

STATE OF SOUTH CAROLINA

IN THE SUPREME COURT

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S.C. Supreme Court

APPEAL FROM THE ADMINISTRATIVE LAW COURT
Ralph King Anderson, III, Administrative Law Judge

Docket No 09-ALJ-07 00029-CC

Kiawah Development Partners, II,

Respondent,

v

South Carolina Department of Health and Environmental Control,

Appellant

Docket No 09-ALJ-07-00039-CC

South Carolina Coastal Conservation League,

Appellant

v

South Carolina Department of Health and Environmental Control and
Kiawah Development Partners, II,

Of Whom

South Carolina Department of Health and Environmental Control is,

Appellant,

and Kiawah Development Partners, II, is,

Respondent

RECORD ON APPEAL
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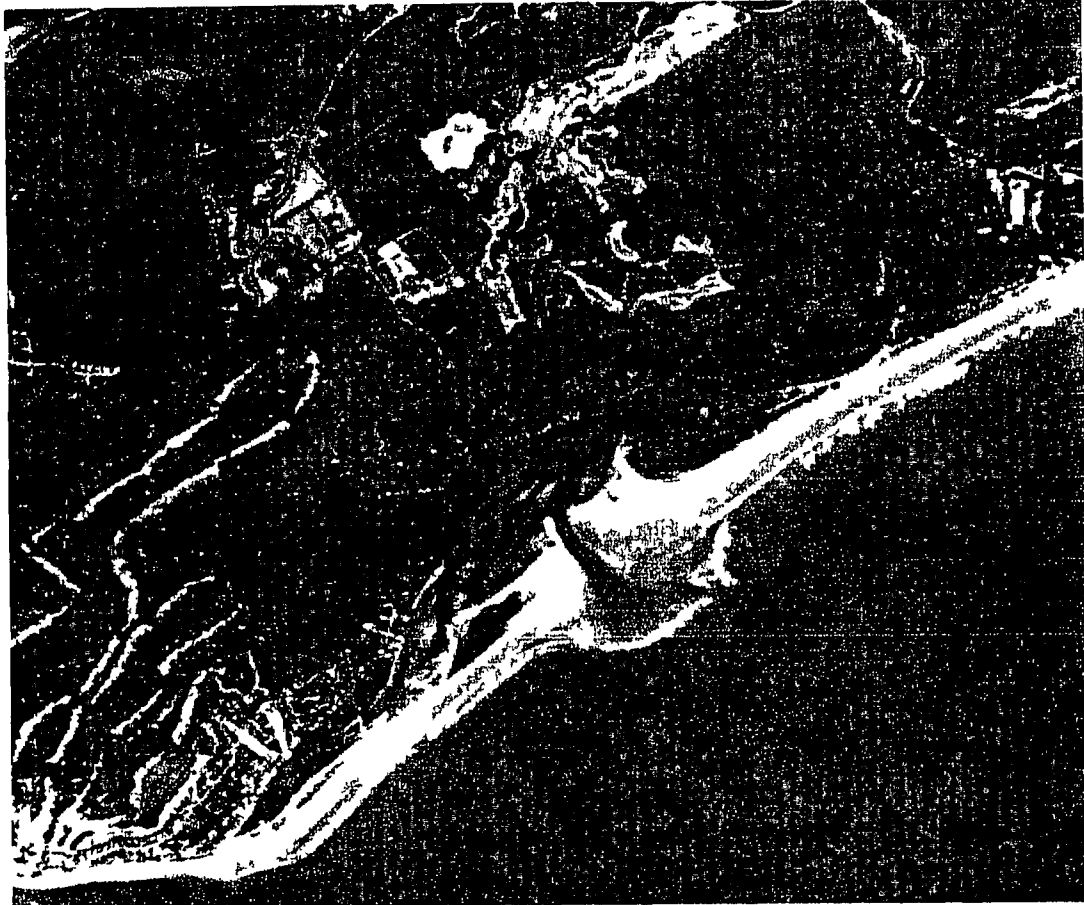
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Impact of Proposed Kiawah River Revetment on Seabrook Island, South Carolina



by

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for

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Charleston, SC**

June 2008

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002165

Background

In 2006, erosion along the outer bend area of the south branch of the Kiawah River was threatening the gazebo and parking lot of Beachwalker Park (on Kiawah Island). The County Park and Recreation Commission authorized a study that recommended bulkhead construction at Beachwalker Park. In 2007, the Charleston County Parks and Recreation Commission made an application to the SC SCDHEC-OCRM to stabilize an eroding shore at Beachwalker Park on Kiawah Island. The Kiawah Development Partners (KDP) requested a delay until a more comprehensive analysis of the entire outer bend area could be completed.

KDP retained Thomas and Hutton Engineering, Inc., Beach Consultants, Inc. and Hollow-core Reef Enterprises, Inc. to study the causes of erosion and to develop alternatives for resolving the problem. An extensive survey and review of the literature concerning the physical environment for Kiawah Island, the Kiawah River, Stono Inlet, Captain Sam's Inlet, and the adjacent Seabrook Island was conducted in the summer of 2007. The history of Captain Sam's Inlet between 1696 and 1979 is found in Hayes et al. (1979) and demonstrates a natural cycle of Kiawah Spit breaching at Beachwalker Park with inlet migration occurring at 40-80 year intervals. Artificial relocations of Captain Sam's Inlet in 1983 and 1996 (see Kana, 1989, CSE 2008) provide valuable information on sand transport along the ocean shoreline of Kiawah Spit. Our own study showed a history of seaward accretion (progradation) ranging from 5-15 ft/yr. The toe of the beach face is also quite stable during the last decade and should provide a good foundation for future stability of the ocean side of Kiawah Spit.

Much less documentation exists for the landward side of Kiawah Spit. As a result, we pulled together all the available data we could find and gathered new data. Relying on previous studies and additional investigations, we modeled the morphodynamic and hydrodynamic processes affecting the stability of the eroding riverbank. This provided a basis for our recommendation to install a combination bulkhead-ACB revetment for the entire eroding section of the riverbank. Our recommendation also called for the consideration of the potential use of training jetties in the river.

Our recommendation for the combination bulkhead-ACB revetment is embodied in the Permit Application to the SCDHEC-OCRM. Concerns raised for this permit are addressed herein.

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Concerns

Concerns about the potential impact of the proposed revetment on Seabrook Island were raised by the Seabrook Island Property Owners Association (Mr Sam Reed, President of SIPOA, May 30, 2008), the Town of Seabrook Island, (Mayor Frank McNulty, May 28, 2008), and the South Carolina Department of Natural Resources (Ms Susan Davis, Coastal Environmental Coordinator, May 22, 2008)

Concerns expressed are summarized as follows

- 1 SIPOA ' possible erosion of SIPOA owned property, beach front trust property, and property owned by individuals living on Seabrook' ,
- 2 SIPOA ' could enhance its (the fragile neck of Kiawah Spit) durability, and allowing it to continue to grow in front of Seabrook Island"
- 3 SC DNR is the "unnecessary encroachment of sensitive intertidal habitats

Below is a summary of why we feel there is no possibility of erosion on Seabrook Island caused by construction of the proposed revetment on the Kiawah River and a brief description of how the project will enhance the quality of the benthic habitat

Sand Resources and Budgets Seabrook Island

Both the Stono River to the north and the North Edisto River to the south influence the sediment budget of Seabrook Island Strong tidal currents flowing through the inlets of these systems produce large ebb deltas that deposit large volumes of sand in the coastal zone The sediment drift and flow around the ebb delta of Stono Inlet has an important influence on the sediment budget of Kiawah Island beaches *"Historical data indicate Seabrook Island is fundamentally an accreting beach-ridge island deriving its sediment from Kiawah Island and*

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Stono Inlet to the north (direct quote from Kana , 1989 in Shore and Beach) (References are Hayes et al , 1975, Kana et al , 1984 and Moslow, 1980)

Deveaux Bank is a large deposit in the mouth of N Edisto River ebb delta The sediment drift and currents around the ebb delta of N Edisto Inlet has an important influence on the sediment budget of Seabrook Island beaches On a smaller scale, bypassing of sand across Captains Sam s inlet is another sand source for Seabrook Island

The migration of Kiawah Spit and sand bypassing at Captain Sam's Inlet is governed by the sediment-transport potential of water currents in the inlet Sand naturally bypasses across Captains Sam's Inlet on an ebb delta located just seaward of the inlet The bypassing rate is relatively slow compared with the rate of sand drift along straight shorelines Natural, relatively slow migration of Kiawah Spit has been historically documented through the twentieth century The southern end of Kiawah Spit was 'unnaturally' bypassed to Seabrook Island in 1983 and 1996 Artificial inlet relocations were permitted by the OCRM to reduce the time and increase the volume of sand reaching Seabrook Island

The two main currents that influence bypassing and spit migration at Captain Sam's Inlet are longshore currents and tidal currents of the southern branch of the Kiawah River Since the project is located landward of the coastline, it will not impact the longshore current regime The project is about 6000 feet landward from Captain Sam's Inlet

Inlet tidal currents are governed by the size of the tidal watershed and this project will not change the size of the watershed The south branch of the Kiawah River has a relatively small tidal-watershed compared with the larger Stono River system to the north Our recent studies have demonstrated that only about one half of the tidal flood volume returns as ebb flows through Captain Sam's Inlet The remainder is captured by and exits through Stono Inlet Consequently, the small volume of sand eroded from the outer bend area is transported landward toward the Kiawah River Bridge and stays within the tidal watershed of the south Kiawah River

Sediment from the south branch of the Kiawah River is NOT a significant source of sand for Seabrook Island The Kiawah River is a tidal river that does not extend into upland reaches of the Coastal Plain and therefore has an insignificant sediment supply to nearshore beaches An extremely small and insignificant volume of sediment (sand silt, and clay) materials is transported in the south Kiawah River by flood and ebb tides The proposed revetment to halt erosion in the

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river bend will therefore have zero impact on the extremely small amount of sand volume in the Kiawah River reaching Captain Sam's Inlet

Habitats

The present sandy shore is a non-vegetated surface that provides habitat for sparse fauna of benthic animals. The project will increase habitat and productivity at the new surface. The concrete ribs of the mattress provide hard surfaces for oyster colonization and reef development. The oysters will filter and clean the water.

Areas between the concrete ribs provide sediment pockets where seedlings of *Spartina alterniflora* and *S. patens* will be planted. As marsh grasses spread, a productive wetland community will replace the former eroding sandy surface. Over 2000 feet of new productive wetland may develop. High and low-marsh wetlands will enrich the intertidal ecosystem and trap fine-grained sediment enhancing water quality and wetland productivity. Additionally upland habitat will be preserved and not subject to loss through rapid erosion.

Conclusions

In response to the concerns cited above:

(1) There is no possibility of erosion on Seabrook Island caused by construction of the proposed revetment on the Kiawah River and

(2) Enhancement of the durability of the narrow access region of Kiawah Spit will insure continued spit growth, provide sand for release and access for construction of future inlet relocations of Capt Sam's Inlet to benefit Seabrook Island.

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Impact of Proposed Kiawah River Revetment on Adjacent Areas and Habitats

Beachwalker Park to Captain Sam's Inlet



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Charleston, SC

August 2008

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002171

Executive Summary

This report is in response to the request by Mr Trenholm Walker (July 20 2008 email) to address the concerns of the SC Dept of Natural Resources (ltr dated May 22 2008) and the US Fish and Wildlife Service (ltr dated June 12 2008) in regards to the proposed revetment along the Kiawah River at Kiawah Spit. These concerns may be summarized as (1) *Plover and Sensitive Habitat* and (2) *Hard Structures Cause Erosion Adjacent to the Structures*. Details are presented in this report and summarized in direct response to the following quoted concerns from these letters:

Plover and Sensitive Habitat

"This shoreline is characterized by a low sandy bluff subject to daily tidal inundation and natural erosional patterns. The proposed bulkhead/revetment would result in the armoring and unnecessary encroachment of sensitive intertidal habitats" (SCDNR)

*The Service is concerned that the project may adversely affect the threatened piping plover (*Charadrius melodus*) and modify its designated habitat. Piping plovers have been observed in close proximity to the proposed project and the proposed project is in the immediate vicinity of designated critical habitat unit SC 10 (USF&WS)*

There is no apparent reason the proposed bulkhead should be built especially considering the proposed projects potential effects to federally listed species and their critical habitat (USF&WS)

Most of Kiawah Spit is densely vegetated with dune grasses and/or dune shrubs and scrub trees. Only the linear berm and overwashed spit end fit the criteria for the potential critical habitat (see Figure herein). These surfaces are very dynamic and may change in size and location in response to fluctuations in the littoral sediment budget. The flow of the South Kiawah River has no influence on the berm. The interaction of tidal and littoral currents influences the migration and location of the overwashed end of the spit. As the overwashed end of the spit migrates the surface area may expand and contract in response to natural processes. Cyclic erosion at the distal end of the spit may cause periodic overwash and increased surface area for plover habitat.

The intertidal bars on the seaward and landward sides of Captain Sams Inlet provide foraging surfaces for Plover. The size of intertidal bars on the landward side of Captain Sams Inlet is dependent on the local sediment budget and colonization by marsh vegetation (*Spartina alterniflora* and *Spartina patens*). Plover habitat is dependent on the presence of active barren surfaces. These surfaces require periodic overwash by waves. The project is located about a mile upriver from Captain Sams Inlet and in no way obstructs waves from overwashing berm surfaces on the ocean beach or inlet margins.

Hard Structures Cause Erosion Adjacent to the Structure

"Hard erosion control structures have been proven to cause erosion in front of and adjacent to the structure itself thereby transferring a perceived erosion control problem instead of correcting it. Installation of the project will likely accelerate erosion and scouring on the backside of the island. The proposed project could therefore denigrate habitat downstream of the bulkhead (USF&WS)

Since waves are relatively small the dominant mechanism for initiation and transport of sediment is the tidal current. We have developed an analytic tidal hydraulics model of the south end of the Kiawah River that has been calibrated with field data taken by Applied Technology and Management Inc (ATM) Charleston SC.

The cross sectional average maximum flooding velocity decreases from the end of the revetment at Sta 51+00 to Sta 30+00 and then increases to Captain Sams Inlet. Or, in the opposite flooding direction the cross sectional average current decreases from the inlet to about Sta 30+00 increases in the bend area and then decreases further upstream. Since the revetment on the outer bank does not alter the cross sectional area there is no physical way the hardened shoreline can cause erosion to the adjacent upstream natural shoreline during flooding conditions.

For ebbing conditions the cross sectional average currents are relatively constant for about 2000 ft from the end of the revetment toward Captain Sams Inlet. Since the revetment on the outer bank does not alter the cross sectional area the hardened shoreline cannot cause erosion to the adjacent natural downstream shoreline during ebbing conditions.

The difference in flooding and ebbing flow volumes produces a net flow over each tidal cycle. The net flow is in the flood direction. The net sediment transport in the bend area is thus also in the flood direction.

The distribution of flow in channels is strongly influenced by the orientation of channels. In straight channels, the maximum velocities are close to the central part of the channel and the channel adjusts to an equilibrium cross sectional area controlled by the current velocities. This is the case for the Kiawah River channel between Captain Sams Inlet and Section 55+00.

When a channel bends, flow is squeezed into the down current side of the channel and velocities increase along the outside radius of the bend. At the inside radius of the bend, flow decreases in the lee of the upstream bank. Decreases in flow generally cause sediment accumulation (on a point bar) at the inside radius of the bend and a decrease in cross section area. Deviation from the equilibrium cross sectional area results in velocity increases along the outside radius of the bend increase and erosion. The process of inside bend deposition and outside bend erosion causes the lateral migration of the channel. This is precisely the process that has been influencing the Beachwalker Park area. Since the net flow is in the flood direction, most of the sediment eroded from the outside bend is deposited in a mid channel bar north of Beachwalker Park.

Installation of the revetment along the outside radius of the meander bend will eliminate the erosion of the bank and protect the valuable upland area of Kiawah Island. In doing so, channel migration will also be halted but the point bar will continue to migrate into the channel. The reduced section area will cause a temporary increase in average section velocity and lowering of the channel floor adjacent to the toe of the revetment until the cross sectional area again reaches equilibrium. We expect the slope at the base of the revetment to increase to about 30° and the depth to increase by 5.6 feet.

In 1998, an ACB mattress revetment was installed in Bass Creek on the northeastern end of Kiawah Island near Stono Inlet. Condition surveys in 1999, 2000, 2001, 2003, 2005, 2006, 2007, and 2008 have proven the success of the ACB revetment (Compilation Reports 1996-2008, Coastal Science and Engineering, Columbia, SC, June 2008). This local experience with the successful performance of the ACB mattress at Bass Creek on Kiawah Island bodes well for a similar installation on the Kiawah River at Kiawah Spit to eliminate the outer bank erosion and not create any erosion on the adjacent natural shores.

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SUMMARY CONCLUSIONS

DISCLAIMER

ENGAGEMENT

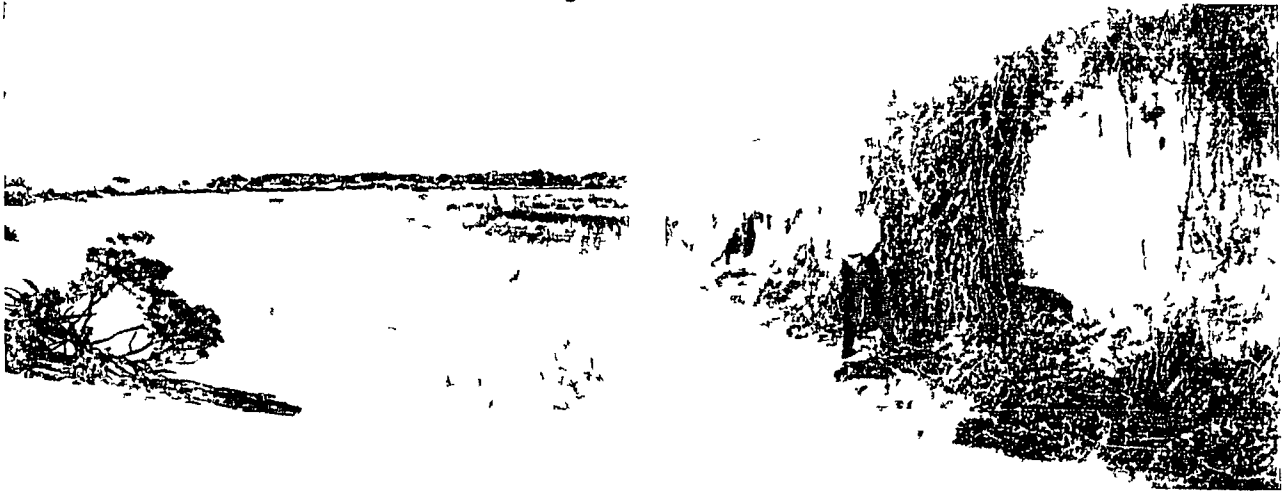
Purpose

In October of 2006, Kiawah Development Partners Inc engaged the team of Beach Consultants, Inc and Hollow core Reef Enterprises Inc to investigate the feasibility of assuring access to Kiawah Spit by investigating the processes impacting the proximal end of the spit near Beachwalker Park

Scope of Study

The study of Kiawah Spit began with a two day field investigation of the site. The site visit included observations of eroding and stable sections of the Kiawah River between Beachwalker Park and Captain Sam's Inlet (Figure 1)

Figure 1



Detailed observations were also made of the beach and dune system of Kiawah Spit. Following the site visit, a thorough review of the scientific and engineering literature was made to provide a background on the history of Kiawah Spit with respect to the surrounding areas.

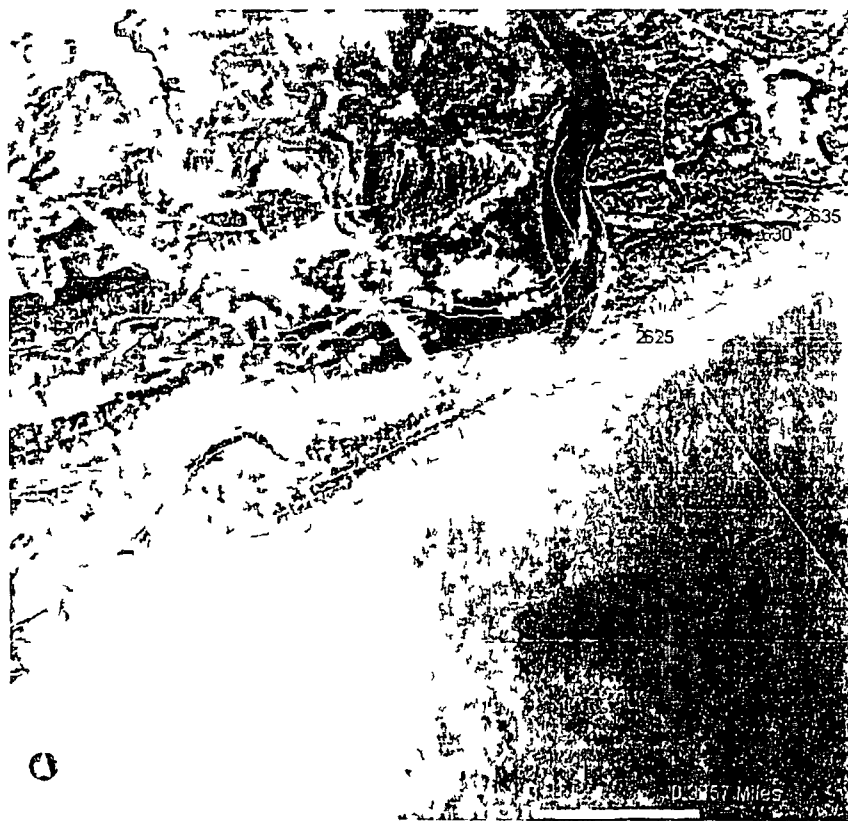
Models and Analyses

Several models were made of the region to evaluate the processes that have produced the present conditions. On the landward side of Kiawah Spit, a tidal hydraulics

model was developed to understand the rates and magnitudes of ebb and flood currents in the south Kiawah River (and tidal basin). In 2008, Drogue and ADCP current studies were used to verify and 'tune' the model.

On the ocean side of Kiawah Spit, beach profile data was used to generate an island wide sediment budget influencing Kiawah Spit. Finally, detailed observations of modern and historic shorelines and landforms (such as marsh hammocks and tidal point bars) were used to understand the long term evolution of the coastal region around the south Kiawah River.

Figure 2



Initial Findings (August 2007)

An important initial finding of the literature review and model analyses was that the sediment budgets along the ocean and landward sides of Kiawah Spit were working independently of each other. Wave processes and littoral drift on the ocean side of the spit had a positive sediment budget causing beach building. Between 1998 and 2007, the seaward migration of the shoreline was about 12-15 feet per year.

Tidal processes on the landward side of the spit were facilitating point bar and channel migration directly into the stem of the spit near Beachwalker Park. Migration of the channel into Kiawah Spit has been occurring at a rate of about 8.9 feet per year.

Advice

In August 2007, nine alternative solutions were presented for spit access and channel stabilization. A recommendation to place a revetment along the outside radius of the meander bend was considered the best option. An articulated concrete block (ACB) mattress concept selected by Thomas and Hutton was chosen for application to the site. Beach Consultants Inc and Hollow core Reef Enterprises, Inc reviewed the conceptual design plans for the application. The length of 2,100 feet for the proposed revetment was based on: 1. The total length of bank erosion on the backside of the spit, 2. The area of maximum tidal current pressure along the outside radius of the bend, and 3. The region of maximum morphodynamic pressure being exerted by point bar migration. A 40 foot wide mattress was designed by Thomas and Hutton Engineering, Co.

Thomas and Hutton Engineering was the agent that submitted the permit application on behalf of Kiawah Development Partners Inc. Hydraulic and morphologic investigations (by Beach Consultants, Inc and Hollow core Reef Enterprises Inc) were later conducted to investigate the potential for toe scour at the base of the ACB revetment. Results indicated that the width of the ACB mattress should be at least 60 feet wide (or greater) and that training jetties could be used to realign tidal flow away from the mattress toe toward the axis of the channel.

AWARENESS OF CONCERNS

After application of a permit request several concerns were raised by Seabrook Island residents, the South Carolina Department of Natural Resources and the U.S. Fish and Wildlife Service (USFWS).

Seabrook Island residents were concerned that the project may in some way shift the erosion problem to their area. The USFWS was concerned that the project might erode beach berms, overwash areas and tidal flats (on and adjacent to the spit) that are important sites for wintering Piping Plover. In general, the concerns were all related to the fear that the project may somehow cause erosion areas over a mile west of the project.

down to Seabrook Island While this is highly unlikely because of the processes involved, the following sections of this report will attempt to describe why these adjacent areas will not be impacted

BACKGROUND for PLOVER CONCERNS

Habitat Definition

Habitat is a combination of environmental factors that provides food, water cover and space that a living thing needs to survive and reproduce

Plovers-Family Charadriidae

Wilson's Plover *Charadrius wilsonia*

Piping Plover *Charadrius melodus*

Killdeer *Charadrius vociferus*

Species Description Piping plover *Charadrius melodu*

Figure 3



Identification Tips Length 5.5 inches Small shorebird Short stubby bill Upper parts pale gray Under parts white White collar, Orange legs

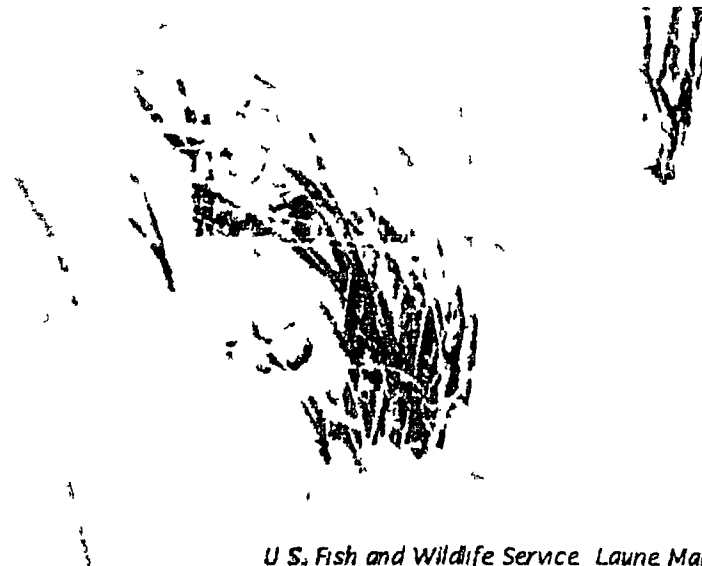
Adult alternate Thin black breast band Orange base to dark bill White forehead Black line from eye to eye across forehead Gray crown

Similar species The pale gray upperparts distinguish the Piping Plover from all other small plovers except the Snowy Plover

Predation and Stress

Predation has been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast site. Predators of piping plover eggs and chicks include red fox, striped skunk, raccoon, Norway rat, opossum, crows, ravens, gulls, common grackles, American kestrel, domestic and feral dogs and cats, and ghost crabs. Shrubs and dense grasses provide cover for these predators. Plover can spot predators as they enter open areas and distract them from chicks and nests (open scrapes).

Figure 4



U.S. Fish and Wildlife Service, Laune MacIvor

Stabilized dunes and dense vegetation may also impair piping plover nest site selection and/or chick survival by blocking access to bayside feeding areas. Flightless plover chicks able to reach bay beaches and the island interior had significantly higher survival rates than those that foraged solely on the ocean beaches. General management recommendations stress the importance of sparsely vegetated access routes to bayside beaches maintained by washover deposits. Overwash processes are important components of interior habitat maintenance. Piping plover broods on some portions of barrier beaches have been observed walking across gently sloped barrier beach from ocean to bayside feeding areas.

Primary constituent elements are physical and biological features of the designated critical habitat essential to the conservation of the species. Essential components (primary constituent elements) of wintering piping plover habitat include

- 1 **sand and/or mud flats with no or very sparse emergent vegetation** In some cases, these flats may be covered or partially covered by a mat of blue green algae
- 2 Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also essential, especially for roosting piping plovers. Such sites may have debris detritus (decaying organic matter), or micro topographic relief (less than 50 cm above substrate surface) offering refuge from high winds and cold weather
- 3 Essential components of the beach/dune ecosystem include surf-cast algae for feeding of prey
 - a **sparsely vegetated backbeach (beach area above mean high tide seaward of the dune line,** or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road) for roosting and refuge during storms,
 - b **spits** (a small point of land, especially sand running into water) for feeding and roosting,
 - c **washover** areas for feeding and roosting

Washover areas are broad, unvegetated zones with little or no topographic relief that are formed and maintained by the action of hurricanes, storm surge or other extreme wave action. Several of these components (sparse vegetation little or no topographic relief) are mimicked in artificial habitat types used less commonly by piping plovers, but that are considered critical habitat (e.g., dredge spoil sites)

FACTORS EFFECTING HABITAT SIZE

Coastal beaches have unvegetated areas sparsely vegetated hummocky areas and densely vegetated primary dune ridges (Figure 5). The unvegetated and sparsely vegetated areas are called the beach berm or just the **berm**. The dry surface of the berm is the main source of wind blown sand for dune development. Two distinctly different processes control the width of the berm.

Figure 5 Photo of shore showing unvegetated berm (left) vegetated upper berm (center) and densely vegetated dune ridge (right)



- 1 Coastal sediment budget is a major factor influencing berm width. Beaches with negative sediment budgets are erosional causing the berm to narrow as the shoreline migrates closer to the primary dune ridges. Beaches with positive sediment budgets are accretional causing the berm to broaden as the shoreline migrates seaward.

These changes may occur annually in response to seasonal wave climate. Broad berms are associated with long, wavelength swell whereas narrow berms follow stormy conditions.

- 2 Vegetation is another major factor influencing berm width. Wind and waterborne dispersion of seeds accumulate in wrack lines of berms. In time seedlings of dune plants will sprout from the berm surface. The pioneer vegetation may include Croton, Cakile, Russian Thistle, and common dune grasses (*Uniola p*, *Panicum a*, *Ammophila b* and *Spartina p*). Initially, the pioneer plants are very sparse providing suitable sites for Plover utilization. However, plant density increases rapidly via rhizomes spreading and eventually there is too much cover for predators. At stable beaches the

vegetative succession begins with sparse vegetation and advances to dense grasses, shrubs and maritime forests. Thus berms need to be periodically stripped of vegetation by tides, overwash or storms to maintain a sparsely vegetated surface.

KIAWAH SPIT

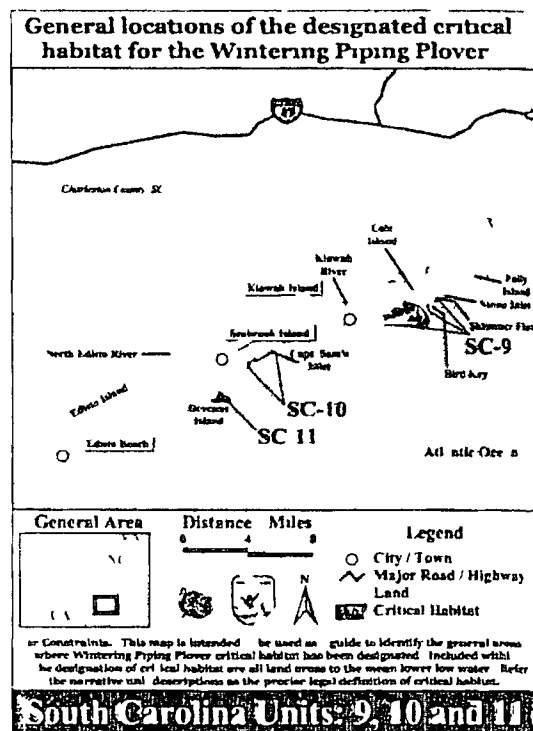
USFWS Habitat Designation

The USFWS has designated critical wintering habitat sites for Piping Plover. The site adjacent to Kiawah Spit is designated Unit SC-10 and is described below.

Unit SC-10 Seabrook Island 117 ha (290 ac) in Charleston County

This unit runs from just 0.16 km (0.10 mi) north of Captain Sams Inlet to the southwest approximately 3.4 km (2.1 mi) along the Atlantic Ocean shoreline. It includes land areas from the MLLW on the Atlantic Ocean to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Most of this unit is privately owned.

Figure 6



Kiawah Spit Habitat

The USFWS description is purposely very broad as to encompass 'potential' areas where conditions may be suitable for critical habitats. Actual conditions at the site must be used to determine the actual suitable surface area for Plover habitat.

Most of Kiawah Spit is densely vegetated with dune grasses and/or dune shrubs and scrub trees. Only the linear berm and overwashed spit end fit the criteria for the potential critical habitat (see shaded area below). These surfaces are very dynamic and may change in size and location in response to fluctuations in the littoral sediment budget. The flow of the South Kiawah River has no influence on the berm. The interaction of tidal and littoral currents influences the migration and location of the overwashed end of the spit. As the overwashed end of the spit migrates, the surface area may expand and contract in response to natural processes. Cyclic erosion at the distal end of the spit may cause periodic overwash and increased surface area for plover habitat.

Figure 7 Potential nesting area (yellow) and potential foraging area (outlined in brown)



The intertidal bars on the seaward and landward sides of Captain Sams Inlet provide foraging surfaces for Plover. The size of intertidal bars on the landward side of Captain Sams Inlet is dependent on local sediment budget and the rate of colonization by marsh vegetation (*Spartina alterniflora* and *Spartina patens*)

EFFECT OF PROJECT ON ADJACENT AREAS

Background

To begin, a clear distinction is needed between hardened shorelines along inland, tidal waterways and open, coastal beaches. The dominant mechanism for initiation and transport of sand is different in each case. For open, coastal beaches, breaking waves put sediment into suspension for transport parallel to the shoreline by wave generated longshore currents. Changes in the distribution of wave energy are the dominant factors influencing the erosion, transportation and deposition of sand along ocean shorelines. This is the case for the ocean side of Kiawah Spit.

On the inland, Kiawah River side of Kiawah Spit, the turbulent bottom shear stresses generated by tidal currents are the dominant forces influencing the erosion, transportation and deposition on the boundaries of tidal channels. Sand transport in tidal channels is predominantly by the slow migration of ripples on meandering channel floors. Changes in flow direction are the dominant factors influencing the erosion, transportation and deposition.

Piping Plover Habitat

Plover habitat is dependent on the presence of "active" barren surfaces. These surfaces require periodic overwash by waves. The project is located about a mile upriver from Captain Sams Inlet and in no way obstructs waves from overwashing berm surfaces on the ocean beach of inlet margins.

Hardened Surfaces

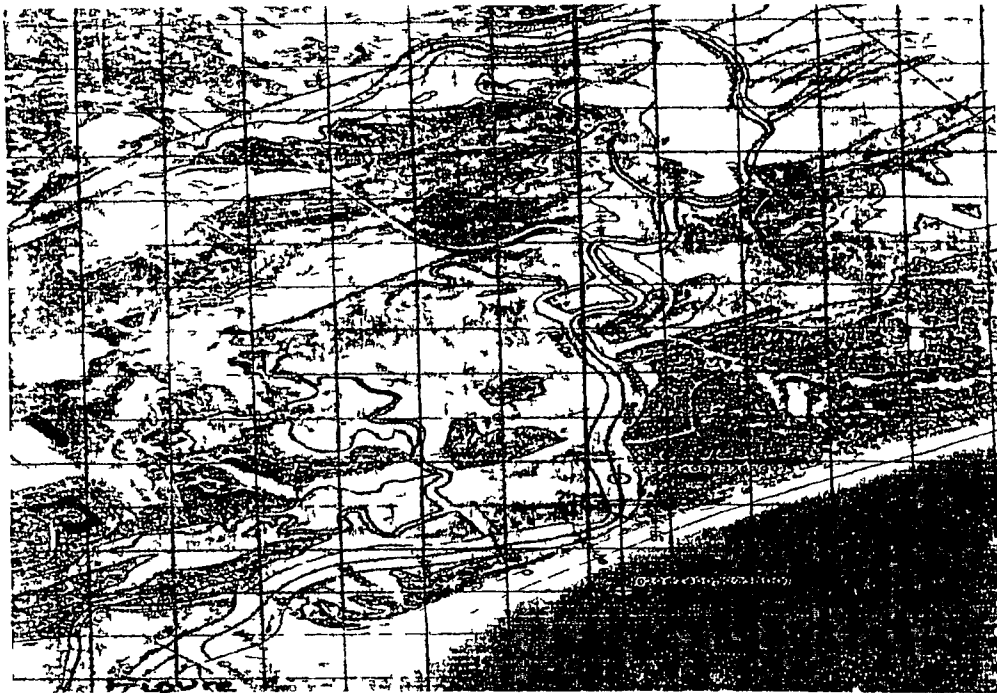
Hard structures (seawall bulkheads, and revetments) placed along inland tidal waterways or open, coastal beaches interact differently with the adjacent native materials along the shoreline

Possible mechanisms for flanking (down drift) effects of hard structures on adjacent, open coast beaches are (1) sand trapped behind the structure, (2) rip currents and return flows, (3) blockage of littoral drift (groin effect) and , (4) headland/parabolic bay systems. A complete review is found in Basco (Journal of Coastal Research, SI 39, p 741-744, 2004) including a list of the many references cited for open coast beaches. Note that all mechanisms are wave induced and wave heights are also correlated with toe scour at the structure base

On all eroding shorelines (open coast or inland waterway) the structure fixes the shoreline position relative to the adjacent, 'natural' shoreline which may (or may not) continue to erode at the background rate. The observed shoreline retreat adjacent to structures may be the original erosion rate and not caused by the hardened shoreline

Inland, Tidal Waterway Shorelines – Kiawah Spit Since waves are relatively small, the dominant mechanism for initiation and transport of sediment is the tidal current. We have developed an analytic, tidal hydraulics model of the south end of the Kiawah River that has been calibrated with field data taken by Applied Technology and Management, Inc (ATM) Charleston SC. The one-dimensional, volumetric flow rate in space x and time, t $Q(x, t)$ is calculated for any tidal amplitude function $\eta(x, t)$ at Captain Sams Inlet ($x=0$). The mean tide range is 5.6 feet. Figure 8 schematically illustrates the stationing system employed and State Plane coordinates on an aerial photo. The bend area is around Sta 66+00, or 6600 ft from the entrance at Captain Sams Inlet. Surface areas were taken from aerial photographs and river bathymetry obtained from hydrographic surveys provided for this effort.

Figure 8

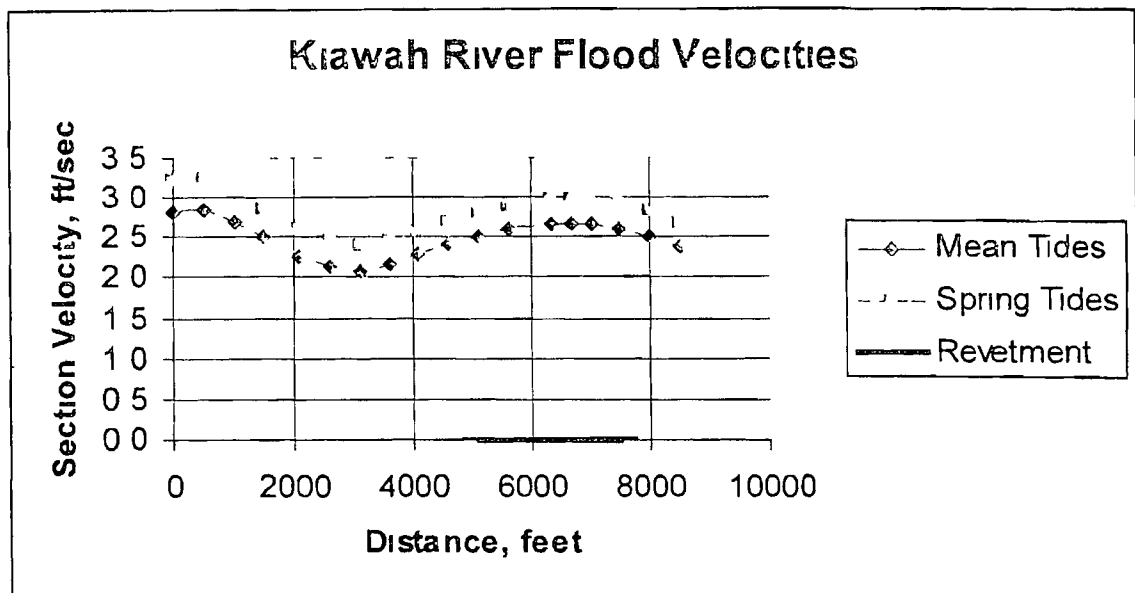


Cross-sectional areas were calculated below the Mean Tide Level (MTL) at selected locations from the entrance at Captain Sams Inlet (Sta 0+00) to Sta 85+00 which is well above the bend area. The cross-sectional average velocity at the maximum flood and ebb flows at these selected locations was then simply found as the $V=Q/A$ current. As expected, maximum currents are found in the bend area.

