State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Office of Coastal Protection and Restoration

2010 Operations, Maintenance, and Monitoring Plan

for

Highway 384 Hydrologic Restoration (CS-21)

State Project Number CS-21
Priority Project List 2

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Cameron Parish

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2010 Operations, Maintenance, and Monitoring Report
For
La. Hwy 384 Hydrologic Restoration (CS-21)

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I. Introduction

The La. Highway 384 Hydrologic Restoration project area contains 935 ac (378 ha) of deteriorated wetlands located along the northeast shoreline of Calcasieu Lake in Cameron Parish. The project area is bounded by Calcasieu Lake to the west, the Gulf Intracoastal Waterway (GIWW) to the east, and higher elevation prairie formations to the north and south.

The project area (figure 1) is divided into three Conservation Treatment Units (CTUs). CTU 1 extends from Calcasieu Lake easterly to the La. Highway 384 embankment and includes 250 ac (101 ha) of open water and brackish marsh. A shell oilfield access road forms its northern boundary and prairie formations form its southern boundary. CTU 2 includes 226 ac (91 ha) of open water and intermediate marsh. This unit extends easterly from the La. Highway 384 embankment. The northern boundary of CTU 2 is the prairie formation on which the community of Grand Lake is located. A continuous oil field road embankment joins the prairie formations north and south of the project area and forms the remainder of the southern and eastern boundaries of CTU 2. CTU 3 lies between CTU 2 and the GIWW and includes 459 ac (186 ha) of intermediate marsh. Increased tidal volumes, enlargement of tidal exchange routes, and salt water intrusion resulting from human-induced changes to the area's hydrology are the primary causes of wetland loss in the project area.

Two small reference areas have been selected for monitoring this project. Reference Area 1 (R1) is comprised of 424 ac (172 ha) of deteriorated brackish marsh and open water located 2 mi (3.2 km) south of the community of Grand Lake along the east bank of Calcasieu Lake (figure 1). Reference Area 2 (R2) consists of approximately 106 ac (43 ha) of open water and deteriorated brackish marsh located along the north side of the shell road that forms the northern boundary of CTU 1.

Hurricane Rita struck the coast of southwestern Louisiana on September 24, 2005 with maximum storm surge of approximately 7 ft (2.1 m) in the CS-21 project area. USGS calculated the amount of land that changed to water resulting from the storm to be 98 square miles in southwestern Louisiana, 22 square miles of land lost in the Calcasieu/Sabine basin (Barras, 2006). This land loss can be attributed to several patterns. Shearing, which is ripping and removal of marsh vegetation in historically healthy marshes was observed north of Johnson's Bayou and south of the Sabine National Wildlife Refuge. The removal of remnant marsh from areas with historical land loss from the surge was observed in the marsh just north of Johnson's Bayou and north of Mud Lake.

The objective of the project is to protect and maintain approximately 935 ac (378 ha) of intermediate to brackish wetlands by reducing water level variability, thereby increasing the abundance of emergent vegetation. This will be achieved through structural modification of hydrologic conditions. Construction for the La. Highway 384 Hydrologic Restoration Project began on October 20, 1999 and was completed on January 4, 2000.

The principal project features include:

1. Set of 3 culverts (ES-1), each with a manual sluice gate on the exterior and a flap gate on the interior to provide controlled freshwater introduction from the GIWW (CTU 2/CTU 3 perimeter levee).

2. Approximately 95 ft (28 m) of armored plug (ES-8) to reduce hydrologic exchange with Calcasieu Lake and to decrease tidal scour and salinity in the project area (existing exchange point in CTU 1).

3. Set of 2 culverts (ES-12), each with a variable-crested weir inlet and flap gated outlet to reduce and stabilize tidal ranges and salinity in project area south of the central shell road in CTU 1 (existing shell road along north side of CTU 1).

4. Maintenance of approximately 10,000 ft (3 km) of existing road embankment to maintain the hydrologic barrier between CTU 2 and CTU 3 (existing southern and eastern perimeter embankment of CTU 2).

5. Maintenance of 1 flow-through culvert (ES-11) to maintain an existing storm water drainage point for the adjacent prairie formation (existing southern perimeter embankment of CTU 2).

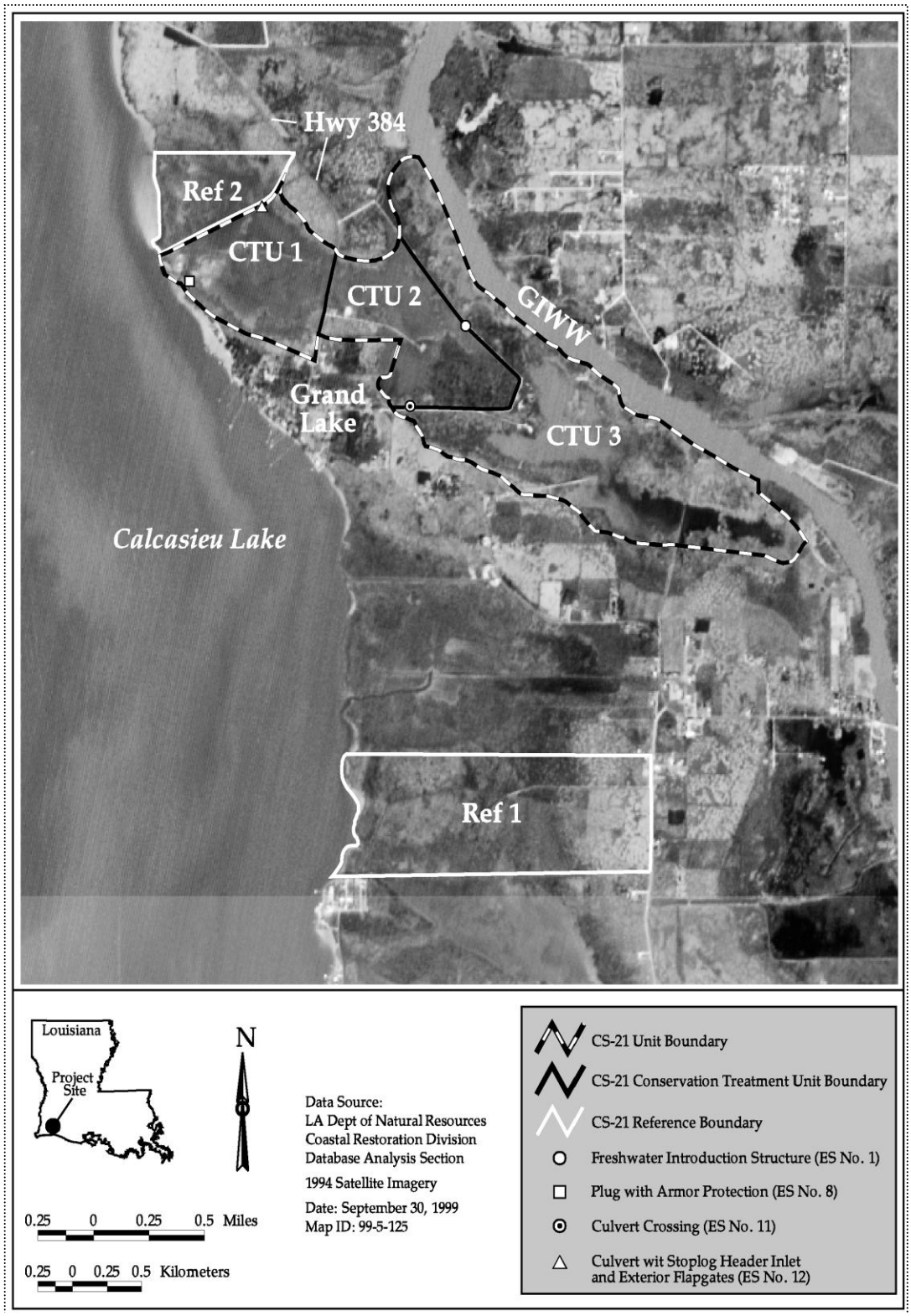


Figure 1. La. Highway 384 Hydrologic Restoration (CS-21) project and reference area boundaries and features.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Hwy. 384 Hydrologic Restoration Project (CS-21) 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, OCPR 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, 2003). The annual inspection report also contains a summary of maintenance projects, if any, which were completed since completion of the constructed project features 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 B.

