State of Louisiana
Department of Natural Resources
Coastal Restoration Division

2006 Annual Inspection Report

CAERNARVON OUTFALL MANAGEMENT

State Project Number BS–03a
Priority Project List 2

November 17, 2005
Plaquemines Parish

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I. Introduction

The Caernarvon Outfall Management Project (State Project No. BS-03a) was approved on the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Second Priority Project List The project is located to the south and west of Big Mar, a body of water which formed as the result of a failed agricultural impoundment. The project features are located entirely in Plaquemines Parish and the project outfall area encompasses 15,556 acres in Plaquemines Parish. Project features are located on a number of streams in the outfall area. The site was inspected on November 17, 2005 by LDNR & NRCS personnel.

II. Inspection Purpose and Procedures

The purpose of the annual inspection of the Caernarvon Outfall Management Project (BA-03a) is to evaluate the constructed project features to identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, LDNR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs (O&M Plan May 15, 2003). The annual inspection report also contains a summary of maintenance projects and an estimated projected budget for the upcoming three (3) years for operation, maintenance and rehabilitation. The three (3) year projected operation and maintenance budget is shown in Appendix C. A summary of past operation and maintenance projects completed since completion of the Caernarvon Outfall Management Project are outlined in Section IV.

An inspection of the Caernarvon Outfall Management Project (BA-03a) was held on November 17, 2005 on a clear and cool day. This inspection was held in November in order to serve as a post hurricane in conjunction with the required annual project inspection. In attendance were George Boddie, Garrett Broussard, Tom Bernard, Barry Richard, and Brady Carter of LDNR; and Loland Broussard of NRCS. The team left the EBI boat launch in Caernarvon at mid-morning. Not all of the sites were inspected; even the airboat could not make it through some areas of hurricane debris. Photographs of that inspection are included in Appendix B of this report. Not all of the structures were accessible; therefore, some of the photographs from the 2005 pre-storm inspection were used as noted.

III. Project Description and History

In August, 1991, the Caernarvon Freshwater Diversion Structure on the east bank of the Mississippi River near Big Mar, was placed into operation. The Caernarvon structure was constructed (construction funded by the Water Resources Development Act) for the purpose of diverting Mississippi River water through Big Mar into the marshes to the south and west of Big Mar. These marshes, since the early 1900's, had deteriorated due, largely, to being isolated, because of levee construction, from direct river influxes. This isolation, with the resultant absence of minerals and nutrients formerly regularly deposited during high river stages, caused a net loss of the organic soils prevalent in the project area. The specific mechanisms causing the soil loss included natural subsidence, erosion, salt water intrusion and oxidation.

In addition to the losses due to Mississippi River levee construction, the increased construction of navigation and oil/gas canals in the project area contributed to the problem. These straight canals provided a perfect avenue for saltwater intrusion and the canals' high water velocity led to increased erosion rates.

An earlier hurricane also contributed to the loss of wetlands in the project area. In 1965, storm surges from Hurricane Betsy traveled over the above-discussed canals and the forested swamp area in the northern part of the project area was destroyed by salt stress when the salt water from the storm surge became trapped behind Tigers Ridge.

From 1932 to 1990, 5,546 acres of land in the project area were converted to open ware via the above-discussed mechanisms. In addition, by 1978, saltwater intrusion had transformed the project area from a primarily intermediate marsh to primarily a brackish marsh.

The Caernarvon Freshwater Diversion Structure was intended to counter some of the mechanisms causing wetlands loss in the project area particularly the saltwater intrusion and loss of sediment input resulting from the Mississippi River levee construction and the new oil/gas and navigation canals that have been constructed. Specifically, the Caernarvon structure was intended to increase wildlife and fisheries productivity, enhance emergent marsh vegetation growth, and reduce marsh loss.