Flooding Currents The volume of the tidal prism from flooding of the south end of the Kiawah River through Captain Sams Inlet is about $130 \times 10^6 \text{ ft}^3$ [Kana and Mason, 1988 estimate $138 \times 10^6 \text{ ft}^3$]. Figure 9 shows the cross-sectional average velocity under maximum flooding conditions for both the mean tide (5.6 ft) and spring tide (6.4 ft) ranges. The peak current is about 2.7 ft/sec in the bend area around Sta 66+00 during mean tide and decreases in both directions and then increases again toward the inlet. The solid black line along the bottom is the location of the proposed revetment running between Sta

51+00 and Sta 75+00. The cross sectional average maximum flooding velocity decreases from the end of the revetment at Sta 51+00 to about Sta 30+00 and then increases again to Captain Sams Inlet. Or, in the opposite flooding direction, the cross sectional average current first decreases and then *increases* from Sta 30+00 to the bend area. Since the revetment on the outer bank does not alter the cross sectional area (See Point Bar Migration below), there is no physical way the hardened shoreline can cause erosion to the adjacent upstream natural shoreline during flooding conditions.

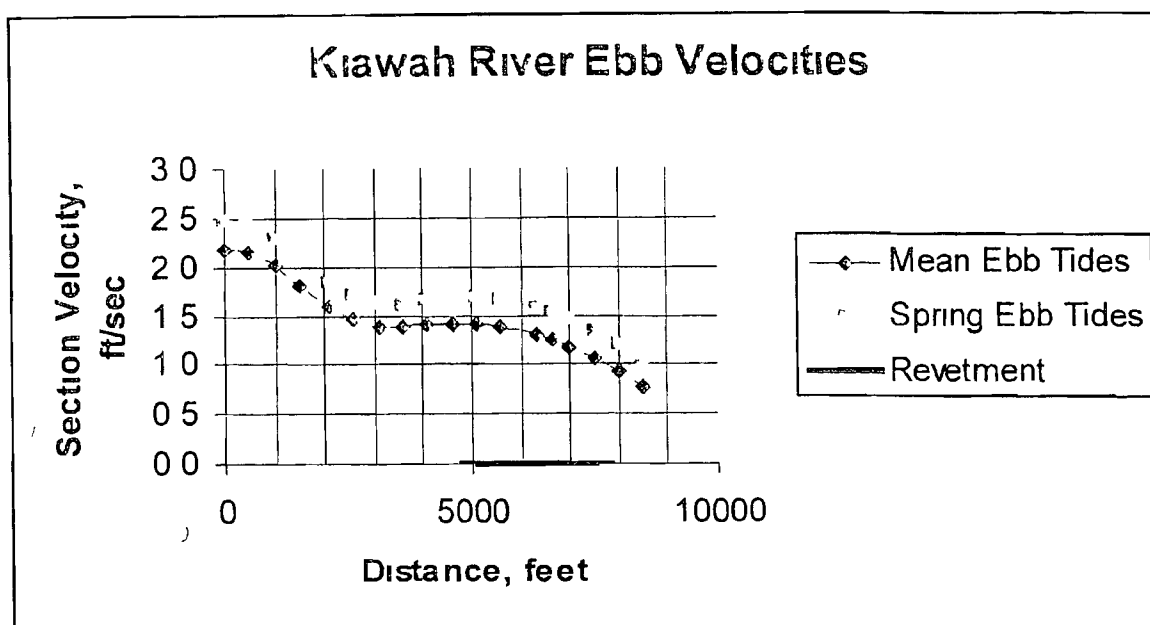
Figure 9



Ebbing Currents From the field measurements, it was discovered that the tidal volumes flooding in and ebbing out of Captain Sams Inlet are unbalanced. More water volume enters during the flood cycle than leaves during the ebb cycle. Part of the flood volume entering is effectively 'captured' by the ebbing flow volumes leaving through Stono Inlet. As a result, the maximum volumetric flow rates during ebbing conditions are reduced and therefore so are the cross-sectional velocities. Figure 10 displays the cross sectional average velocity for both mean and spring tide ranges. During mean tide the peak ebbing current is reduced to about 1.4 ft/sec and occurs from Sta 30+00 to 55+00. The solid black

line along the bottom is again the location of the proposed revetment. For ebbing conditions, the cross sectional average currents are relatively constant for about 2000 ft from the end of the revetment toward Captain Sams Inlet. Since the revetment on the outer bank does not alter the cross sectional area (See next section), the hardened shoreline cannot cause erosion to the adjacent natural downstream shoreline during ebbing conditions.

Figure 10



Net Flows The difference in flooding and ebbing flow volumes produces a net flow over each tidal cycle. The net flow is in the flood direction. The net sediment transport in the bend area is thus also in the flood direction (see below).

Point Bar Migration

The distribution of flow in channels is strongly influenced by the orientation of channels. In straight channels, the maximum velocities are close to the central part of the channel and the channel adjusts to an equilibrium cross-sectional area controlled by the

current velocities. This is the case for the Kiawah River channel between Captain Sams Inlet and Section 55+00.

When a channel bends, flow is squeezed into the down current side of the channel and velocities increase along the outside radius of the bend. At the inside radius of the bend, flow decreases in the lee of the upstream bank. Decreases in flow generally cause sediment accumulation (on a point bar) at the inside radius of the bend and a decrease in cross-section area. Deviation from the equilibrium cross sectional area results in velocity increases along the outside radius of the bend and increases erosion. The process of inside bend deposition and outside bend erosion causes the lateral migration of the channel. This is precisely the process that has been influencing the Beachwalker Park area. Since the net flow is in the flood direction, most of the sediment eroded from the outside bend is deposited in a mid channel bar north of Beachwalker Park.

Toe Erosion of the Revetment

Installation of the revetment along the outside radius of the meander bend will eliminate the erosion of the bank and protect the valuable upland area of Kiawah Island. In doing so, channel migration will also be halted but the point bar will continue to migrate into the channel. The reduced section area will cause a temporary increase in average section velocity and lowering of the channel floor adjacent to the toe of the revetment until the cross sectional area again reaches equilibrium. We expect the slope at the base of the revetment to increase to about 30° and the depth to increase by 5-6 feet.

SUMMARY CONCLUSIONS

Point bar migration in the south Kiawah River is the main cause of erosion in the Beachwalker Park area of Kiawah Spit. Processes along the ocean shore are allowing the shoreline to advance seaward at a higher rate than the erosion on the landward side of the spit. This whole region has been building seaward for many decades and probably several centuries. A few early breaches in the spit were at times when the spit and Kiawah shoreline were further to the west. Since, the ocean shoreline has been accretional, erosion mitigation in the Beachwalker Park area has been directed toward the landward

side of the spit. An erosion mitigation project there will not affect the wave driven sediment budget on the ocean side.

Erosion in the Beachwalker Park area is a result of tidal current scour caused by point-bar migration. Installation of the revetment along the outside radius of the meander bend will eliminate the erosion of the bank and protect the valuable upland area of Kiawah Island. This will halt channel migration and cause a modest increase in channel depth adjacent to the revetment. However, it will not change the average tidal current velocities in the channel down to Captain Sam's Inlet. The volume of water discharging and recharging through the tidal basin controls velocities in that area. These volumes will not be altered by the project.

On the northeastern end of Kiawah Island near Stono Inlet, the Bass Creek tidal river was experiencing rapid scour in the bend area along the outer bank and threatened to undermine an existing road and buried utilities. In 1998, an ACB mattress revetment was constructed to replace an existing riprap revetment. Condition surveys in 1999, 2000, 2001, 2003, 2005, 2006, 2007, and 2008 have proven the success of the ACB revetment. On both ends, the transition to the natural bank and old riprap sections remain in good condition from top to bottom. Vegetation and oysters are prevalent, suggesting the ACB revetment is stable. (Compilation Reports, 1996-2008, Coastal Science and Engineering, Columbia, SC, June 2008)

This local experience with the successful performance of the ACB mattress at Bass Creek on Kiawah Island bodes well for a similar installation on the Kiawah River at Kiawah Spit to eliminate the outer bank erosion and not create any erosion on the adjacent, natural shores.

Disclaimer

Findings presented above are based on best scientific and engineering concepts. Models used to arrive at these findings are also based on the best available data for the region. Findings are not appropriate for extreme catastrophic events that may change boundary conditions and exceed the range of normal processes.

Dr Oertel is a coastal marine geologist with 35 years of academic and consulting experience in basic research and management of coastal systems. Specialties are hydrodynamic and morphodynamic investigations of barrier islands, coastal waterways and tidal inlets. He has developed and patented innovative techniques for stabilizing beaches and waterways and has assisted in designing permitting, maintaining and managing coastal communities from Virginia to Florida.

Education

Bachelor of Science 1966 Geology
The Ohio State University

Bachelor of Science 1968 Geology
University of Iowa

Doctor of Philosophy 1971, Geology
University of Iowa

Academic Experience

Research Scientist Skidaway Institute of Oceanography Savannah Georgia

Professor of Oceanography Old Dominion University Norfolk VA

Director of ODU Barrier Island Program

Associate Director of ODU Spatial Analysis of Coastal Environments Program

Has published over 75 professional papers and over 100 technical reports and abstracts

Applied Experience

Coastal Consultant George F. Oertel Consultants 1973-1996

Coastal Consultant and President

Hollow-core Reef Enterprises Inc 1996-2008

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Consulting Project Experience

State of Georgia Provide input and advice to the Department of Natural Resources for a publication on the value and vulnerability of coastal dunes. Provide scientific advice for establishing a shore protection ordinance and a shore setback line.

City of Tybee Island, GA Provide historic rates of shoreline stability and locate primary dune ridges needed for establishing a shore setback line. Write local dune protection ordinance for City of Tybee Island.

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Sea Island Erosion Study, Sea Island, GA Worked with W G Foster of Thomas and Hutton Engineering to analyze the physical conditions causing erosion along the Sea Island shoreline Included a monitoring plan for the semi-annual accounting of beach volumes and shoreline positions

Sea Island Beach Management Plan, Sea Island, GA Project manager responsible for design and implement a comprehensive beach management plan for Sea Island Included a monitoring plan for the semi-annual accounting of beach volumes and shoreline positions

Sea Island Beach Nourishment, Sea Island, GA Worked with W G Foster of Thomas and Hutton Engineering Company to determine feasibility design permitting and implementation of an island wide beach nourishment plan for Sea Island beach Final design involved innovations including modular T-head groins and a Hollow-core breakwater

Sea Island Beach Recycling, Sea Island, GA Worked with W G Foster of Thomas and Hutton Engineering Company to determine feasibility design permitting and implementation of a plan to collect and recycle beach sand in eroding areas Recycling is based on monitoring of sand volumes and shorelines

Sea Island Beach Monitoring, Sea Island, GA Project manager responsible for accounting of beach sand on Sea Island beaches and for monitoring rates of shoreline migration Consultant provides comprehensive reports with advice two to three times per year

Study of Tybee Inlet Dynamics, US Army Corp of Engineers, Consultant providing assistance to US Army Corps of Engineers Designed Lagrangian study and analyzed data for determining mechanics of flow through the inlet and ebb delta system Report was used in determining the feasibility of using ebb delta sand for beach nourishment

Wild Dunes Beach Monitoring Isle of Palms, SC, Project consultant responsible designing a sand accounting plan for Wild Dunes Developers and monitoring the sediment budget to determine patterns of beach erosion and stability Provided annual reports with advice on beach condition

Siltation Study for the Landings Marina on Skidaway Island, GA Consultant providing assistance to Thomas and Hutton Engineering Company Project consultant responsible for evaluating output from siltation model and flow studies Results used to design a plan to inhibit silt collection in marina

Delegal Creek Marine Study, Landings Association, GA Project consultant responsible for morphodynamic analysis and ADCP-flow of shoaling sections of Delegal Creek access to Delegal Creek Marina Advice was used to make decisions about proposed marina expansion viability and future maintenance requirements for marina entrance

Cabin Bluff Land Management, Inc , GA Project consultant subcontractor to Cabin Bluff Land Management Inc Developed the shore management section of the comprehensive island management plan Plan has been adopted by the Jekyll Island Authority and has been used as a guideline for revitalization of Jekyll beaches

Jekyll Island Authority Project RFP Review, GA Advising consultant reviewed a draft request for proposals (RFP) for a beach restoration project for the north end of Jekyll Island Made comprehensive re-organization with recommendations that were incorporated into a revised on RFP

Seabrook Island Property Owners Association Review, SC Project consultant worked with Dr Basco of Beach Consultants Inc to conduct analysis review data and make recommendations regarding beach erosion and potential breaching of beach ridges adjacent to Captain Sam's Inlet

Kiawah Development Partners Advice, SC Project consultant worked with Dr Basco of Beach Consultants Inc to conduct field observations and make model analyses of hydraulics and morphodynamics impacting riverbank erosion in the Kiawah River Analyses lead to advice for incorporation into a bank stabilization plan

Linger Longer Communities, Land Planning, GA Project consultant providing beach stability advice for designing a Beach Village master plan for Jekyll Island revitalization Evaluations involved historical morphodynamics wave energy dynamics shoreline stability and impacts of sea level rise

SUMMARY CURRICULUM VITAE

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EDUCATION B S Civil Engineering, University of Wisconsin, 1960
M S Civil Engineering University of Wisconsin 1962
Ph D Civil Engineering Lehigh University 1970
Dip H E (Delft), International Institute for Hydraulic Engineering,
The Netherlands, 1976

TEACHING EXPERIENCE Instructor Lehigh University 1965 67
Assistant Professor of Civil Engineering, Texas A&M Univ 1969 73
Associate Professor of Civil Engineering, Texas A&M Univ 1973 83
Professor of Civil Engineering Texas A&M Univ , 1983 86
Professor of Civil Engineering Old Dominion University 1986 Present
Adjunct Professor of Oceanography, Old Dominion University, 1987 Present

PROFESSIONAL EXPERIENCE Engineer U S Bureau of Reclamation Denver, Co 1960 61
Engineer, Allis Chalmers Mfg Co , Milwaukee, WI, 1962 65
Consulting Engineer, E2O Consultants, Inc , College Station TX, 1971 86
Consulting Engineer Private Practice Norfolk VA 1986 1995
President, Beach Consultants, Inc , Norfolk, VA 1995 Present
Professional Engineer Mississippi Texas Virginia

RESEARCH EXPERIENCE Research Assistant, Univ Of Wisconsin, Madison, WI, 1961 62
Research Associate Lehigh Univ , Bethlehem, PA, 1965 68
Research Engineer, USAE Waterways Experiment Station Vicksburg MS
1967 69 -
Assistant Director Center for Dredging Studies, Texas A&M Univ College
Station TX 1969 73
Research Engineer Texas Engineering Experiment Station, Texas A&M Univ ,
College Station, TX 1969 1986

NSF Faculty Fellow Fluid Mech Institute Colorado State Univ Fort Collins CO, June Aug 1972
Visiting Research Professor Delft Technical Univ Delft, The Netherlands Aug Nov 1975
NSF Faculty Fellow, International Institute Hydraulic Engineering, Delft, The Netherlands, 1975 76
Research Hydrologist U S Geological Survey, Reston, VA, 1979 – 1986 (WAE status)
Visiting Research Professor, Technical Univ of Denmark Lyngby and Danish Hydraulic Institute Computational Hydraulics Center Horsholm, Jan Aug 1982 (Sabbatical Leave)
Director Coastal Engineering Institute, Old Dominion University Norfolk, Virginia, 1986 1992
Director Coastal Engineering Centre ODU, Norfolk, VA, 1995 – Present

PROFESSIONAL INTERESTS

Coastal engineering as practiced by civil engineers Coastal hydrodynamics, sediment transport, and water wave mechanics the physical and numerical modeling of wave breaking phenomena The stochastic design of coastal structures Factual understanding of how seawalls and beaches interact Alternatives for increasing the effective fill life of re nourished beaches Dredging engineering and siltation of harbors and marinas Computational fluid dynamics the numerical simulation of free surface long and short wave phenomena in rivers, estuaries and in near shore coastal regions

CURRENT PROJECTS

Process based models of barrier island breaching Development of a Coastal Storm Impulse scale (COSI) for the combined effects of storm surge waves, and storm duration The Relative Trough Froude Number (RTFN) to quantify wave breaking initiation, duration and termination in phase-resolving numerical models The numerical modeling of three dimensional water flows around large submerged objects in tidal estuaries The development of ADCP technology to distinguish breaking and broken water waves in an irregular wave train

BOOKS AND BOOK CHAPTERS (5 as of March 2008)

My Story May Be Different, ' chapter in Water Education for a Changing World, Messages from Alumni in the Field Jubilee Symposium UNESCO IHE Delft, the Netherlands June 2007 pp 239-244

State of the Region s Beaches Hampton Roads Virginia Chapter in Annual State of the Region Report, the Regional Studies Institute Old Dominion University September 2006 with Christopher Colburn

Shore Protection Projects Chapter 3 Part V The Coastal Engineering Manual US Army Corps of Engineers Washington D C 2002 115p (<http://chl.wes.army.mil/cem030.html>)

Example Problems for Design of Coastal Structures, Chapter 7, Part VI, The Coastal Engineering Manual US Army, Corps of Engineers Washington D C 2002 (<http://chl.wes.army.mil/ccm030.html>)

Computational Fluid Dynamics An Introduction for Engineers, Addison Wesley Longman United Kingdom with Michael B Abbott 1989 4th printing 1997

JOURNAL PUBLICATIONS AND CONFERENCE PROCEEDINGS (69 as of March 2008)
(None listed herein)

TECHNICAL REPORTS (104 as of March 2008)
(Recent Since 2000)

Calibration of a One Dimensional Numerical, Tidal Hydraulics Model of the Mattaponi River – Influence of Upstream Inflow Hydrographs” Appendix for Malcolm Pirnie Inc Newport News VA March, 2008

Water Wave Conditions for Breakwater Design, Cape Charles, Virginia for Langley and McDonald Inc , Virginia Beach, VA October 2007

“Kiawah Spit Study Preliminary Assessment of Processes Affecting Spit Stability with Alternatives for Stabilization Interim Report for Kiawah Development Partners Charleston, SC August 2007 with George Oertel

‘ Optimum Orientation of the Water Intake System at Scotland Landing Mattaponi River, for the King William Reservoir Report One Calibration of a One Dimensional Numerical Tidal Hydraulics Model of the York, Pamunkey, and Mattaponi Rivers in Virginia ’ for Malcolm Pirnie Inc and the City of Newport News VA May 2007

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Bay Creek Pier Design Criteria for Water Levels and Wave Characteristics for Langley and McDonald Inc Virginia Beach VA, November 2005

FHWA Guidelines Coastal Bridges and Design Storm Frequency (Krolak 2005) comments for Virginia Department of Transportation (VDOT) Richmond VA October 2005

“The Natural Variability of Beaches Ocean Outfall Design at 42nd Street Virginia Beach VA for Archer Western Contractors Ltd Chicago IL July 2004

Chesapeake Bay Shoreline Study City of Norfolk Virginia for Moffatt and Nichol Engineers Raleigh NC January 2004

Assessment of Sedimentation Processes City Marina Alexandria Virginia for Post Buckley Schuch & Jernigan Inc Newport News VA November 2003

Chesapeake Bay Shoreline Study City of Virginia Beach for Williams Mullen and City of Virginia Beach VA August 2003

Study for Repairs to Breakwater, Lajes Field Azores Portugal’ for TranSystems Inc , Norfolk and Virginia Beach VA August 2003

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Baer Family Versus DNR State of Wisconsin, Deposition Exhibits, for Brennam Steel Basting & MacDougall S C Jamesville WI May 2003

Applications to Existing Conditions and Beach Profile Design ' FIMP Project, Phase III for Moffatt and Nichol NY, with Gary Vangsantitrakul, April 2003

Breakwater Repairs and Wave Study Lajes Field, Azores, Section I — Wave Climate and Statistics ' Final Report for TranSystems Inc Norfolk, VA October 2002

HRSD Atlantic Outfall Diffuser Study (Cause and Potential Deepening of Exposed Pipe) Final Report for Collins Engineers, Inc Newport News VA September 2002

Floating Breakwater Model Studies of Wave Transmission Coefficients Final Report for Elemental Innovation Inc West Caldwell, NJ August 2002

Patterns and Causes for Channel Shoaling at Seven Federally Maintained Navigation Inlets for Coastal Inlets Research Program U S Army Corps of Engineers Vicksburg MS June 2002

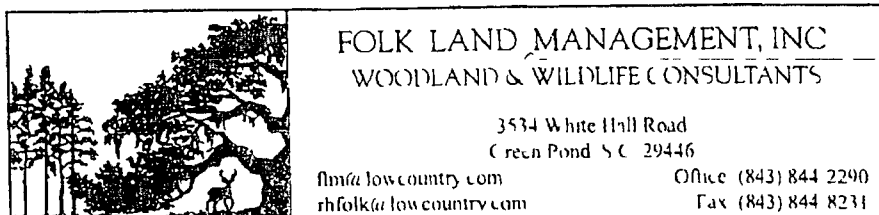
"Cavalier Beach Club Shoreline Study Phase I—Shoreline Movements' for Williams Mullen Clark & Dobbins Virginia Beach VA June 2002

Determination of Design Negligence New Waterfront Shops Pier and Breakwater, U S Coast Guard Station Sabine, Texas, for U S Coast Guard Facilities Design & Construction Center Atlantic Norfolk VA May 2001

' Estimate of Beach Profile Variability and Suggested Base Elevation for Ocean Outfall at 42nd St Virginia Beach VA, Final Report for Collins Engineers, Inc Newport News VA May 2000

Beach Monitoring Results and Management Plan FCTCLANT Dam Neck Virginia Beach VA Final Report for Department of the Navy NAVFAC and Glenn and Sadler Norfolk, VA, April 2000

A full copy of my CV is available upon request basco@cee.odu.edu



June 23, 2008

Mr Ray Pantlik
Kiawah Development Partners Inc
7 Beachwalker Drive
Kiawah Island SC 29455

Dear Ray,

I have reviewed permit number OCRM 08 117-E for a proposed 2 783 bulkhead and concrete revetment at Captain Sam's Spit. You requested my opinion concerning the impacts this activity may have on piping plover habitat. I have reviewed the scientific literature and the construction plans and have several comments concerning the potential impact this may have on plover habitat. In order to be as explicit as possible, I will use references to other sources, and the complete reference is at the end of this letter. If you would like copies of these sources, I would be happy to provide them.

First, piping plovers utilize Captain Sam's Spit and the greater Deveau's Bank area as wintering grounds. Sanders et al (2006) indicate Kiawah Seabrook and Deveau's Bank are among the most important wintering areas in South Carolina. While in the area, plovers utilize broad, flat areas with sandy or mud substrates (i.e., beaches and mudflats). Nicholls and Baldassarre (1990) reported that utilized beach areas had an average width of 227.4 feet (± 23.0 feet Standard Error) and average slope of 0.6% ($\pm 0.2\%$ Standard Error $0.31^\circ \pm 11^\circ \text{SE}$). Given these criteria from the scientific literature, I contacted Rick Karkowski with Thomas & Hutton to obtain slope estimates of the area covered by the proposed bulkhead and revetment. Mr. Karkowski indicated the minimum slope in this area is 9%, thus the minimum slope of the area covered by the proposed bulkhead/revetment exceeds estimates describing regularly used habitats in Nicholls and Baldassarre (1990). Furthermore, the area of the proposed bulkhead/revetment is much narrower than the 227 feet reported in Nicholls and Baldassarre (1990). However, high quality habitat does exist approximately 3300 feet to the south of the proposed bulkhead activity. This area, the lower flat of Captain Sam's, presents high quality habitat due to its relative flatness, wide sand flats, and adjacency to the Kiawah River inlet. Numerous site specific studies (e.g., Dodd et al 1999, Sanders et al 2006) and general habitat studies (e.g., Nicholls and Baldassarre 1990, Noel 2006) have validated this as high quality habitat. Numerous outreach opportunities exist to educate beach-goers of the

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ecological significance of piping plovers and the unique natural history of habitats preferred by piping plovers

One additional comment concerns post-construction conditions immediately behind the proposed bulkhead. The natural condition for this area consists of relatively low plant density and the majority of the area in open sand. This vegetative architecture is critical to many of the species that exist in the area of proposed activities. I recommend that post construction activities should restore as much area as possible to pre-construction conditions.

In my assessment the bulkhead would not constitute conversion of high quality piping plover habitat, however, future considerations about the post-construction, vegetative conditions behind the bulkhead should be evaluated.

Regards,

Travis H. Folk, Ph.D.

REFERENCED LITERATURE

- Dodd, S. L., M. D. Spinks, and P. M. Wilkinson. 1999. Abundance and distribution of wintering piping plovers on the coast of South Carolina: findings from the 1997, 1998, and 1999 mid-winter censuses. *The Chat* 63: 155-166.
- Nicholls, J. L. and G. A. Baldassarre. 1990. Habitat associations of piping plovers wintering in the United States. *Wilson Bulletin* 102: 581-590.
- Noel, B. L. 2006. The winter ecology of the piping plover (*Charadrius melodus*) in coastal Georgia. M.S. thesis. Georgia State University, Statesboro, Ga.
- Sanders, F. S., Dodd, T., Murphy, and M. Spinks. 2006. Distribution and abundance of wintering piping plovers in South Carolina. *Proceedings of the Symposium on the Wintering Ecology and Conservation of Piping Plovers*. U.S. Fish and Wildlife Service, Raleigh, N.C.

Sand Accumulation on Kiawah Spit



by

George Oertel, Ph D
Hollow-Core Reef Enterprises, Inc
Newport News, VA

for

Kiawah Development Partners, Inc
Charleston, SC

August 2008

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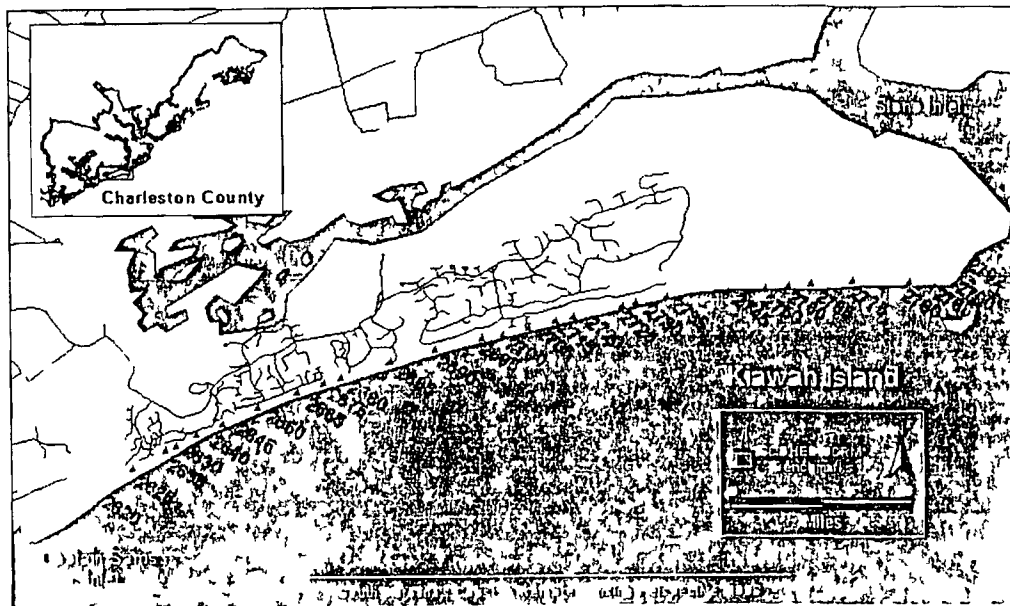
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Executive Summary

REQUEST This executive summary on *Kiawah Spit Sand Accretion* was prepared for use by Leonard Long (KDP) at the request of Trenholm Walker on August 21, 2008

Kiawah Spit is located at the western end of Kiawah Island. The pattern of sand accumulation or loss on the spit is governed the to sediment budget of the entire ocean shoreline of Kiawah Island. In 2007, profile data collected for SC OCRM were obtained from <http://gis.coastal.edu/> for the purpose of analyzing the island sediment budget. Profile data are filed in a section of the web site called PMAS (Profile Management and Analysis System) files. The web site also has historic shoreline data of Kiawah Island that was used to develop an understanding of Kiawah coastal evolution. Profiles are generated from monuments established along the Kiawah shoreline. Periodically profiles are surveyed from each of these monuments to evaluate the condition of the beach. Kiawah Monuments are numbers 2792 at the northern region to 2720 at Kiawah Spit.

Figure 1



Hollow core Reef Enterprises, Inc. used profile data collected in 1998 and 2007 to do a study of the sediment budget and shoreline dynamics of Kiawah Island beaches.

Monuments 2615, 2620 and 2625 are monuments located on Kiawah Spit. However only 2625 and 2630 were surveyed during both the 1998 and 2007 data collection events. It would be prudent for KPD to establish monuments all of the way to Captain Sam's Inlet and monitor them annually.

Island-wide Sand Accounting

Sand accounting on Kiawah beach was divided into five shore adjacent reaches (NISB, GCB, TPB, WB and KS) illustrated in Figure 2. Only the river-bend area of KS was surveyed. The net change in each zone was determined by difference between the 1998 beach volume and the 2007 beach volume. The net change was then annualized to get an average annual rate of change. The beach was also divided into four vertically stratified prisms (Dry Beach, Beach above MHW, Beach above MLW and Beach above -3 depth).

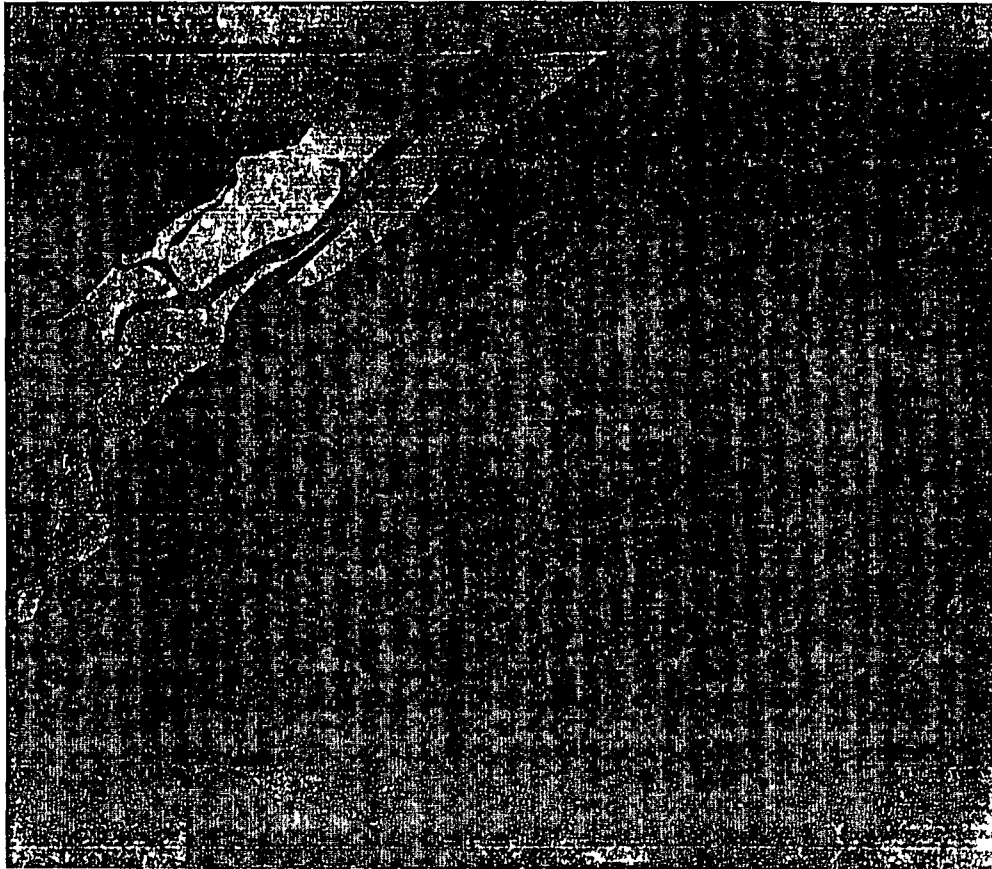
Figure 2



All of the reaches along the Kiawah Island shoreline appear to have a positive sand budget with the exception of the Golf Course Beaches (GCB) — There was insufficient data in the northern most reach to determine rates of sand volume change. While the Kiawah Spit River bend area (KS-RBA) showed a relatively modest sand accumulation rate (7,850 cubic yards per year), it was actually equivalent to the other regions because it covered a relatively short stretch of shoreline. For the entire length of Kiawah Spit (KS) the rate is estimated to be about 21,000 cubic yards per year.

Island-wide Shoreline Dynamics

Figure 3



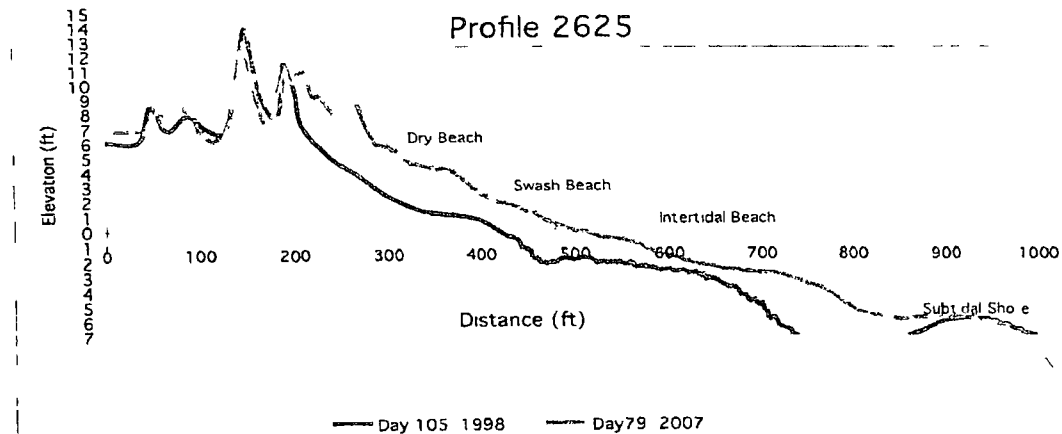
Shoreline shifts at each of the reaches and each of the vertical layers were also determined and annualized. Since shorelines occur at several vertical horizons (Dry wet line, MHW line, MHW line, etc) we have we have determined the shift rates at each

horizon By averaging the shift rates of the dry-beach shoreline and the MLW shoreline one can get a reasonable rate of average shoreline shift For example, Golf Course Beaches (GCB) had an average shift rate of 0.25 ft/yr indicating the area was generally stable Turtle Point Beaches (TPB) were building seaward at an average rate of about 4.7 feet per year Western Beaches (WB) were building seaward at 4.0 feet per year Beaches adjacent to the riverbend of Kiawah Spit were building seaward at about 15 feet per year The rates for each reach and vertical horizon are shown in Table 1 below

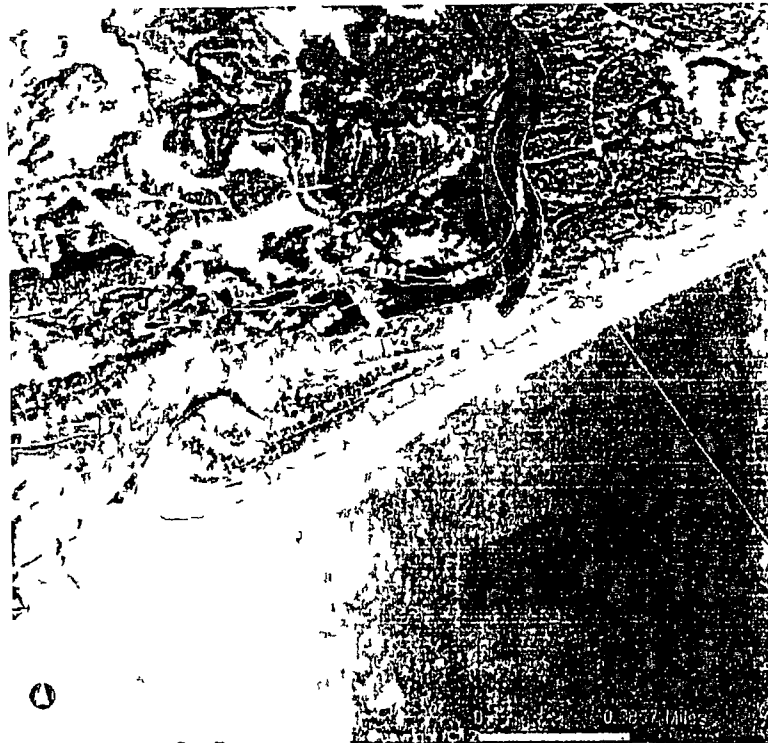
Table 1

1998 to 2007									
Total volume-change by REACH (cubic yds)					Total shoreline shift by REACH (feet)				
Reach	MSE Shore	MHW Shore	MLW Shore	PCD Shore	Reach	MSE Shoreline	MHW Shoreline	MLW Shoreline	PCD Shoreline
KS RBA	7374	25685	70468	9189	KS RBA	150	148	174	24
WB	47	76	17130	11448	WB	27	27	27	51
TPB	111848	1168	305401	23074	TPB	20	16	58	4
GCB	207	11025	1015	18507	GCB	24	27	7	104
Σ =	7528	11249	31151	24380					
Annual volume-change (by reach) (cu yds/yr)					Annual shoreline shift rate by reach (ft/yr)				
KS RBA	7374	25685	70468	9189	KS RBA	17.3	16.5	13.8	30.4
WB	47	76	17130	11448	WB	4.2	3.6	3.7	5.7
TPB	111848	1168	305401	23074	TPB	2.9	2.0	6.5	0.4
GCB	11080	1111	1007	200	GCB	2.7	4.1	2.2	12.1
KS	6143	13023	51	254					
Σ =	5030	0248	6647	57					
Annual volume per foot of shoreline (cu yds/ft/yr)									
KS RBA	1.46	2.15	4.26	5.48					
WB	0.37	0.57	1.46	1.81					
TPB	1.02	1.47	2.79	3.08					
GCB	1.29	1.51	2.33	2.45					

The magnitude of change (1998-2007) in the Kiawah Spit river bend area (KS-RBA) is also illustrated below by comparing the profiles for 1998 and 2007 (see Figure 4 below). Note that the inner part of the beach has built vertically and has actually formed a new dune ridge since 1998. Also, the beach profile is relatively flat, indicating high potential for more accretion and building.

Figure 4**Long-term trend**

A report by Coastal Science and Engineering, Inc (CSE) in 1999 has a figure that illustrates ten historic shorelines in the Kiawah Spit area. The shoreline positions have been used to demonstrate that Kiawah Spit may have been breached by the Kiawah River around 1882, 1922 and 1949. They suggest that the breaching was by 'large storms or hurricanes'. The last event occurred over 60 years ago. The relative stability of the spit since then is probably related to the continuous and rapid growth of the Kiawah Spit—the recurved spit west of Beachwalker Park (CSE 1999). They also state 'An important implication of this is that the Neck of Kiawah Spit near Beachwalker Park has tended to widen with time making it less vulnerable to breaching' (CSE 1999). While there is little doubt of the lateral movements of the shoreline in the CSE figure we believe that there is also a significant offshore migration of the shoreline that is not apparent in the figure. Over the last 60 years the entire shoreline of Kiawah Island has probably built seaward over 0.25 miles. The long-term trend in beach building is verified by historic shoreline positions and coastal landforms (Figure 5). This suggests that earlier spit breaches probably occurred when the shoreline was further to the northwest under different conditions. The 1949 shoreline pattern (CSE 1999) of Kiawah Spit suggests that the last breaching of the spit was a washover event that probably did not form a new inlet.

Figure 5

The positions of earlier shoreline seen in Figure 5 illustrate a longer-term trend for beach accretion since at least 1933. The tidal-channel pattern also illustrates that earlier positions of the Kiawah River were once considerably further inland than they are today. Distances between channels banks were used to estimate a rate of channel migration at the river bend to be about 8.9 feet per year. More recent survey data (2005 and 2008) from the area yielded a comparable rate of about 9 feet per year. Although the ocean shoreline is building seaward faster than the channel is shifting.

Linear hammocks in the area also suggest that the river and ocean shorelines were once considerably further landward than today.