An inspection of the Hwy. 384 Hydrologic Restoration Project (CS-21) was held on November 12, 2009 under sunny skies and mild temperatures. In attendance were Dewey Billodeau, Darrell Pontiff, and Pat Landry of OCPR and Dale Garber representative of NRCS. Parties left the Lafayette Field Office of CED, and proceeded to the CS-21 project area in the community of Grand Lake, LA. The annual inspection began at approximately 10:25 a.m. at Structure #12.

The field inspection included a complete visual inspection of all features. Staff gauge readings where available were used to determine approximate elevations of water, rock plugs, earthen embankments, and other project features. Photographs were taken at each project feature (see Appendix A) and Field Inspection notes were completed in the field to record measurements and deficiencies (see Appendix C).

b. Inspection Results

Structure #1

The structure is in good condition. Water level on the outside was elevation +1.65 NAVD88 and the level inside could not be determined because the staff gage was not readable. The inside staff gauge will need to be replaced. Rock placed on the bank during the maintenance event of June 2002 is stable and in no need of repair. Two of the outlet flapgates were locked open with small nails. The operations contractor was contacted to unlock the flaps. The hyacinth fence is in good condition; however there is trash accumulating on the outside of the fence which needs to be removed. (Photos: Appendix A, Photos 1-3).The road/levee leading up to the structure is in good condition since it was repaired in June 2006. The recently installed Portable Multi-Parameter Water Quality Troll 9500 – 29r operation sonde was not functioning and the operations contractor was also contacted to trouble shoot the problem. The solar panel should be cleaned and bird excluder devices installed.

Structure #12

The structure is in good shape and the inlet and outlet sides appear undamaged. Water level on the outside was elevation +1.8 NAVD88 and the level inside was +1.6 NAVD88. Pile caps on the outlet side and the padlocks on the stop log locking devices have rusted and will eventually need to be replaced. Rock that was placed during the maintenance of Nov. 2000 is stable. The road/levee leading up to the structure is in good condition since it was repaired in June 2006. (Photos: Appendix A, Photos 4-5).

Site #8

The rock plug is in good condition. Water levels could not be determined because the outside staff gage is missing and the inside staff gauge was leaning and not readable. Both staff gages will need to be replaced. The earthen levee that was built as part of the May 2002 maintenance is in excellent condition and vegetation exists beyond the channel limits. Maintenance work completed in May 2005 to repair the plug from vandalism held up well under the high storm surge waters. The lakeside of the rock plug has accretion building and also has vegetation growing towards the lakeside. (Photos: Appendix A, Photo 6).

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

ii. Programmatic/ Routine Repairs

Install bird excluder device on the solar panel and replace the staff gage at Structure No. 1. Replace the metal pile cap covers and install bird excluder device on the solar panel at Structure No. 12. Replace inside and outside staff gauges at Structure No. 8.

d. Maintenance History

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since January 2000, the construction completion date of the La. Highway 384 Hydrologic restoration Project (CS-21).

Nov. 2000- Glenn Lege Construction
Placed 40.32 cy. of #610 limestone on the road near Structure #12 due to some overtopping of the road during high tidal events.
Placed 12 cy. of man size rip-rap on the inlet side of Structure #12 due to some scouring of the bank line around the structure.

TOTAL CONSTRUCTION COST- $3,461.14

June 2002- Glenn Lege Construction
Provided labor and materials to construct a "hyacinth fence" on the inlet side of Structure #1. The fence is constructed of galvanized woven wire and CCA treated timber piles and whalers. Provided labor and materials to reinforce the existing levee around Structure #1 with graded crushed stone. Provided labor and materials to repair an existing rock plug at Structure No. 8 that had been leaking and also had been vandalized. The plug was repaired by hauling in earth fill from an off-site location and pushing it over the existing rock plug with a bulldozer. The earthen plug was then planted under separate contract by DNR plantings group.

TOTAL CONSTRUCTION COST- $14,386.87

February 2004 – Lonnie G. Harper and Associates
Provided a survey of the existing shoreline to determine elevations within the project area along the eastern side of Calcasieu Lake.

TOTAL COST- $3,345.00

May 2005- Bertucci Construction
Provided labor, material and equipment to repair thirteen linear feet of the rock plug at site #8. The rock was removed by vandals. 39.9 tons of 1200# rip rap stone was used to repair the thirteen foot gap. A four foot thick layer of 150# stone was applied to the marsh side slope of the plug to prevent water flow through the plug. This required 343.4 tons of rock. Completion and final acceptance was on May 15, 2005.

TOTAL CONSTRUCTION COST- $45,090.00

May 2006- F. Miller & Sons
Provided labor, material and equipment to repair the existing access roads to permit elevations (+3.0 on Roadway No.1 West side of Hwy 384, +2.5 on Roadway No. 2, East side of Hwy 384). Approximately 3,225 tons of recycled concrete were used to elevate the roadways. Two Portable Multi-Parameter Water Quality Troll 9500 units were provided through this contract and installed by Simon & DeLany for operation of Structures No. 1 and No. 12. Completion and final acceptance was on June 28, 2006.

Engineering, Design ,Surveying,	
Construction Oversight & As-Builts	$ 26,705.00
Construction Cost	$150,000.00

TOTAL CONSTRUCTION COST $176,705.00

June 2006 – F. Miller & Sons

Provide labor, material and equipment to refurbish and install flap gate on west culvert of Structure No. 12. This flap gate was vandalized during spring of 2006. Completion and final acceptance was on June 28, 2006.

TOTAL CONSTRUCTION COST $1,600.00

March 2007 – Simon & Delany
Provide labor necessary to remove and dispose of trash and debris which has accumulated within the hyacinth fence and adjacent to the sluice gates at Structure No.1

TOTAL CONSTRUCTION COST $900.00

May 2010 – Simon & Delany
Provide labor necessary to remove and dispose of trash and debris which has accumulated within the hyacinth fence and adjacent to the sluice gates at Structure No.1

TOTAL CONSTRUCTION COST $2,000.00

III. Operation Activity

a. Operation Plan

HIGHWAY 384 HYDROLOGIC RESTORATION
CS-21

"WATER MANAGEMENT PLAN"

Revised 05-03 -06

ES #1 Structure - 3-24" Aluminum culverts with Interior 24" Flapgates and Exterior 24" Sluice Gate

	Culvert # 1		Culvert #2		Culvert #3	
Salinity	Sluice	Flap	Sluice	Flap	Sluice	Flap
≥ 7 ppt	down	down	down	down	down	down
< 7 ppt	open	down	open	down	open	down

Average Marsh Level CTU 2 = 1.253 ft NAVD88

NOTE: When exterior salinities at ES #1 structure meet or exceed 7 ppt, the structure will be set according to the above chart. When exterior salinities fall below 7 ppt, the structure will be reset according to the above chart.

ES #12 Structure - 2-48" Aluminum Culverts, each with an Interior 10' Variable-Crested Weir Inlet with a 4" vertical slot and an Exterior 48" Flapgate.