The structure has a discharge capacity of approximately 8,000 cubic feet of freshwater per second. Once diversion waters enter Big Mar, 66% of the water exits to the southeast via Bayou Mandeville which flows into Lake Lery. Eventually this flow reaches Bayou Terre aux Boeufs. So, in summary, 66 % of the discharge water flows to the southeast of Big Mar and only 34 % flows to the more-deteriorated marshes to the southwest of Big Mar. An additional problem is that, prior to the present Caernarvon Outfall Management Project, much of the flow of water to the southwest channeled rapidly to the lower

reaches of the basin and did not inundate the interior marshes as was originally intended. The present project promotes better utilization and distribution of water from the Caernarvon Freshwater Diversion Structure. Project features will allow water from the channels to flow into the marsh interior and will cause the water to be retained in the marsh for a longer period of time. The project features are listed below:

All elevations are at NAVD 88. Inspection photos of the features are shown in an attachment.

A. Site/Structure # 13 – Rock fill channel plug with riprap armor located along the west bank of Bayou Mandeville. The plug is set at an elevation of +4.0 ft. and is 100 ft. long x 100 ft. wide with 18 inches of riprap armor. The crest of the structure is 10 ft. wide. The plug includes a one (1) 48" diameter corrugated aluminum pipe which pass through the rock fill plug at an elevation of -3.5 ft. with an aluminum combination gate attached to the pipe on the interior side of the marsh. A timber walkway to the gate is at elevation +4.0.

B. Site/Structure # 25 - Earth and rock fill channel plug with riprap armor located on the Forty Arpent Canal near Big Mar. The plug is set at an elevation of +4.0 ft and is 169 ft. long and 100 ft. wide with 18 inches of riprap armor. The crest of the structure is 10 ft. wide. The plug includes two (2) 48" diameter corrugated aluminum pipes which pass through the rock fill (and are supported by the rock fill) at an elevation of -4.0 ft. Earth fill has been placed on each side of the rock fill. Aluminum canal gates are attached to the end of each pipe on the exterior side of the marsh. A timber walkway to the gates is at elevation +4.0.

C. Site/Structure # 26 – Earthen channel plug with riprap armor plate located along Reggio Canal spoil bank. The plug is set at a crest elevation of +4.0 ft. and is 154 ft. long and 100 ft. wide and is capped with 18 inches of riprap rock. The crest of the structure is 10 ft. wide. The plug includes four (4) 48" corrugated aluminum pipe which pass through the earthen material at an elevation of -4.0 ft. Aluminum canal gates are attached to the end of each pipe on the exterior side of the marsh. The pipe and gates are supported by a timber pile system. A timber walkway is installed at elevation +4.0 ft.

D. Site/Structure # 32 – Riprap channel plug across an unnamed channel which flowed into Lake Lery at the west end of the lake. The plug is 117 ft. long and the 6 ft. wide plug crest is set at +4.0 ft. The 70 ft. stretch of channel from the plug eastward to Lake Lery has 2 feet thick riprap placed on both channel banks.

E. Site/Structure # 40 – Earth fill and rock fill channel plug with riprap armor along the Reggio canal spoil bank. The plug is 142 ft. long and 100 ft. wide. The crest of the structure is 10 ft. wide and is set at an elevation of +4.0 ft. The plug includes 2- 48" diameter corrugated aluminum pipes thorough the rock fill portion of the rock fill at an elevation of -4.0 ft. Earth fill was placed on each side of the rock fill. The entire

structure is capped with an 18" thick layer of rip-rap. Aluminum combination gates are attached to the ends of the aluminum pipes on the exterior side of the marsh. The pipe and gates are supported by a timber pile system and a timber walkway to the gates is installed at elevation +4.0 ft.

F. Site/Structure # 50 – Rock fill channel plug with riprap armor along the west bank of Bayou Mandeville. The plug is 55 ft. long and 100 ft. wide. The crest of the structure is 10 ft. wide and is set at an elevation of +4.0 ft. The plug includes one (1) 48" diameter corrugated aluminum pipe through an aggregate embankment at an elevation of -3.5 ft. The embankment is capped with an 18" thick layer of rip-rap. The pipe has a combination gate attached on the pipe end on the interior side of the marsh. The pipe and gate are supported by a timber pile system and a timber walkway to the gate is installed at elevation +4.0.

