts. Saltmarsh bulrush becomes stressed and seed production is greatly reduced or eliminated. Under these conditions, sea purslane may flourish in higher marsh zones normally vegetated by saltmarsh bulrush. Managers alert to these circumstances can adjust management procedures to take advantage of sea purslane production. Many managers flood over mature sea purslane in the late summer period to produce a late-season crop of widgeongrass in September and October.

Efforts to correct soil conditions in brackish marshes that had been drained for at least 5 years, indicated that repeated flooding and drawdown was successful in elevating soil pH to levels supporting desirable duck foods. A pH of slightly above 4.0 is generally necessary for dwarf spikerush growth and pH value of approximately 5.0 or greater is required for widgeongrass. However, a rapid transition to more alkaline conditions may result in water severely stained with red or orange iron compounds. These observations are consistent with numerous field experiences involving plant response to various water management schedules throughout the South Atlantic coastal region and suggest that a gradual exchange of water is the most desirable method to encourage dwarf spikerush and, ultimately, widgeongrass in marshes that have been subjected to prolonged drawdowns. In marshes where iron compounds stain water, a series of drawdowns followed by quick reflooding and continuous water circulation are the most effective techniques for improving water quality.

HERBICIDE USE

Herbicidal applications generally are not recommended for control of undesirable vegetation in coastal wetland habitats because such applications are expensive and the results often temporary. Successful management of coastal wetland habitats can be achieved through integrated management techniques including water level manipulations, water quality manipulations, prescribed fire or mechanical techniques. Therefore, herbicides should be applied only to limited areas of potentially difficult to control species such as common reed. Common reed (phragmites) can be effectively controlled by spraying with a glyphosate under the brand name of Rodeo. Recent approval of the amazapyr herbicide for wetland application and sold under the brand name of Habitat has produced impressive results in controlling phragmites.

MAINTENANCE CONSIDERATIONS

Dikes and water control structures may require some annual maintenance. Bulkheads around structures should be carefully inspected for erosion, washouts and undermining of structures. The manager should be sure that all of the water control structures are in good working order prior to any critical period in the annual management cycle.

TOOLS OF THE TRADE

The following items are needed for effective management of most coastal habitats:

1. Drip torch - For prescribed burning within managed impoundments.
2. Refractometer - Salinity testing device essential for use in management of brackish impoundments.
3. Bottom sampler - Bottle with stopper on long pole for sampling tidewaters from bottom of inlet canal at trunks during high tide.
4. Rain gauge - To keep records of rainfall that affects management.
5. Tide charts - For your region of the coast to monitor highest and lowest tides of the month. Remember that onshore winds (east to northeast) may increase tidal height while offshore winds (westerly) may have the opposite effect.

SUMMARY

The habitat manager must have the capability of evaluating management potential of the various wetland habitats on the subject property. The manager should consider any possibilities for upgrading management capabilities such as new or additional water control structures, cross-diking, internal ditching or runaround ditch systems. Most of these activities will require federal and/or state permits.

Basic to any intensive management program within coastal wetlands is a system of sound dikes and properly designed, located and installed water control structures.

A well developed management plan for the subject property that addresses all of the physical and chemical factors affecting management will be a very useful reference for the habitat manager. The management plan is primarily a guide or reference for information that will allow the manager to intensify his efforts when physical and chemical factors are favorable and make adjustments in the management approach when variables interfere with typical management procedures.

The typical management procedures previously outlined may have to be altered from time to time as habitat quality begins to deteriorate due to plant succession or changing environmental conditions. As noxious weeds and competing vegetation begin to proliferate and dominate, the procedures outlined under the sections "Getting the Impoundment in Shape" will have to be repeated.

Variable conditions that develop during the growing season may prevent strict adherence to the recommended management approach. Such occurrences as excessive rainfall, extensive droughts that increase salinity levels, high temperatures and algal blooms or infestations may require a management adjustment during the growing season.

Brackish habitat managers often use varying degrees of salinity, as well as, water level manipulations to reduce competing vegetation within managed impoundments.

Techniques have been developed to manage for a variety of target plant species under a wide variety of soil and water quality conditions. Certain other techniques have been developed to improve soil pH

problems in brackish and saline habitats after extended drying has resulted in cat clay formation.

Annual maintenance of dikes, water control structures, tractors and equipment will prevent problems from occurring at critical periods of the annual management cycle.

There are certain tools of the habitat manager that are needed for effective management of coastal wetland habitats.

Intensive management of coastal wetland habitats is designed to increase food and cover resources that provide essential nutrients and behavioral needs of dabbling ducks and diving ducks. Habitat characteristics such as the types of food plants and associated cover types dictate species use of various coastal wetland habitats. Other factors besides the availability of food and cover resources affect waterfowl use in relation to management. Among these are variables in weather, harvest or hunt management on the subject property, disturbance from within and without managed habitats and water level fluctuations in managed areas that affect food and cover availability.