	Culvert #1			Culvert #2		
Salinity	Flap	Stoplog	Slot	Flap	Stoplog	Slot
< 7 ppt	open	.88 ft	open	open	None	open
7-10 ppt	down	.88 ft	open	open	None	open
>10 ppt	down	.88 ft	open	down	.38 ft	open

Average Marsh Level CTU 1 = 1.38 ft NAVD88
"None" refers to removal of all stop logs.
Salinity will be monitored on the northern side of the shell road at ES #12

b. Actual Operations

In accordance with the operation schedule outlined in the Operation and Maintenance Plan and USACE Permit, structures were manipulated as required by Simon & Delany, Resource Management personnel who are under contract with DNR. Copies of the quarterly reports that are provided as well as a copy of the operations contract between DNR and Simon & DeLany are attached in the "Structure Operations" section of the CS-21 Hwy. 384 Operation & Maintenance Plan. The original operating procedures for Structure #1 was based on water level only, there was no provision for salinity control. Records for the structure showed salinities of 9+ ppt. The procedure was modified to close the Structure #1 sluice gates at 7 ppt. Operations for Structure #12 were not changed. To view the real time conditions at structure #1 (29R) or structure #12 (15R) log on to www.isi-data.com and use "ocprguest" for both the username and pass word.

IV. Monitoring Activity

The original monitoring plan was approved in December 1996 and was modified in 1998 when it was determined that water level and salinity would be monitored continuously from 1997 through 2002, and then evaluated to determine if the project goals were achieved. It was determined that the goals had been met and monitoring was discontinued in 2004.

Pursuant to a decision made on November 9, 1999 by the Natural Resources Conservation Service and the Louisiana Department of Natural Resources, the project area boundary was revised to exclude the northernmost third of CTU 1 and all associated structural measures due to landright constraints. The monitoring plan was modified to reflect changes in reference areas and elimination of shoreline change monitoring.

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System-*Wetlands* (CRMS-*Wetlands*) for CWPPRA, updates were made to the CS-21 Monitoring Plan to merge it with CRMS-*Wetlands* and provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. There are no CRMS-*Wetlands* sites in the CS-21 project area.

a. Monitoring Goals

The objective of the La. Highway 384 Hydrologic Restoration Project is to protect and maintain 935 ac (378 ha) of intermediate and brackish wetlands by reducing water level variability, thereby increasing the abundance of emergent vegetation.

The following goals will contribute to the evaluation of the above objective:

1. Decrease the rate of marsh loss in the project area.
2. Reduce water level variability within the project area.
3. Maintain salinity levels within CTU 1 at ≤ 10 ppt for brackish marsh vegetation.
4. Maintain salinity levels in CTU 2 and CTU 3 within the 0-5 ppt target range (1997 – 2004) and 0-7 ppt (2005 – present) for intermediate marsh vegetation
5. Increase the coverage of emergent wetland vegetation and submersed aquatic vegetation (SAV) in shallow open water areas within the project area.

b. Monitoring Elements

Habitat Mapping

Near-vertical, color-infrared aerial photography (1:12,000 scale, with ground controls) was used to measure vegetated and non-vegetated areas for the project and reference areas. The photography was obtained preconstruction for the project area and reference area 2 in December 1996 and again in January 1997 due to overexposed frames. In March 1997, R1 was flown. Post-construction photography was obtained December 15, 2002. The original photography was checked for flight accuracy, color correctness, and clarity and was subsequently archived. Aerial photography was scanned, mosaicked, and georectified by USGS/ NWRC personnel according to the standard operating procedures (Steyer et al. 1995, revised 2000). No additional photography is scheduled.

Salinity

Water salinity was monitored monthly at twenty-nine discrete sampling stations and hourly at four continuous recorder stations within the project and reference areas (figure 2). The recorders were operated from May 1997 until July 2004 to determine project goals. It was determined that the goals had been met and project specific monitoring was discontinued in 2004.

In accordance with the operation schedule outlined in the Operation and Maintenance Plan and USACE Permit, continuous and discrete monitoring stations where established to allow for structure operations. In July 2006, two continuous recorder (15R-29R) and eight discrete (12R-15R-16-18-18R-19-26-29R) sampling stations were established and monitored. In December 2009 the eight discrete stations were decreased to five discrete stations (15R-16-19-26-29R) due to project improvements. Stations 15R and 29R collect hourly salinity data to aid in structure operations. Station 15R is operated under a 10 ppt threshold and station 29R was operated under a 5 ppt

threshold from 1997 – 2004 and modified to operate under a 7 ppt threshold to better achieve project goals.

Water Level

Water level was monitored monthly at twenty-nine discrete sampling stations, four staff gauges installed in/out near the project structures and hourly at four continuous recorder stations within the project and reference areas (figure 2). The recorders were operated from May 1997 until July 2004 to determine project goals. It was determined that the goals had been met and project specific monitoring was discontinued in 2004.

In accordance with the operation schedule outlined in the Operation and Maintenance Plan and USACE Permit, continuous monitoring stations where established to allow for structure operations. In July 2006, two continuous recorder sampling stations (15R -29R) were installed. Stations 15R and 29R collect hourly water level data (NAVD 88 ft) to aid in structure operations. While water level is not the main trigger for operations, the structures are closed under extreme high tides and hurricane events.

Emergent Vegetation

Vegetation was monitored at a maximum of 30 sampling stations established uniformly along transects in the project and reference areas (CTU 1, CTU 2, CTU 3, R1, and R2). At each sampling station, percent cover, species composition, and dominant plant height was documented in a 2m x 2m sampling plot marked with a pole in the southeast corner of the plot to allow for revisiting each site over time. Vegetation was evaluated at the sampling sites pre-construction in 1997, and post-construction in 2002. No additional vegetation sampling is scheduled.

A subset of twenty three of the established CS-21 vegetation stations was monitored in 2005, 2006, 2007 & 2008 using the Floristic Quality Index (FQI) to determine the impacts of Hurricane Rita within the project and reference areas. The data is available in the CS-21 2007 OM&M Report.

Floristic Quality Indices (FQIs) have been developed for several regions to determine the quality of a wetland based on its species composition (Cohen et al. 2004; Bourbaghs et al. 2006). A Floristic Quality Index (FQI) was developed by Jenneke Visser and an expert panel for Louisiana as part of CRMS. A list of plants occurring in Louisiana's coastal wetlands (~500 species) was provided to all known Louisiana coastal vegetation experts and their input on scoring was requested. The panel then provided an agreed upon group score (Coefficient of Conservatism or CC Score) for each species. CC scores are weighed based on cover in the FQI for Louisiana coastal wetlands. All species known to occur in the coastal zone were given a floristic quality score on a scale of 0 to 10. Species that scored lowest were considered by the panel to indicate disturbance or unstable marsh environments.

Submerged Aquatic Vegetation (SAV)

SAV was monitored using the modified rake method (Chabreck & Hoffpauir 1962, Nyman and Chabreck 1996). Within each study area (CTU 1, CTU 2, CTU 3, and R2), 2 ponds were sampled for presence or absence of SAV at 25 random points within each pond. Species composition and frequency of occurrence [freq = (n occurrences SAV species / n total sampling points)*100] were determined. SAV was monitored once pre-construction in October 1996 and once post-construction in September 2002. No additional SAV sampling is scheduled.

Soil Characteristics

Soil samples were collected from the emergent vegetation sampling plots established in the project and reference areas and analyzed for bulk density, percent organic matter, and soil salinity. Soil samples collected pre-construction in 1997 were not collected post construction.