G. Site/Structure # 52 – Rock fill channel plug with riprap armor along DP Canal spoil bank. The plug is 100 ft. long and 100 ft. wide. The crest of the structure is 10 ft. wide and is set at an elevation of +4.0 ft. The plug includes two (2) 36" diameter corrugated aluminum pipes through the embankment at -3.0 ft. The embankment is capped with a 18" thick layer of riprap. Aluminum combination gates are attached to the end of each pipe on the interior side of the marsh. The two pipes are supported by a timber pile system and a timber walkway to the gates is installed at elevation +4.0.

H. Site/Structure # 54 – Earth fill and rock fill channel plug with riprap armor located at the intersection of Reggio Canal and Promise Land Canal. The canal is 140 ft. long and 150 ft. wide. The crest of the structure is 10 ft. wide and is set at an elevation of +4.0 ft. The plug includes two (2) 48" diameter corrugated aluminum pipes through the rock fill portion of the embankment at an elevation of -4.0 ft. Earth fill was placed of each side of the rock fill. The entire embankment is capped with a 18" thick layer of riprap. Aluminum combination gates are attached to the end of each pipe on the exterior side of the marsh. The pipes and gates are supported by a timber pile system and a timber walkway to the gates installed at elevation +4.0 ft.

The existing spoil bank on the south side of Promise Land Canal was degraded in three locations on the west side of Structure # 54. The excavated material was placed on the south side behind the existing spoil bank.

I. Site/Structure # 56 - Rock riprap channel plug across an unnamed channel on the east side of the Reggio Canal. The plug is 208 ft. long and the side slopes of the plug are 3 horizontal to 1 vertical. The crest of the structure is 6 ft. wide and is set at an elevation of +4.0 ft.

J. Site #57 – Consists of 5,315 linear feet of spoil bank restoration along the east side of the Reggio Canal between the Delacroix Canal and Site # 54. The spoil bank restoration consists of an earth fill embankment placed on existing spoil to an elevation of +4.0 ft. with a 12 ft. top width and 3 horizontal to 3 vertical side slopes. The entire length of embankment has been seeded to permanent vegetation.

K. Site # 58 – Consists of 5,244 linear ft. of spoil bank restoration along the west side of Bayou Mandeville between the Delacroix Canal and Site # 13. The spoil bank restoration consists of an earth fill embankment placed on existing spoil to an elevation of +4.0 ft. with a 12 ft. top width and 3 horizontal to 3 vertical slope. The entire length of embankment has been seeded to permanent vegetation.

L. Site/Structure # 60 – Rock fill channel plug at the intersection of Reggio Canal and an existing pipeline canal. The plug is 200 ft. long and 100 ft. wide. The crest of the structure is 10 ft. wide and set at an elevation of +4.0. The plug includes two (2) 36" diameter corrugated aluminum pipes through the rock fill plug at an elevation of -3.0 ft. The entire length of the plug is capped with an 18" layer of riprap. Aluminum canal gates are attached to the end of each aluminum pipe on the interior side of the marsh. The pipes and gates are supported by a timber pile system and a timber walkway to the gates is installed at elevation +4.0 ft.

IV. Summary of Past Operation and Maintenance Projects

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since the previous annual inspection on February 26, 2004:
There were no O & M tasks either scheduled or performed during the period since the last annual inspection. Three flow meters were installed at structures No. 26, 40, and 54 to monitor the flow of fresh water into the interior marshes to determine if it would be necessary to maintain the associated channels to increase flow.

2004 Structure Operations:

In accordance with the operation schedule outlined in the Operations and Maintenance Plan. None of the structures were operated this past year. All gates have been left in the open position to allow fresh water in all the marsh areas.