Summary Conclusions

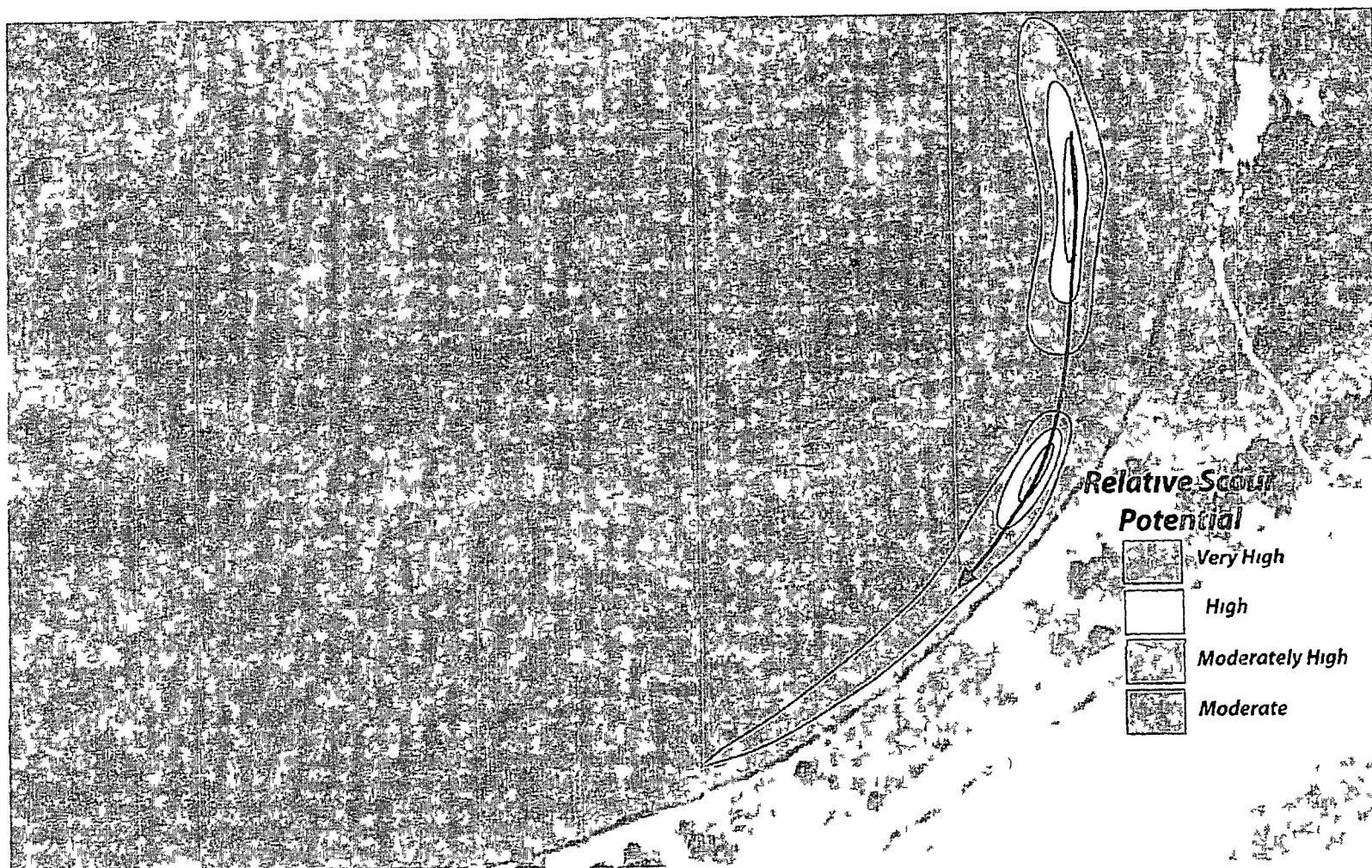
- The long term trend of the Kiawah Island and Captain Sams Spit shoreline has been accretional (probably for several centuries) Recent rates verified since 1998 have been about 15 feet per year The average rate over the past 60 years is likely about 9 feet per year
- The last (1949) overwash breaching (likely due to a storm event) of the neck at Kiawah Spit (over 60 years ago) probably did not form a tidal inlet and healed rapidly following the storm The width of the beach today (as opposed to 60 years ago) is very wide which will inhibit inlet formation following storms
- The growth history of shore and spit growth should continue with the positive sediment budget supplied from the Stono Inlet area

For
KDP Exhibit 26

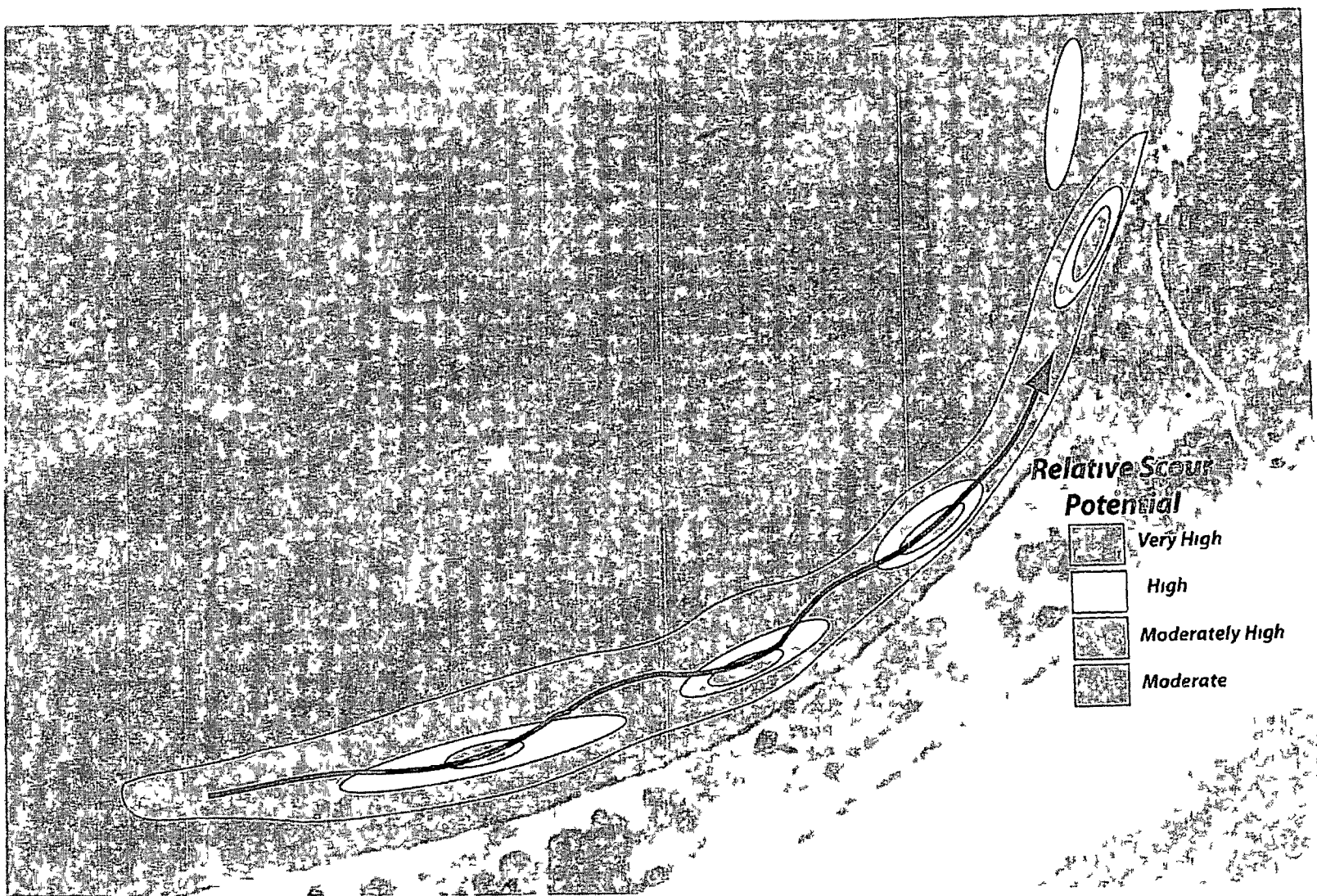
Please see
KDP Exhibit 25,
on page 2171

For
KDP Exhibit 27

Please see
KDP Exhibit 25,
on page 2200



Variability in ebb scour potential



Variability in flood scour potential

THOMAS & HUTTON ENGINEERING CO

935 HOUSTON NORTHCUTT BOULEVARD

POST OFFICE BOX 1522

MOUNT PLEASANT SOUTH CAROLINA 29465 1522

TELEPHONE (843) 849 0200

FAX (843) 849 0203

September 2 2008

Mr Bill Eiser
OCRM
1362 McMillan Ave , 4th Floor
Charleston SC 29405

Re OCRM-08-117-E
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Dear Mr Eiser,

We are assisting Kiawah Development Partners with permit application OCRM-08-117-E. There has been much misinformation circulated about this permit and we offer this correspondence to clarify and correct the issues surrounding this permit application.

I will first address the misconception that the proposed revetment will negatively affect Seabrook Island. At our urging Kiawah Development Partners retained Dr George Oertel and Dr David Basco from Old Dominion University to thoroughly evaluate any impacts from this revetment. I have attached a copy of a letter from Dr Timothy W Kana PhD to the Seabrook Island Property Owners Association (SIPOA) dated August 28 2008. Dr Kana's firm, Coastal Science & Engineering Inc, evaluated the proposed revetment (including information provided by Dr Oertel and Basco) for SIPOA. Dr Kana concluded "I do not believe the proposed structures will modify Captain Sams Inlet, its hydraulics or migration cycles. Based on scientific studies and evidence Dr Kana, Dr Oertel and Dr Basco have all reached the same conclusion that the proposed revetment will not have an adverse impact on Seabrook Island. I have attached the report from Dr Kana and a report from Dr Oertel for your reference.

I will next respond to the incorrect statements contained in the letter to OCRM dated May 22 2008 from Ms Susan Davis of SCDNR. Ms Davis states "This area is located along an undeveloped spit of land currently used as a public park." This statement is only partially true as an important function of part of the proposed revetment is to protect the public Beachwalker Park. However the vast majority of the revetment will be extended along property of Kiawah Development Partners that the Town of Kiawah Island has zoned for development. Ms Davis twice states in her letter that the revetment is "unnecessary." The proposed revetment is necessary to prevent further erosion of the bank along Beachwalker Park and to prevent further erosion of the seaward shoreline of the Kiawah River to protect lands of Kiawah Development Partners. The recommendation to deny the permit application by Ms Davis is not supported by any data and must surely be only based on Ms Davis' personal opinion. Permit decisions must be based on facts and not personal opinions.

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Mr Bill Eiser
September 2, 2008
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In their August 14, 2008 letter to USACOE the US Fish & Wildlife Service states that "it is our opinion that this action is not likely to adversely affect federally protected species and/or designated or proposed critical habitat." This is the primary area of purview for USFWS and this application clearly does not impact threatened or endangered species. USF&WS also chose to raise other issues outside their purview that I will address. Their letter states that "The construction of a 2,783 foot long combination bulkhead and articulated concrete block revetment appears to be an attempt to address north. This is excessive to what is necessary to stabilize the area adjacent to the County Park's parking lot." I am not privileged to the technical data upon which USF&WS bases this statement but I do take exception to their statement. Kiawah Development Partners (KDP) first initiated their review of this area based on a permit application by the Charleston County Park and Recreation Commission (CCPRC) for a bulkhead to protect the parking lot at Beachwalker Park. KDP asked Thomas & Hutton Engineering Co. to evaluate the request and advise them of the potential impact of the proposed bulkhead. Because of the complex current and tidal effects in this area we recommended KDP hire Dr. George Oertel and Dr. David Basco to thoroughly evaluate the impacts of the CCPRC proposal. The length of the revetment was determined by three methods, observation in the field of the characteristics of the outer bank of the river bend and the relative river width, measurement of the flow velocities of the river in the area of the bend and modeling the flows of the Kiawah river in the area of the bend. The results of the three methods are consistent and corroborative.

By observation of the bend's outside bank one can see the different characteristics of effects the water flows have on the essentially homogenous sandy bank materials including, a steep scarp with little if any fine (silt and mud) sediments in the areas of high flow velocity versus significant accumulations of fine sediments in the areas of low flow velocities. The vegetation also varies with velocity with lower velocity reaches having growth of marsh vegetation, predominantly *Spartina Alterniflora* as is typical in South Carolina coastal areas, as opposed to little, if any, vegetation below the scarp and upland vegetation above the scarp. In the area of CCPRC Beachwalker park the bank with a significant scarp and without significant marsh vegetation extends from an area of marsh near the gate to the park downstream to where marsh grasses are growing approximately across from the mouth of a creek entering the Kiawah river on the inside bank of the bend. Observation of the relative river width as it approaches the bend from upstream to where it leaves the area of the bend indicate approximately equal widths with banks on both sides of the river appearing to be relatively stable as indicated by the bank vegetation at these same areas where the marsh vegetation is present on the outside bank upstream and downstream of the bend.

Mr Bill Eiser
September 2 2008
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As a part of this project a field measurement tidal current study of the water velocity was done by Applied Technology and Management. The areas of relatively higher water velocity and therefore relatively greater potential scour approximately extend the same extents as the area of the outside bank with a significant scarp and little if any marsh vegetation as can be seen in the attached two graphics.

The hydrographic surveys and tidal modeling of the river indicate higher average velocities in the constricted area of the bend with the maximum velocity of both flood and ebb tide exceeding the critical velocity for sand scour for approximately 2.5 hours (flood) and 2 hours (ebb) of MLLW - MHW - MLLW tide elevation changes. The average velocities decrease with broadening of the river both upstream and downstream of the constricted area of the bend. As you can clearly see only after extensive study of the area was the currently proposed permit submitted. We insist that USF&WS submit the technical data to support their claims or that OCRM dismiss the claims as unsubstantiated.

USF&WS also claims that this application "does not meet the requirements or the intent of Nationwide Permit 13." Again, USF&WS makes unsubstantiated claims. We concur with the US Army Corps of Engineers that this application does meet the requirements of Nationwide Permit 13 and is the minimum necessary as proven by scientific analysis. USF&WS further makes lengthy comment on the proposed amendment to the Coastal Barrier Resources Act. I have attached a copy of an excerpt from U.S. Representative Henry Brown's latest newsletter in which he states that he is cancelling the bill to modify SC-M08. The cancellation of the proposed bill will remove these objections. There is no basis for any of the USF&WS objections and therefore you must dismiss their opposition to this project.

There have been many statements in news article and letters to the editor stating that the area of the proposed revetment is "unstable." I have attached an excerpt from your own "ANNUAL STATE OF THE BEACHES REPORT 2008" which states "Stations 2615 through 2645 are located at the western end of Kiawah, where land use consists of undeveloped property, a beach park, single family homes and some multi-family structures. This is usually one of the most stable sections of Kiawah Island. For all stations here the primary dune was stable and the beach profile seaward of the dune showed either no change or minor accretion." Clearly your very own data refutes the notion that this area is unstable.

We have attempted to address all outstanding issues associated with this permit request. We believe we have done so with substantial engineering and scientific data. We do not know of any outstanding issues that have not been addressed and therefore look forward to having the permit issued very soon. If there are issues that have not been addressed that would prevent OCRM from issuing the permit we request that OCRM inform us of the issue immediately and we will

Mr Bill Eiser
September 2 2008
Page 4

address the concern promptly Otherwise we expect OCRM to issue the permit very soon so that
Kiawah Development Partners can complete this most urgent project

Sincerely,

THOMAS & HUTTON ENGINEERING CO



J Mitchell Bohannon III, P E
President/CEO/Chairman of the Board

JMB/mbp

Enclosures

cc Ms Carolyn Boltin / OCRM
Ms Barbara Neale / OCRM
Mr Leonard Long / Kiawah Development Partners
Mr Ray Panthik / Kiawah Development Partners
Mr Curtis Joyner / OCRM



COASTAL SCIENCE & ENGINEERING
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*Egi: To. Ray, Mitchell,
George, TW,
David
CPD,
TL
return*

August 28, 2008

Mr John Wells
Seabrook Island Property Owners Association
1202 Landfall Way
Johns Island SC 29455

RE Comment on Plan by Kiawah Development Partners for a Revetment Along Kiawah River
Upstream from Captain Sams Inlet [CSE2282]
Public Notice Dated 16 May 2008 (P/N OCRM 08 117-E)

Dear John

I have obtained a copy of the drawings for the above-referenced permit application by Kiawah Development Partners (KDP) and offer the following comments at your request

KDP is proposing to armor ~2,800 linear feet of shoreline along Kiawah River on Kiawah spit between Beachwalker Park and Captain Sams Inlet. The applicant intends to construct a combination vertical bulkhead and A-B Mat revetment along the curve of shoreline extending from the vicinity of the Beachwalker Park parking lot to a point ~3 000 linear feet upstream of the mouth of Captain Sams Creek. It is unclear from the drawing exactly how far upstream from the Kiawah/Seabrook town line across Kiawah spit the revetment will end. It would be helpful to have a scalable map and set of coordinates which show the revetment/bulkhead in relation to the town line.

The purpose of the revetment is for erosion control along the backside of Kiawah spit. According to Prof D Basco (pers comm July 2008), the neck of the spit has a decadal erosion rate averaging around 8 feet per year (ft/yr). CSE has not seen the analysis or reviewed the historical data, but the rate is probably accurate for the past ten years. I do not think such a rate is representative of the past 50 years (ie, ~400 ft of shoreline retreat). Such a high rate would have jeopardized the spit.

The revetment, as proposed, will stabilize the neck of the spit and reduce the possibility of a breach near Beachwalker Park. The application drawings do not indicate the final crest elevation of the revetment and bulkhead, so it is not possible to determine the extent of visual exposure (reveal) at high tide or low tide. It is probable the crest will be set at least 6 ft above sea level, meaning the low tide vertical relief will be at least 9 ft. This is something that should be specified in the application so that the reviewers can make an informed decision about the structure's visual impact.

As you know, my company (CSE) and my predecessor company, Research Planning Institute Inc, have long championed soft engineering solutions for beach maintenance along Kiawah Island and

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Seabrook Island Dr Miles Hayes was the first to recommend setback lines for Kiawah Island (1974) and to present detailed studies of Kiawah spit. The spit had a long history of breaches at the neck (near Beachwalker Park) and subsequent rebuilding to the southwest. My company used this history to recommend periodic relocation of Captain Sams Inlet so as to maintain the integrity of the spit (northeast of the town lines) and free sand periodically to migrate onto Seabrook's beach. The 1983 and 1996 relocations achieved this goal without exacerbating erosion along Beachwalker Park. In fact, the ocean shoreline has been building seaward at ~4 ft/yr over the past 30 years.

In my opinion, construction of the revetment will not alter the processes that are responsible for the flow of sand along Kiawah's oceanfront or the natural instability of Captain Sams Inlet. Flows in and out of the inlet, including the portion of tide that empties via Kiawah River, will remain the same. (This, in turn, will maintain the same hydraulics and sediment dynamics of Captain Sams Inlet.) The revetment will tend to attract and hold the deepest part of the channel on the Kiawah spit side of the river; its effect on channel migration further downstream will be incremental and minor, diminishing with distance from the structure.

The potential impact on Seabrook docks immediately downstream of the structure are uncertain. Docks closest to the structure on the other side of the channel may experience incremental shoaling years to decades later but will probably not see obvious changes over the first decade or so. This effect, if it occurs, will take years to happen and can be mitigated by extending the docks further into the river (i.e., follow the thalweg of the channel if it meanders toward the spit). Because the effect of the structure diminishes with distance downstream, it becomes difficult to distinguish meandering induced by the presence of the structure from natural meandering that occurs in this type of setting. The cost of a study that can quantify and predict the effect would probably be greater than the cost of extending the dozen or so docks that are closest to the revetment.

In summary, I do not believe the proposed structures will modify Captain Sams Inlet's hydraulics or migration cycles. Nor will the revetment change the littoral budget along Kiawah's beach, on which Seabrook's beach stability depends. The revetment will tend to attract the deepest part of Kiawah River toward the neck of the spit, but this effect will diminish with distance downstream of the structure. The potential impact on Seabrook's docks along Kiawah River is not quantifiable without a major study effort, and even then, the results are likely to show only incremental shoaling. It will remain uncertain how much shoaling is due to the presence of the upstream structure and how much is due to natural meandering processes.

The structure will have visual impacts which are uncertain until the crest elevation is specified. I would prefer that any structure contemplated for the site have a minimal visual impact. There may be



alternatives involving a low profile or even an underwater structure that keep the channel from meandering into the back side of the spit while maintaining a softer visual edge. Given the healthy beach and dune system on the ocean side, the threat of a breach at the neck has greatly diminished in the past 50 years. Therefore, a high crested structure along the river side of the neck is not as critical in this case.

If you receive additional information about the revetment plans, please forward it to me for our files.
Thank you for your consideration.

Yours truly,

Coastal Science & Engineering (CSE)

A handwritten signature in black ink, appearing to read 'Timothy W Kana', with a long horizontal flourish extending to the right.

Timothy W Kana PhD

SEABROOK ISLAND
Property Owners Association
1202 Landfall Way Seabrook Island SC 29455
(843) 768-0061 / fax (843) 768-4317

August 31, 2008

Mr. Bill Eiser, Project Engineer,
SCDHEC Office of Ocean and Coastal Resource Management
1362 McMillan Avenue Suite 400,
Charleston, S C 29405

Re P/N # OCRM - 08- 117 - E

Dear Mr. Eiser

Pursuant to our letter of concern to you dated May 28 2008 we have engaged Coastal Science Engineering to advise us whether property on Seabrook Island and within the Town of Seabrook Island might be adversely affected by the above noted proposed project

Dr. Kana tells us that the revetment may have only minor and incremental effect on the Kiawah River channel, and that any potential shoaling on the Seabrook side is uncertain, and might occur only after years or decades. He further does not believe that any such armoring will modify Cap'n Sam's Inlet, its hydraulics, or migration cycles. He does suggest a visually pleasing project with which we concur.

Based upon these findings we respectfully withdraw our letter of concern mentioned above.

Sincerely yours,

/Samuel L. Reed /
Samuel L. Reed
President SIPOA

KDP 0344

002219

TOWN OF SEABROOK ISLAND

2001 Seabrook Island Road • Seabrook Island SC 29455
Phone (843) 768 9121 • Fax (843) 768 9830

Mayor
Frank W. McNulty
Municipal Judge
Dennis E. O'Neill Esq
Associate Judge
Edward L. Phipps Esq
Council
John B. DuBois
Thomas L. Flynn
William F. Holtz
Robert M. Savin M.D.
Town Administrator
Randy M. Pierce
Clerk
Faye Albritton
Administrative Assistant
Lynda Whitworth

September 2, 2008

Mr. Bill Eiser, Project Manager
SCDHEC Office of Ocean & Coastal Resource Management
1362 McMillan Avenue, Suite 400
Charleston, South Carolina 29405

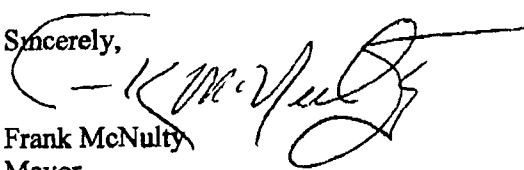
RE P/N #OCRM - 08-117-E

Dear Mr. Eiser

I have been informed by Mr. Sam Reed, President of the Seabrook Island Property Owners Association, that The Association has completed its assessment of the above referenced project and does not object to its approval. The Town of Seabrook Island supports this conclusion.

Thank you for being receptive to our earlier request (letter of 05/30/2008) requesting time to properly evaluate the proposal.

Sincerely,


Frank McNulty
Mayor

CC Sam Reed, Seabrook Island POA
Buddy Darby, Kiawah Development Partners
Leonard Long, Kiawah Development Partners
Seabrook Island Town Council

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SEP 4 2008

DHEC-CORM
CHARLESTON OFFICE

Leonard L. Long, Jr.
EXECUTIVE VICE PRESIDENT

September 3, 2008



P 843 958 8472
F 843 723 2058
C 843 860 6265
E leonard.long@kiawahisland.com

Mr. Bill Eiser
Project Manager
SC DHEC-OCRM
1362 McMillan Avenue, Suite 400
Charleston, SC 29405

RE Permit # OCRM-08-117-E

Dear Mr. Eiser:

By now you likely have received a letter from Ray Pantlik of Kiawah Development Partners enclosing several Reports from Drs. Oertel and Basco, Dr. Travis Folk, and our island's long time engineer Mitchell Bohannon of Thomas & Hutton. I'm also advised that you have received a letter from the POA Director at Seabrook Island withdrawing its letter of concern in light of the findings set out in the Report by Tim Kana's firm (he enclosed) for Seabrook Island concluding that there will be *no* negative impact to Seabrook from the planned revetment. Further, I was notified that you have also received a memo from Charleston County PRC's Executive Director asking that our permit request be granted.

Mr. Eiser, this erosion has been going on for several years and indeed the PRC brought to our attention the urgency of the situation when it prepared engineering plans and began a permit application process to put a revetment in place because of significant concerns it had about its public parking lot being eroded away. We asked the PRC to stop, and KDP took over all expenses of the PRC so that one *comprehensive* solution and one type of engineering approach/plan for a revetment would be installed on the land leased long-term to the County/PRC, as well as KDP's adjoining property that winds around the bend westward along the Kiawah river beside Captain Sam's Spit.

When our study ended nine months ago, we filed the permit application with OCRM, etc. The highland is sloughing off more now, *particularly* with the high tides of recent weeks at an alarming rate with trees, bushes, and dirt falling into the river all along the area where we need to place the revetment. The storms approaching this week could be hugely detrimental.

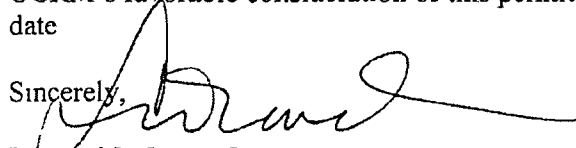
As you know, there have been a number of revetments of various types at Kiawah that have been successful. This current plan is, however, the most innovative and comprehensive revetment we've had designed. Innovative because of the way it allows marsh grass to grow through and partially screen the structural members, while also providing much additional habitat.

In sum, the Town of Kiawah (because of its zoning which is to allow this to be a low-key residential development), the State (because it changed its setback line for Captain Sam's to allow limited development with the beach surveys under the direction, I presume, of OCRM), the Seabrook POA, and Charleston County and Charleston County PRC are *all* in favor of protecting the improvements and the land areas involved here. They serve vital public and private purposes, conserve taxpayer repair expenditures, and protect property against needless destruction.

In addition, much of the land to be protected and saved runs along the Kiawah River when it turns west from the Park. Captain Sam's Spit has about 130 acres per a survey three years ago, likely far more land today as 1.4 miles of beach is accreting at 15' per year for the last 10 years – *a tremendous buildup*. All but about 30 acres will one day be placed under a "no development" conservation easement with Kiawah's Conservancy and then granted, subject to that easement, to the Kiawah Community Association in perpetuity as "greenspace." Those moves as well as the far reaching Master Plan, which we are working on with a number of experts and scientists, will enhance, restore, and enlarge the amount of habitat available for a variety of birds and animals on Captain Sam's.

OCRM's favorable consideration of this permit would be appreciated at the earliest possible date.

Sincerely,



Leonard L. Long Jr.

Cc: C. P. Darby III, Townsend Clarkson, Ray Pantlik, Mitchell Bohannon, G. Tienholm Walker Esq.

From Tom O Rourke <TORourke@CCPRC.com>
To <eiserwc@dhec.sc.gov>
Date 9/5/2008 11:18 AM
Subject Beachwalker Park

Bill

I am writing this email to support KDP's position as it relates to the erosion control situation at Kiawah Island. As you know we have been operating Beachwalker County Park for almost 30 years. It is an essential facility to the citizens of Charleston County. This letter is serving as our official notification that we are strongly in favor of making sure that we do not lose this treasured asset through erosion.

Thank you for your time.

Tom O Rourke

Executive Director

Charleston County Park & Recreation Commission

861 Riverland Drive

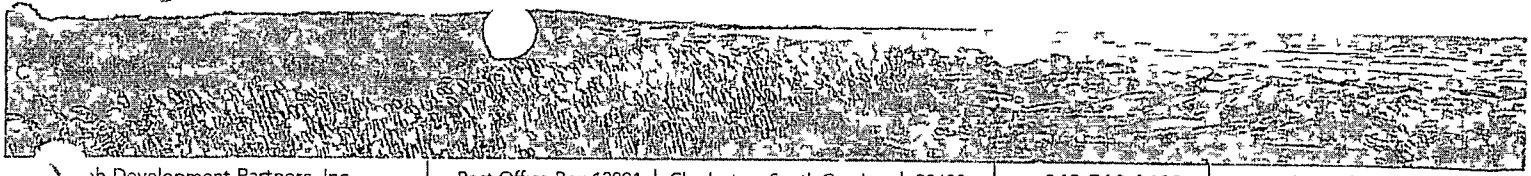
Charleston SC 29412

(843) 762 2172

torourke@ccprc.com <mailto:torourke@ccprc.com>

Where Fun Comes Naturally!

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ah Development Partners Inc

Post Office Box 12001 | Charleston South Carolina | 29422

p 843 768 3400

www.kiawahisland.com



September 8, 2008

Bill Eiset, Project Manager
SC DHEC-OCRM
1362 McMillan Avenue, Suite 400
Charleston, SC 29405

RE Permit No OCRM-08-117 E
Applicant Kiawah Development Partners II, Inc

Dear Bill,

I am writing to address a false or spurious issue that has been raised in the news media without foundation regarding the proposed 'length' of the proposed ACB revetment adjacent to the Charleston County Parks Recreation and Tourism's Beachwalker Park and other lands of the Kiawah Development Partners II, Inc. I am writing to refute the contention raised by the Resource agencies and individuals suggesting that the length of this revetment is *excessive*.

The proposed revetment length was determined by our coastal engineers, Thomas & Hutton, and our coastal geologist to be the length of the *existing* eroded escarpment at the site. The proposed revetment seeks to *only* stop erosion in the location where the high ground meets the river bank. This is keeping with OCRM's standard practice of limiting the length of erosion control structures so that they do not result in the armoring of marshland.

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SEP 9 2008

DHEC-OCRM
CHARLESTON OFFICE

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OCRM FOI 12/12/08

002224

Please let me know if you need any additional information to evaluate this permit. We look forward to the prompt issuance of this much needed permit.

Sincerely,



Ray C. Pantlik, P.E.
Director of Development

CC: Dean Herndon, US Army Corps of Engineers
Leonard L. Long Jr, Kiawah Development Partners, Inc.
Mitchell Bohannon, Thomas & Hutton Engineering Co., Inc.
G. Trenholm Walker



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
CHARLESTON DISTRICT CORPS OF ENGINEERS
69A Hagood Avenue
CHARLESTON SOUTH CAROLINA 29403

RECEIVED

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

SEP 10 2008

Regulatory Division

DHEC-OCRM
CHARLESTON OFFICE

Mr Leonard L Long Jr
Kiawah Development Partners II, Inc
Two North Adgers Wharf
Charleston South Carolina 29401

COPY

Dear Mr Long

This is in response to our letter dated July 14 2008 suspending Department of the Army Nationwide Permit (SAC 2008-0441-2ND) to construct a revetment in the Kiawah River As you will recall this permit was suspended due to concerns raised by the U S Fish and Wildlife Service (USFWS) that the proposed undertaking may impact a threatened species the piping plover

After further review of the piping plover critical habitat boundary as well as the additional information provided by your consultant, Thomas and Hutton Engineering Company the USFWS has reassessed their original opinion and determined that the project is now not likely to adversely affect federally protected species and/or any designated or proposed critical habitat The Corps agrees with this determination and this is to advise you that the referenced nationwide permit is hereby reinstated All of the conditions to which the work was made subject remain in full force and effect

If you have any questions concerning this matter please contact Mr Dean Herndon of my staff at 843-329 8037

Respectfully

J Richard Jordan III
Lieutenant Colonel U S Army
District Engineer

Copy Furnished

U S Fish and Wildlife Service
Attn Mr Timothy N Hall
176 Croghan Spur Road Suite 200
Charleston South Carolina 29407

190
OCRM FOI 12/12/08

002226

Mr Bill Eiser
South Carolina Department of Health
and Environmental Control
Bureau of Ocean and Coastal
Resource Management
1362 McMillan Avenue Suite 400
Charleston South Carolina 29405

Mr Patrick Rogers
Thomas and Hutton Engineering Co
935 Houston Northcutt Blvd
Mt Pleasant South Carolina 29464



September 18, 2008

Mr. Bill Eiser, Project Manager
SC DHEC-OCRM
1362 McMillan Avenue, Suite 400
Charleston, SC 29405

RE Permit No. OCRM-08-117-E
Applicant: Kiawah Development Partners II, Inc.

RECEIVED
SEP 18 2008
DHEC-OCRM
CHARLESTON OFFICE

Dear Bill,

I am writing to supplement my letter of September 2, 2008, in which I went over the specific reasons that the application and proposed project meet the applicable OCRM regulatory guidelines. In my letter, I inadvertently omitted reference to the further considerations in R 30-11(C). Please consider this letter to supplement my earlier letter to explain why the application and project are in compliance with the further guidelines set forth in subpart (C).

C (1) The extent to which long-range, cumulative effects of the project may result within the context of other possible development and the general character of the area

As set forth in my letter of September 2, 2008, and explained in the report of Drs. Oertel and Basco enclosed therein, there will be no long-range cumulative adverse effects from the revetment. As stated in the conclusion of their report titled "Impact of Proposed Kiawah River Revetment on Adjacent Areas and Habitats" at Page 20, the long-range cumulative effect of the revetment is as follows:

Installation of the revetment along the outside radius of the meander bend will eliminate the erosion of the bank and protect the valuable upland area of Kiawah Island. This will halt channel migration and cause a modest increase in channel depth adjacent to the revetment. However, it will not change the average tidal current velocities in the channel down to Captain Sam's Inlet.

The limited high ground development possible in the future will have no effect on the revetment or alter the water flows and channel dynamics discussed in the report of Drs. Oertel and Basco. The governmental decision whether development should occur on high ground rests within the providence of local government.

In this case the Town of Kiawah Island adopted zoning allowing limited residential development. The immediate and long-term effect of the project is the preservation of the riverbank, thereby perpetuating the general character of the area. The project will not have an adverse effect on the critical area under OCRM's jurisdiction or the high ground beyond its reach.

(C)(2) Where applicable, the extent to which the overall plan and design of a project can be submitted together and evaluated as a whole, rather than submitted piecemeal and in a fragmented fashion which limits comprehensive evaluation

The pending application proposes a single, interconnected structure. The reason that the applicant requested that Charleston County PRC refrain from proceeding on its December 2006 application for a much shorter revetment to protect only its parking lot from erosion, was precisely to accomplish the objective stated in subpart (C)(2). The 270 foot wooden bulkhead proposed by Charleston County PRC (Permit No. OCRM-06-396-B) was a piecemeal solution that would have provided but bandaid protection for the PRC high ground without solving the chronic erosion to either side.

The reason for the extended length of the proposed revetment under consideration by OCRM is to accomplish a complete solution to the eroding riverbank that does not shift the erosion laterally along the bank. The length proposed in the application, which was recommended by Drs. Oertel and Basco, also eliminates any negative impact from the revetment in other areas as well.

(C)(3) The extent and significance of negative impacts on Geographic Areas of Particular Concern (GAPC). The determination of negative impacts will be made by the Department in each case with reference to the priorities of use for the particular GAPC. The priorities of use are found in Chapter IV of the Coastal Management Program

The initial Coastal Zone Management Program did not designate this riverbank as a GAPC. To our knowledge there has been no later designation of this riverbank as a GAPC.

In addition to not having a negative impact on a GAPC, the proposed project will have no negative effect on critical habitat under the purview of United States Fish & Wildlife. USF&W has withdrawn its letter of concern to the extent it was based on the revetment's possible influence on critical habitat. The report of Drs. Oertel and Basco, previously referenced, explains in detail the reasons why the revetment will have no adverse effect on this habitat.

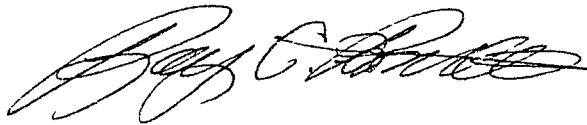
I believe that the conclusions I have stated as to these three additional considerations are all evident from the materials already in OCRM's permitting file. I thought it would be helpful nonetheless, for me to link these materials and findings to these specific guidelines stated in R-30-11(C).

There does not appear to be any credible, legitimate argument that the application is in compliance with the governing regulations. As indicated before, if there is any additional information you need to evaluate this permit application, please let me know.

I couldn't help but notice, in closing, that 17 property owners (of 4,500) at Kiawah have objected on one point or another. Most respectfully, their concerns are not well founded and at variance both with the facts and the governing regulations. Proper public notice was given, and this revetment serves a valid purpose. Our track record for over two decades has been to do things correctly and with only the most careful advice. That's been our approach here.

We would like to thank the staff for its thorough consideration of our application.

Sincerely yours



Ray Pantlik, P E
Director of Development

c Dean Herndon—US Army Corp of Engineers
Leonard L. Long, Jr.—Kiawah Development Partners, Inc.
Mitchell Bohannon—Thomas & Hutton Engineering Co., Inc.
G. Trenholm Walker Esq.

**SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT**

CRITICAL AREA PERMIT & COASTAL ZONE CONSISTENCY CERTIFICATION

Permittee(s)	Kiawah Development Partners II, Inc	SEE SPECIAL CONDITION(S)
Permit Number(s)	OCRM-08-117-E	
Date of Issuance	December 18, 2008	
Expiration Date	December 18, 2013	
Location	On and adjacent to the Kiawah River at Beachwalker Park, Kiawah Island, Charleston County, South Carolina	

This permit is issued under the provisions of S C Code Ann Section 48-39-10, *et seq*, and 23A S C Code Ann Regs 30-1 through 30 18 (Supp 2007) Please carefully read the project description and the special conditions that appear on this permit/certification as they will affect the work that is allowed The general conditions are also a part of this permit/certification and should be read in their entirety The S C Contractor's Licensing Act of 1999, enacted as S C Code Ann Section 40 11-5 through 430, requires that all construction with a total cost of \$5 000 or more be performed by a licensed contractor with a valid contractor's license for marine class construction, except for construction performed by a private landowner for strictly private purposes Your signature on and acceptance of this permit denotes your understanding of the stated law regarding use of licensed contractors **All listed special and general conditions will remain in effect for the life of the project if work commences during the life of the permit This applies to permittee, future property owners, or permit assignees**

DESCRIPTION OF THE PROJECT, AS AUTHORIZED

The permit has been issued with significant modifications from the original request to build a 2 783' erosion control structure Specifically a 270' section of bulkhead and articulated concrete block revetment has been approved for the northeastern end of the project area, along the southwest portion of the parking lot in Beachwalker Park but the remaining 2,513 of the proposed erosion control structure to the southwest of the park is not authorized

With the exception of the parking lot and associated infrastructure for Beachwalker Park there is currently no high-ground development in the general vicinity of the project area The applicant provided general information that indicated up to 50 residential homes on approximately 20 acres is planned and approved by the local government If issued as requested, the permit will prevent the shoreline movement in an area that historically has seen inlet formation and facilitate development in a pristine dune area that is currently undeveloped and adjacent to federally designated critical habitat for the piping plover, a threatened species and as such is designated a Geographic Area of Particular Concern (GAPC) This area is also federally designated as a COBRA unit Regulation 30-11(C) requires that consideration must be given to the extent to which long range cumulative impacts of the project may result within the context of other possible development and the general character of the area the extent to which overall plans and designs of a project can be submitted together and evaluated as a whole, and the extent and significance of negative

/ *df* //
002231

impacts on GAPCs, in this case the piping plover habitat and the Retreat Policy in its broadest sense Regulation 30-11(B) requires that consideration must be given to the extent to which the development could affect the habitats for rare and endangered species Section III(C)(3)(XII)(A) of the Coastal Management Program Document identifies barrier islands and dune areas outside of the critical area as areas of special resource significance that are unique and environmentally fragile, which would apply to this area Consequently, the permit will be issued to authorize a 270' erosion control structure adjacent to Beachwalker Park parking lot and the remainder of the proposed structure will not be authorized The purpose of the proposed activity is for erosion control

SPECIAL CONDITIONS

- 1 Provided that a 270 section of the proposed erosion control structure located along the southwest portion of the parking lot in Beachwalker Park is approved but the remaining 2 513 of the proposed structure is not approved
- 2 Provided that an as-built survey of the erosion control structure must be submitted to the Department within 90 days of the expiration date of the final construction placard The survey must be performed by a registered land surveyor, must show all edges of the structure, and must list the starting and ending coordinates of the structure in the SC State Plane Coordinate System, which can be obtained by survey-grade Global Positioning System equipment
- 3 Provided that in the event that archaeological or paleontological remains are found during the course of work, the applicant should notify the South Carolina Institute of Archaeology and Anthropology (Mr James Spirek at 803-777 8170) pursuant to South Carolina Underwater Antiquities Act of 1991, (Article 5 Chapter 7, Title 54, Code of Laws of South Carolina, 1976) Archaeological remains consist of any materials made or altered by man, which remain from past historic or prehistoric times (ie, older than 50 years) Examples include old pottery fragments metal wood arrowheads stone implements or tools, human burials, historic docks structures, or non-recent vessel remains Paleontological remains consist of old animal remains, original or fossilized such as teeth tusks, bone or entire skeletons

PERMITTEE'S ATTENTION IS DIRECTED TO GENERAL CONDITIONS NUMBERS FOUR (4) AND FIVE (5) BY ACCEPTANCE OF THIS PERMIT, PERMITTEE IS PLACED ON NOTICE THAT THE STATE OF SOUTH CAROLINA, BY ISSUING THIS PERMIT, DOES NOT WAIVE ITS RIGHTS TO REQUIRE PAYMENT OF A REASONABLE FEE FOR USE OF STATE LANDS AT A FUTURE DATE IF SO DIRECTED BY STATUTE

THE PERMITTEE, BY ACCEPTANCE OF THIS PERMIT AGREES TO ABIDE BY THE TERMS AND CONDITIONS CONTAINED HEREIN AND TO PERFORM THE WORK IN STRICT ACCORDANCE WITH THE PLANS AND SPECIFICATIONS ATTACHED HERETO AND MADE A PART HEREOF ANY DEVIATION FROM THESE CONDITIONS, TERMS, PLANS AND SPECIFICATIONS SHALL BE GROUNDS FOR REVOCATION, SUSPENSION OR MODIFICATION OF THIS PERMIT AND THE INSTITUTION OF SUCH LEGAL PROCEEDINGS AS THE DEPARTMENT MAY CONSIDER APPROPRIATE

2 of 11

**SEE SPECIAL
CONDITION(S)**

SEE SPECIAL CONDITION(S)

Permit Number OCRM-08-117-E

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit

(PERMITTEE(S))

Kiawah Development Partners II, Inc

(DATE)

This permit becomes effective when the State official, designated to act for the Office of Ocean and Coastal Resource Management, has signed below

William C. Eiser

12/18/2008

(PROJECT MANAGER, WETLAND SECTION) (DATE)

William C Eiser

Or his Designee

Other Authorized State Official

GENERAL CONDITIONS

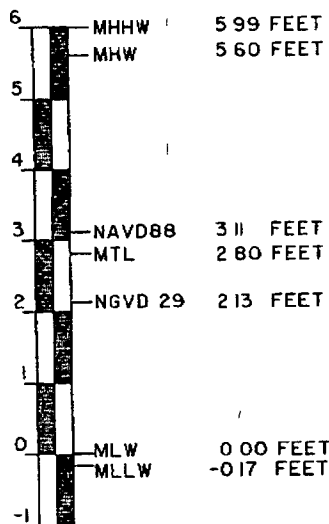
This construction and use permit is expressly contingent upon the following conditions which are binding on the permittee

- 1 That the permittee, in accepting this permit covenants and agrees to comply with and abide by the provisions and conditions herein and assumes all responsibility and liability and agrees to save OCRM and the State of South Carolina its employees or representatives harmless from all claims of damage arising out of operations conducted pursuant to this permit
- 2 That if the activity authorized herein is not constructed or completed within five years of the date of issuance this permit shall automatically expire A request in writing for an extension of time shall be made not less than thirty days prior to the expiration date
- 3 That all authorized work shall be conducted in a manner that minimizes any adverse impact on fish, wildlife and water quality
- 4 That this permit does not relieve the permittee from the requirements of obtaining a permit from the U S Army Corps of Engineers or any other applicable federal agency nor from the necessity of complying with all applicable local laws ordinances, and zoning regulations This permit is granted subject to the rights of the State of South Carolina in the navigable waters and shall be subject, further to all rights held by the State of South Carolina under the public trust doctrine as well as any other right the State may have in the waters and submerged lands of the coast
- 5 That this permit does not convey, expressly or impliedly, any property rights in real estate or material nor any exclusive privileges, nor does it authorize the permittee to alienate, diminish, infringe upon or otherwise restrict the property rights of any other person or the public nor shall this permit be interpreted as appropriating public properties for private use
- 6 That the permittee shall permit OCRM or its authorized agents or representatives to make periodic inspections at any time deemed necessary in order to ensure that the activity being performed is in accordance with the terms and conditions of this permit
- 7 That any abandonment of the permitted activity will require restoration of the area to a satisfactory condition as determined by OCRM
- 8 That this permit may not be transferred to a third party without prior written notice to OCRM either by the transferee s written agreement to comply with all terms and conditions of this permit or by the transferee subscribing to this permit and thereby agreeing to comply
- 9 That if the display of lights and signals on any structure or work authorized herein is not otherwise provided for by law such lights and special signals as may be prescribed by the United States Coast Guard shall be installed and maintained by and at the expense of the permittee
- 10 That the permit construction placard or a copy of the placard shall be posted in a conspicuous place at the project site during the entire period of work
- 11 That the structure or work authorized herein shall be in accordance with the plans and drawing attached hereto, and shall be maintained in good condition Failure to build in accordance with the plans and drawings attached hereto or failure to maintain the structure in good condition shall result in the revocation of this permit
- 12 That the authorization for activities or structures herein constitutes a revocable license OCRM may require the permittee to modify activities or remove structures authorized herein if it is determined by OCRM that such activity or structures violates the public s health safety, or welfare or if any activity is inconsistent with the public trust doctrine Modification or removal under this condition shall be ordered only after reasonable notice stating the reasons therefore and provision to the permittee of the opportunity to respond in writing When the Permittee is notified that OCRM intends to revoke the permit Permittee agrees to immediately stop work pending resolution of the revocation
- 13 That OCRM shall have the right to revoke, suspend, or modify this permit in the event it is determined the permitted structure (1) significantly impacts the public health safety and welfare and/or is violation of Section 48 39-150 (2) adversely impacts public rights, (3) that the information and data which the permittee or any other agencies have provided in connection with the permit application is either false incomplete or inaccurate or (4) that the activity is not in compliance with the drawings submitted by the applicant That the permittee upon receipt of OCRM s written intent to revoke suspend or modify the permit has the right to a hearing Prior to revocation, suspension or modification of this permit OCRM shall provide written notification of intent to revoke to the permittee, and permittee can respond with a written explanation to OCRM (South Carolina Code Section 1 023 370 shall govern the procedure for revocation suspension or modification herein described)
- 14 That any modification suspension or revocation of this permit shall not be the basis of any claim for damages against OCRM or the State of South Carolina or any employee agent or representative of OCRM or the State of South Carolina
- 15 That all activities authorized herein shall if they involve a discharge or deposit into navigable waters or ocean waters, be at all times consistent with all applicable water quality standards effluent limitations and standards of performance, prohibitions and pretreatment standards established pursuant to applicable federal, state and local laws
- 16 That extreme care shall be exercised to prevent any adverse or undesirable effects from this work on the property of others This permit authorizes no invasion of adjacent private property and OCRM assumes no responsibility or liability from any claims of damage arising out of any operations conducted by the permittee pursuant to this permit

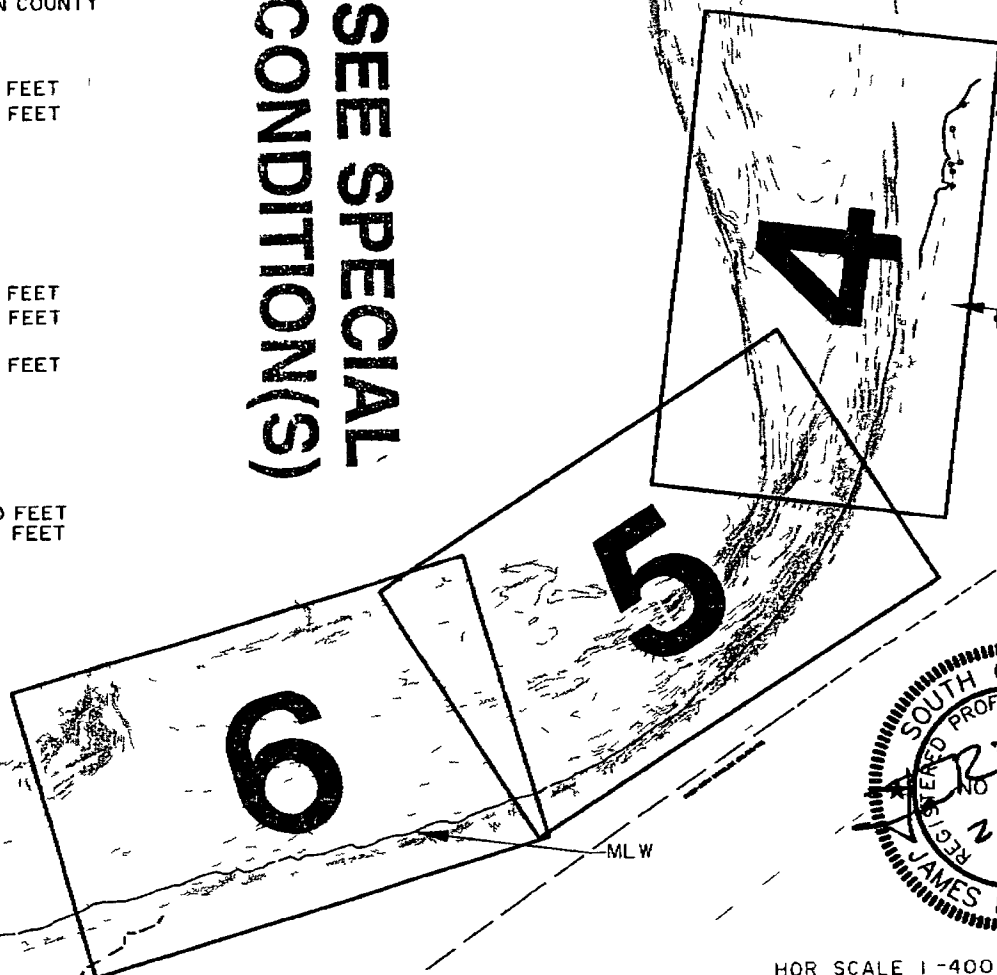
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STATION ID 8667062
KIAWAH BRIDGE CHARLESTON COUNTY
83-00 EPOCH

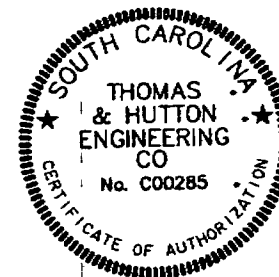
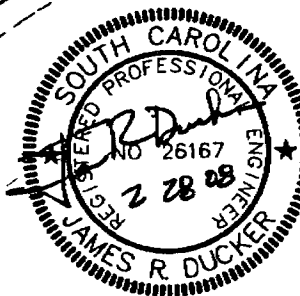


**SEE SPECIAL
CONDITION(S)**



BEACHWALKER PARK

NOTE
FOR PERMITTING ONLY
NOT FOR CONSTRUCTION



APPROXIMATELY 2783 LINEAR FEET
OF RIVER FRONTAGE PROPOSED TO
BE IMPACTED



935 HOUSTON NORTHCUTT
BOULEVARD
MOUNT PLEASANT SC 29464
(843)849-0200
SAVANNAH GA
MYRTLE BEACH SC

**EXISTING SITE
CONDITIONS &
SHEET INDEX**

OCR1-08-117-E

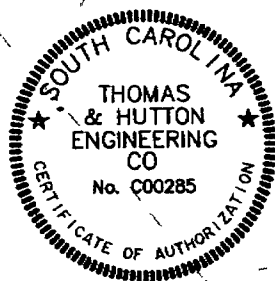
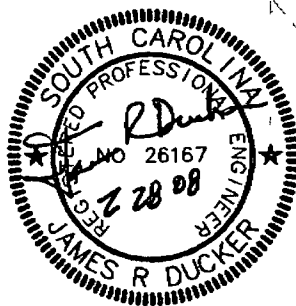
**KIAWAH RIVER BEND
EROSION CONTROL**

PROPOSED ACTIVITY
EROSION CONTROL DEVICE
COUNTY CHARLESTON
APPLICANT KIAWAH DEVELOPMENT PARTNERS II INC

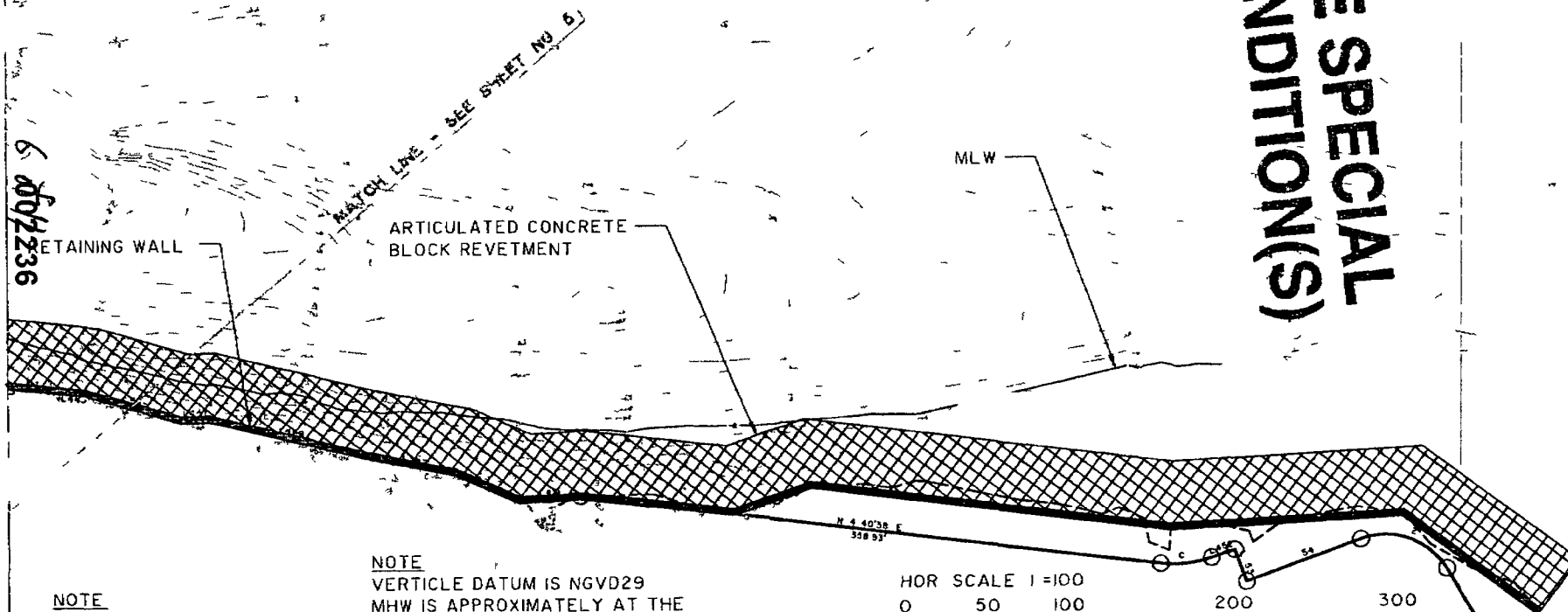
FEBRUARY 14 2008

SCALE 1" = 400'

SHEET 3 OF 7

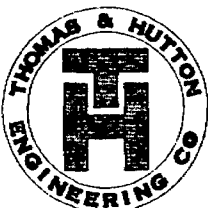


**SEE SPECIAL
CONDITION(S)**



NOTE
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NOT FOR CONSTRUCTION

NOTE
VERTICLE DATUM IS NGVD29
MHW IS APPROXIMATELY AT THE
TOP OF THE REVETMENT



935 HOUSTON NORTHCUTT
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MOUNT PLEASANT SC 29464
(843)849-0200
SAVANNAH GA
MYRTLE BEACH SC

SITE DEVELOPMENT

CRM-08-117-E

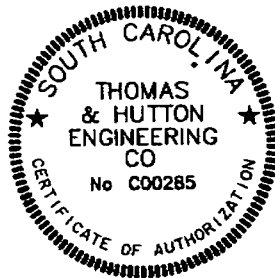
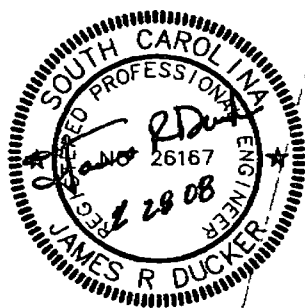
**KIAWAH RIVER BEND
EROSION CONTROL**

PROPOSED ACTIVITY
EROSION CONTROL DEVICE
COUNTY CHARLESTON
APPLICANT KIAWAH DEVELOPMENT
PARTNERS II INC
FEBRUARY 14, 2008

SCALE 1" = 100'
SHEET 4 OF 7

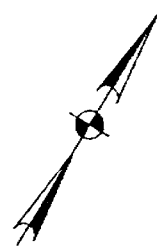
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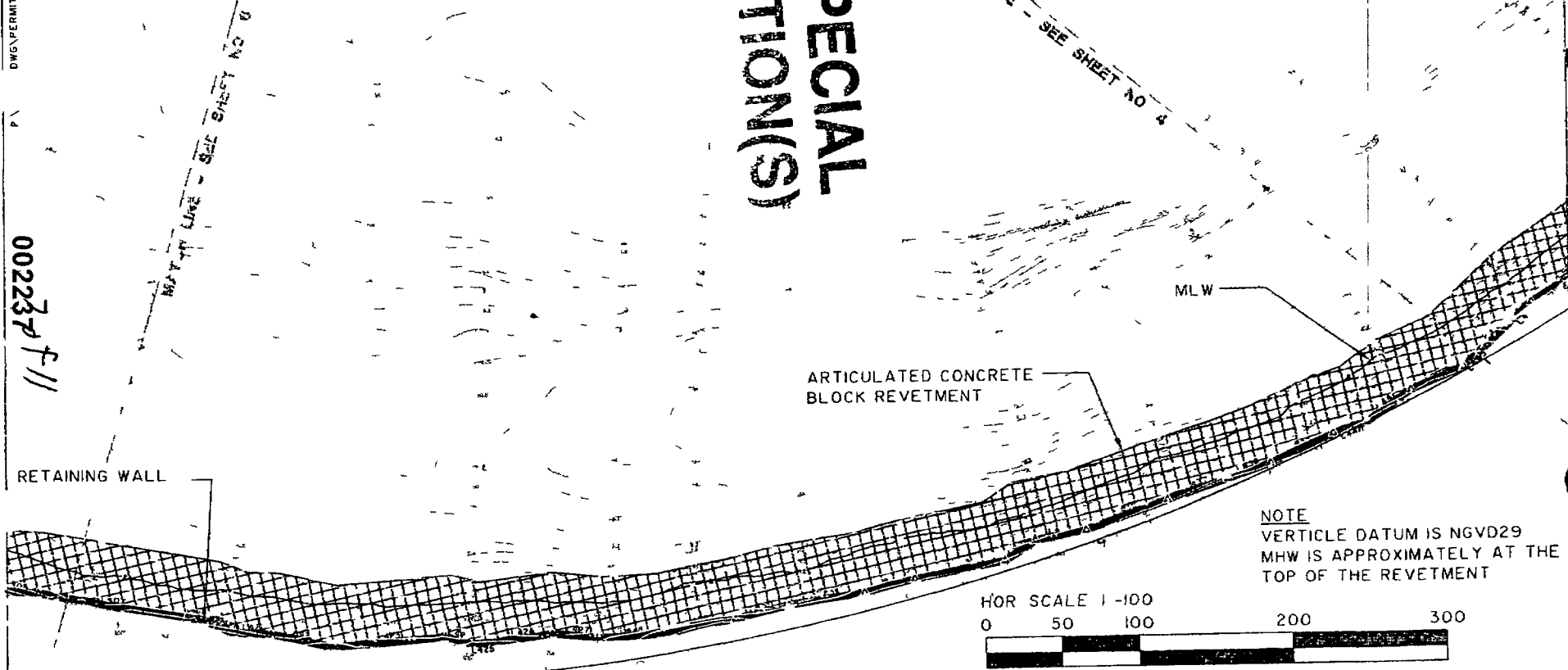


NOTE
FOR PERMIT ONLY
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SEE SPECIAL
CONDITION(S)



MATCH LINE - SEE SHEET NO. 4

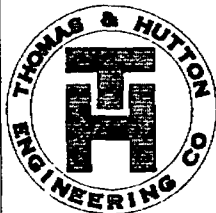


MLW

ARTICULATED CONCRETE
BLOCK REVETMENT

RETAINING WALL

NOTE
VERTICAL DATUM IS NGVD29
MHW IS APPROXIMATELY AT THE
TOP OF THE REVETMENT



935 HOUSTON NORTHCUTT
BOULEVARD
MOUNT PLEASANT SC 29464
(843)849-0200
SAVANNAH GA
MYRTLE BEACH SC

SITE DEVELOPMENT

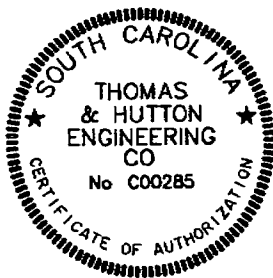
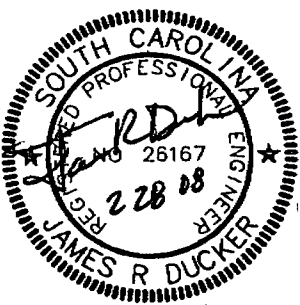
OCRM-08-117-E

KIAWAH RIVER BEND
EROSION CONTROL

PROPOSED ACTIVITY
EROSION CONTROL DEVICE
COUNTY CHARLESTON
APPLICANT KIAWAH DEVELOPMENT PARTNERS II INC
FEBRUARY 14 2008

SCALE 1" = 100'
SHEET 5 OF 7

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SEE SPECIAL
CONDITION(S)

NOTE FOR PERMITTING
ONLY NOT FOR
CONSTRUCTION

NOTE
VERTICLE DATUM IS NGVD29
MHW IS APPROXIMATELY AT THE
TOP OF THE REVETMENT

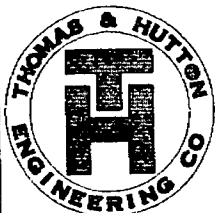
ARTICULATED CONCRETE
BLOCK REVETMENT

M L W

RETAINING WALL

HOR SCALE 1"=100'

0 50 100 200 300



935 HOUSTON NORTHCUTT
BOULEVARD
MOUNT PLEASANT SC 29464
(843)849 0200
SAVANNAH GA
MYRTLE BEACH SC

SITE DEVELOPMENT

OCRM-08-117-E

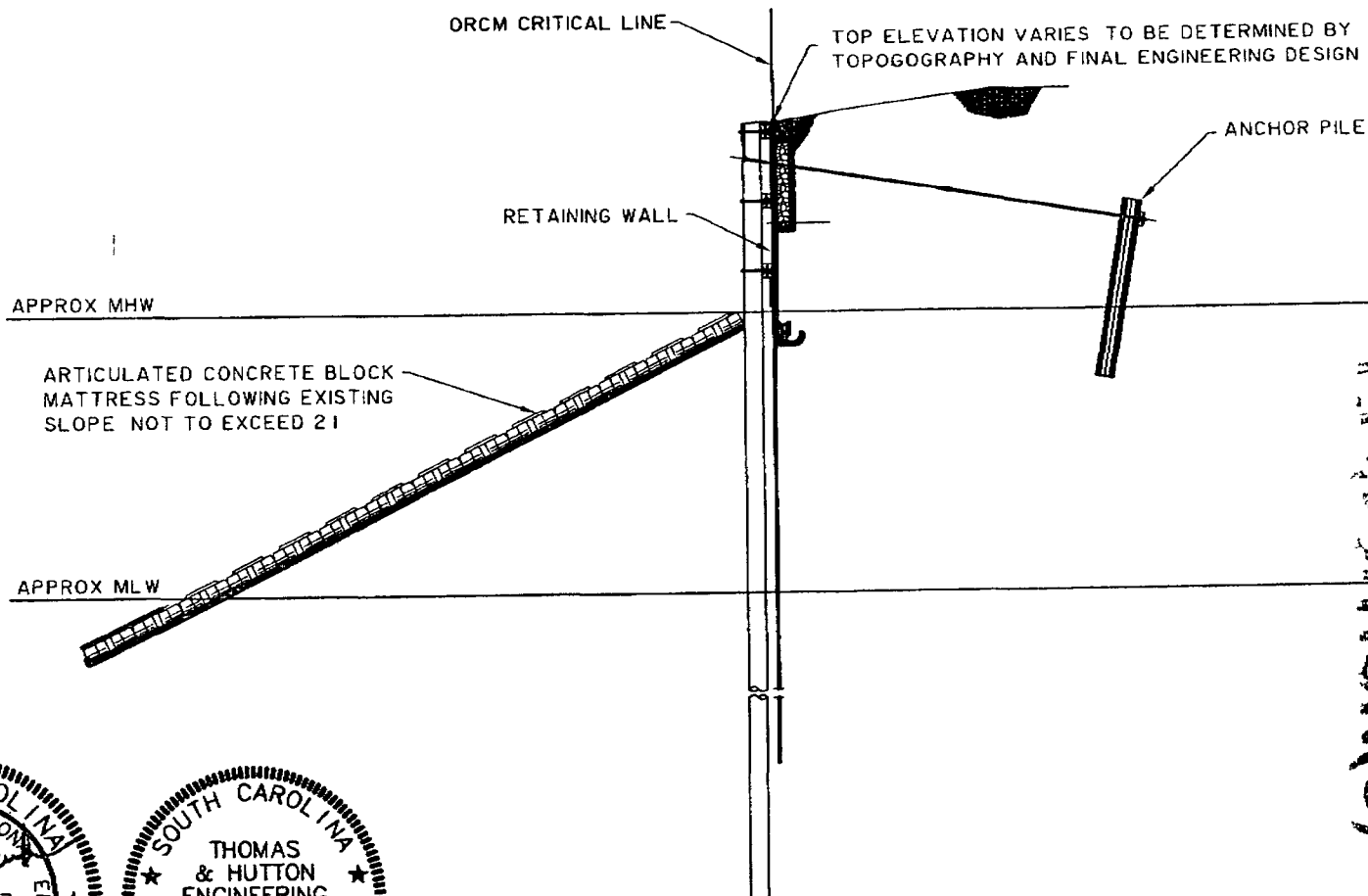
KIAWAH RIVER BEND
EROSION CONTROL

PROPOSED ACTIVITY
EROSION CONTROL DEVICE
COUNTY CHARLESTON
APPLICANT KIAWAH DEVELOPMENT PARTNERS II INC

FEBRUARY 14 2008

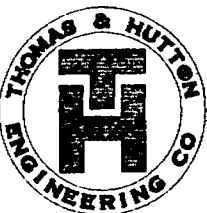
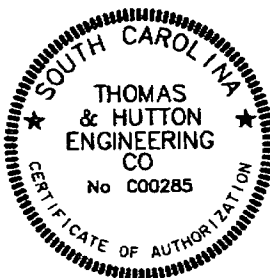
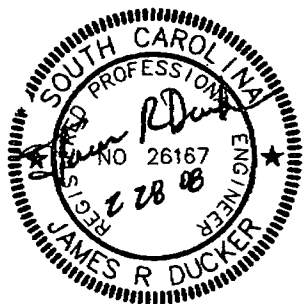
SCALE 1" = 100'

SHEET 6 OF 7



**SEE SPECIAL
CONDITION(S)**

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935 HOUSTON NORTHCUTT
BOULEVARD
MOUNT PLEASANT SC 29464
(843)849-0200
SAVANNAH GA
MYRTLE BEACH SC

SECTION DETAIL

OCRM-08-117-E

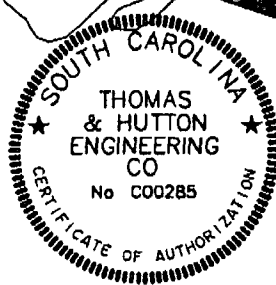
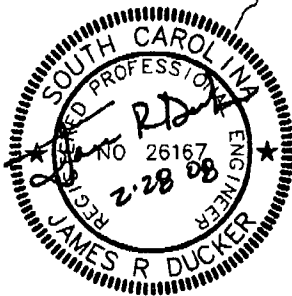
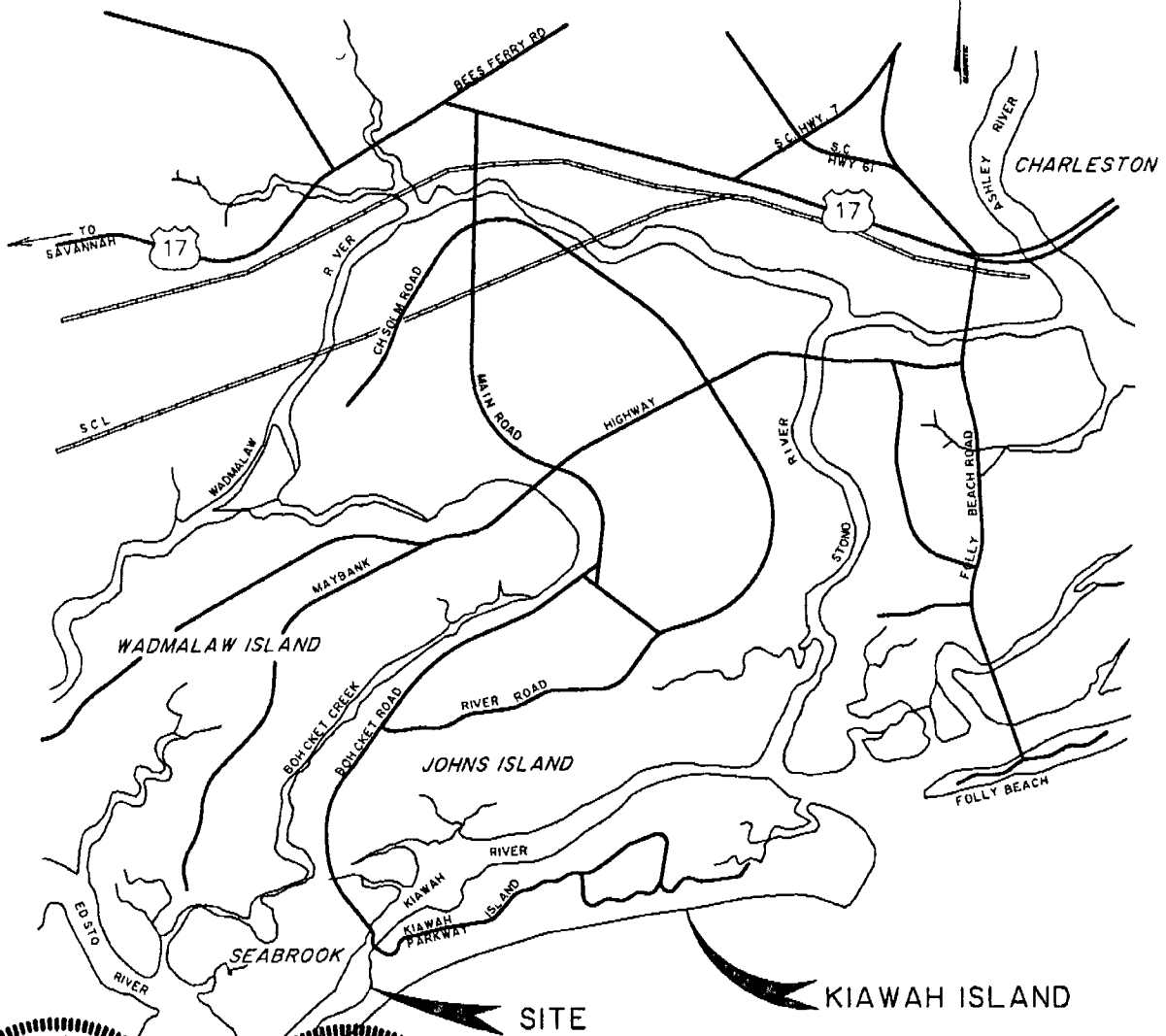
**KIAWAH RIVER BEND
EROSION CONTROL**

PROPOSED ACTIVITY
EROSION CONTROL DEVICE
COUNTY CHARLESTON
APPLICANT KIAWAH DEVELOPMENT PARTNERS II INC

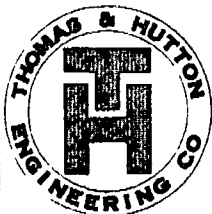
FEBRUARY 14, 2008

NOT TO SCALE
SHEET 7 OF 7

SEE SPECIAL CONDITION(S)



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935 HOUSTON NORTHCUTT
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MYRTLE BEACH SC

10 of 11

VICINITY MAP

OCRM-08-117-E

KIAWAH RIVER BEND
EROSION CONTROL

PROPOSED ACTIVITY
EROSION CONTROL DEVICE
COUNTY CHARLESTON
APPLICANT KIAWAH DEVELOPMENT
PARTNERS II INC
FEBRUARY 14 2008

NOT TO SCALE

SHEET 2 OF 7

KDP's Exhibit 48
is oversized
& has been
filed separately

South Carolina

**Annual State of the Beaches
Report**

2008



**Ocean and Coastal
Resource Management**

KDP 1107

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Kiawah Island

Kiawah Island is a ten-mile long barrier island, located between Seabrook Island and Captain Sams Inlet to the west, and Stono Inlet and Folly Beach to the east. Kiawah is one of the most stable barrier islands in the state, although the eastern and western ends of the island are more dynamic due to their proximity to inlets. Most oceanfront development here is single-family residential, although there are some multi-family residential buildings, commercial structures, a golf course, and a public park. The long-term erosion rate averages a half-ft per year for most of the island.

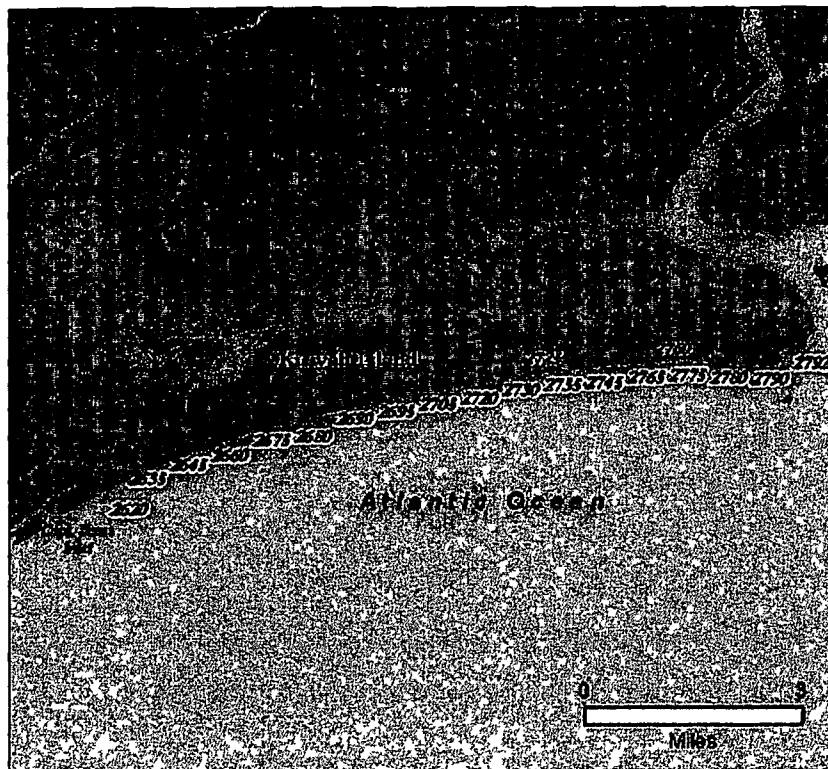


Figure 11 Station numbers for Kiawah Island

Table 7 Beach profile data for Kiawah Island

Benchmark	Profiles Collecte d in 2007	Profiles Collecte d in 2006	First Survey Year	Total Profiles
2775	03/19	None	2001	2
2765	03/19	None	1999	5
2760	03/19	None	1999	5
2755	03/19	None	2001	1
2750	03/19	None	1998	6
2735	03/19	None	1998	5
2730	03/19	None	1998	7
2725	03/19	None	1998	7
2720	03/19	None	1998	7
2715	03/19	None	1998	7
2705	03/19	None	1998	7
2700	03/19	None	1998	6
2695	03/19	None	1998	7
2690	03/19	None	1998	7
2685	03/19	None	1998	7
2680	03/19	None	1998	6
2675	03/19	None	1998	7
2665	03/20	None	1998	5
2660	03/20	None	1998	7
2645	03/20	None	1998	7
2640	03/20	None	1998	7
2635	03/20	None	1998	6
2630	03/20	None	1998	6
2625	03/20	None	1998	6

Eighteen beach monitoring stations on Kiawah Island were most recently surveyed in June 2004, May and June 2005, and March 2007. Stations 2615 through 2645 are located at the western end of Kiawah, where land use consists of undeveloped property, a beach park, single-family homes, and some multi-family structures. This is usually one of the most stable sections of Kiawah Island. For all stations here the primary dune was stable and the beach profile seaward of the dune showed either no change or minor accretion. Some of the 2007 profiles document the formation of a small dune twenty ft seaward of the 2005 shoreline.

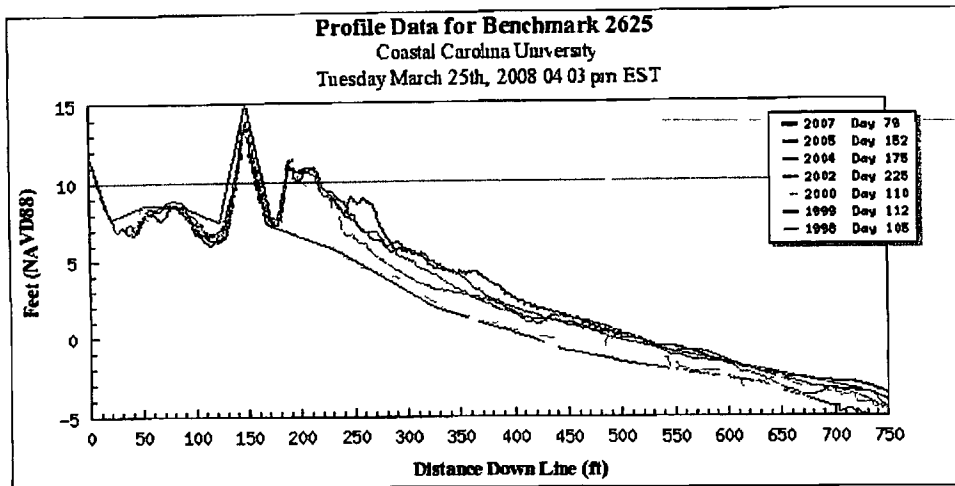
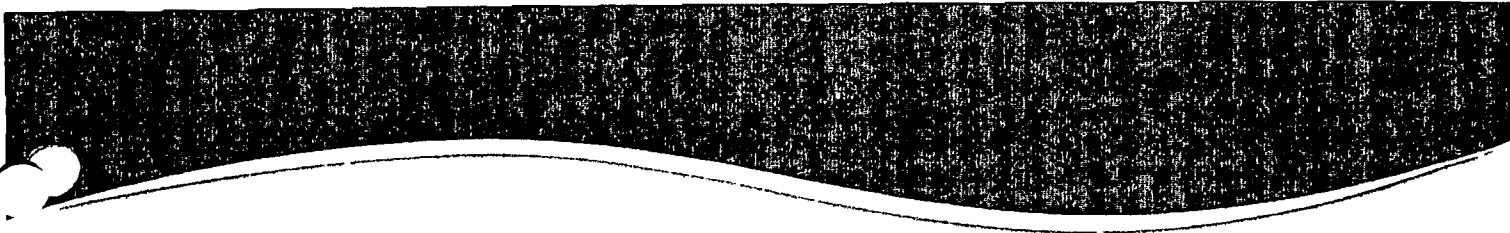


Figure 12 Beach profiles for station 2625 on Kiawah Island

The area from station 2660 near the middle of Eugenia Ave, through station 2680, at the eastern end of Windswept Villas, experienced significant erosion in 1995 and 1996, stabilized from 1997 through 1999, became erosional again in 2000 and 2001, and was accretional between 2002 and 2004. Through March 2007 the dune field was stable but the beach seaward of the dune showed minor erosion. Other stations to the northeast, from 2685 on Turtle Beach Lane to 2735 at the Kiawah Beach Club, also showed a stable dune and minor changes seaward of the dune.

The condition of the beach changes along the Ocean Course golf course from station 2745 to 2780, which historically has been the most unstable section of Kiawah Island. Station 2750 experienced dune scarping and about 50 ft of erosion seaward of the dune from 2004 to 2005, with continued erosion through 2007. Station 2755 exhibited a loss of the 2001 dune, with a substantial longer-term accretion of the beach. Erosion at 2760 near the 18th fairway and 2765 near the Clubhouse continued in the upper beach, but the lower beach built up significantly between +5 and -5 ft. The erosion at stations 2775 and 2780, where emergency sand scraping was repeatedly performed during the fall of 2005, was alleviated with the large volume of sand artificially placed on the beach as shown in the 2007 survey data. The last two Kiawah Island monitoring stations, 2785 and 2790, are located along the Stono Inlet shoreline far from any development and were not surveyed during 2007.