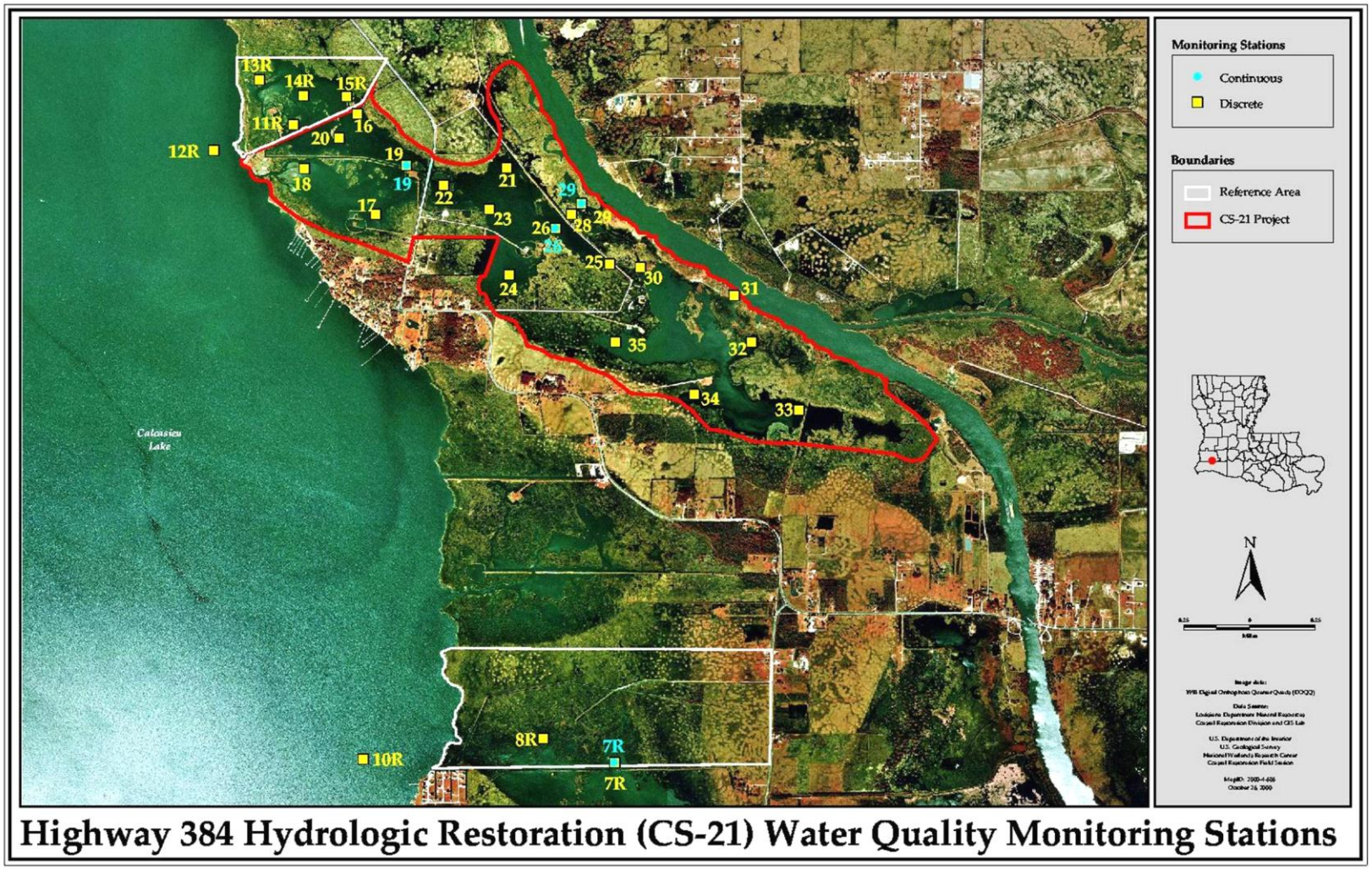


Figure 2. Location of continuous recorders and discrete water quality stations for La.Highway 384 Hydrologic Restoration (CS-21).

IV. Monitoring Activity (continued)

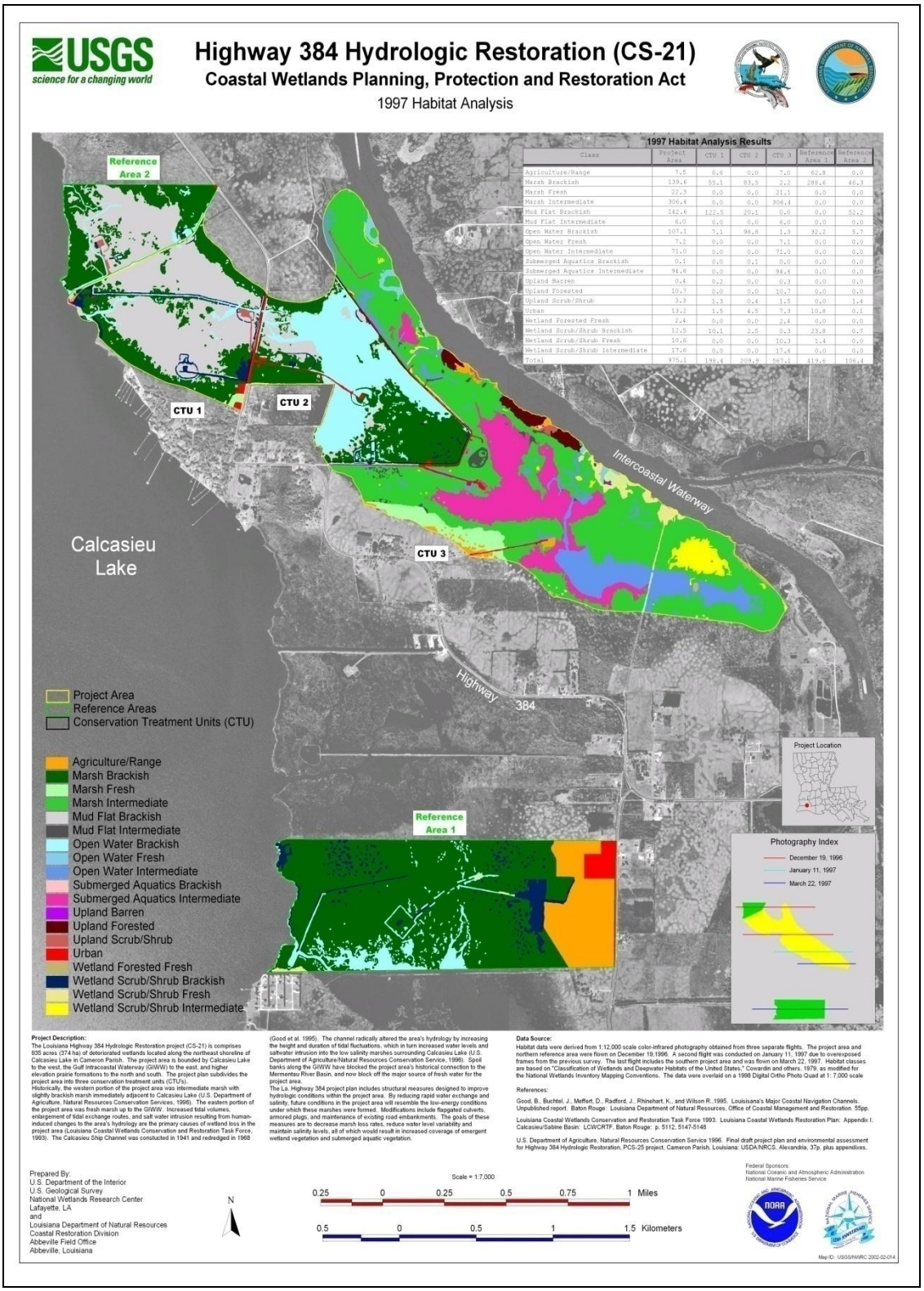
c. Preliminary Monitoring Results and Discussion

Habitat Mapping

Photography of the project area was obtained by USGS in 1997 and 2002 (figures 3 and 4). The two flights showed a modest increase in the percentage of each area that can be considered land (figure 5). The greatest increase in land was in CTU3 (4.2%), which is not actively managed. The total increase for the project areas combined was 3.4% while the reference areas collectively increased by 1.7% (table 1). The increases were small in both the project and reference areas although they were larger in the project areas.