V. Inspection Results (See Appendix B for photos of each site)

As a result of Hurricane Katrina, large amounts of marsh balls were transported from the southern end of the basin and deposited throughout the upper outfall area. Much of the marsh settled in the distribution channels and on, in, and around all of the structures causing them to become ineffective and inoperable. Many of the distribution channels were either completely or partially blocked with this marsh debris. Because of this, the inspection team could not reach all of the project features; therefore, some pictures from the 2005 inspection were used, as noted, to accompany the comments for identification.

A. Site/Structure # 13 – The entire structure is covered with marsh debris from the storm. The culvert is also clogged with debris and gates are not operable. (Photo 1,2 are from 2005 inspection)

B. Site/Structure # 25 –The entire structure is covered with marsh debris from the storm. The culverts are clogged with debris and are not operable. (Photos 3, 4 from 11/05)

C. Site/Structure # 26 – The structure is still in place but is completely covered with storm debris. All 4 culverts are clogged with debris and the gates are inoperable. The flow meter that was installed before the storm event was not recovered. (Photos 5, 6 from 11/05)

D. Site/Structure # 32 –Overall condition was good with the exception of the area that was vandalized in early 2003. That area was partially repaired by the 2003 inspection team; however, that repair was again vandalized to the original depth. The condition of the closure appears to have not changed but is now covered with storm debris. This structure was constructed to keep diversion water from entering Lake Leary from the western lake rim; the storm devastated that portion of the lake rim rendering this structure ineffective. (Photos 7, 8 from 2005 inspection)

E. Site/ Structure # 40 – The entire structure is covered with marsh debris. The culverts are also clogged with storm debris and are inoperable. The flow meter was recovered from this structure. (Photos 9, 10 from 11/05)

F. Site/Structure # 50 – The entire structure is covered with storm debris, marsh balls, marsh grass, etc. The gate is inoperable and the culvert completely blocked and ineffective. Photos (11, 12 from 2005 inspection)

G. Site/Structure #52 – The entire structure and rock plug is completely covered with marsh debris, marsh ball, etc. The gates are also covered with marsh grass and marsh balls and are inoperable. The culverts are completely blocked and ineffective. (Photo 13, 14 from 2005 inspection)

H. Site/Structure # 54 – Marsh debris covers the entire structure, the gates and the rock closure. The culverts are completely clogged and the gates are inoperable. The flow meter that was installed at this site was missing after the storm. Small amount of

earthen embankment erosion is still noticeable on both sides of closure.(Photo 15, 16 from 11/05)

I. Site/ Structure # 56 - No subsidence was noted in this rock structure since the 2005 inspection. The entire rock closure is covered with storm debris and the canal that was closed by the structure is completely clogged with marsh that was placed there by the storm. Both warning signs were damaged during the storm.(Photo 17 from 11/05)

J. Site # 57 – The entire reach of spoil bank along the east side of the Reggio Canal was inundated with storm debris. It appears that most of the vegetation that was destroyed while being covered with debris. What high standing vegetation that was there before the storm was flattened. (Photo 18 was from 2005 inspection)

K. Site # 58 – The entire reach of spoil bank restoration along the west side of Bayou Mandeville was destroyed by the storm. The tidal wave and storm debris took its toll on this west bank and destroyed what there was of any bank restoration that was done. (Photo 19, 20 from 11/05)