South Carolina

Annual State of the Beaches Report

2009



KDP 1133

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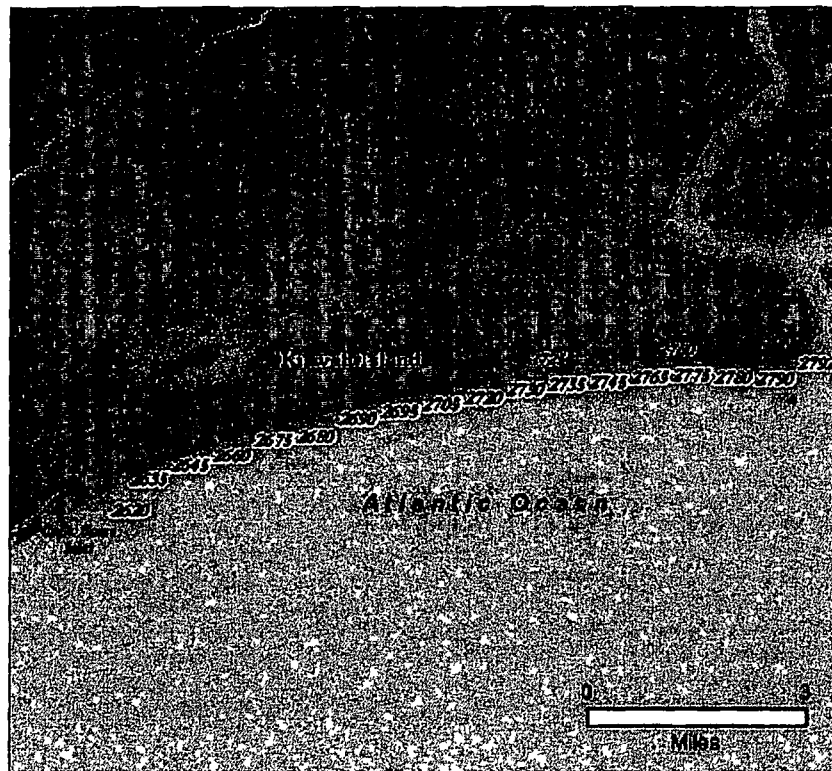


Figure 14 Station numbers for Kiawah Island

KDP 1135

Table 8 Beach profile data for Kiawah Island

Benchmark	2008	2007	2006	First Survey Year	Total Profiles
2775	03/03	03/19	None	2001	2
2765	03/03	03/19	None	1999	5
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2705	03/03	03/19	None	1998	7
2700	03/03	03/19	None	1998	6
2695	03/03	03/19	None	1998	7
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2665	03/03	03/20	None	1998	5
2660	03/03	03/20	None	1998	7
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State of the Beaches 2008 Benchmark 2625 All Profile Plots

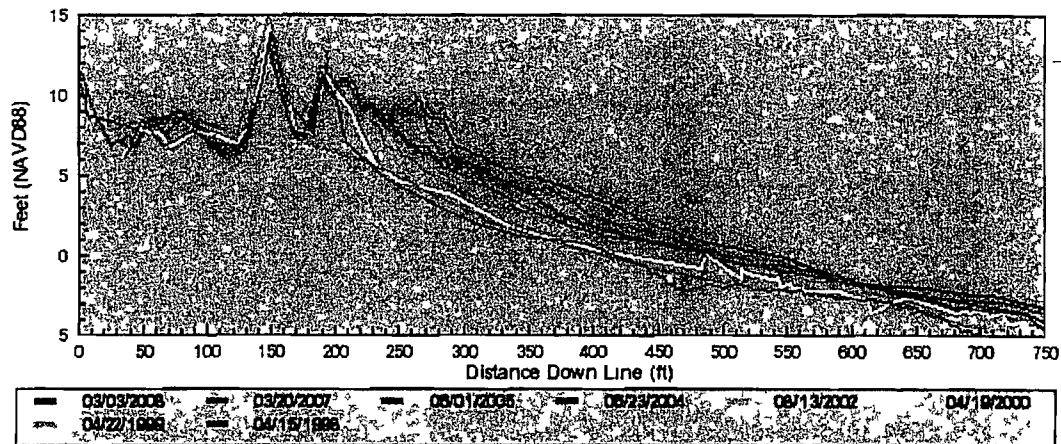


Figure 15 Beach profiles for station 2625 on Kiawah Island

The area from station 2660, near the middle of Eugenia Ave, through station 2680, at the eastern end of Windswept Villas, experienced significant erosion in 1995 and 1996, stabilized from 1997 through 1999, became erosional again in 2000 and 2001, and was accretional between 2002 and 2004. Through March 2007 continuing into March 2008 the dune field was stable but the beach seaward of the dune showed minor erosion. Station 2665 showed the development of a more pronounced berm, with minor erosion of the shoreface. Other stations to the northeast, from 2685 on Turtle Beach Lane to 2735 at the Kiawah Beach Club, also showed a stable dune and minor changes seaward of the dune and accretion in the shoreface.

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was alleviated with the large volume of sand on the beach in the 2007 survey. The last two Kiawah Island monitoring stations, 2785 and 2790, are located along the Stono Inlet shoreline far from any development and were not surveyed during 2008.

KDP 1138

KDP's Exhibits
56 & 57
are oversized
& have been
bound separately

002255

DRAFT

Conceptual Sketch Study

Kiawah Development Partners

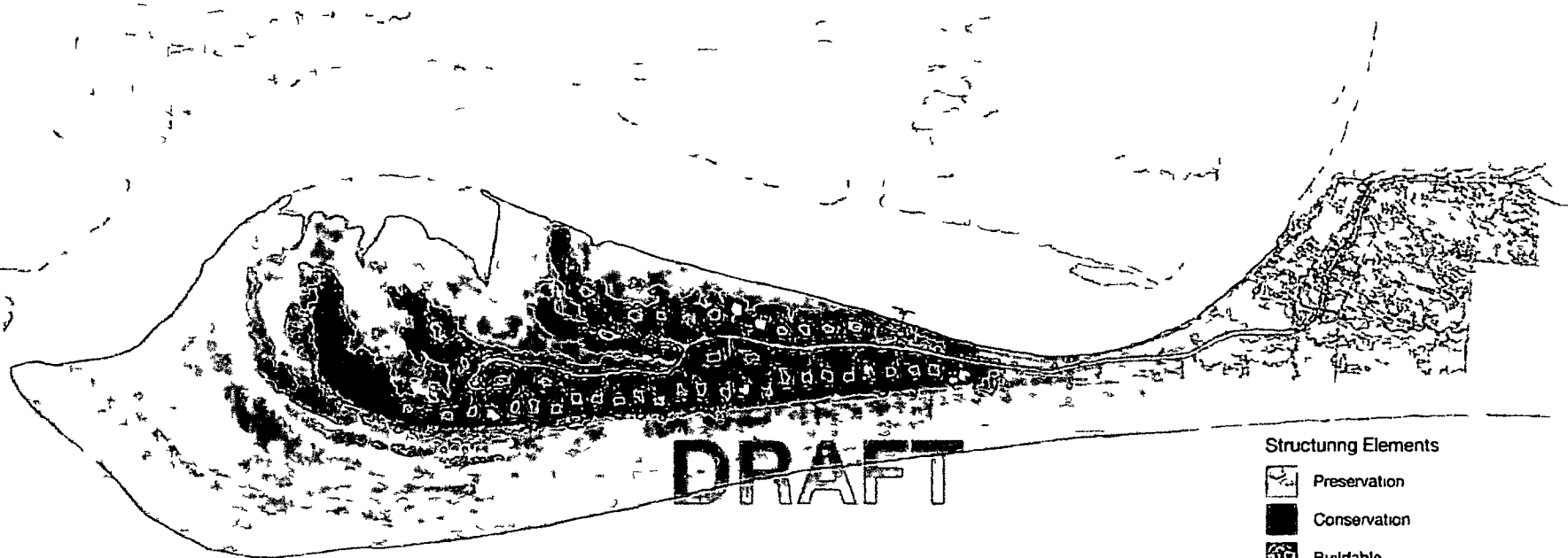
Captain Sams
Kiawah Island

Kdp planning and design 0 100 200 400 1000
perimeter 03.20.09

Notation: This is not a site plan, development plan, nor master plan.
It is a non-binding schematic sketch of a possible conceptual layout
not reviewed or approved by KDP II. There has been no final
decision as to number, size, or location of sites, which will be
integrated into natural features. This sketch should not be relied
upon nor reproduced.

KDP 1099

002256



Captain Sams Kiawah Island

Kiawah Development Partners

kdp planning and design 0 100 200 400 1000
perimeter 03.20.09

Notation: This is not a site plan, development plan nor master plan. It is a non-binding schematic sketch of a possible conceptual layout, not reviewed or approved by KDP II. There has been no final decision as to number, size, or location of sites, which will be integrated into natural features. This sketch should not be relied upon nor reproduced.

KDP 1100

RESUME

CSE

TIMOTHY W KANA, PhD PG **Senior Coastal Scientist**

Education

PhD Geology (Coastal Processes) University of South Carolina (USC) 1979
MS Geology (Coastal Geology) USC 1976
BA Natural Sciences (Geological Oceanography) The Johns Hopkins University 1971

Experience Highlights

Dr Kana is founder and president of Coastal Science & Engineering (CSE) (1984–present) and Adjunct Professor of Geology at the University of South Carolina (1981–present). Prior to 1984 he was a founder and principal in the firm of Research Planning Institute Inc. Kana is an internationally recognized expert in coastal and estuarine processes and has written over 250 publications and technical reports. His contributions to the coastal engineering literature include reports on estuarine sedimentation and harbor shoaling, flocculation and agglomeration of clays, nontidal circulation and turbidity maxima in estuaries, sediment partitioning among marshes, beaches and tidal channels, potential impacts of sea level rise on coastal wetlands, preparation of sediment budgets, and beach nourishment design.

Kana served as staff oceanographer for four years at Chesapeake Bay Institute (The John Hopkins University) where he managed projects involving current measurements and sampling of suspended sediments throughout Chesapeake Bay for purposes of calibrating the USACE physical model, measurements of sediment loads and shoaling during extreme storms, analyses of paleochannels and shoreline erosion, and laboratory studies of biologic processes affecting sediment flocculation and settling.

Coastal Erosion Studies – Technical work by Kana includes development of a methodology for objective delineation of present shorelines and setback lines along the South Carolina coast. Prototype application of the methodology was implemented by Myrtle Beach (1984) and incorporated in local zoning ordinances. In 1988 the methodology was incorporated into the state's Beach Management Act and used to establish development setback lines throughout the coast. The methodology is the first in the United States to provide for quantitative placement of setback lines based on the volumetric condition of the beach.

Kana has been principal investigator for contracts from the US Army Corps of Engineers for a number of coastal engineering studies including Buffalo

District (inventory and analysis of 200 shore protection structures Lake Ontario) New York District (sediment budget Fire Island Inlet to Montauk Point) Charleston District (sand search Horry County SC and ICWW erosion) and CERC (sediment transport at Duck NC and performance evaluation of three SC beach nourishment projects).

Beach Nourishment — Dr Kana has served as project director or technical advisor on more than 30 beach restoration projects totaling nearly 22 million cubic yards. His work emphasizes soft engineering solutions to erosion along the oceanfront. Among the innovative projects Kana has directed was an inlet relocation at Seabrook Island (SC) which resulted in long term restoration of two miles of eroded beach.

Major nourishment projects Kana directed in North and South Carolina and New York include

Myrtle Beach	1.3 million cubic yards
Hunting Island	0.75 million cubic yards
Bogue Banks	4.5 million cubic yards
Seabrook Island	0.6 million cubic yards
Smith Point County Park	0.4 million cubic yards

Sea Level Rise Studies — Pioneering work by Dr Kana includes two of the earliest case studies of the potential impacts of sea level rise on coastal wetlands for the U.S. Environmental Protection Agency which quantified the controlling physical conditions and processes for tidal wetlands evolution.

International Experience

Dr Kana has served on design and environmental impact assessment teams for numerous projects in the Caribbean, West Africa, Kuwait and other Middle East countries. From 1977 to 1989 he served as coastal processes and environmental monitoring consultant on the 20 km Kuwait Waterfront (KWF) project. Work included establishing a beach erosion monitoring program, periodic field measurements over many years, and assistance to the project engineers on Phases I–V. Kana was senior scientist for a Kuwait Foundation for the Advancement of Science (KFAS) study of environmental and water quality impacts of the KWF (1984–1986).

Expert Testimony (1982–present)

Qualified and admitted in the following areas

Marine geology	Coastal processes
Estuarine processes	Beach erosion

Professional Affiliations

Board of Directors – American Shore & Beach Preservation Association
Member – American Geophysical Union
Affiliate Member – American Society of Civil Engineers
Registered Professional Geologist (NC and SC)
Certified PADI Scuba Instructor



RESUME – Timothy W Kana

Education

PhD Geology (Coastal Processes)
University of South Carolina (USC)
MS Geology (Coastal Geology) USC
BA Natural Sciences (Geological Oceanography)
The Johns Hopkins University

Technical and Consulting Reports 1989 to Present

Kana has been senior author of over 150 technical and consulting reports since 1979 on topics including beach management plans shoreline assessments and monitoring estuarine circulation and sedimentation marina design criteria nourishment feasibility studies and oil spills. He has co authored an additional 50 consulting and technical reports.

Experience

1984 present Founder and president Coastal Science & Engineering (CSE) Columbia SC

1977 1984 Founding partner Research Planning Institute, Inc (RPI) Columbia SC
Director Coastal Dynamics Division

1981 present Adjunct professor Department of Geology USC Columbia SC

1974 1979 Graduate research assistant Dept of Geology USC

1969 1973 Research assistant Chesapeake Bay Institute The Johns Hopkins University Baltimore MD

1966 1972 U S Naval Reserve

Registration

Professional geologist (SC 564 NC 1752)

Professional Memberships

SEPM (since 1974)
ASBPA (since 1980)
Sigma Xi (since 1981)
ASCE (since 1982)
AGU (since 1987)
COPRI (since 2000)

Affiliation

Coastal Science & Engineering
160 Gills Creek Parkway 29209
PO Box 8056 Columbia SC USA 29202
[Tel 803 799 8949 Fax 803 799 9481]
[e mail tkana@coastalscience.com]

Research Grants

Since 1978 Dr Kana has received over a dozen research grants and contracts from federal and state agencies and foreign governments including the U S Army Corps of Engineers Minerals Management Service National Oceanic and Atmospheric Administration U S Army Research Office South Carolina Sea Grant U S Coast Guard South Carolina Coastal Council South Carolina Department of Parks Recreation and Tourism U S Environmental Protection Agency United Nations (UNEP) and Kuwait Foundation for the Advancement of Science. Representative grants and contracts for which Kana was principal investigator include:

U S Army Corps of Engineers – Sediment budget for the south shore of Long Island New York (\$152 000)
U S Minerals Management Service – Development and testing of a model for prediction of oil spill movement in the surf zone (\$410 000)
SC Sea Grant – Morphologic evolution and sediment dynamics of a new tidal inlet (\$35 000)
SC Department of Parks Recreation and Tourism – Feasibility study design and construction management of the Hunting Island beach nourishment project (\$190 000)
U S Environmental Protection Agency – Potential impacts of sea level rise in Charleston South Carolina and Great Bay New Jersey (\$45 000)
South Carolina Coastal Council – Development of methodology and delineation of baselines and setback lines for coastal development along the South Carolina coast (\$80 000)
Kuwait Foundation for the Advancement of Science – Evaluation of impacts of the Kuwait Waterfront Project on coastal processes and water quality (co investigator) (\$65 000)
U S Geological Survey – South Carolina Coastal Erosion Study – Sediment budget development (co investigator) (\$110 000)
U S Army Corps of Engineers – (CERC) Performance evaluation of three nourishment project in South Carolina (\$45 000)



RESUME – Timothy W Kana

Supervisory Experience

As a founder of Research Planning Institute Inc (RPI) (1977) Dr Kana was responsible for marketing project management and technical work in connection with the Coastal Dynamics Division Between 1979 and September 1984 he supervised 25 staff scientists and engineers and was directly responsible for approximately \$150 000 per year in research projects

With another RPI partner Kana founded Coastal Science & Engineering (CSE) in October 1984 serving as president and senior scientist Between 1984 and the present Kana supervised 4–10 staff scientists and engineers being responsible for approximately \$600 000 per year in coastal research projects CSE presently maintains offices in Columbia (SC) and Morehead City (NC) with a full time staff of 10 people

Consulting Contracts

Dr Kana has received consulting contracts from a variety of federal state municipal development and industrial clients since 1979 including

Alabama Dept of Environmental Control
Bellemead Development Corp (FL)
Brevard County (FL)
Carteret County (NC)
Charleston County (SC) PRC
DeBordieu Colony
Dewberry & Davis
Drake Development Corporation
Dresdner Robin Associates
Edens & Avant Company
Fripp Island Public Service District
Greenman Pedersen Inc
Greenwood Development Corporation
Han Padron Associates
Hilton International Corporation
Holiday Inn Corporation
ICF Corporation
Kemron Corporation
Kiawah Island Community Association
Kiawah Island Company
Kuwait Foundation
for the Advancement of Science
Kuwaiti Engineers Office
La Ala Al Kuwait Real Estate Company
Mayes Sudderth & Ethendge
McLaren Hart/ChemRisk Company
Melrose Development Corporation
Metcalf & Eddy
Municipalities
City of Myrtle Beach (SC)
City of North Myrtle Beach (SC)
Town of Atlantic Beach (SC)
Town of Edisto Beach (SC)
Town of Hilton Head Island (SC)
Town of Kiawah Island (SC)
Town of Pawleys Island (SC)
Town of Topsail Beach (NC)
Village of Asharoken (NY)
Town of Emerald Isle (NC)
Town of Nags Head (NC)
Town of Kitty Hawk (NC)
Town of Indian Beach (NC)
Town of Pine Knoll Shores (NC)
Town of Ocean Isle Beach (NC)

New York Coastal Partnership
New York State Department of State
North Inlet Corporation
Owens Corning Corporation
Pawlowski Associates
Perception & Decision Systems
Sands Investment Corporation
Sasaki Associates
The Scott Company
Scruggs & Hammond (KY)
Seabrook Island Company
Seabrook Island POA
The Sea Island Company
SeeWeed Company
Solomon Zauderer Ellenhorn Frischer & Sharp
South Carolina
Office of Coastal & Resource Mgmt
Department of Mental Health
Dept Parks Recreation & Tourism
Sea Grant Consortium
Suffolk County Parks Department (NY)
Sugar Beach POA (St Croix VI)
Sverdrup Corporation
Taylor Construction (VA)
Trammell Crow Hotel Company
United Nations UNEP
U S Army Corps of Engineers
U S Army Research Office
U S Coast Guard
U S Department of Commerce
NOAA NOS
U S Department of Interior
Minerals Management Service
Geological Survey
U S Environmental Protection Agency
Wilbur Smith Associates
Wild Dunes Associates

Reviewer (Professional Articles)

Reviews of Manuscripts/Proposals (1988 to present)

Al-Zanel	2004	Kuwait University
Peterson & Wells	2003	North Carolina Sea Grant
Posey et al	2003	North Carolina Sea Grant
Peterson	2001	North Carolina Sea Grant
Judge & Overton	1999	Journal of Coastal Research
Al-Sarawi & Al-Zamel	1996	Kuwait University
Spencer & Terchunian	1996	Shore & Beach
Ebersole et al	1995	Shore & Beach
Moriarty	1995	New England Marine Aquarium
Lawrence & Davidson-Arnott	1995	Journal Coastal Research
Conley	1995	New York State Sea Grant
Pizzuto & Kraft	1994	Delaware Sea Grant
Yamashita et al	1994	Marine Geology
Wijnberg & Terwindt	1994	Marine Geology
Pompe J	1993	Journal of Ocean and Coastal Management
Prestedge C	1992	Shore & Beach
Joyner L	1991	<i>The Southern Coast</i> Southern Living
Leatherman SJ	1990	Shore & Beach
Goldsmidt PM et al	1990	Shore & Beach
Davis RA Jr	1988	Sea Grant (proposal)
Matsushita and McCann	1988	Earth Surface Processes and Landforms

M S /Ph D Committee Advisor (USC)

Vogel M	1981	MS
Svetlichny M	1982	MS
Mason J	1986	MS
Frankenburg A	1987	MS
Frankenburg A	1990	PhD
Barua D	1992	PhD
MacMahan J	1997	MS
Gaudiano D	1999	MS

Courses Taught (USC)

GEO 772 — Coastal Dynamics
GEO 854 — Readings in Coastal Processes

Journal Subscriptions

American Scientist	Jour Coastal Research
Civil Engineering	Jour Sedimentary Petrology
Coastal Engineering	Jour Waterways Port Coastal & Ocean Engineering
Coastal Management	Mariners Weather Log
Engineering News Record	Shore & Beach
EOS JGR (Oceans)	



Refereed Publications (RP), Book Chapters (BC), Booklets (B), Articles (A) – 1989 to Present

Dr Kana has been senior author for over 50 and co author of about 25 journal articles book chapters guidebooks and proceedings papers since 1976 Topics include beach nourishment coastal processes tidal inlets sea level rise coastal structures oil spill impacts and suspended sediment in the surf zone

Kana T W TE White and PA McKee 2004 (RP)
Management and engineering guidelines for groin
rehabilitation Jour Coastal Research Special
Issue 33 (NC Kraus and KL Rankin eds) pp 57
82

Kana T W 2003 (B) *Coastal Erosion and Solutions –
A Primer* Coastal Science & Engineering
Columbia SC 25 pp

Kana T W E J Hayter and P A Work 1999 (A)
Mesoscale sediment transport at Southeastern
U S tidal inlets conceptual model application to
mixed energy settings Jour Coastal Research
Vol 15(2) pp 303 313

Kana T W and R K Mohan 1998 (RP) Analysis of
nourished profile stability following the fifth
Hunting Island (SC) beach nourishment project
Jour Coastal Engineering Vol 33 pp 117 136

Kana T W R E Katmarian and P A McKee 1997
(RP) The 1986 1995 Myrtle Beach nourishment
project ten year performance summary Shore &
Beach Vol 65(1) pp 8 23

Kana T W 1996 (BC) Chapter 4 45 United States
South Carolina soft engineering beach
restoration In J R Clark *Coastal Zone
Management Handbook* CRC Lewis Publishers
Boca Raton FL pp 622 626

Kana T W 1995 (RP) A mesoscale sediment budget
for Long Island New York Marine Geology Vol
126(1995) pp 87 110

Kana T W 1992 (A) Hurricane Hugo poststorm
beach reconstruction The South Carolina
Engineer Vol XLII(1) pp 9 11

Kana T W 1991 (BC) Chap 3 14 Treating the coast
as a dynamic system In J R Clark (ed) *The
Status of Integrated Coastal Zone Management A
Global Assessment* CAMPNET Coastal Area
Management and Planning Network Miami Fla
pp 60 61

Kana T W F D Stevens and G Lennon 1990 (RP)
Beach and dune restoration following Hugo
Shore & Beach Vol 58(4) pp 57 63

Kana T W 1990 (B) *Conserving South Carolina
Beaches Through the 1990s A Case for Beach
Nourishment* South Carolina Coastal Council
Charleston SC 33 pp (est 2 500 copies in print)

Kana T W 1989 (A) Coastal hazards (global warming
and hazards policy three perspectives) *Natural
Hazards Observer* Vol XIII(6) pp 2 4

Kana T W 1989 (RP) Erosion and beach restoration
at Seabrook Island South Carolina Shore &
Beach Vol 57(3) pp 3 18

Kana T W 1988 *Beach Erosion in South Carolina*
M Goodwin and F Rogers (eds) South Carolina
Sea Grant Consortium Charleston SC SCSG
SP 88 1 55 pp (estimated 5 000 copies in print)

Co Author

Gaudiano DJ and TW Kana 2001 (A) Shoal
bypassing in South Carolina tidal inlets
geomorphic variables and empirical predictions
for nine mesotidal inlets Jour Coastal Research
Vol 17 pp 280 291

Leatherman S P R G Dean T W Kana and F J
Anders 1997 (A) Goldsmith Inlet and adjacent
areas north shore of Long Island New York
erosion problems and suggested modifications
Shore & Beach Vol 65(3) pp 13 16

Barua D and T W Kana 1995 (RP) Deep water
wave hindcasting wave refraction modeling and
wind and wave induced motions in the least
Ganges Brahmaputra delta coast Jour Coastal
Research Vol 11(3) pp 834 848

ASCE Task Committee 1992 (RP) Effects of sea
level rise on bays and estuaries Jour Hydraulic
Engineering ASCE Vol 118(1) pp 1 10

Reed M E R Gundlach T W Kana 1989 (RP) A
coastal zone oil spill model development and
sensitivity studies Oil and Chemical Pollution
Vol 5 pp 411 449

Proceedings Papers — 1989 to Present

- Kana TW G Rudolph JW Forman Jr PA McKee
2005 The restoration of Bogue Banks North
Carolina 1999 – 2004 In Proc Beach
Preservation 2005 18th Natl Conf on Beach
Preservation Technology
- Baca BJ M Al Sarawi and TW Kana 2005 Recent
bioremediation results on oil spilled during the
1991 Gulf War In Proc Oil Spill Conf Paper 374
14 pp
- Kana TW and PM McKee 2003 Relocation of
Captain Sams Inlet – 20 Years Later In Proc 5th
Intl Symposium on Coastal Engineering and
Science of Coastal Sediment Processes Book of
Abstracts Coastal Sediments 03 East Meets
West Productions Corpus Christi TX pp 168 169
(paper on CD 12 pages)
- Kana TW T E White JW Forman Jr PA McKee
2002 Shoreline erosion along Bogue Banks
North Carolina In L Ewing and L Wallendorf
(eds) Proc Solutions to Coastal Disasters 02
ASCE Reston VA pp 561 575
- Kana TW 2002 Reclaiming the coast for sustainable
development – lessons from Arabia In Proc Intl
Conf on Coastal Zone Management & Dev
elopment (18–20 March 2002) Environment
Public Authority State of Kuwait pp III 1 to III 14
- Kana TW 2002 Barrier island formation via channel
avulsion and shoal bypassing In Proc 28th Intl
Conf Coastal Engineering (Cardiff) pp
3438–3448
- White TE and TW Kana 2002 Dredging at tidal
inlets and examples of beneficial and harmful
practices In Proc Dredging 02 (Orlando) ASCE
Abstract (2 pp)
- Kana TW 1999 Long Island s south shore beaches
a century of dynamic sediment management In
Proc Coastal Sediments 99 ASCE New York
NY pp 1584 1596
- Kana TW and R Mohan 1997 Profile volumes as a
measure of erosion vulnerability In B L Edge
(ed) Proc 25th Intl Coastal Engineering Conf
ASCE NY pp 2732 2745
- Mohan R K and TW Kana 1997 The effect of grain
sorting on profile stability of nourished beaches
In B L Edge (ed) Proc 25th Intl Coastal
Engineering Conf ASCE NY pp 4756 4769
- Katmarian RE PA McKee and TW Kana 1997
Hydraulic controls on tidal wetlands In BL Edge
(ed) Proc 25th Intl Coastal Engineering Conf
ASCE NY pp 4314 4324
- Kana TW 1996 Signatures of coastal change at
mesoscales In W R Dally and R B Zeidler
(eds) Proc Coastal Dynamics 95 ASCE NY
pp 987 997
- Kana TW 1995 What shapes the south shore
coastline? In Proc 6th Annual Conf The
Economics (and Politics) of Shore Protection
Long Island Coastal Alliance Coastal Reports
Inc New York NY pp 28 32
- Kana TW and C J Andrassy 1995 Beach profile
spacing practical guidance for monitoring
nourishment projects In B L Edge (ed) Proc
24th Intl Conf Coastal Engineering ASCE NY
Chap 152 pp 2100 2114
- Kana TW 1993 Coastal processes and Long
Island s south shore after the storms of 1992
1993 In J R Schubel and J Lsarrocca (eds)
Long Island (N Y) Coastal Conference —
Scenario Planning MSRC Spec Rept No 105
SUNY Stony Brook New York pp 27 32
- Kana TW 1993 The profile volume approach to
beach nourishment In D K Stauble and N C
Kraus (eds) *Beach Nourishment Engineering and
Management Considerations* ASCE New York
NY pp 176 190
- Kana TW 1993 South Carolina beach nourishment
projects successes and failures In P Bruun
(ed) Proc Hilton Head Island Intl Coastal
Symposium co sponsors Jour Coastal Research
South Carolina Coastal Council and South
Carolina Shore & Beach Pres Assoc 6 9 June
1993 Hilton Head Island SC pp 255 260
- Kana TW and F D Stevens 1992 Coastal
geomorphology and sand budgets applied to
beach nourishment In S A Hughes (ed) Proc
Coastal Engineering Practice 92 ASCE New
York NY pp 29 44
- Kana TW F D Stevens and G Lennon 1991 Post
Hugo beach restoration in South Carolina In
Proc Coastal Sediments 91 ASCE New York
NY Vol II pp 1697 1711
- Kana TW F D Stevens and G Lennon 1991
Emergency beach and dune restoration following
Hurricane *Hugo* In Proc 4th Beach Preservation
Tech Conf Florida Shore & Beach Pres Assoc
Tallahassee Fla pp 1 13



RESUME – Timothy W Kana

Technical and Consulting Reports — 1989 to Present

Kana has been senior author of ~150 technical and consulting reports since 1979 on topics including beach management plans shoreline assessments and monitoring estuarine circulation and sedimentation marina design criteria, nourishment feasibility studies and oil spills He has co authored an additional 50 consulting and technical reports

- CSE 1989a Kuwait Waterfront Project — Phase 5 redesign — coastal engineering Final Report to Kuwait Engineers Office Safat CSE Columbia SC 51 pp + app
- CSE 1989b Beach survey and erosion analysis in connection with plans for beach nourishment at DeBordieu Colony Final Report for DeBordieu Colony Property Owners Group and North Inlet Corp CSE Columbia SC 44 pp + app
- CSE 1990a Shoreline assessment and erosion analysis of Fripp Island Rept to Fripp Island Public Service District CSE Columbia SC 6 pp
- CSE 1990b Shoreline analysis and alternatives for beach nourishment Rose Hall Beach Hotel Jamaica Draft Report for Trammell Crow Hotel Company Dallas Texas CSE Columbia SC 43 pp + app
- CSE 1990c North Myrtle Beach emergency nourishment project April 1990 beach survey Final Report to City of North Myrtle Beach CSE Columbia SC 85 pp incl app
- CSE 1990d Erosion assessment and beach restoration alternatives for Hunting Island South Carolina Feasibility Study for South Carolina Department of Parks Recreation and Tourism CSE Columbia SC 66 pp + app
- CSE 1990e Erosion assessment and beach restoration alternatives for Edisto Beach State Park South Carolina Feasibility Study for South Carolina Department of Parks Recreation and Tourism Columbia CSE Columbia SC 61 pp + app
- CSE 1990–1995 Seabrook Island South Carolina beach nourishment project (1990–1991) Survey Reports 1–6 for Seabrook Island POA CSE Columbia SC
- CSE 1991 Geotechnical studies for the Hunting Island beach nourishment project Survey Report for South Carolina Dept Parks Recreation and Tourism CSE Columbia SC 35 pp + app
- CSE 1991–1994 Hunting Island State Park 1991 beach nourishment project Survey Reports 1–4 to SC Dept Parks Recreation & Tourism Columbia CSE Columbia SC
- CSE 1992a Updated shoreline change rate for Litchfield Beach South Carolina Draft Report for The Litchfield Company CSE Columbia SC 28 pp + app
- CSE 1992b City of North Myrtle Beach South Carolina beachfront management plan Final Report to the South Carolina Coastal Council by the City of North Myrtle Beach CSE Columbia SC 65 pp + appendices exhibits and overlays
- CSE 1992c Hog Inlet – Cherry Grove remedial nourishment project 1992 1992 beach surveys Final Report for City of North Myrtle Beach CSE Columbia SC 20 pp + app
- CSE 1992d Edisto Beach nourishment project – engineering report geotechnical studies bathymetric and beach surveys wave modeling studies Draft Report for South Carolina Department of Parks Recreation & Tourism Columbia CSE Columbia SC 120 pp + app
- CSE/CSA 1992 Hunting Island State Park beach nourishment project environmental surveys Final Report to SC Dept Parks Recreation & Tourism Columbia CSE with Coastal Science Associates Inc Columbia SC 31 pp
- CSE 1993a Preliminary survey of creek deposits for possible use in beach nourishment Pawleys Island South Carolina Geotechnical Report for Town of Pawleys Island CSE Columbia SC 27 pp + app
- CSE 1993b Edisto Beach groin study Report for Town of Edisto Beach CSE Columbia SC 132 pp + data app
- CSE 1993c Updated estimate of beach nourishment requirements for North Myrtle Beach Final Report for City of North Myrtle Beach CSE Columbia SC 67 pp + app
- CSE 1993d Tidal hydraulics at Huspa Creek and Hwy 17 near Gardens Corner South Carolina Preliminary Rept to Wilbur Smith Associates Inc CSE Columbia SC 37 pp + app
- Kana T W and C J Andrassy 1993a A review of estuarine circulation and sediment transport processes in Newark Bay New Jersey Proprietary Report to McLaren Hart/ChemRisk Co CSE Columbia SC 30 pp + app

Technical and Consulting Reports — 1989 to Present (continued)

- Kana T W and C J Andrassy 1993b Hunting Island State Park 1991 beach nourishment project Survey Report No 3 for the SCCC and SC Dept Parks Recreation & Tourism CSE Columbia SC 32 pp + app
- Kana T W and C J Andrassy 1993c Performance evaluation of recent South Carolina nourishment projects Final Rept Contract DACW39 92 C 0110 USACE–WES Vicksburg MS CSE Columbia SC 314 pp + app
- Kana T W and R Krishnamohan 1993 Design of an erosion monitoring program for the marine shoreline of New York Final Report to New York Department of State Coastal Resources and Waterfront Revitalization CSE Columbia SC 46 pp + app
- Krishnamohan R T W Kana and C J Andrassy 1993 Comparison of geotechnical properties of beach fill versus borrow area sediments for the fifth Hunting Island (SC) beach nourishment project Tech Report Contract DACW 39 92 C 0110 USACE WES Vicksburg MS CSE Columbia SC 48 pp + app
- Kana T W and R Krishna Mohan 1994 Assessment of the vulnerability of the Great South Bay shoreline to tidal flooding Final Rept New York Coastal Partnership Babylon NY CSE Columbia SC 153 pp + app
- Krishnamohan R and T W Kana 1994 Dredging and disposal feasibility study Pawleys Island Creek Final Rept Town of Pawleys Island SC CSE Columbia SC 62 pp + 7 apps
- CSE 1995a Beach restoration plan Jalousie Plantation Resort St Lucia Report for Resort Services Management St Lucia CSE Columbia SC 36 pp + app
- CSE 1995b Beach stabilization plan for Debidue Beach Preliminary Design for DeBordieu Property Owners Buyout Group Georgetown SC CSE Columbia SC 101 pp + app
- CSE 1995d Relocation of Captain Sams Inlet and beach restoration plan Seabrook Island South Carolina Design Report Seabrook Island POA CSE Columbia SC 159 pp + apps
- CSE 1995e Shoreline assessment and recommendations for dune/beach restoration Kiawah Island SC Final Rept to Town of Kiawah Island CSE Columbia SC 42 pp + apps
- Katmarian R E and T W Kana 1995 Phase II — Pawleys Island Creek — Revised dredging and disposal plan Final Report Town of Pawleys Island South Carolina CSE Columbia SC 24 pp + appendices
- CSE 1996 Myrtle Beach nourishment project a decade of surveys March 1985 to November 1995 Summary Report to City of Myrtle Beach SC CSE Columbia SC 42 pp + app (Conclusion of nine annual survey reports)
- CSE 1996 Postproject borrow area survey Edisto Beach groin repair and beach nourishment project Edisto Island South Carolina Survey Report to Town of Edisto Beach SC CSE Columbia SC 8 pp + app
- CSE 1996 Postproject borrow area survey Hunting Island 1991 beach nourishment project Survey Report to SC Dept Parks Recreation & Tourism Columbia CSE Columbia SC 14 pp + app
- Katmarian E and T W Kana 1996 Shoreline assessment and recommendations for dune/beach restoration Kiawah Island South Carolina Final Report Town of Kiawah Island CSE Columbia SC 44 pp + apps
- CSE 1995 2001 Edisto Beach 1995 beach nourishment project survey reports 1–5 Postproject survey reports for Town of Edisto Beach SC CSE Columbia SC
- CSE 1996 2004 Captain Sams Inlet relocation project Seabrook Island South Carolina survey reports 1 through 8 Postproject survey reports for Seabrook Island POA CSE Columbia SC
- CSE 1997 Review of P/N 97 16 234P – Proposed beach nourishment and construction of groins at Daufuskie Island Reviewed for Central Investment Corp (Cincinnati OH) CSE Columbia SC 16 pp
- CSE 1997 Kiawah Island – state of the beach – winter 1997 Kiawah Island South Carolina Memorandum Report to Town of Kiawah Island SC CSE Columbia SC 14 pp + app
- CSE/Stroud 1999 Shoreline assessment and preliminary beach restoration plan Bogue Banks Executive Summary Report Carteret County NC 38 pp
- CSE 1999 Updated shoreline assessment and condition of the beach Kiawah Island South Carolina Final Report for Town of Kiawah Island CSE Columbia SC 81 pp + apps
- CSE 2000 Inlet sediment dynamics at Bloody Point and beach stabilization recommendations Draft Report to Bloody Point Homeowners Association Daufuskie Island SC CSE Columbia SC 82 pp plus apps



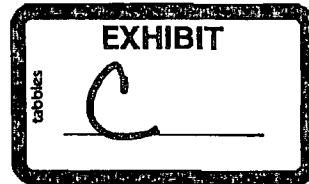
Technical and Consulting Reports — 1989 to Present (continued)

- CSE 2000 Survey report 2000 Bogue Banks North Carolina- Survey Report for Carteret County Beaufort NC CSE Columbia SC 32 pp + Appendices I-IV
- CSE 2001 Shoreline erosion assessment and recommendations for emergency inlet realignment Bogue Inlet North Carolina Memorandum Report for property owners at The Pointe Emerald Isle NC CSE Columbia SC 39 pp + attachment
- CSE 2001 Analysis of alternatives for Bogue Inlet channel realignment and beach nourishment along western Emerald Isle NC Summary Report for Town of Emerald Isle NC CSE Columbia SC 79 pp + app
- CSE 2001 Environmental assessment Bogue Banks beach nourishment project EA submitted in conjunction with the National Environmental Policy Act and Federal Review of Permit Application ID 200000362 prepared for USACE Wilmington NC CSE Morehead City NC 162 pp + appendices
- CSE 2001 Biological assessment Bogue Banks beach restoration plan Prepared for US Army Corps of Engineers submitted by Carteret County Town of Pine Knoll Shores Town of Indian Beach Town of Emerald Isle NC prepared by CSE Columbia SC 125 pp + appendices
- CSE 2001 Monitoring and analyses of the 1993 Folly Beach nourishment and groin repair project Final Report for City of Folly Beach SC CSE Columbia SC Vol I 70 pp + Vol II appendices
- CSE 2002 Task 3 – reconnaissance borings in potential offshore borrow areas Data Report for City of Folly Beach SC CSE Columbia SC ?? pp + appendices
- CSE 2002 Fripp Island groin repair project groin repair options and recommendations Final Report to Fripp Island Public Service District CSE Columbia SC 32 pp plus appendices
- CSE 2002 Coastal erosion assessment Smith Point County Park New York Final Report for Suffolk County Dept Public Works and Greenman Pedersen Inc CSE Columbia SC 71 pp plus Executive Summary and apps
- CSE 2002-2005 Monitoring and analyses of the 1997 Myrtle Beach-Reach 2 shore protection project – beach monitoring reports for 2002 2003 2004 2005 for the City of Myrtle Beach CSE Columbia SC (4 reports)
- CSE 2003a Bogue Banks beach nourishment project Carteret County North Carolina 2001 Phase 1 – Towns of Pine Knoll Shores and Indian Beach Final Report for Town of Pine Knoll Shores and Town of Indian Beach North Carolina CSE Morehead City NC Volumes I-II
- CSE 2003b Bogue Banks beach nourishment project Carteret County North Carolina 2002 Phase 2 – Town of Emerald Isle Final Report for Town of Town of Emerald Isle North Carolina CSE Morehead City NC Volumes I-III
- CSE 2003 Beach restoration plan Edisto Beach South Carolina Draft Summary Report to Town of Edisto Beach SC CSE Columbia SC 48 pp
- CSE 2003 Groin conditions and repair recommendations Edisto Beach South Carolina Summary Report to Town of Edisto Beach SC CSE Columbia SC 42 pp plus appendices
- CSE 2004 Survey report 2004 Bogue Banks North Carolina Monitoring Report for Carteret County Shore Protection Office Emerald Isle NC CSE Columbia (SC) and Morehead City (NC) 82 pp + 4 apps
- CSE 2004 Draft beach restoration plan for a locally sponsored project at Nags Head Memorandum Report for Town of Nags Head North Carolina CSE Columbia (SC) and Morehead City (NC) 29 pp
- CSE-CSA 2004 Al Khiran Pearl City master plan – Phases A2-A5 – environmental impact assessment Final Report for La Ala Al Kuwait Real Estate Co KSC Safat Kuwait CSE (Columbia SC) with Coastal Science Associates-South Inc (Dania FL) 124 pp
- CSE 2005 Preliminary coastal engineering analyses for large scale beach restoration at Nags Head Technical Report for Town of Nags Head North Carolina CSE Columbia (SC) and Morehead City (NC) 88 pp + apps
- CSE 2005 Analysis of potential downdrift impacts – Hunting Island beach restoration project Final Report for SCPRT Columbia SC CSE Columbia SC 82 pp + apps

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Promoting and protecting the health of the public and the environment
S C Board of Health and Environmental Control, Telephone (803) 898-3309 Fax (803) 898-3393

January 14, 2009

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Charleston, SC 29402

91 7108 2133 3935 6630 6901

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Edward and Harriet Molnar
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Kiawah Island, SC 29455

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91 7108 2133 3935 6746 1036

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91 7108 2133 3935 6746 1043

Marilyn Blizard
Diamondback Terrapin Advocate
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8 Sundown Bend
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91 7108 2133 3935 6746 1074

Robert J Feldman
23 Sunlit Bend
Inlet Cove
Kiawah Island, SC 29455

91 7108 2133 3935 6746 1081

Kelly and Gregg Bragg
176 Marsh Island Drive
Kiawah Island, SC 29455

91 7108 2133 3935 6746 1098

John R. Dinkelspiel
Barbara A Burgess
3131 Marsh Gate Drive
Seabrook Island, SC 29455

91 7108 2133 3935 6746 1104

Diane and Charles Beck
97 Jackstay Court
Kiawah Island, SC 29455

91 7108 2133 3935 6746 1111

Margaret B Harvin
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91 7108 2133 3935 6746 1128

Laura Pulley
3029 Edenvale Road
Johns Island, SC 29455

91 7108 2133 3935 6746 1135

Francis Boyd
5 Greensward
Kiawah Island, SC 29455

91 7108 2133 3935 6746 1142

Via Interagency Mail Delivery
Elizabeth A. Dieck, Esquire
SCDHEC – Office of General Counsel
1362 McMillan Avenue, Suite 400
Charleston, SC 29405

RE **Docket No 08-RFR-147** – *Request review of staff decision dated December 18 2008 to issue Permit No OCRM-08-117-E for the construction of an erosion control structure (revetment) at Beachwalker Park, Kiawah Island with conditions that modify the application.*

The S C Board of Health and Environmental Control decided on January 8, 2009, not to conduct a Final Review Conference on the above-referenced matter

S C Code Section 44-1-60(F), 2006 Act No 387, Section 48, provides, "If a final review conference is not conducted within sixty days, the department decision becomes the final agency decision, and an applicant, permittee, licensee, or affected person may request a contested case hearing before the Administrative Law Court, in accordance with the Administrative Procedures Act, within thirty days after the deadline for the final review conference "

A request for a contested case hearing before the Administrative Law Court (ALC) must be filed in accordance with the Rules of the ALC, including payment of the ALC's filing fee, at the following address

Clerk's Office
South Carolina Administrative Law Court
Edgar A. Brown Building
1205 Pendleton St., Suite 224
Columbia, SC 29201

The ALC's Notice of Request for Contested Case Hearing form and the Rules of the ALC can be found at the ALC's website <http://www.scalc.net>. Further information on filing a request for a contested case hearing before the ALC may be obtained by calling the Clerk's Office at the Administrative Law Court (803-734-0550)

If a party files a request for a contested case hearing with the ALC, the party must serve a copy of the request on DHEC and any other parties at the same time the request is filed with the ALC. A copy of the request for a contested case hearing must be delivered or mailed to DHEC at the address at the top of this memorandum

Sincerely,


Lisa Lucas Longshore
Clerk

The above information on filing a request for a contested case hearing before the Administrative Law Court is provided as a courtesy, parties before the ALC are responsible for complying with all applicable requirements of the Court.