Table 1. Ratios of land and water for the La. Highway 384 Hydrologic Restoration (CS-21) project from aerial photography obtained pre-construction in 1997 and post-construction in 2002. The 1997 photography was classified by habitat (figure 3) while the 2002 photography was classified by land and water so acreages of land were summed (figure 4). Mudflats were considered land and upland habitats were included. Total acreages from the two years are not exactly the same, therefore percentages and differences in percentages should be used for comparison.

	Total Project		**CTU 1**		**CTU 2**		**CTU 3**		**Total Reference**		**R 1**		**R 2**	
	ac	**ha**	**ac**	**ha**	**ac**	**ha**	**ac**	**ha**	**ac**	**ha**	**ac**	**ha**	**ac**	**ha**
1997 Land	546.5	221.2	68.8	27.8	90.9	36.8	387.1	156.7	435.9	176.4	387.4	156.8	48.5	19.6
1997 Water	428.6	173.4	129.6	52.4	119.0	48.2	180.0	72.8	90.1	36.4	32.2	13.0	57.9	23.4
2002 Land	580.0	234.7	72.0	29.1	97.0	39.3	411.0	166.3	440.0	178.0	390.0	157.8	50.0	20.2
2002 Water	396.0	160.3	127.0	51.4	113.0	45.7	156.0	63.1	87.0	35.2	30.0	12.1	57.0	23.1
1997 Land %	56.0		34.7		43.3		68.3		77.8		92.3		45.6	
1997 Water %	44.0		65.3		56.7		31.7		22.2		7.7		54.4	
2002 Land %	59.4		36.2		46.2		72.5		80.3		92.9		46.7	
2002 Water %	40.6		63.8		53.8		27.5		19.7		7.1		53.3	
1997 TOTAL	975.1	394.6	198.4	80.3	209.9	84.9	567.1	229.5	526.0	212.9	419.6	169.8	106.4	43.1
2002 TOTAL	976.0	395.0	199.0	80.5	210.0	85.0	567.0	229.5	527.0	213.3	420.0	170.0	107.0	43.3
2002-1997 Land %	3.4		1.5		2.9		4.2		1.7		0.5		1.1	



Class	Project Area	CTU 1	CTU 2	CTU 3	Reference Area 1	Reference Area 2
Agriculture/Range	7.5	0.6	0.0	7.0	62.8	0.0
Marsh Brackish	139.6	55.1	83.5	2.2	288.6	46.3
Marsh Fresh	22.3	0.0	0.0	21.1	0.0	0.0
Marsh Intermediate	306.4	0.0	0.0	306.4	0.0	0.0
Mud Flat Brackish	142.6	122.5	20.1	0.0	0.0	52.2
Mud Flat Intermediate	6.0	0.0	0.0	6.0	0.0	0.0
Open Water Brackish	107.1	7.1	98.8	1.3	32.2	5.7
Open Water Fresh	7.2	0.0	0.0	7.1	0.0	0.0
Open Water Intermediate	71.0	0.0	0.0	71.0	0.0	0.0
Submerged Aquatics Brackish	0.1	0.0	0.1	0.0	0.0	0.0
Submerged Aquatics Intermediate	94.6	0.0	0.0	94.6	0.0	0.0
Upland Barren	0.4	0.2	0.0	0.3	0.0	0.0
Upland Forested	10.7	0.0	0.0	10.7	0.0	0.0
Upland Scrub/Shrub	3.3	1.3	0.4	1.5	0.0	1.4
Urban	13.2	1.5	4.5	7.3	10.8	0.1
Wetland Forested Fresh	2.4	0.0	0.0	2.4	0.0	0.0
Wetland Scrub/Shrub Brackish	12.5	10.1	2.5	0.3	23.8	0.7
Wetland Scrub/Shrub Fresh	10.6	0.0	0.0	10.3	1.4	0.0
Wetland Scrub/Shrub Intermediate	17.6	0.0	0.0	17.6	0.0	0.0
Total	975.1	198.4	209.9	567.1	619.6	106.4

Figure 3. Habitat analysis from aerial photography flown January 11 and March 22, 1997.

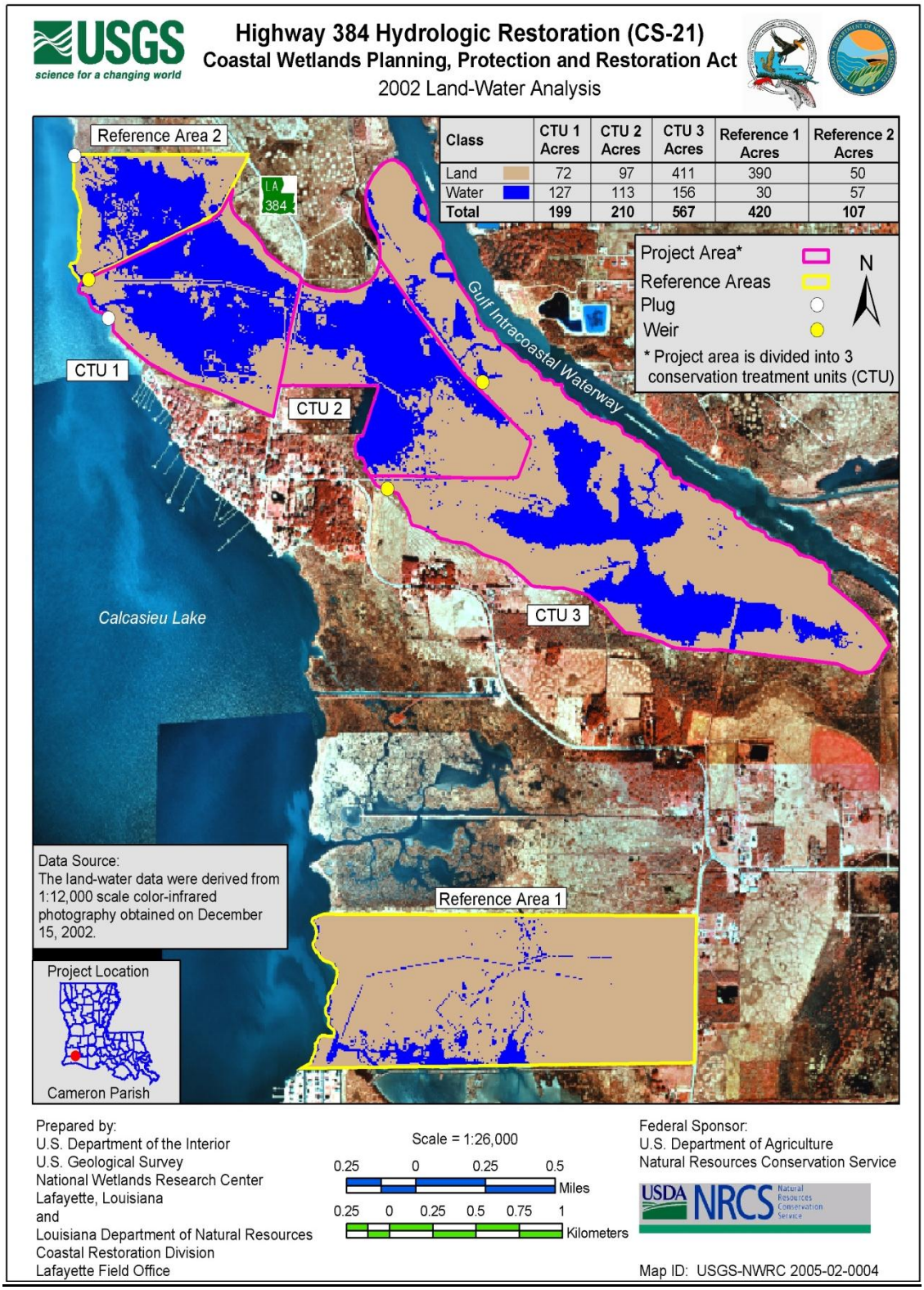


Figure 4. Land to water analysis from aerial photography flown December 15, 2002.