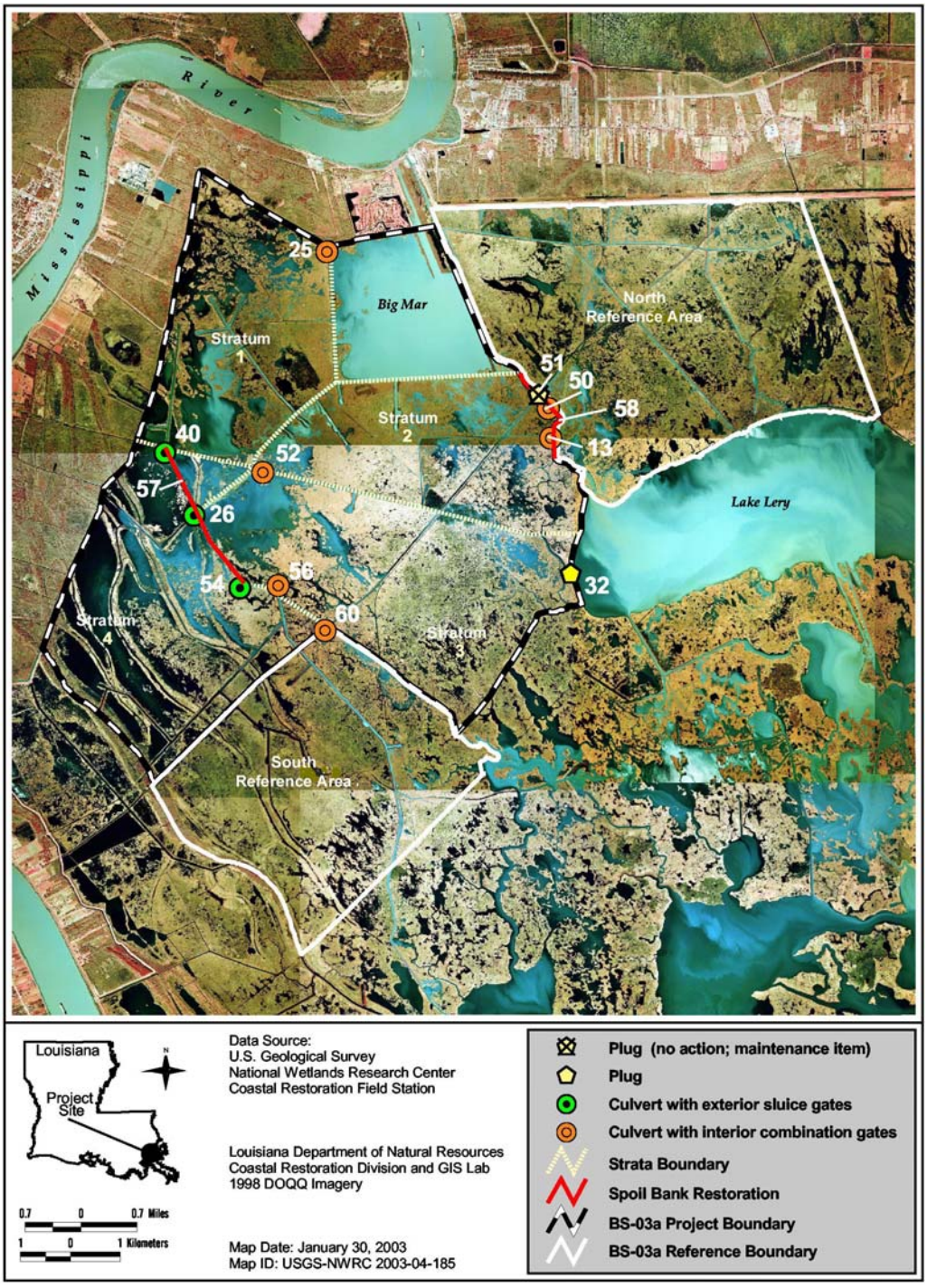
L. Site/Structure # 60 – Both of the structures were completely covered with storm debris. Both culverts were completely blocked with marsh balls and marsh grass placed there by the storm making the structure inoperable.
(Photo 21, 22 from 2005 inspection)