OCG # 20826

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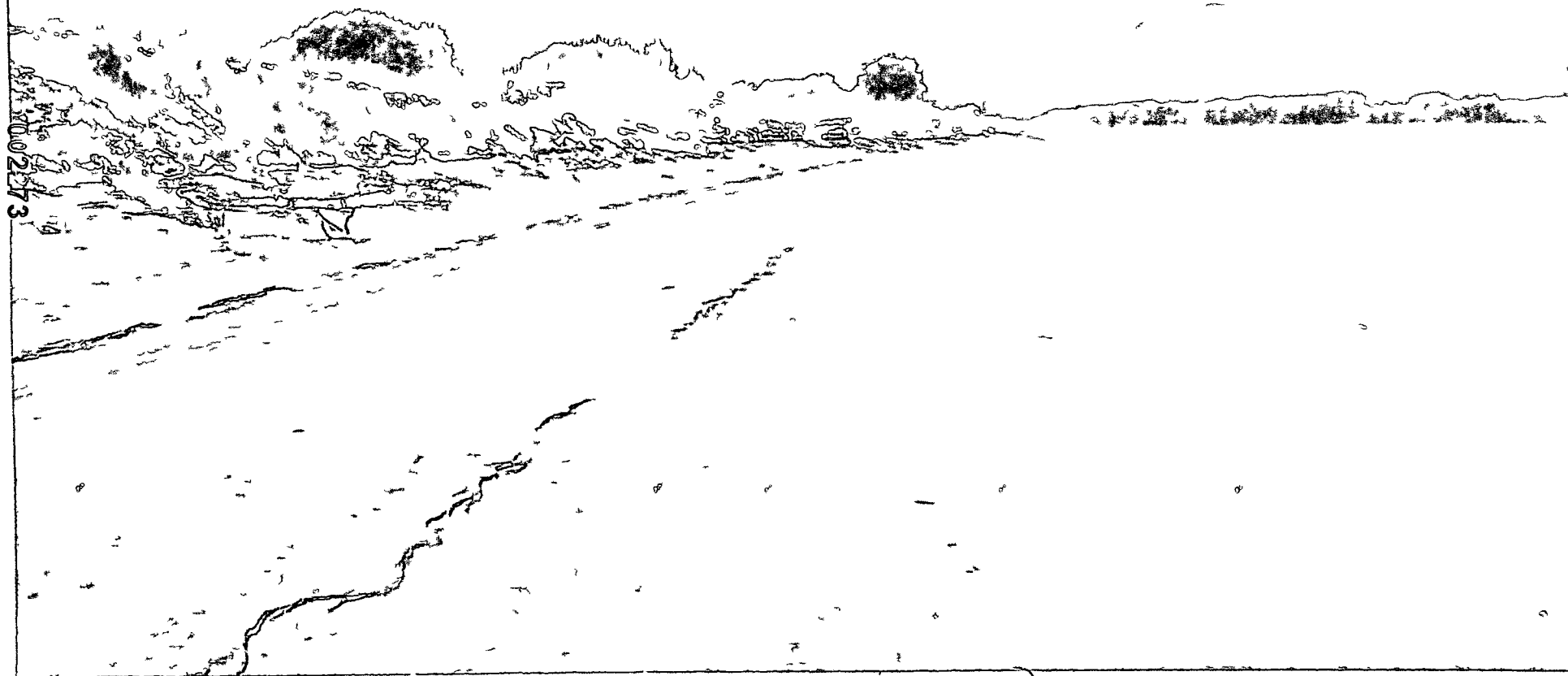
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KDP 1280(G) 75(9) 424

KDP's Exhibit 77
is oversized
& has been
filed separately

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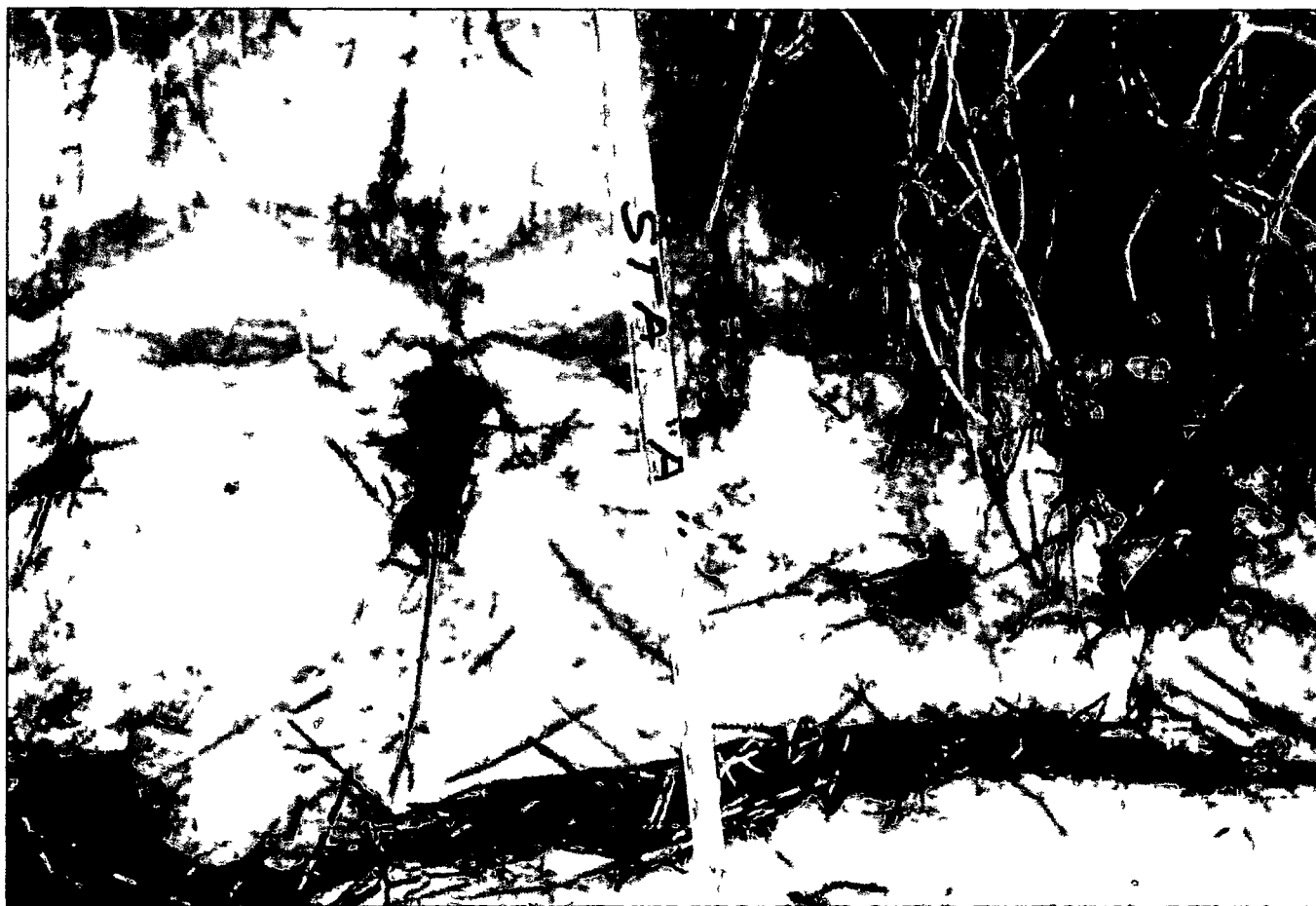


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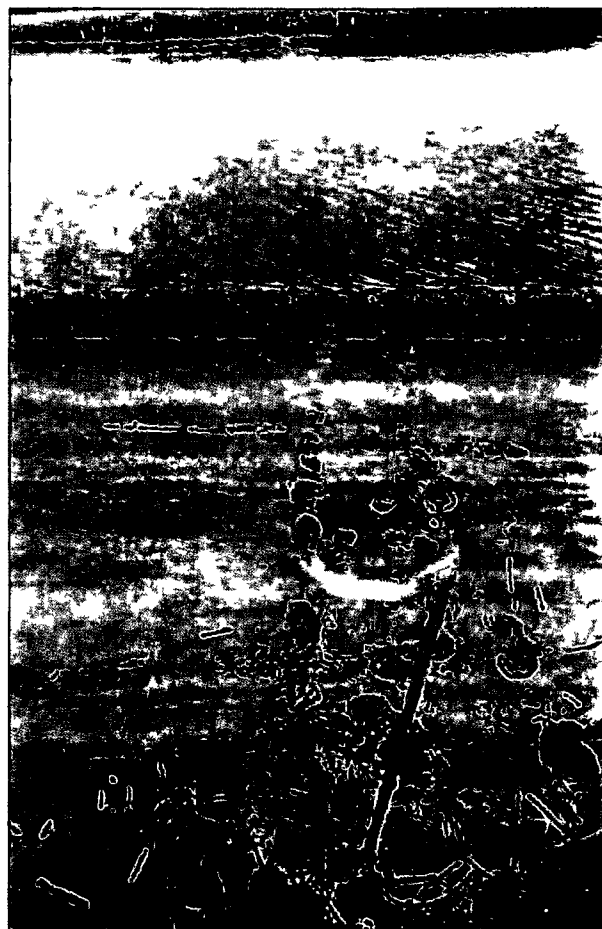


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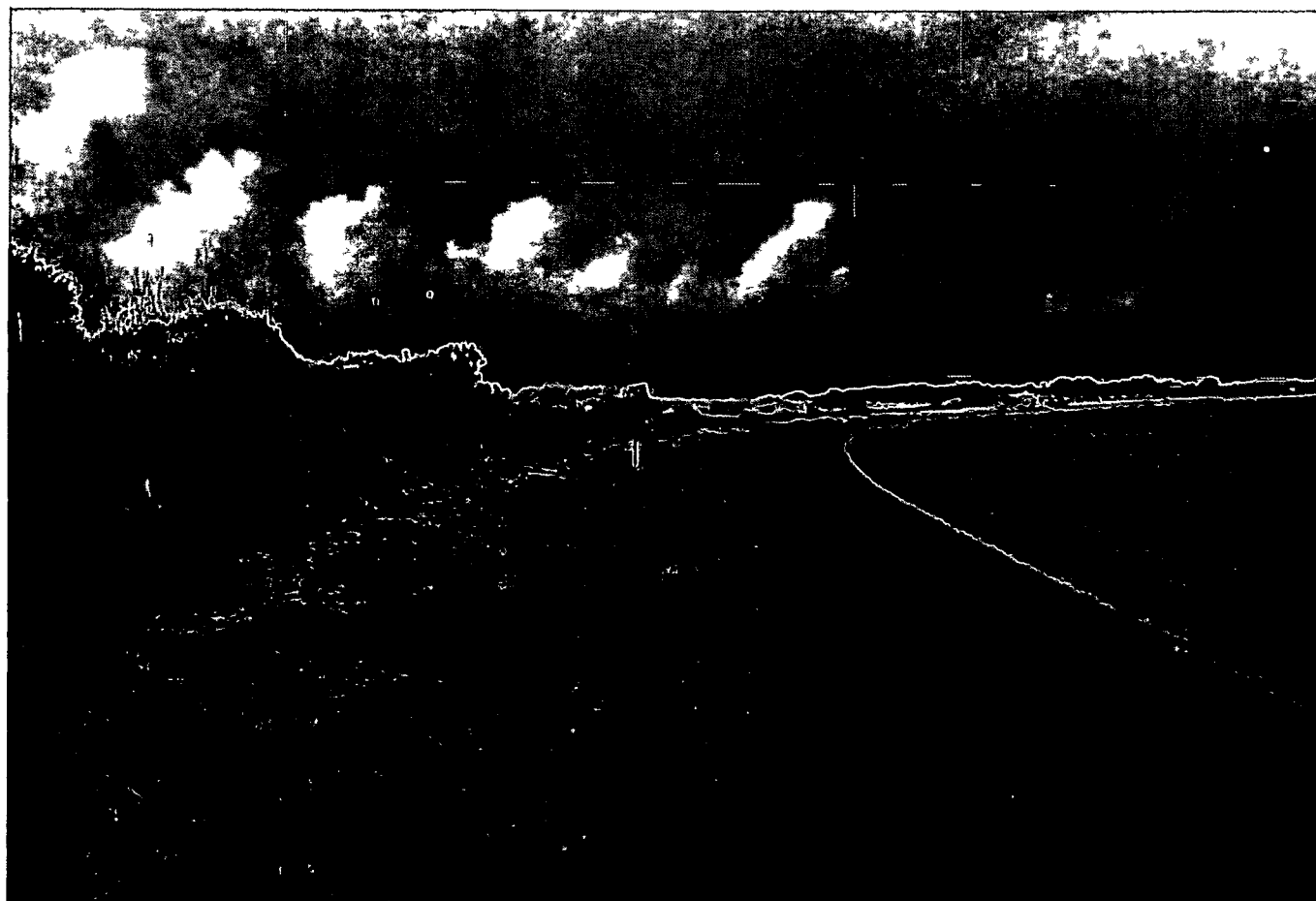


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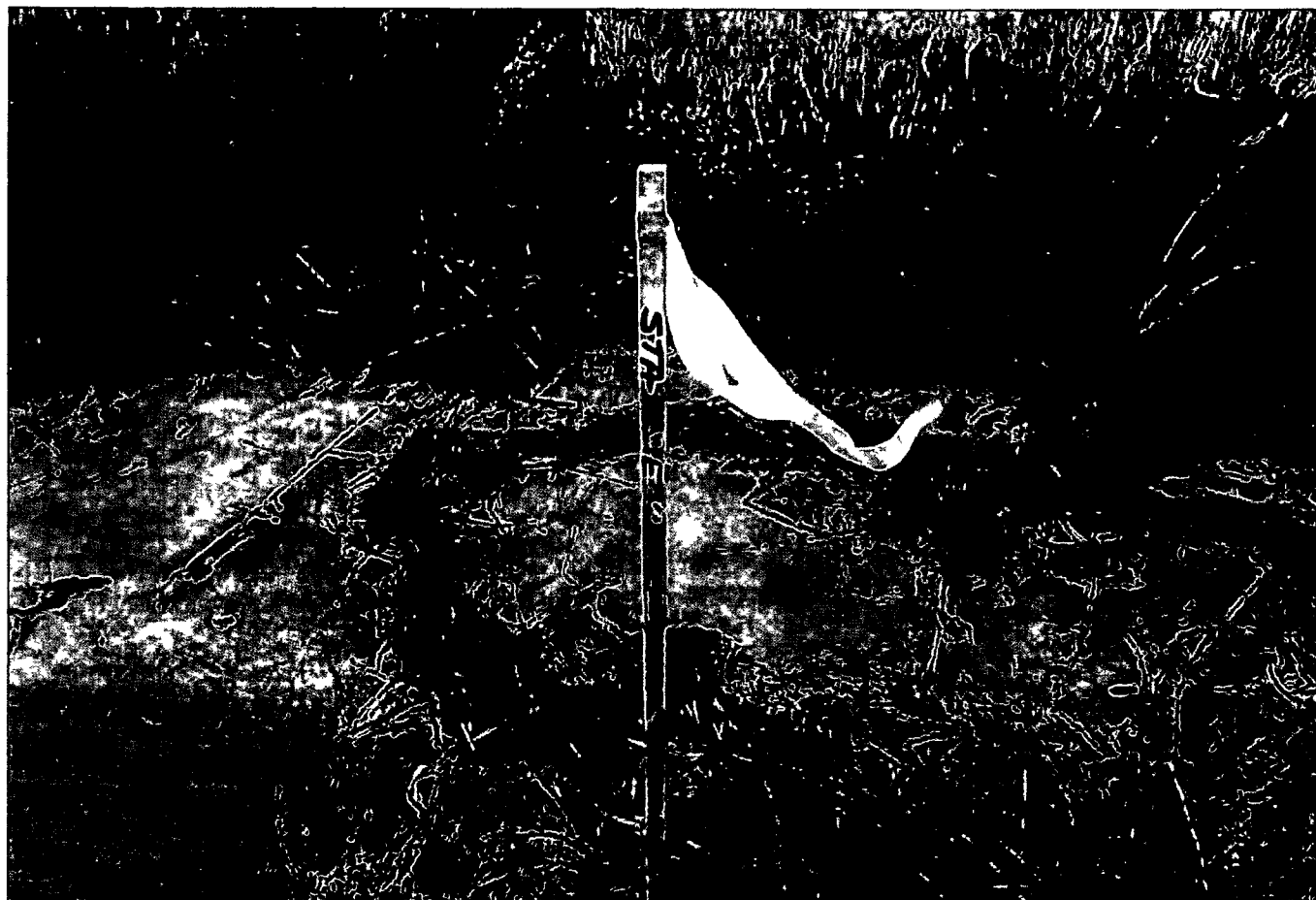


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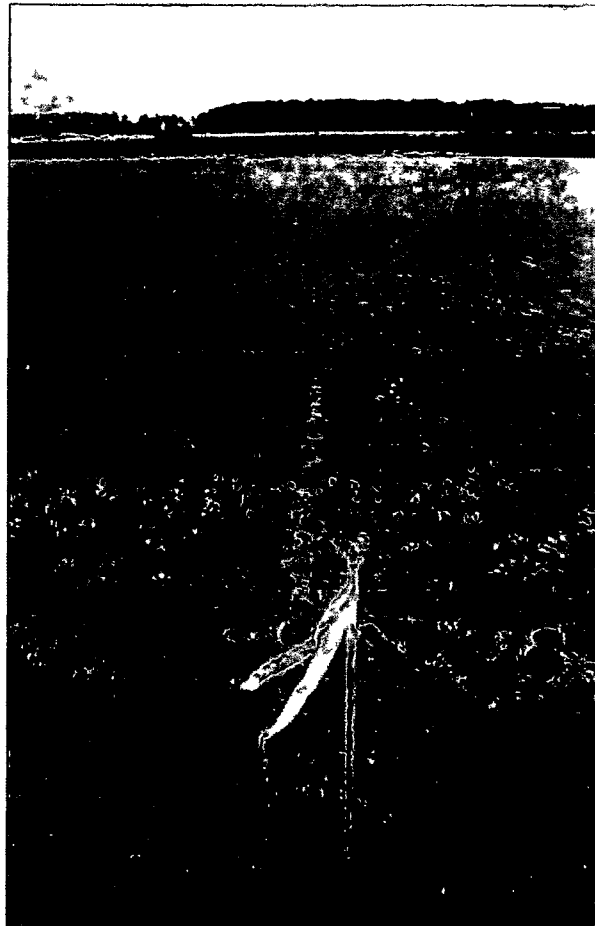


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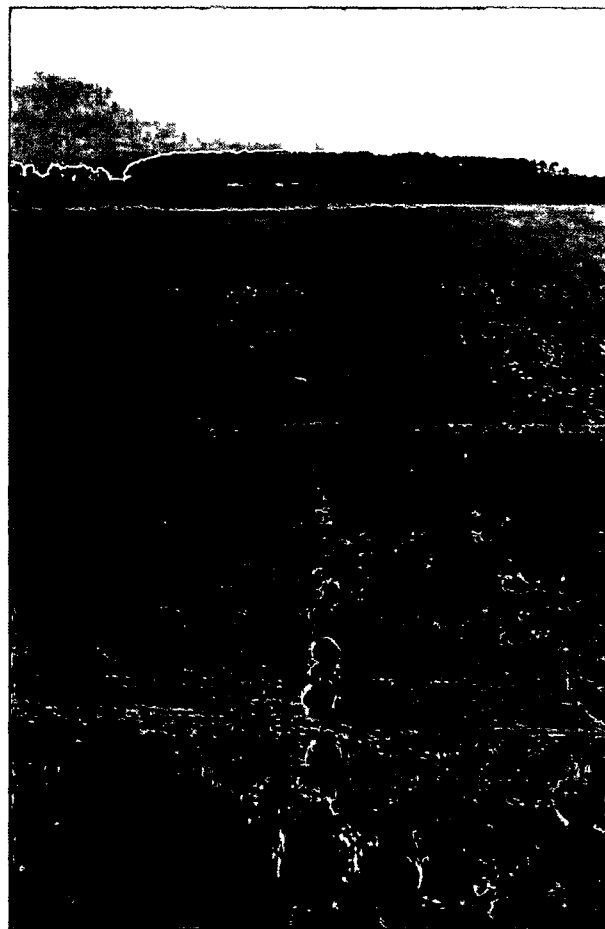


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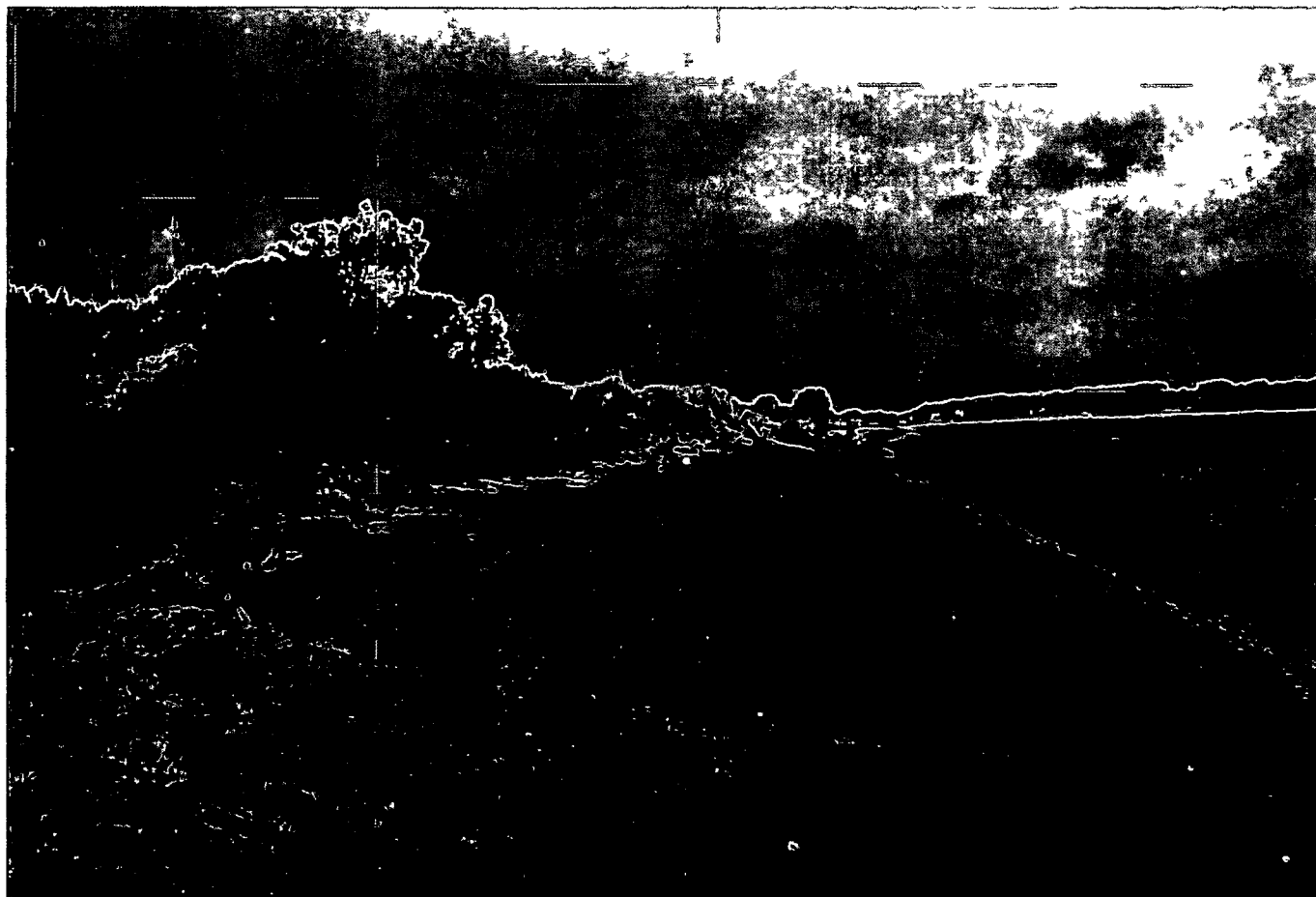


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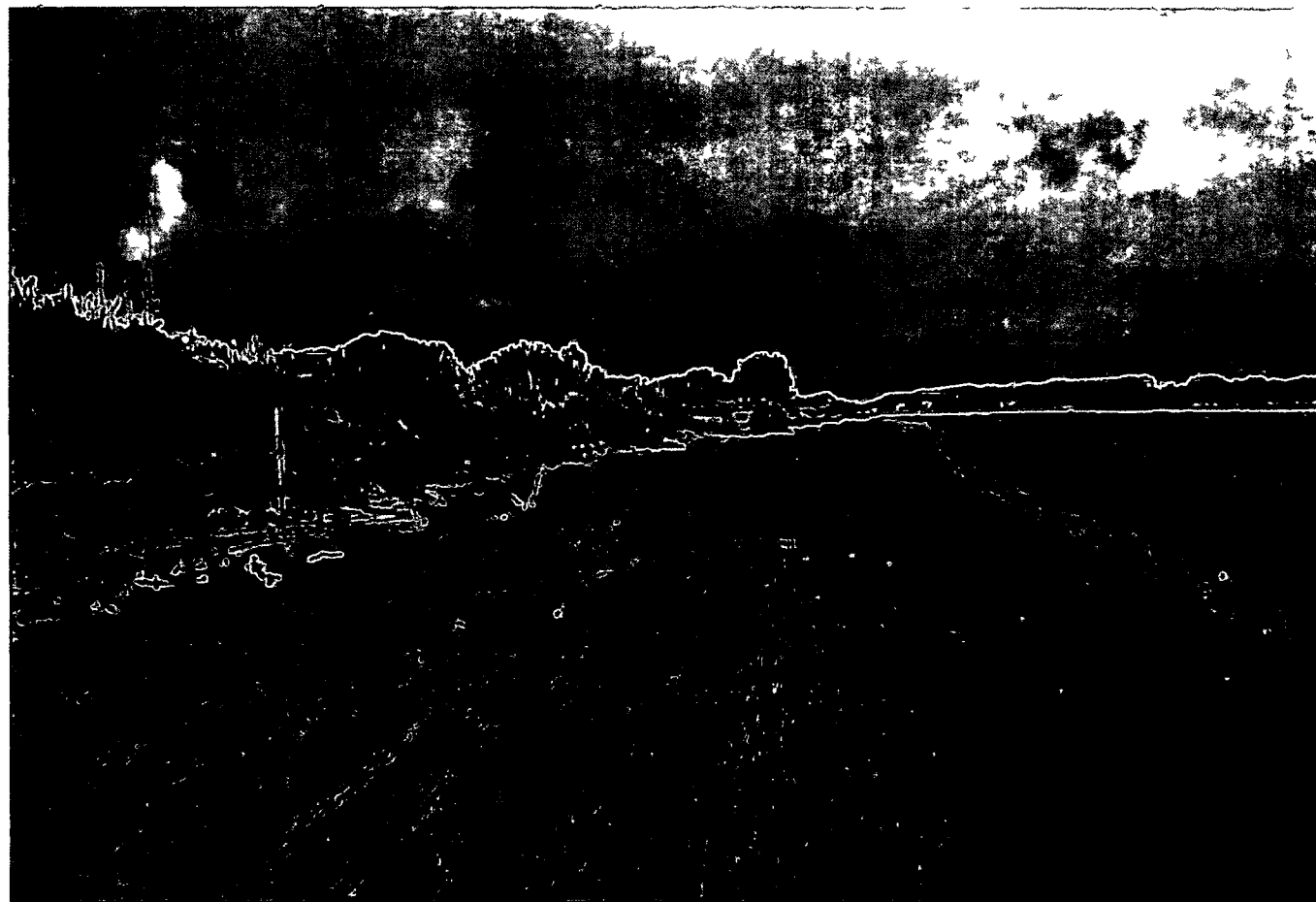


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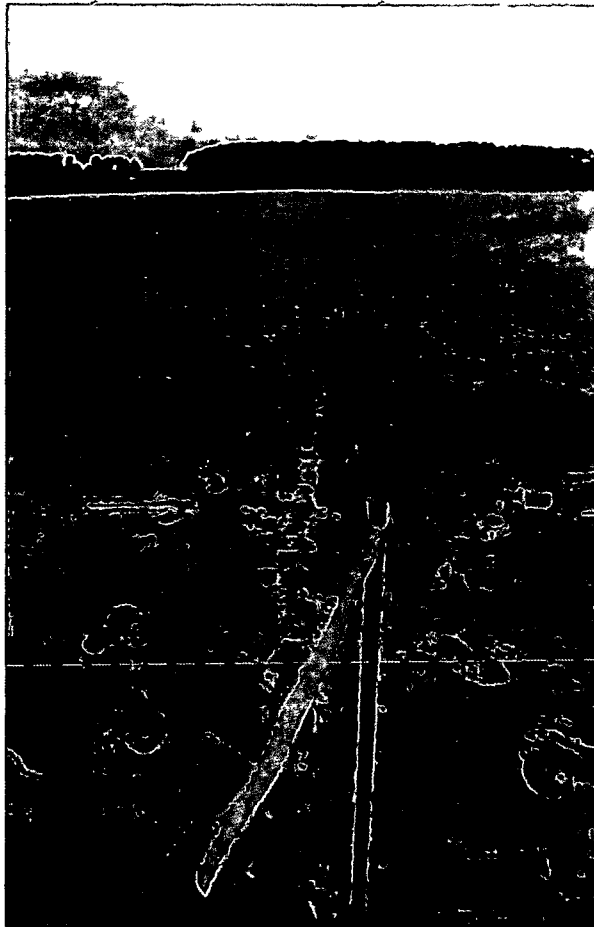


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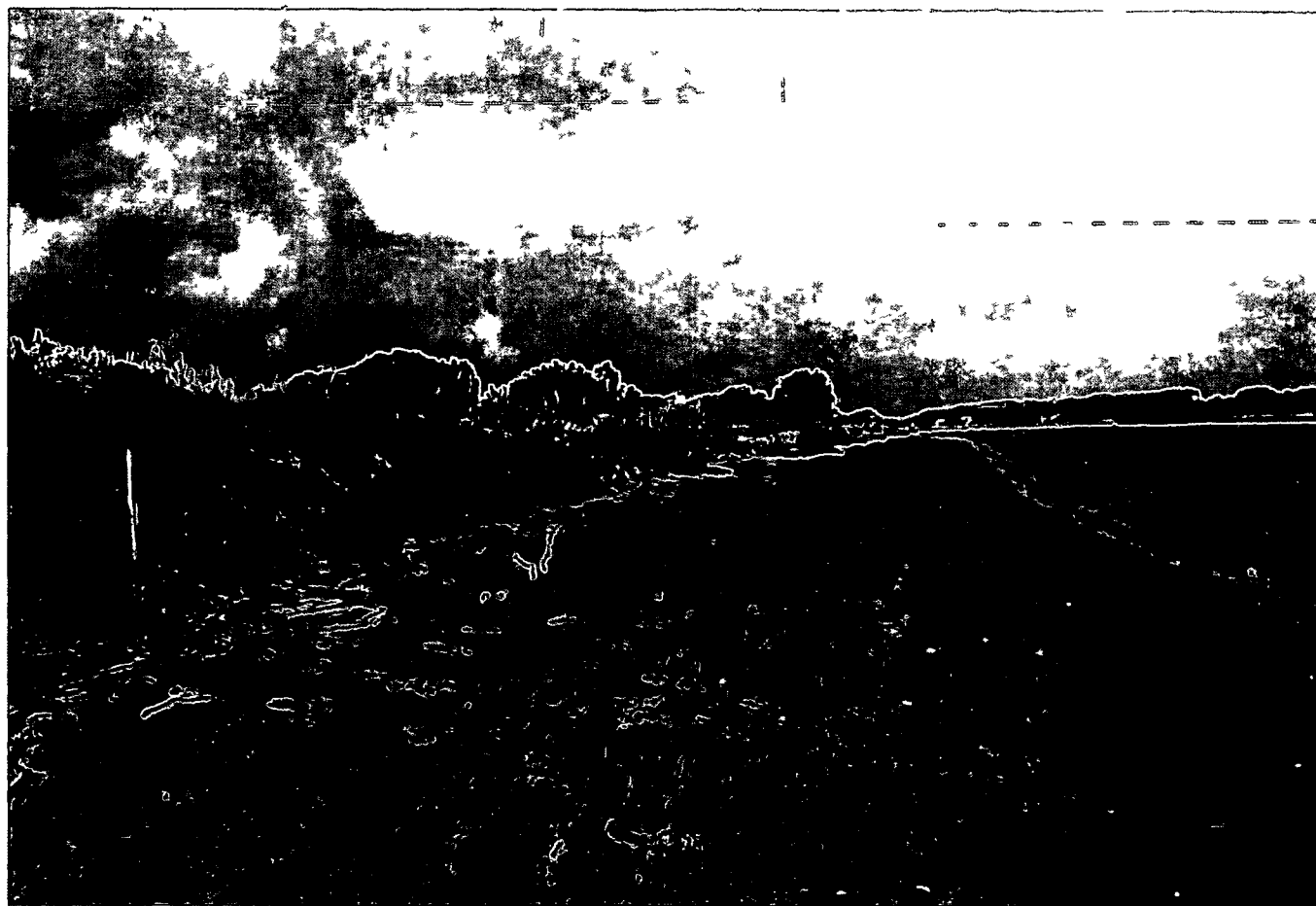


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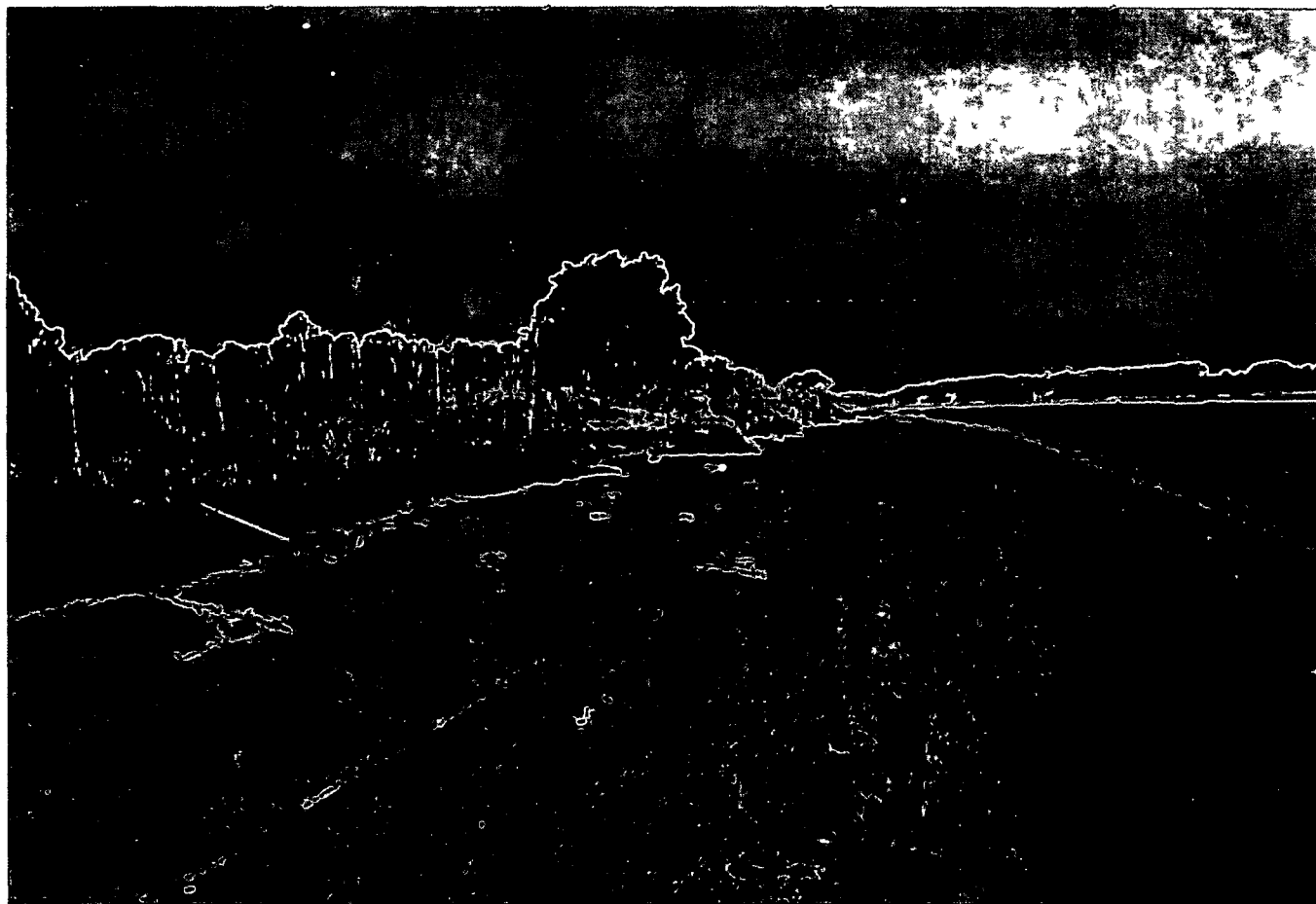