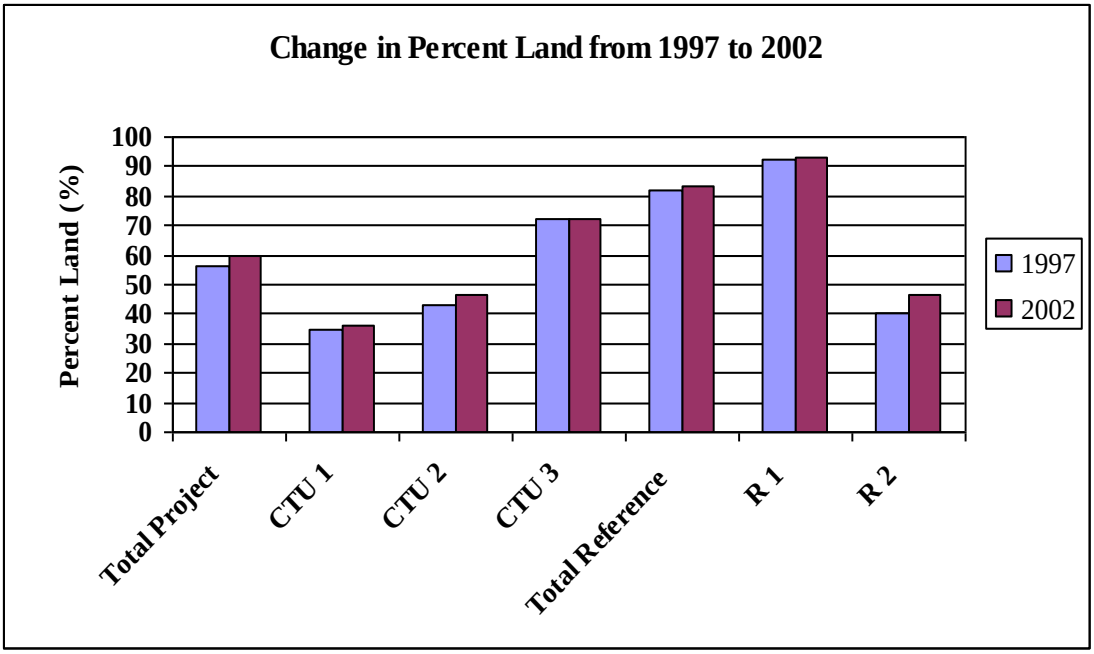


Figure 5. Percent of land area in 1997 and 2002 from aerial photography of each project CTU and the reference areas.

Salinity and Water Level

Hourly salinity and water level data have been collected at the following continuous recorder stations:

Station	Period of data collection
CS21-19 (CTU 1)	January 1997 – July 2004
CS21-26 (CTU 2)	January 1997 – January 2002
CS21-98 (CTU 2)	January 2002 – July 2004
CS21-29 (CTU 3)	January 1997 – July 2004
CS21-07R (R1)	January 1997 – July 2004
CS21-15R (CTU 1)	July 2006 – Present for operations
CS21-29R (CTU 2)	July 2006 – Present for operations

Due to low water levels, the recorder at CS21-26 was no longer able to function properly and was replaced by CS21-98 and moved approximately 100 yards north.

The original project goals for salinity were to maintain salinities in a target range of 0-10 ppt in CTU 1 and 0-5 ppt in CTU 2 and CTU 3. Comparison of the percentages of time salinities were within the target range before and after construction (by years) in CTU 1 and R1 showed that the reference area has been above 10 ppt at least 10% of the year (1999) and up to 80% of the year (2000) from 1997 to 2004 (figure 6). Before construction (which was completed in early January 2000), salinities in R1 and CTU 1

followed the same trend relative to the 10 ppt target level most of the time. In 2000 both units were inundated with salinities above the target range for CTU 1 over 80% of the time due to drought conditions. Following 2000, the project seems to have had an effect on salinities in CTU 1 as the amount of time salinity was above the target range has decreased and the two units have ceased to follow the same trends.

The project goals for salinity in CTU 2 were to maintain salinities in a target range of 0-5 ppt from 1997 to 2004. In 2004 the target range was revised to 0-7 ppt to allow for better management of an intermediate marsh. Comparisons of the percentage of time salinities were within the target range in those units showed a similar trend to CTU 1. Salinities in the reference area were above 5 ppt 40% (1998) to above 90% (2003) of the year from 1997 to 2004 (figure 7). Before project construction, salinities in CTU 2 and CTU 3 were rarely as high as in the reference area, but were consistently above the target range. During the drought of 2000, salinities in CTU 2 exceeded those in the reference area. Following project construction, salinities in CTU 2 and CTU 3 dramatically decreased and were within the target range more often, especially compared to the reference area, R1. CTU 3 has an open breach that connects it to the GIWW, so structure management does not directly affect this unit, although salinities have decreased in CTU 3 since construction. Structure operation when salinities are above 7 ppt will increase the effect of the project on salinities in CTU 2 .

Bi-weekly means of discrete salinities used for operations were analyzed from 2006 to 2010 to review operational oppurtunities within the CTU 1, R1 and CTU 2, R2 units. The CTU 1, R1 unit had less operational opportunities than the CTU 2, R2 unit over time, mainly due to its close proximity to Calcasieu Lake (figures 8-9). Comparison of the percentages of time salinities were within the target range (by years) within R1 ranged from 20% in 2006 to 51% in 2007 with years 2008 to 2010 avereging over 40% (figure 10). Comparison of the percentages of time salinities were within the target range (by years) within R2 ranged from 43% in 2010 to 89% in 2008 with the remaining years averaging over 70% (figure 10).

The project goal was to reduce water level variability in the project areas. This effect was tested using mean daily water level range (ft NAVD 88) by areas and years. The analysis indicates that the project has greatly reduced water level variability (or range) in the three project areas (figure 11). The mean daily range of water levels has increased each year from 1997 to 2004 in the reference area, R1. Following project construction completion in early 2000, water level range significantly decreased in CTU 1 and CTU 2 from between 0.6 and 0.8 ft NAVD 88 pre-construction to below 0.2 ft NAVD 88 post-construction (figure 12). Similarly, water level range in CTU 3 decreased from between 0.3 and 0.6 ft NAVD 88 pre-construction to below 0.4 ft NAVD 88 post-construction. Therefore the project has reached the goal of decreasing water variability. Note that although water level range decreased in the project areas, overall mean water level does not appear to have been affected by the project (figure 12).