VI. Conclusions and recommendations

1. As you can see from the inspection report and photographs, the entire outfall project was totally devastated during the Katrina Storm event. In addition, because of the conditions of the river, the lack of rainfall, and the levee breaches on the perimeter of the project area, we were unable to freshen up the salt ridden project area. It took 4 ½ months, until January 19, 2006, before we were able to operate the diversion structure and start to help the devastated area. To this date, the levee breaches that occurred behind Braithwaite and Scarsdale prevent the structure from being operated at its maximum in fear of further flooding to the east bank of Plaquemines Parish.
2. It is our conclusion that, the outfall project may never be restored to its original condition. The entire complexion of the project has been changed in its entirety. It will take a construction contract to dredge the channels, refurbish and completely clean out all gated structures and culverts, maintain all of the rock channel closures to their original height and section, repair all the degraded embankments that were associated with the areas affected by each individual structure. It will also be necessary to repair the entire west lake rim of Lake Leary that was damaged, so as not to allow diversion water to enter the lake from the west side.

3. LDNR suggests that little, if anything, be done until we can aggressively operate the diversion structure for a full two years with hopes that much of the marsh debris that was deposited by the storm will be displaced from the project area. It is also thought that by operating the structure aggressively, will allow more desirable vegetation to take over and expand over the outfall area where it did exist before the storm. We will then be able to restudy and redesign the project so that it can be maintained to become effective.

APPENDIX A
Project Features Map



APPENDIX B
Photographs

Photo # 1 Site 13 (view 1) Corrosion of locking plates caused them to separate making locking impossible.

Photo # 2 Site 13 (view 2) This photo is from the 2005 Inspection. The entire structure along with rock closure, gate and walkway are covered with storm debris.

Photo # 3 Site 25 (view 1) Looking down the Forty Arpent Canal behind Braithwaite in Plaquemines Parish.

Photo #4 Site 25 (view 2) View from the structure looking South. As noted, the entire structure, including the rock closure is covered with storm debris.

Photo # 5 Site 26 (view 1) Structure is entirely covered with storm debris.

Photo # 6 Site 26 (view 2) A flow meter was installed on this structure. The recorder box was also located on one of the piling. None of the equipment was recovered.

Photo # 7 Site 32 (view 1) This site was opened to the water line by vandals and was partially repaired by the 2003 inspection team. It was then vandalized again. This photo is from the 2005 inspection, debris now covers the structure.

Photo # 8 Site 32 (view 2) This closer view shown that the removed rock was placed just adjacent to the opening.

Photo # 9 Site 40 (view 1) Storm debris covers the entire structure and also completely blocked both culverts.

Photo # 10 Site 40 (view 2) Another view looking south along the rock closure.

Photo # 11 Site 50 (view 1) This entire structure is covered with storm debris. The debris has blocked the 48" culvert.

Photo #12 Site 50 (view 2) Slight erosion is evident on both sides of the rock plug where it ties into the earthen embankment.

Photo # 13 Site 52 This photo is from the 2005 inspection The entire structure is now covered with storm debris. The culvert is completely blocked.

Photo # 14 Site 52 Slight erosion is evident in the areas where the rock closure ties into the earthen embankment in this 2005 inspection photo. Debris covers entire structure.

Photo # 15 Site 54 (view 1) Debris covers entire structure Culverts are also completely blocked.

Photo # 16 Site 54 (view 2) This view taken from the structure looking west. The flow meter and all attachments were destroyed by the storm.

Photo # 17 Site 56 Overall condition of the canal rock closure appears to be good No appreciable subsidence has occurred since the 2005 inspection. The rock closure and the canal are completely covered with storm debris.

Photo # 18 Site 57 Embankment is covered with storm debris. It appears that it is also very badly eroded.

Photo # 19 Site 58 Selective erosion has progressed slightly in this 2005 inspection photo. The entire bank line is very badly eroded from the storm, and is covered with storm debris.

Photo # 20 Site 58 Selective erosion is in areas throughout snite; however, it is located in the slope and has not threatened the embankment crown.

Photo # 21 Site 60 Entire structure is in excellent condition in this 2005 inspection photo; however, the entire structure is covered with storm debris.