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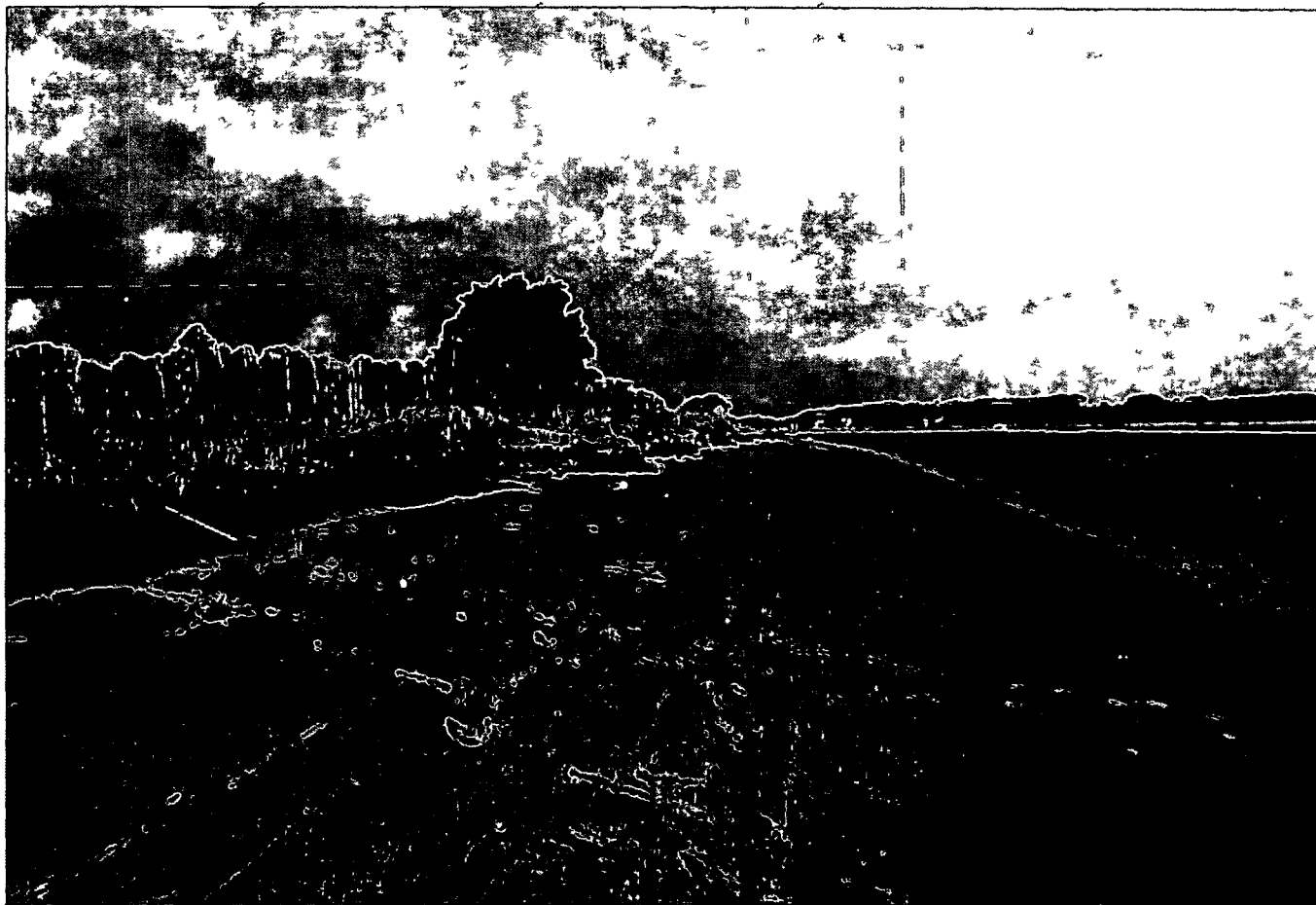


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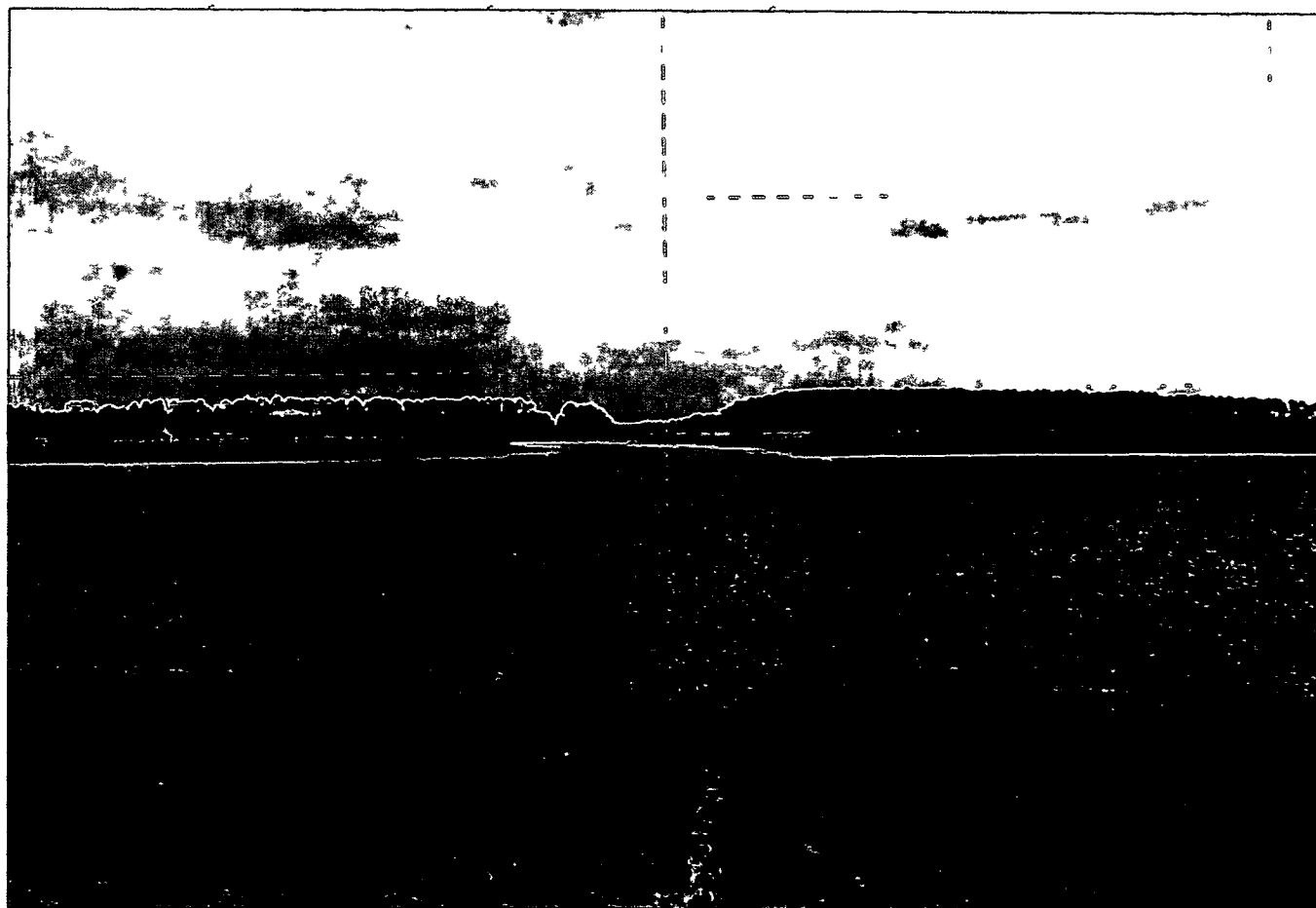
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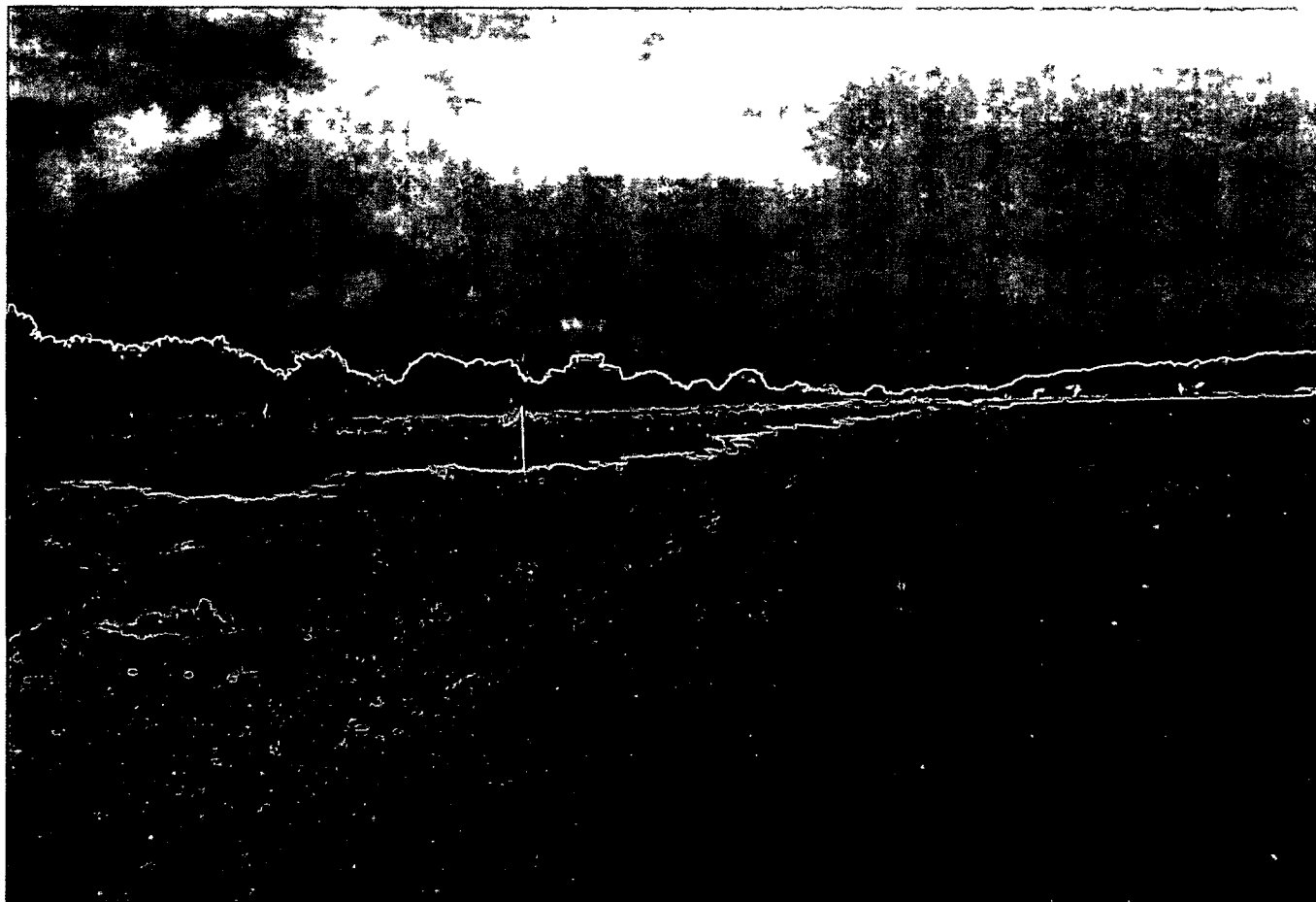


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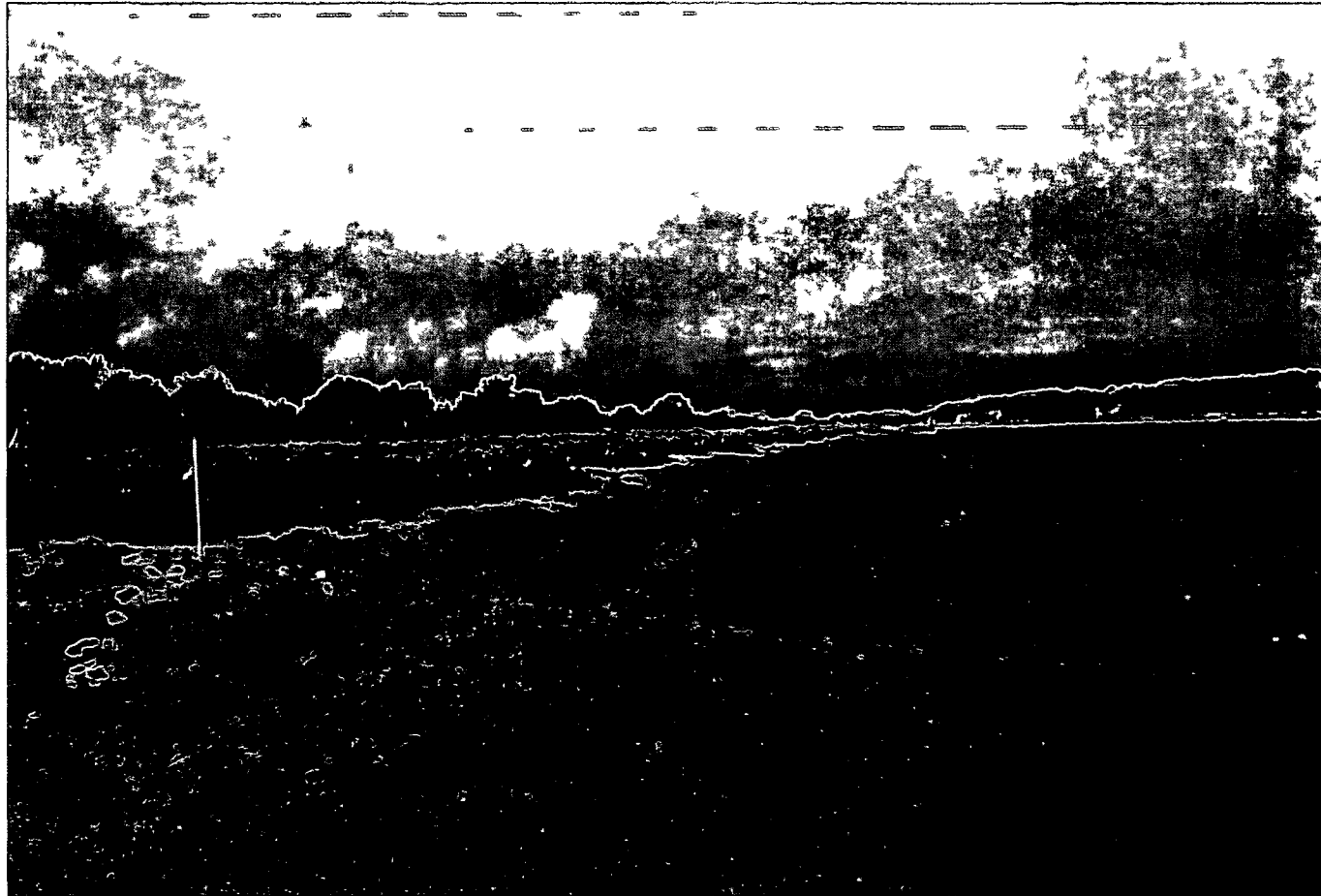


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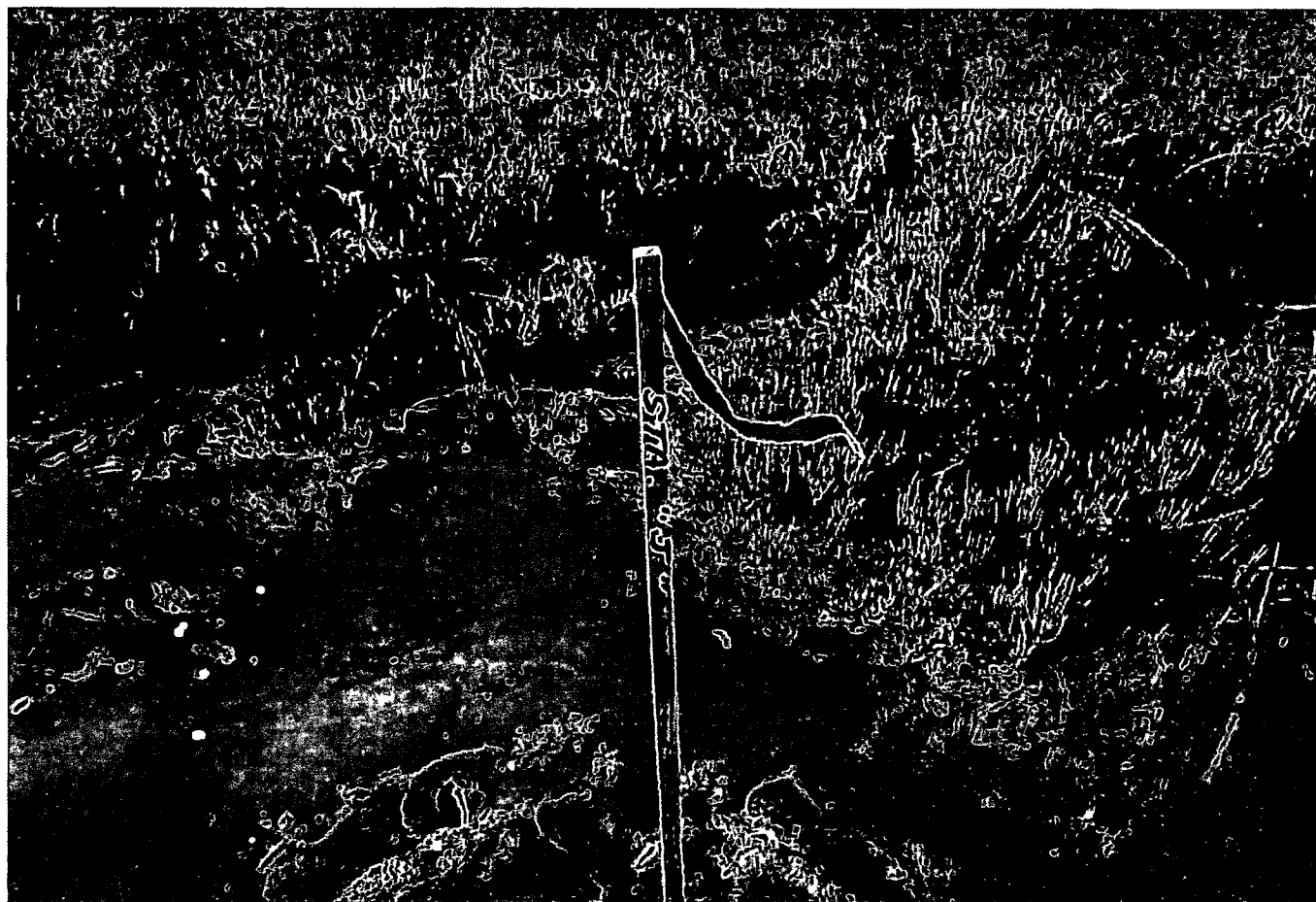


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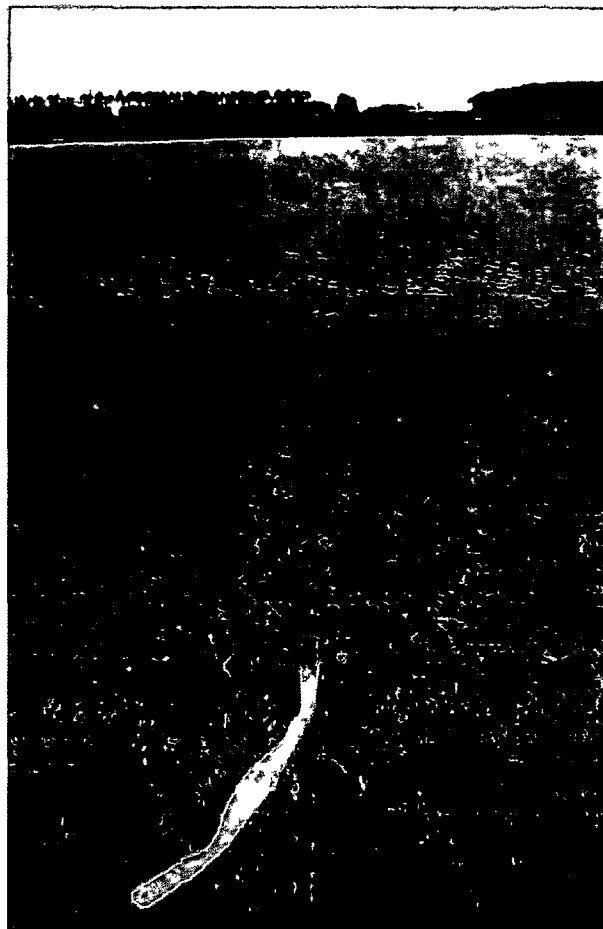


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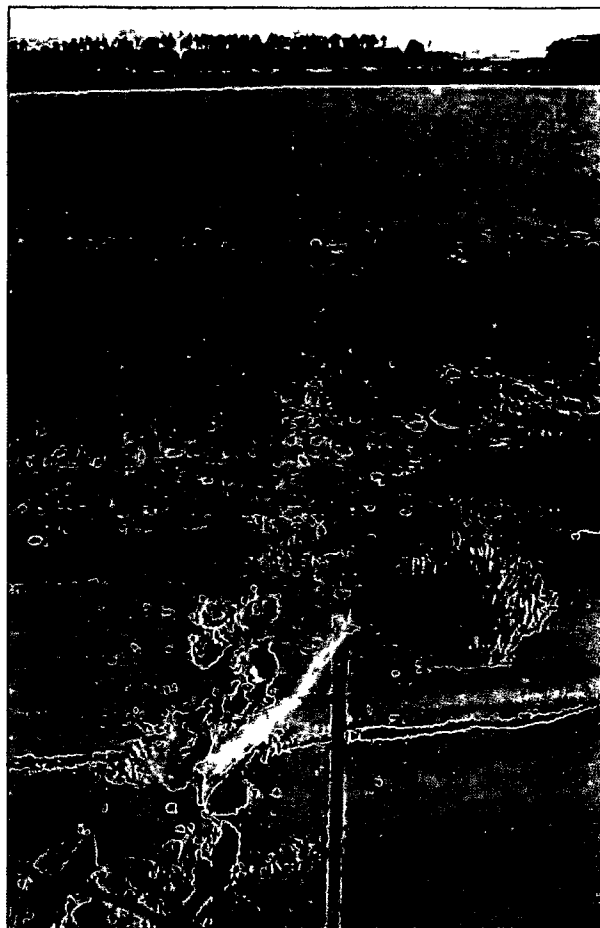
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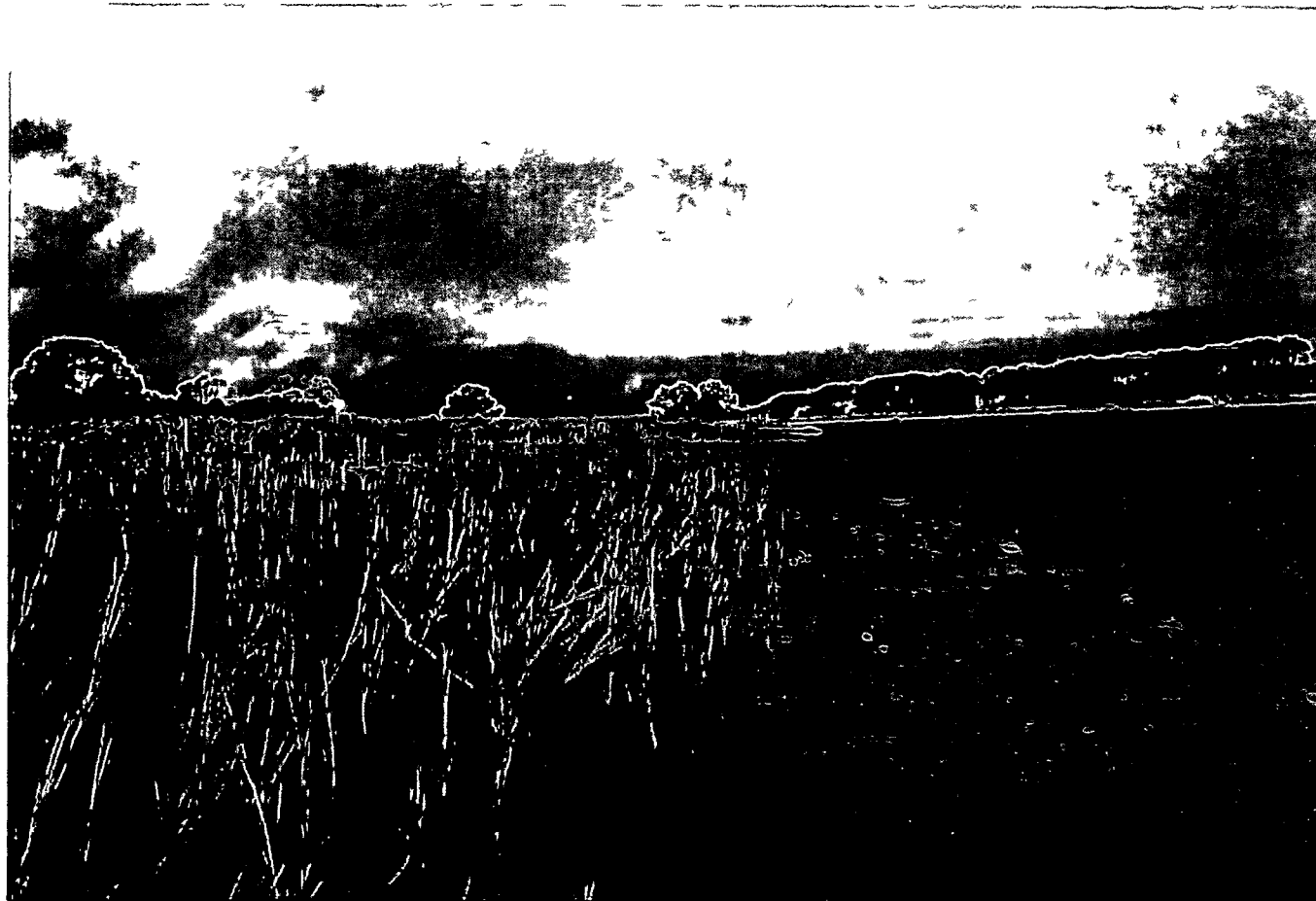


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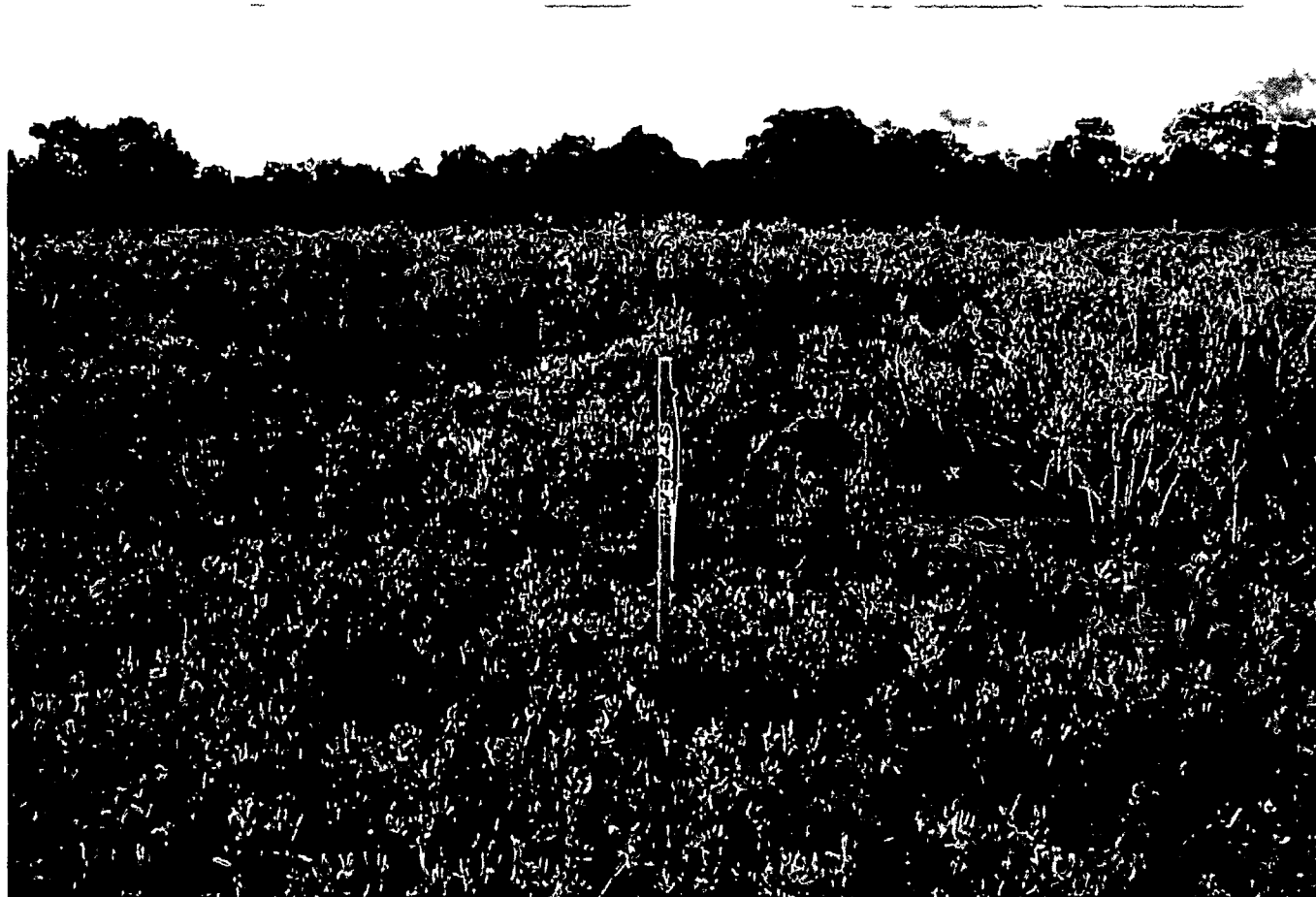


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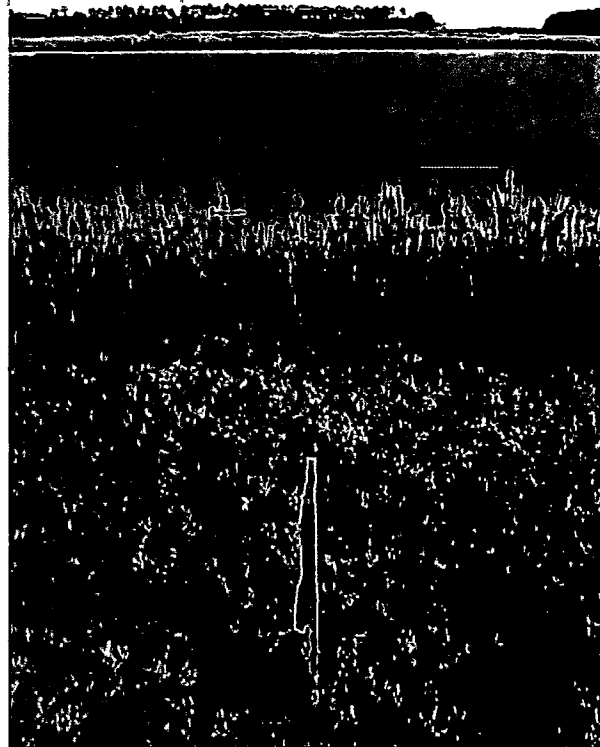


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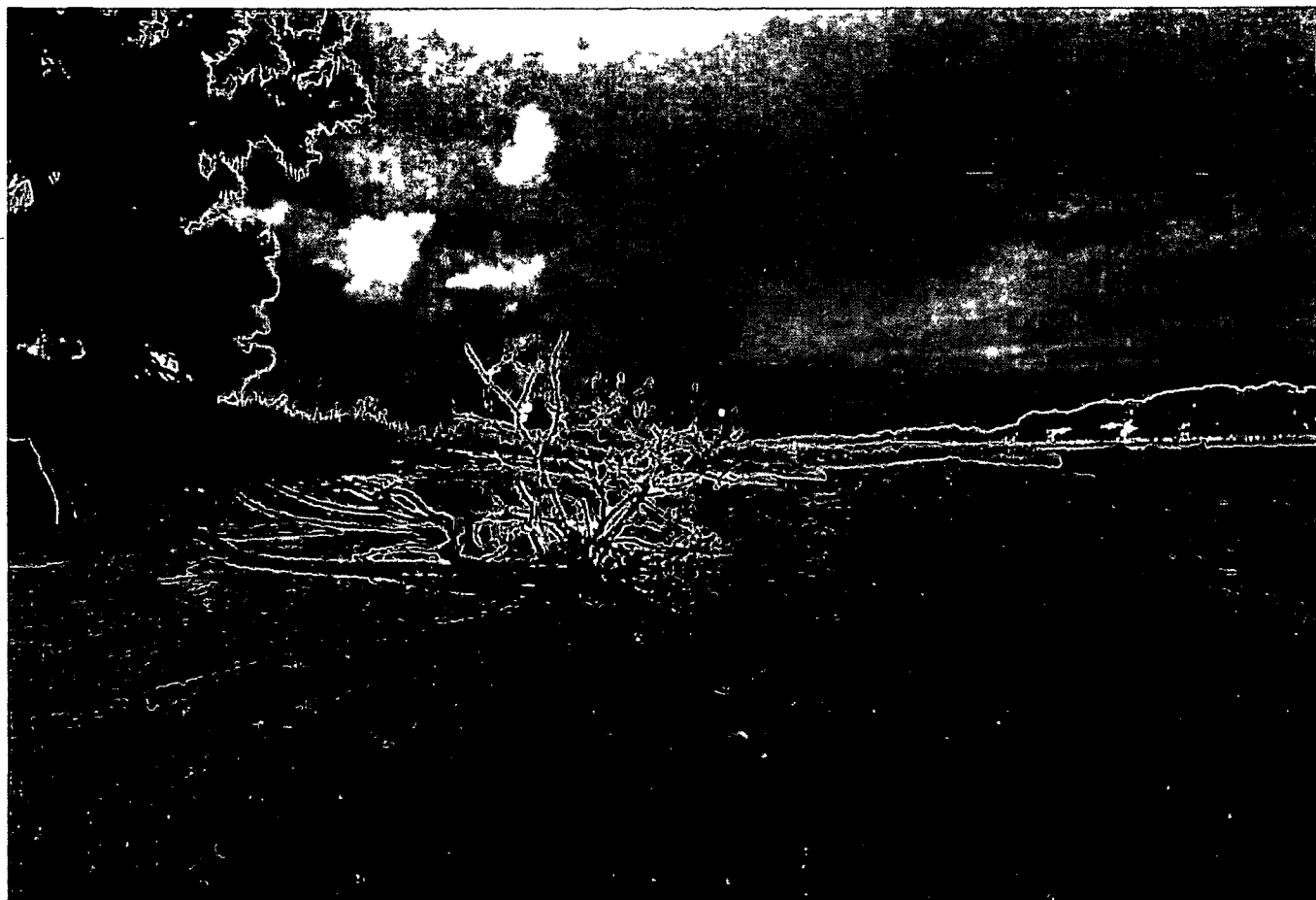


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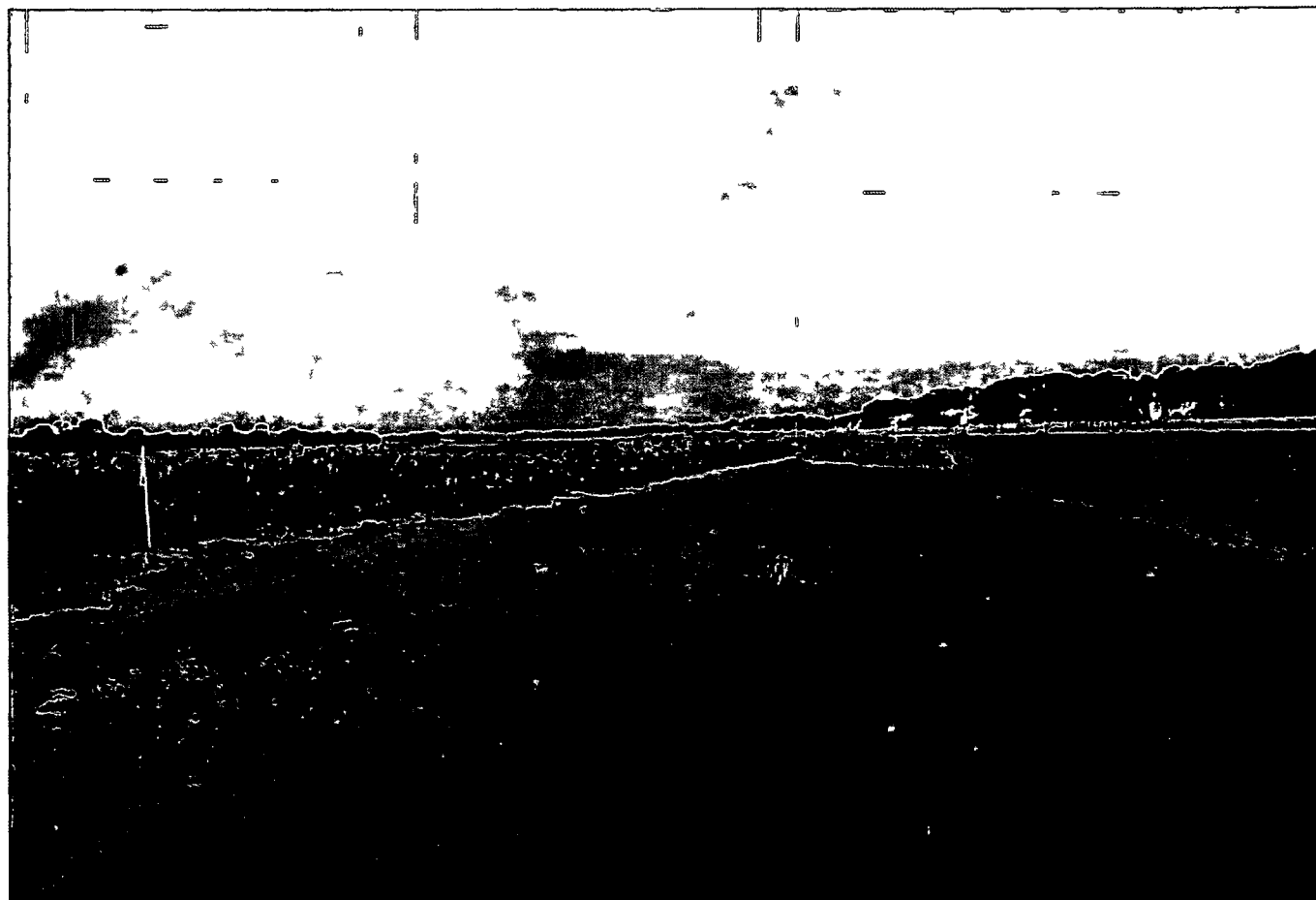


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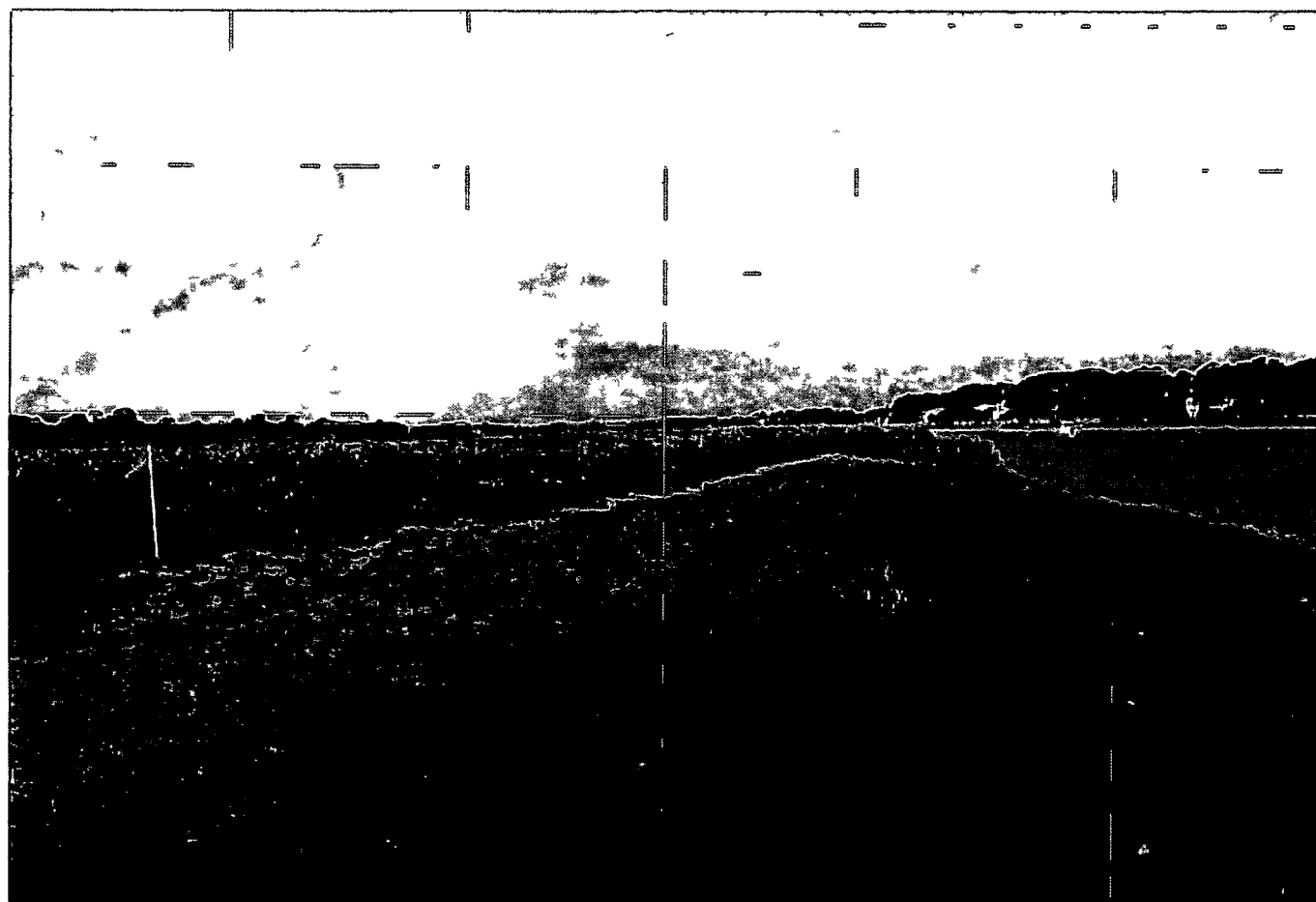