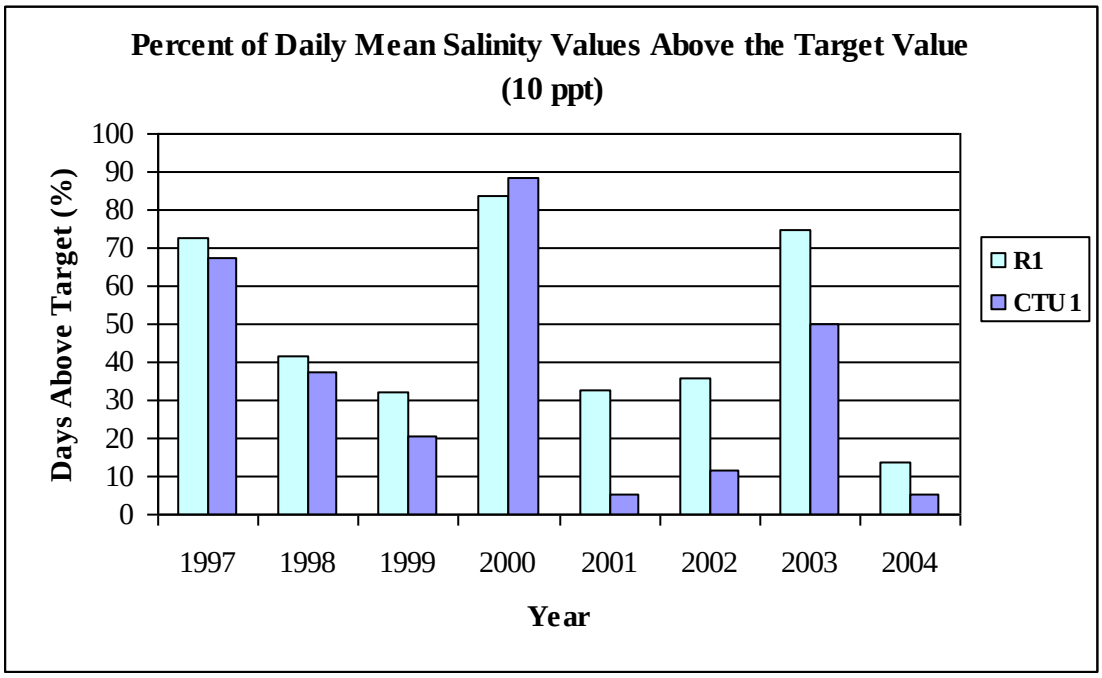


Figure 6. Percent of daily mean salinity values above the target value of 10 ppt in CTU 1 and R1 by years.

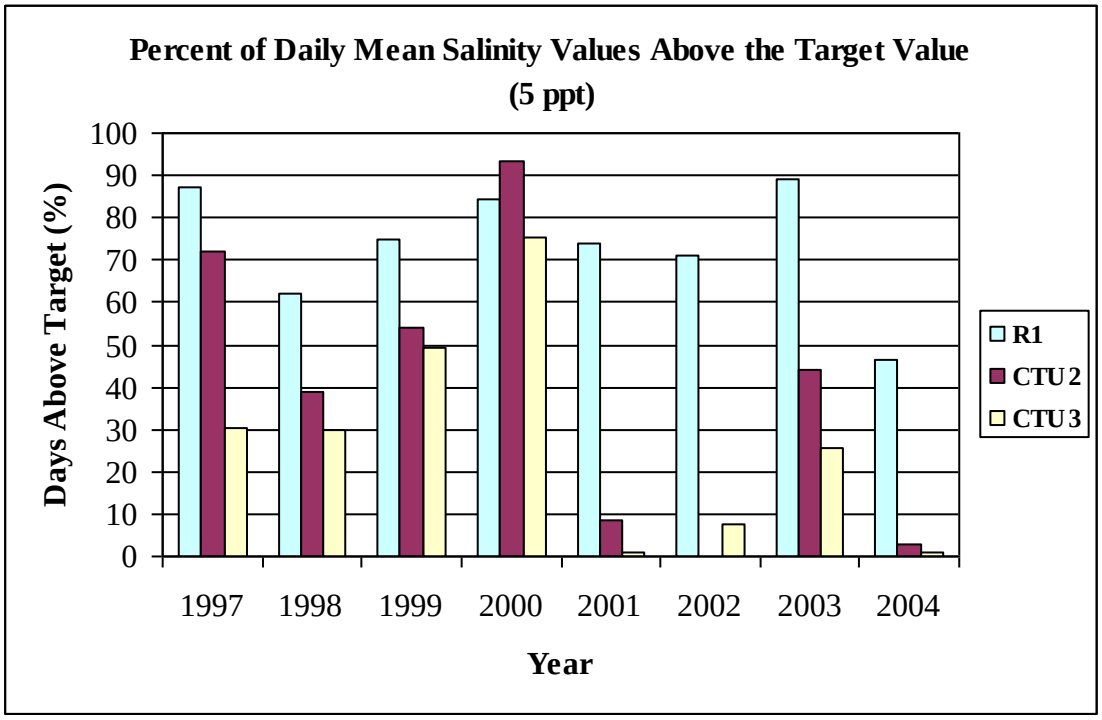


Figure 7. Percent of daily mean salinity values above the target value of 5 ppt in CTU 2, CTU 3, and R1 by years.

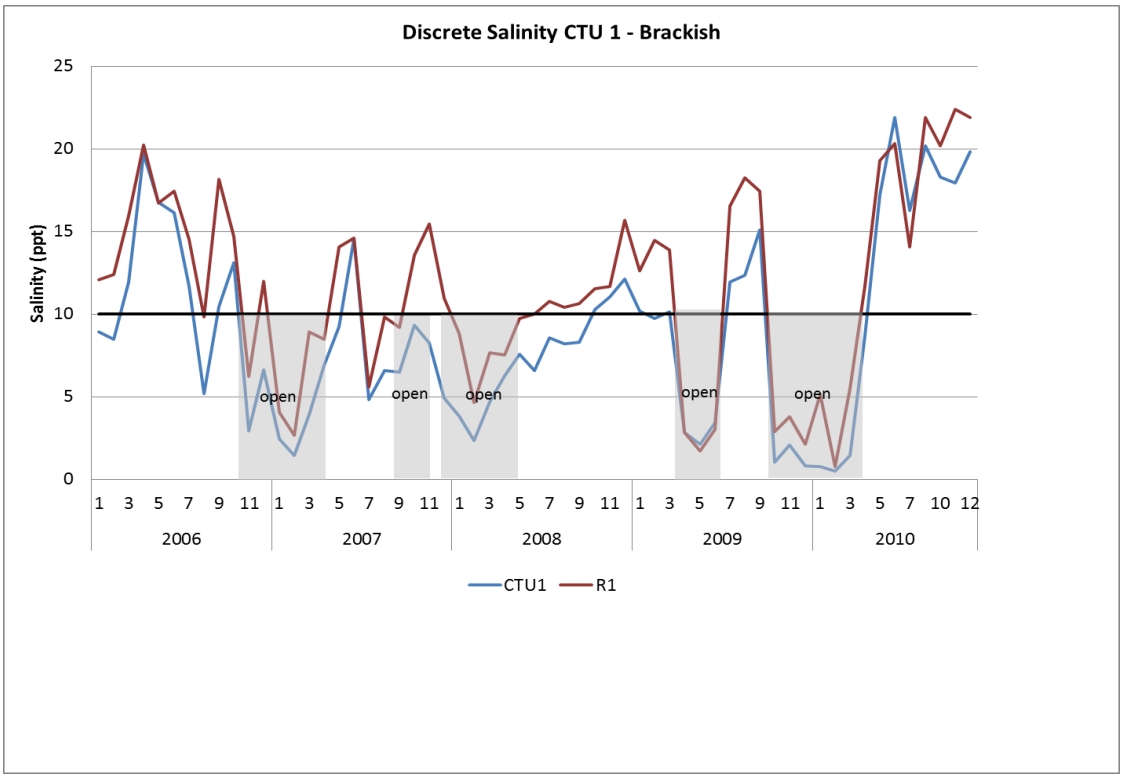


Figure 8. Bi-weekly means of discrete salinities within CTU 1 showing operations performed for the 10 ppt target range.