Photo # 22 Site 60 The decking at the structure site is in excellent condition in this 2005 inspection photo. The entire structure and inflow channel are inundated with storm debris and floating marsh balls.

Appendix C
Three-Year Operations & Maintenance Budgets

CAERNARVON OUTFALL MGMT. / BS03a / PPL2

Three-Year Operations & Maintenance Budgets 07/01/2006 - 06/30/09

Project Manager	O & M Manager	Federal Sponsor	Prepared By
George Boddie	*Bernard*	*NRCS*	*Bernard*

	2006/2007	2007/2008	2008/2009
Maintenance Inspection	$ 5,088.00	$ 10,000.00	$ 10,250.00
Structure Operation	$ 12,634.00	$ 12,855.00	$ 13,176.00
Maintenance/Rehabilitation	$ -	$ -	$ -

06/07 Description:

E&D	
Construction	
Construction Oversight	

Sub Total - Maint. And Rehab. $ -

07/08 Description

E&D	
Construction	
Construction Oversight	

Sub Total - Maint. And Rehab. $ -

08/09 Description:

E&D	
Construction	
Construction Oversight	

Sub Total - Maint. And Rehab. $ -

	2006/2007	2007/2008	2008/2009
Total O&M Budgets	**$ 17,722.00**	**$ 22,855.00**	**$ 23,426.00**

O & M Budget (3 yr. Total)	**$ 64,003.00**
Existing O & M Budget Balance	**$ 998,347.80**
Remaining O & M Budget (Projected)	**$ 934,344.80**

Appendix D
Field Inspection Form

FIELD INSPECTION CHECK SHEET

Project No. / Name: Caernarvon Outfall Management BS-03a

Date of Inspection: 11/17/2005 Time: 9:00 AM

Structure No. **See Report Section III**

Inspector(s): LDNR: Tom Bernard, Barry Richard, George Boddie, Garrett Broussard, Brady Carter. NRCS: Loland Broussard

Structure Description: See Report Section III

Water Level: Inside: 1.00' NAVD 88 Outside: 3.60' NAVD 88

Type of Inspection: 2006 Annual Inspection

Weather Conditions: Clear and Cool

Item	Condition	Physical Damage	Corrosion	Photo	Observations and Remarks
CMP Culverts Earthen / Rock Embankment	Fair	None	None	Appendix B	Some of the culverts have rotated slightly with the differential settlement of the rock structure. The storm has caused some marsh that was broken from its pre-storm location to be pushed into the culverts blocking the flow by 75% to 100%.
Water Control Gates	Fair	None	Slight	Appendix B	All water Control Gates appear to be in fair condition. Bundles of marsh cover most of the gates and the operating mechanism. Until this is cleared, the structures cannot be operated. Also 75% of the canals are blocked with storm marsh.
Rock Canal Closures	Good	See Remarks	N/A	Appendix B	The overall condition of the canal closures is good with small areas of erosion where the rock meets the earthen embankment. The partial repairs (to the vandalism) made by the 2003 inspection team at site #32 was again vandalized.
Timber Piling at Culverts	Good	None	None	Appendix B	All of the timber piling are fine, some of the rock structures have settled as well as the culvert themselves causing some slight rotation in the culverts. Storm debris covers most of all the rock closures.
Timber walkways at Culverts	Good	See Remarks	None	Appendix B	Some of the 4 X 4 timber support posts for the timber walkways settled excessively causing the timber walkway to bend and twist slightly. All walkways are riddeled with large amounts of floating marsh.
Spoilbank Restoration	Good	Minor	N/A	Appendix B	The storm surge has caused extensive damage to all spoilbank work, which was suseptable to erosion from waves. Some of these areas will need to be revegetated in time or armored with riprap.
Flow Meters	Good	None	None	Appendix B	Flow meters were installed at structures No. 26, 40, and 54 to monitor the flow of water going into the interior marsh. Only one of these flow meters was recovered after the storm and the condition of the data is still unknown.