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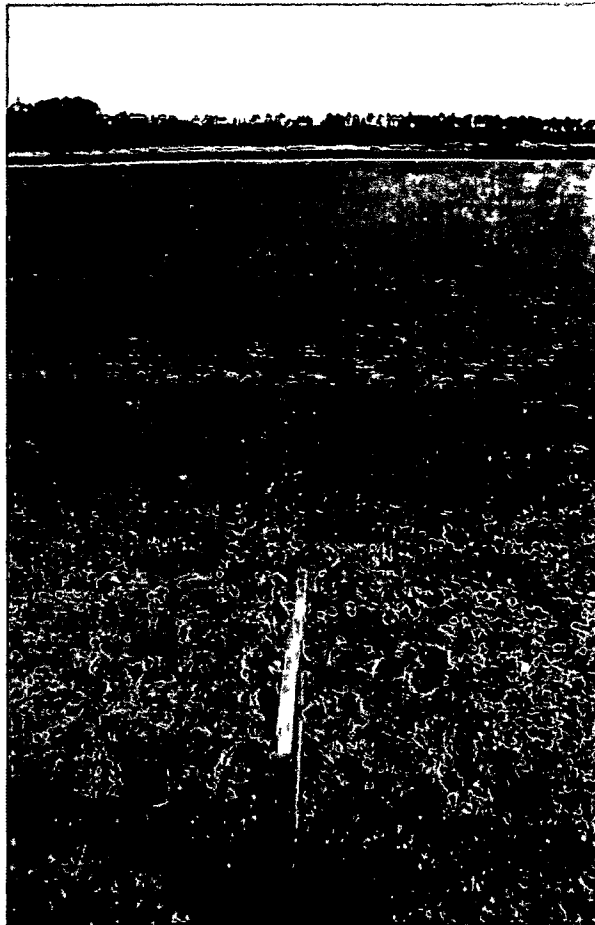
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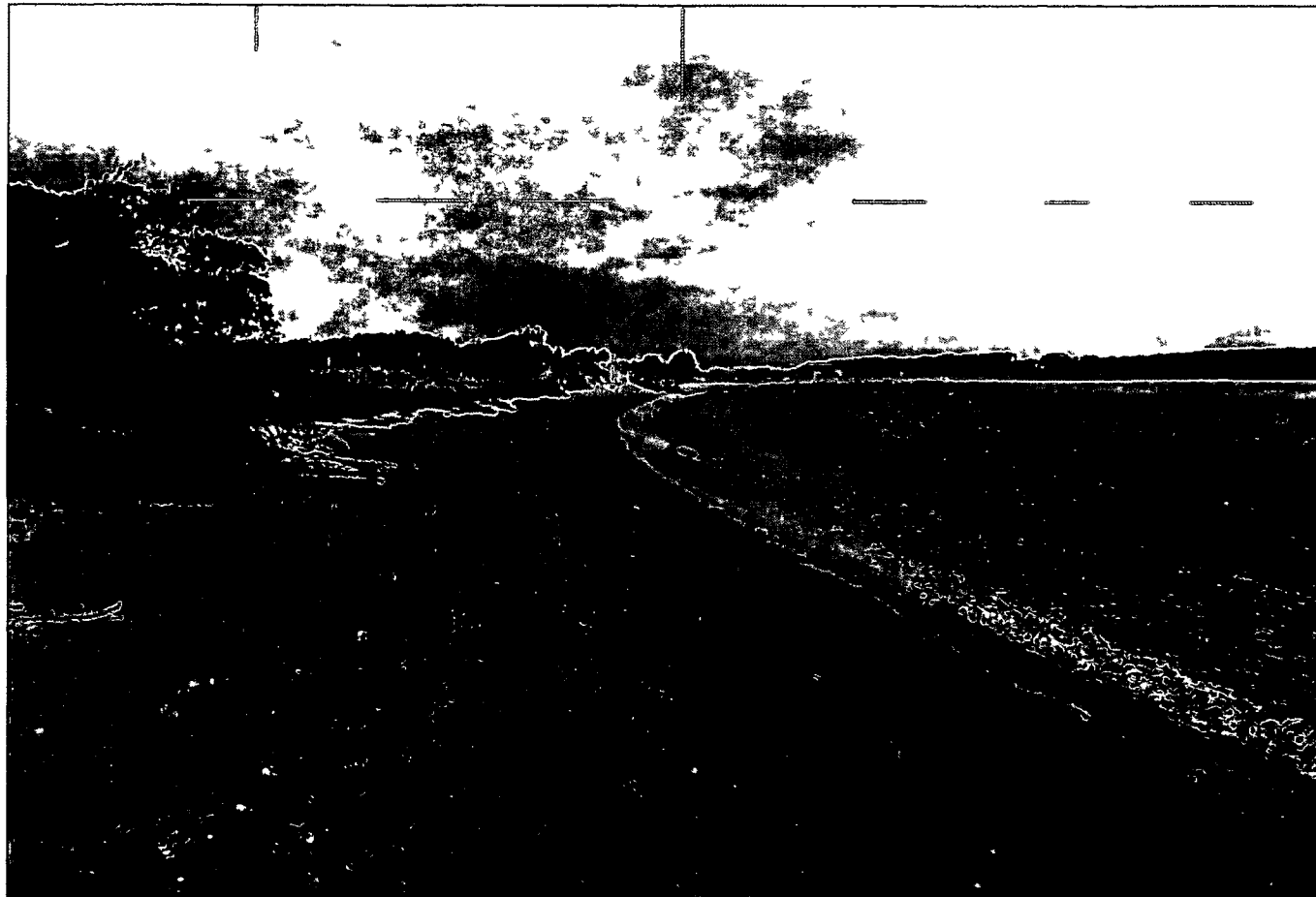


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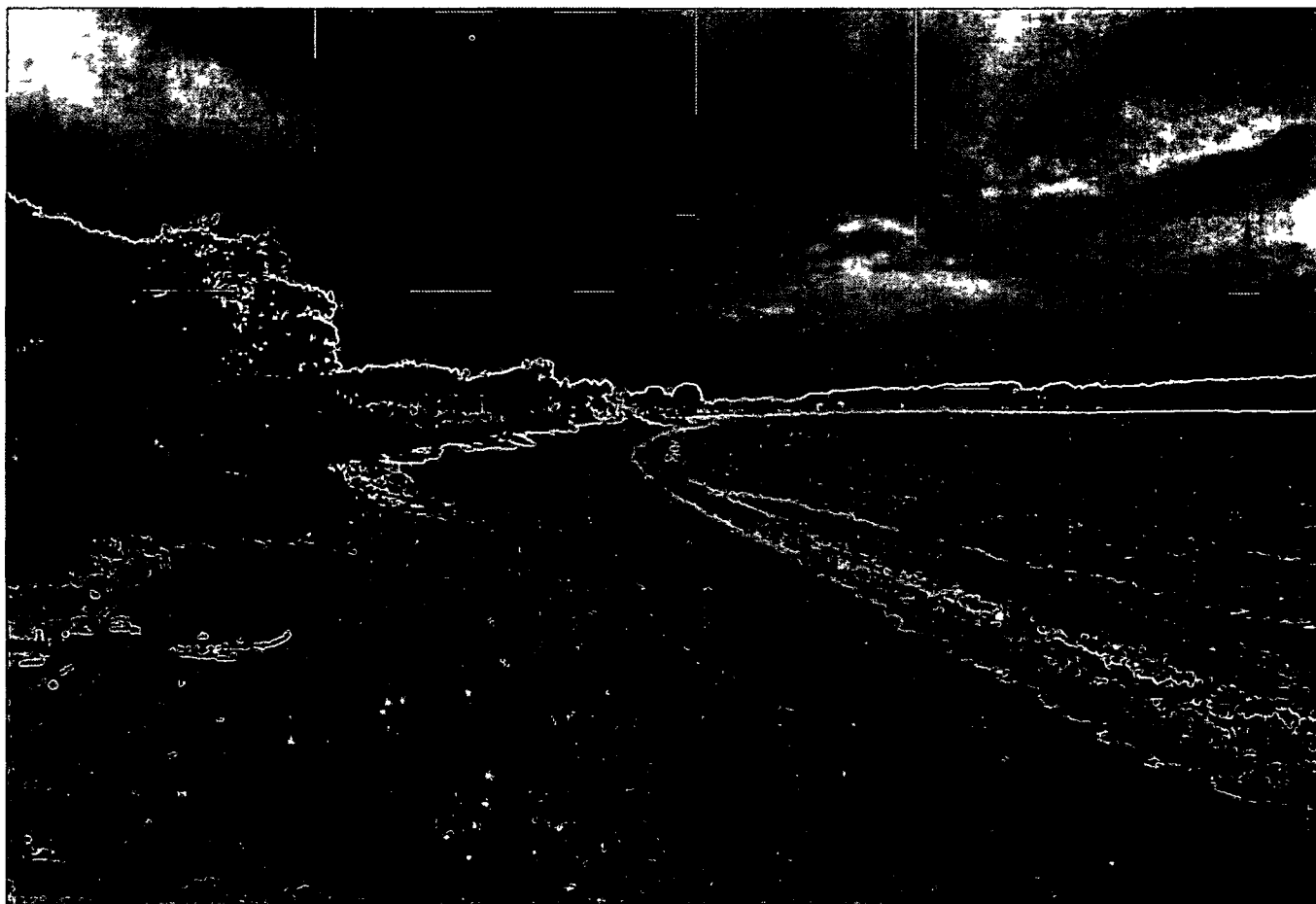


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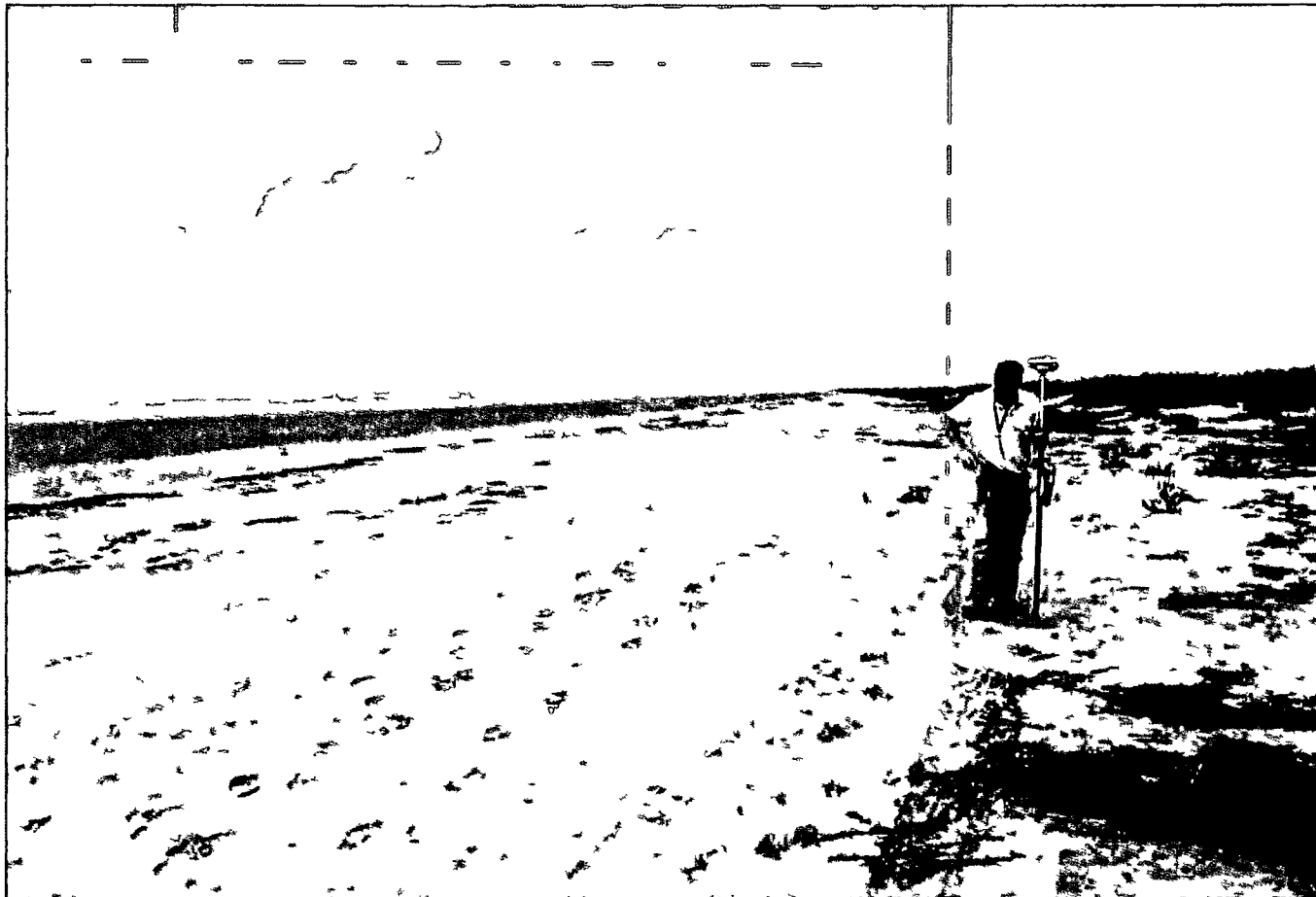


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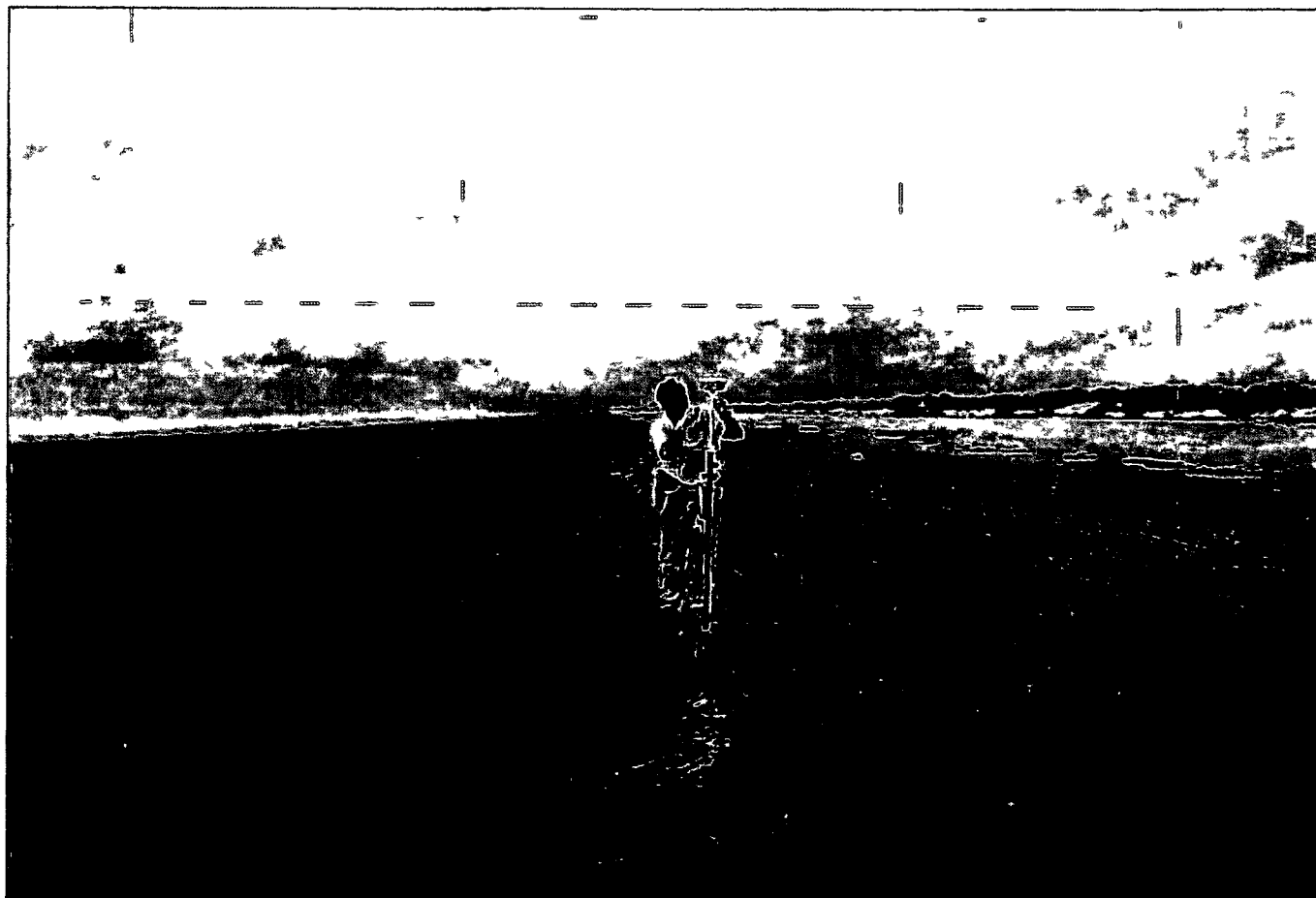


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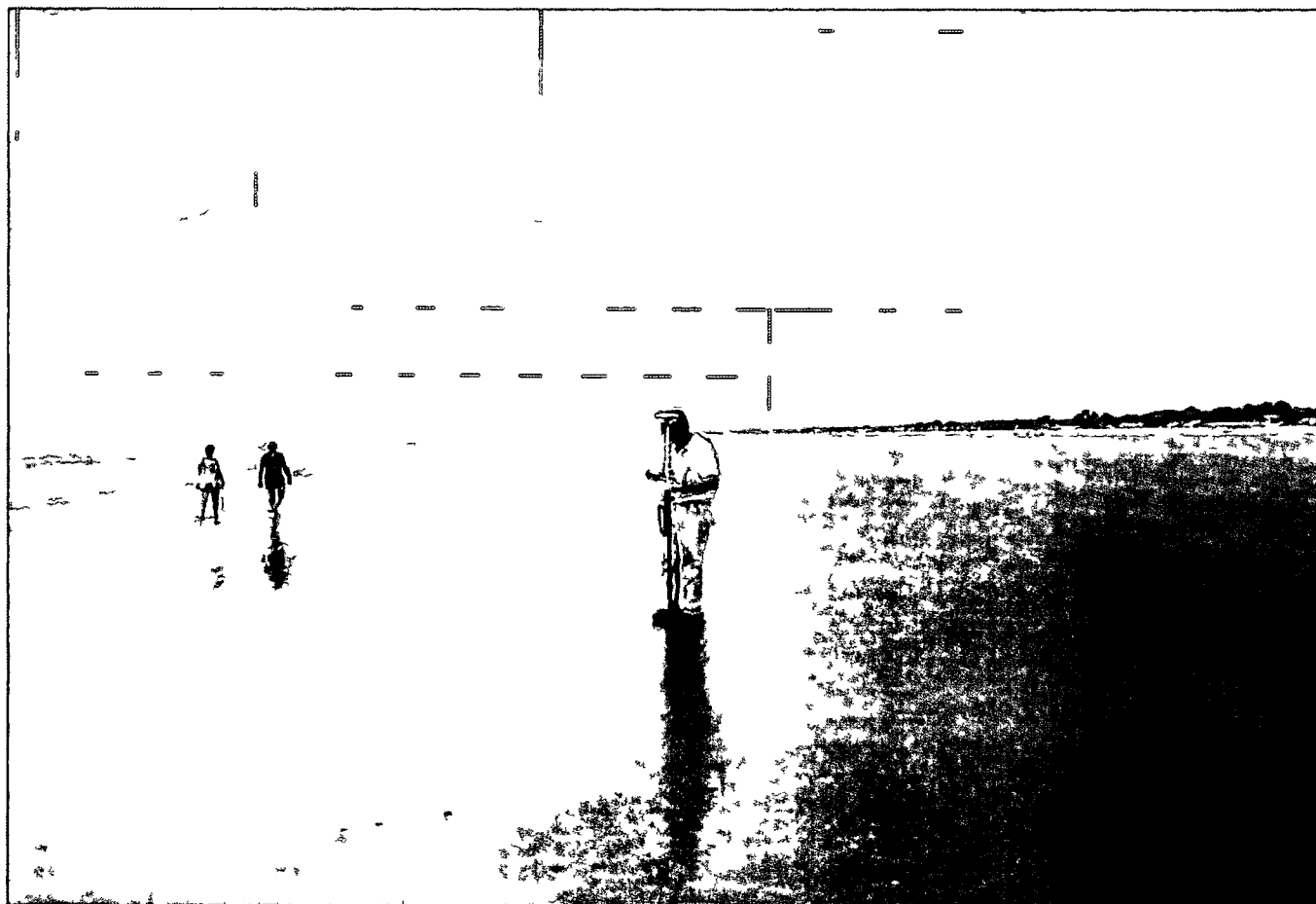


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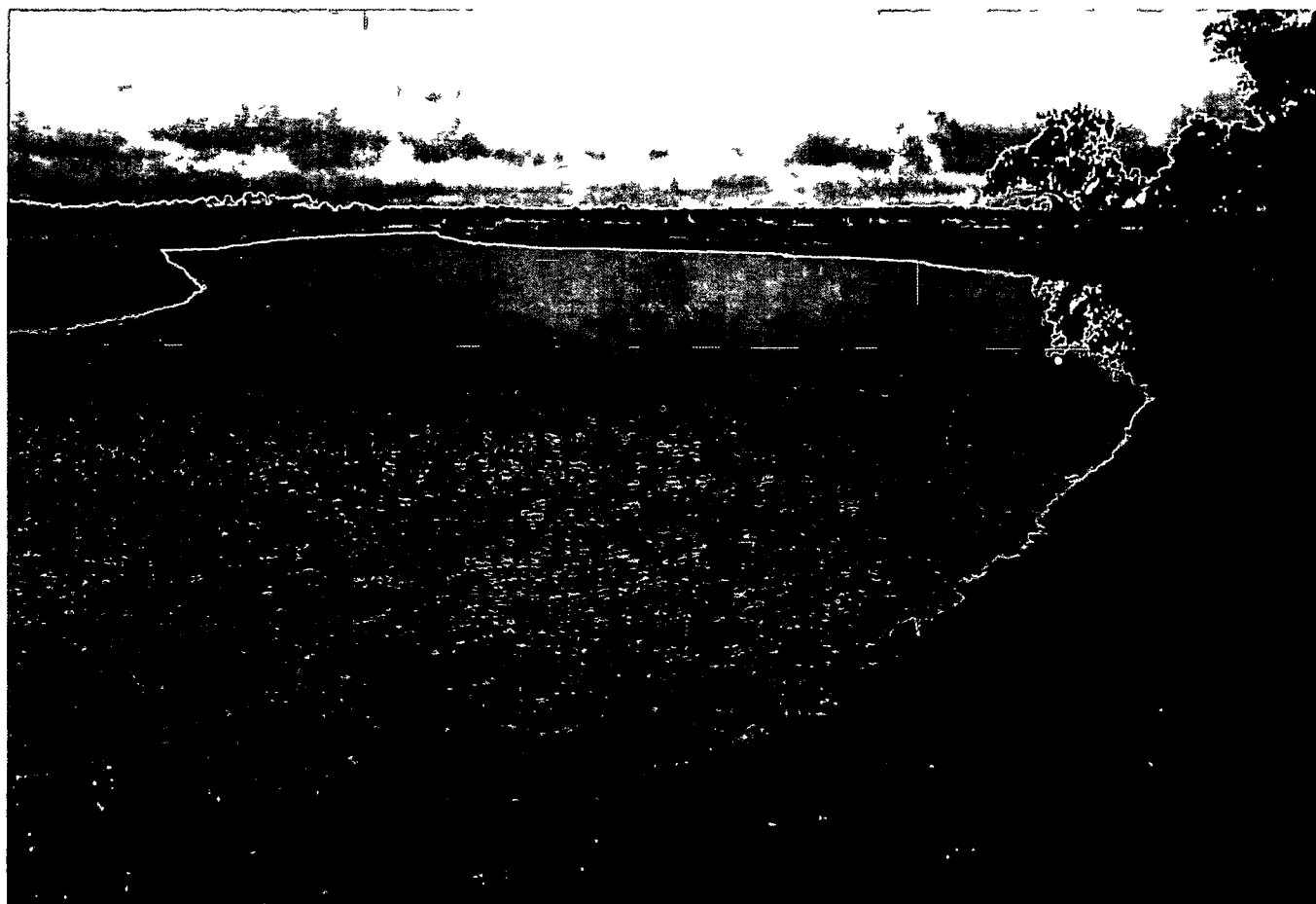


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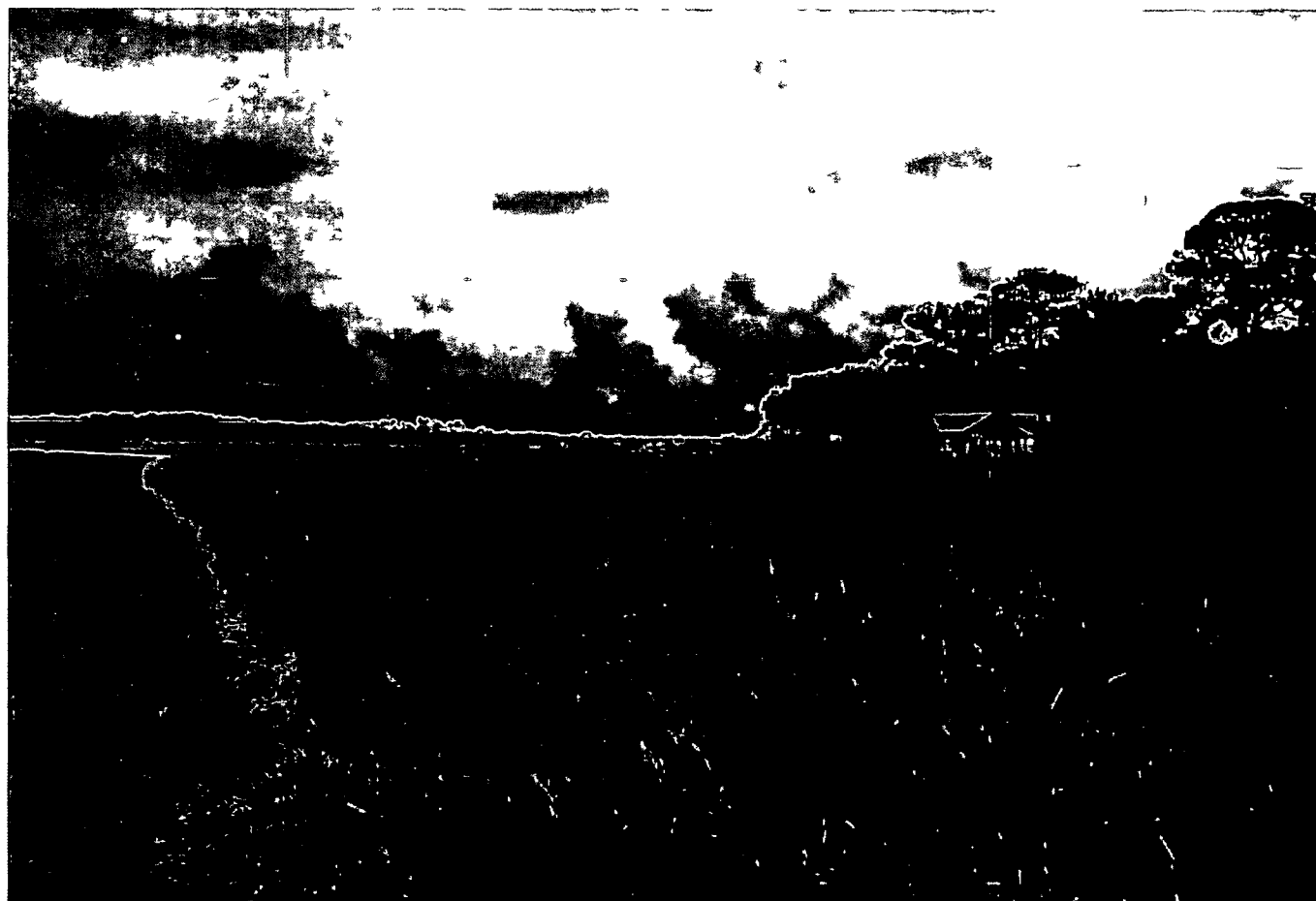


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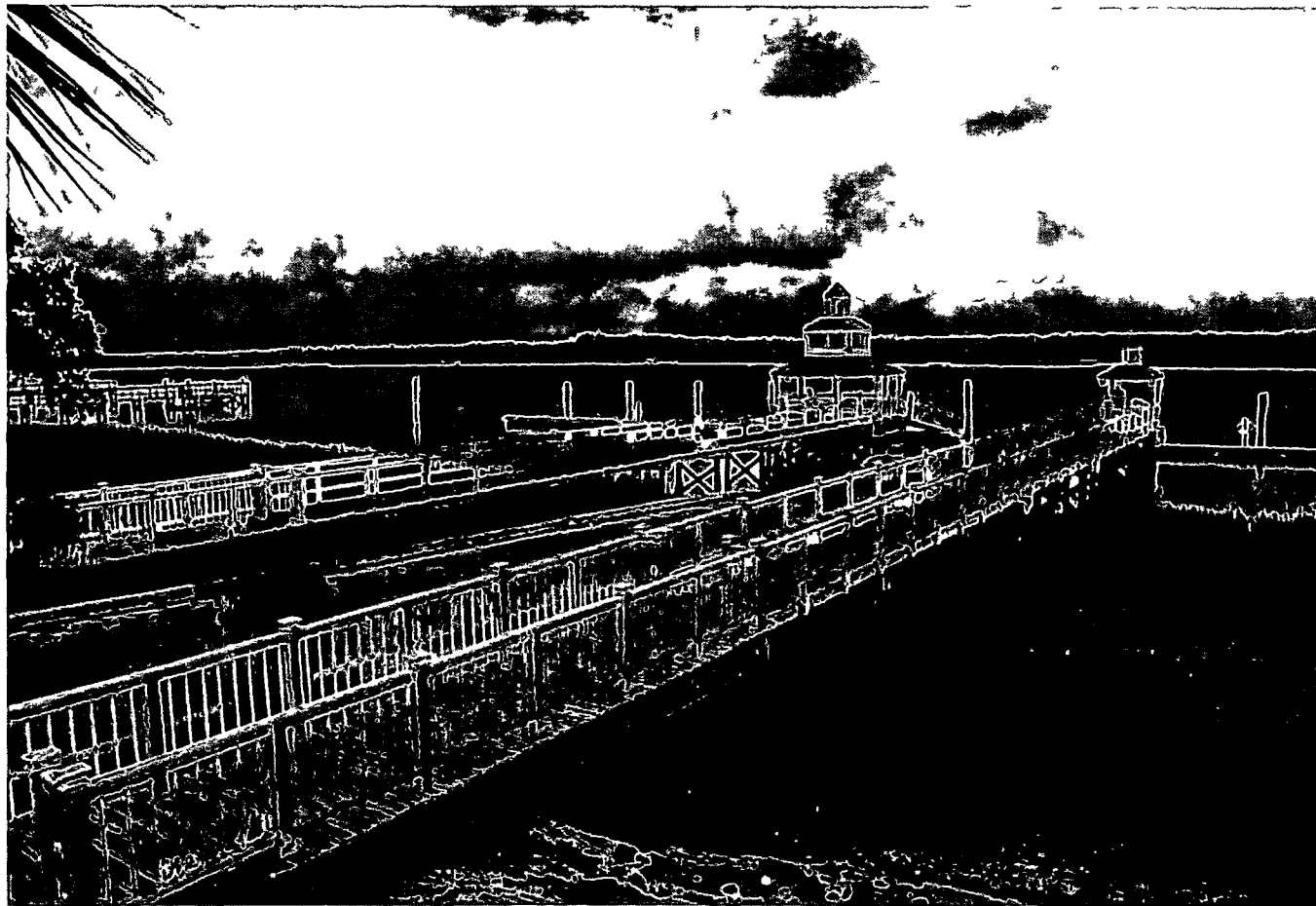


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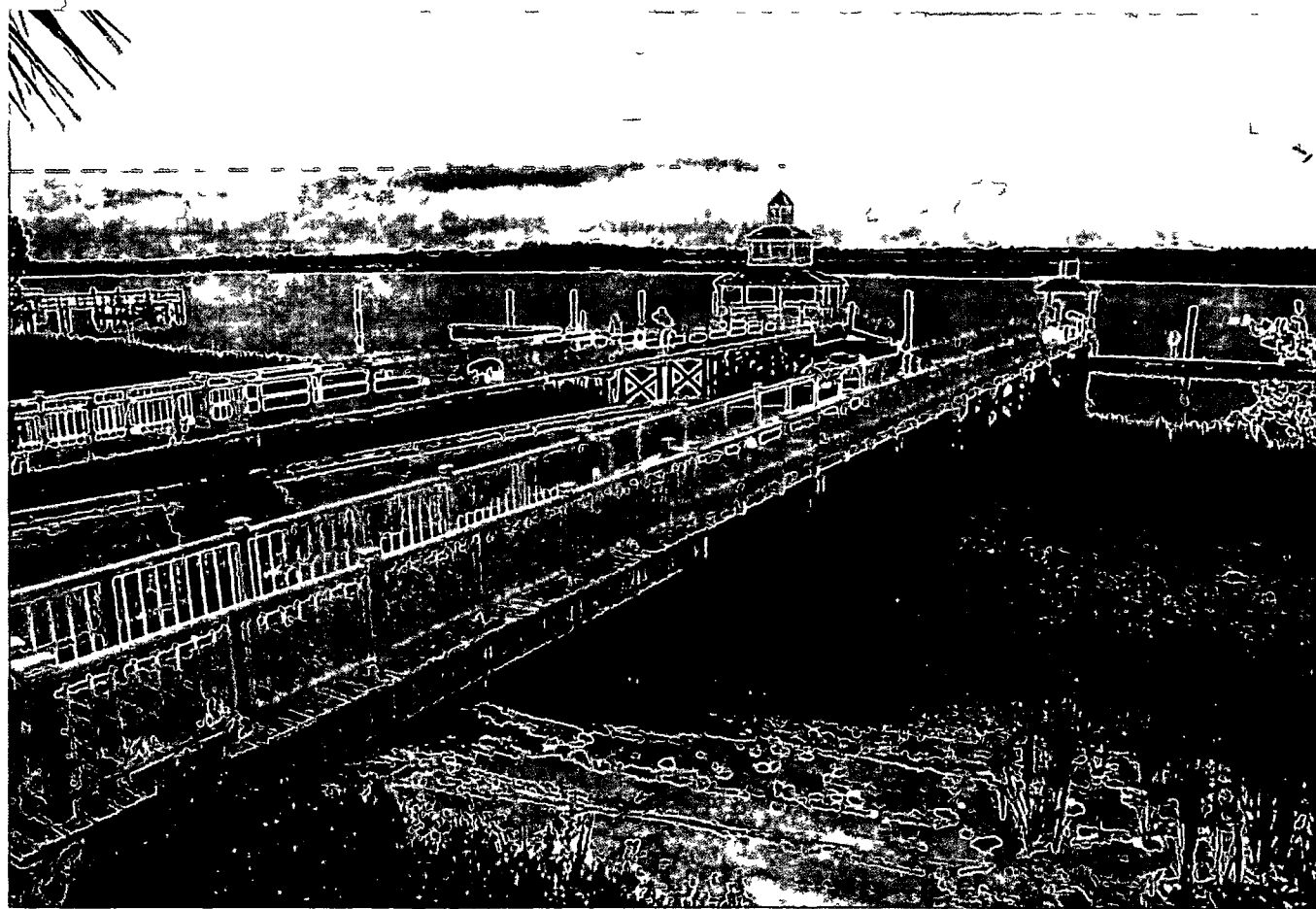


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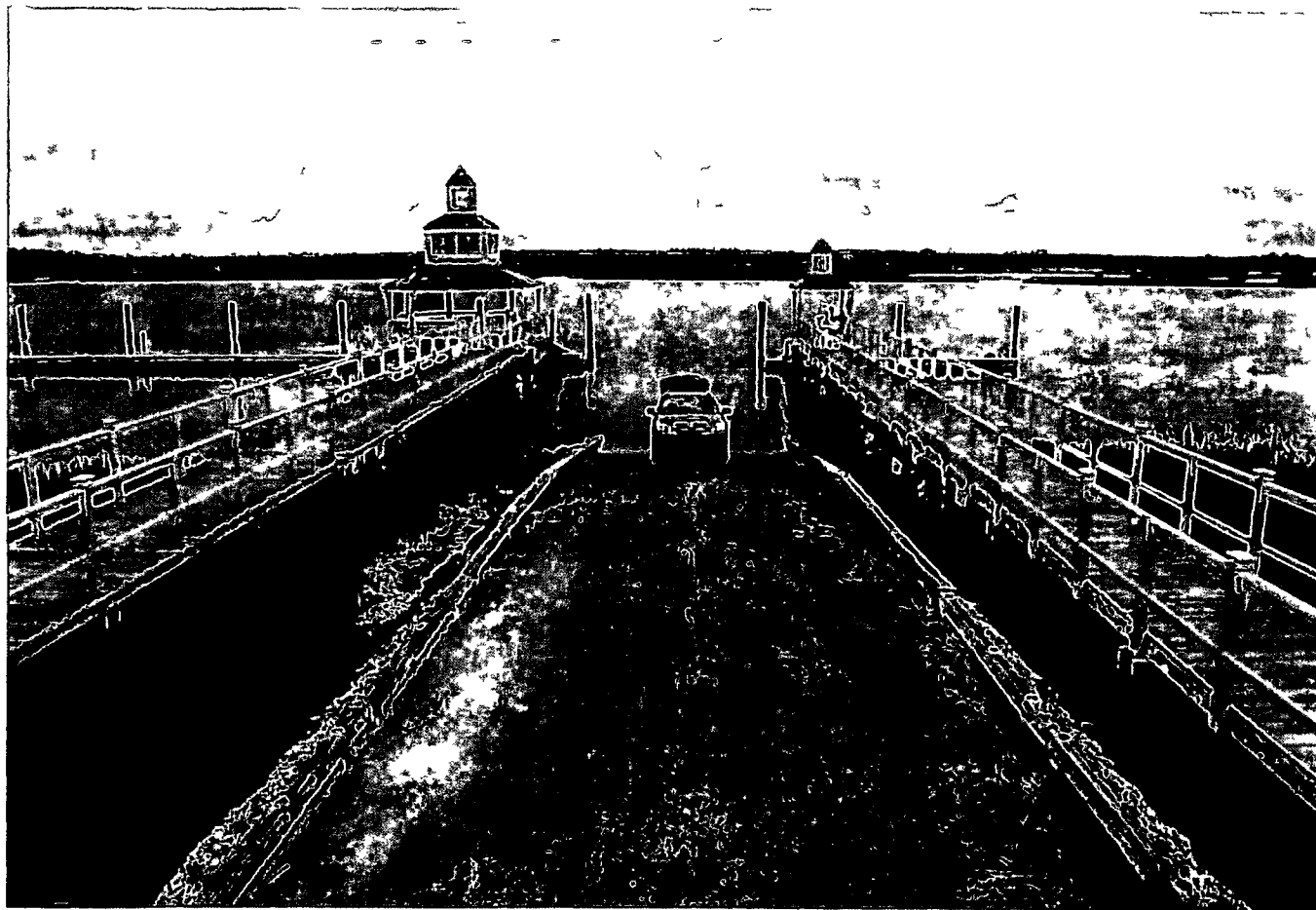


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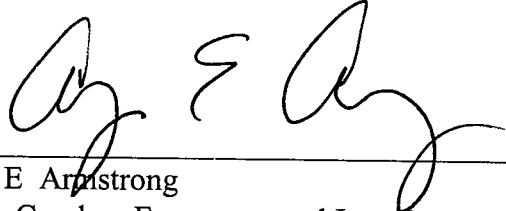
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Certificate of Counsel

The undersigned does hereby certify that this Record on Appeal contains all material proposed to be included by any of the parties and not any other material



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South Carolina Environmental Law Project
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Georgetown, South Carolina

October 27, 2010