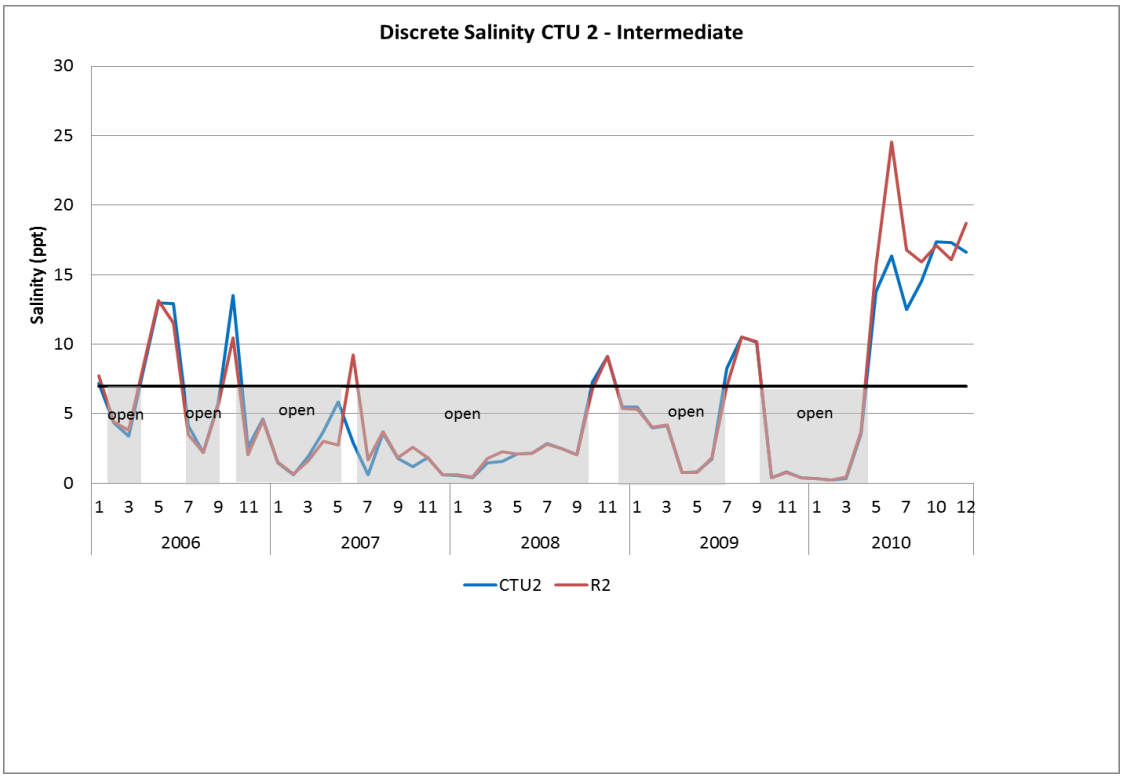


Figure 9. Bi-weekly means of discrete salinities within CTU 2 showing operations performed for the 7 ppt target range.

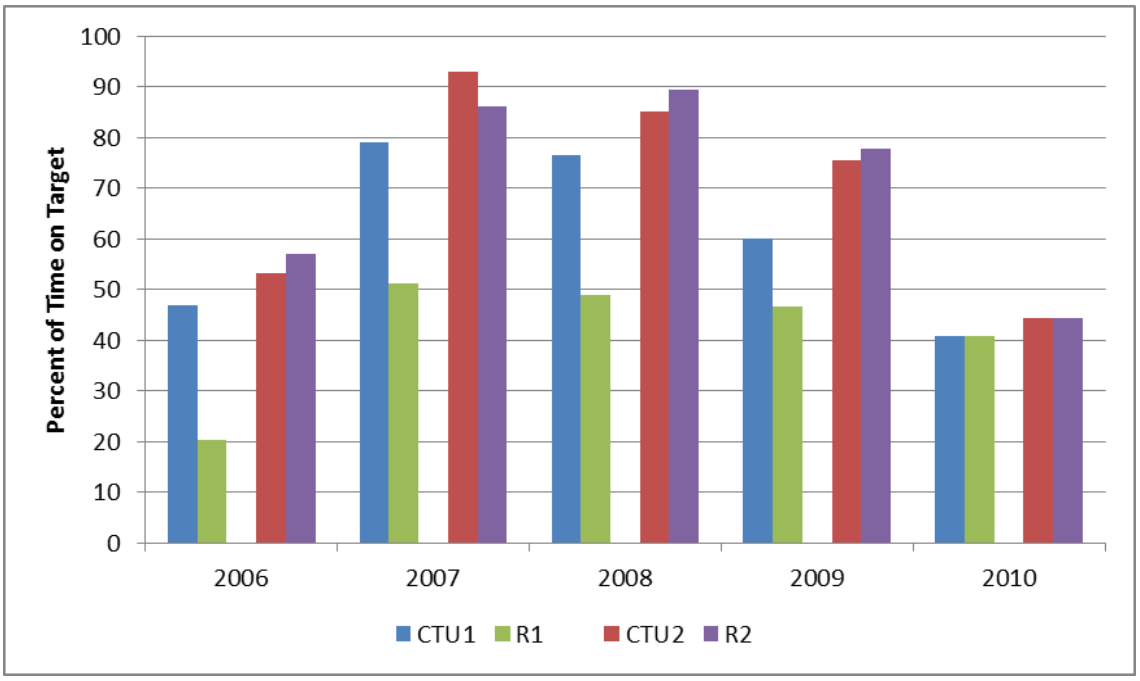


Figure 10. Percent of time salinities where within target range (0-7 ppt)within CTU 1 and CTU 2 from years 2006 to 2010.

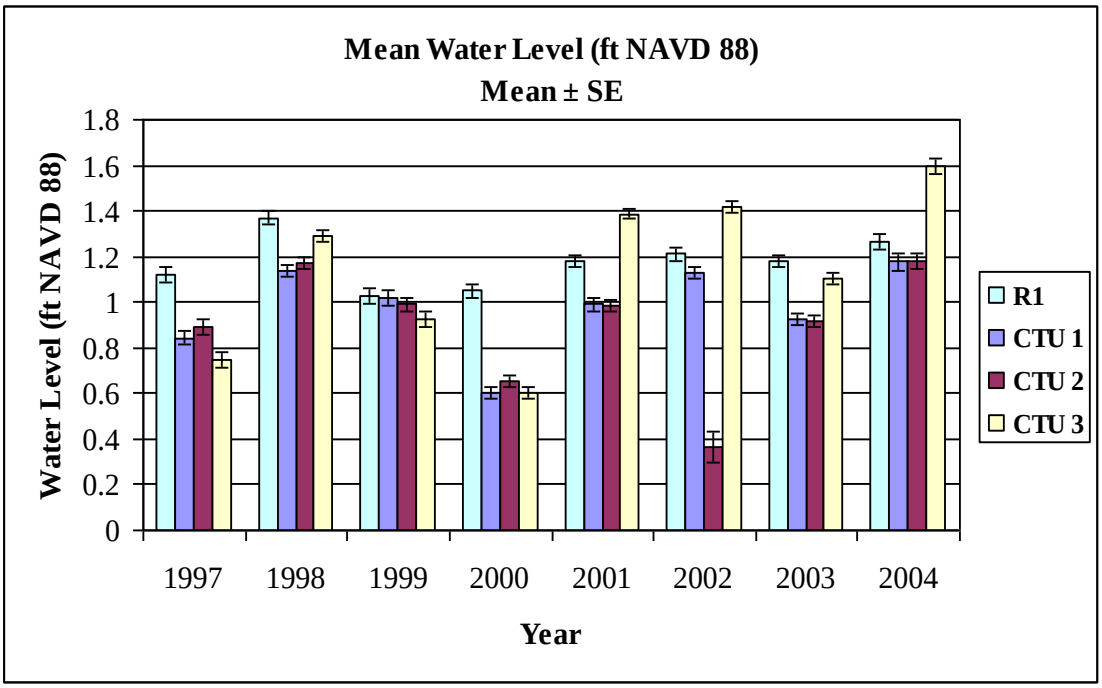


Figure 11. Water level range (ft NAVD 88) in the CS-21 Hwy 384 Project Area from 1997 to 2004.

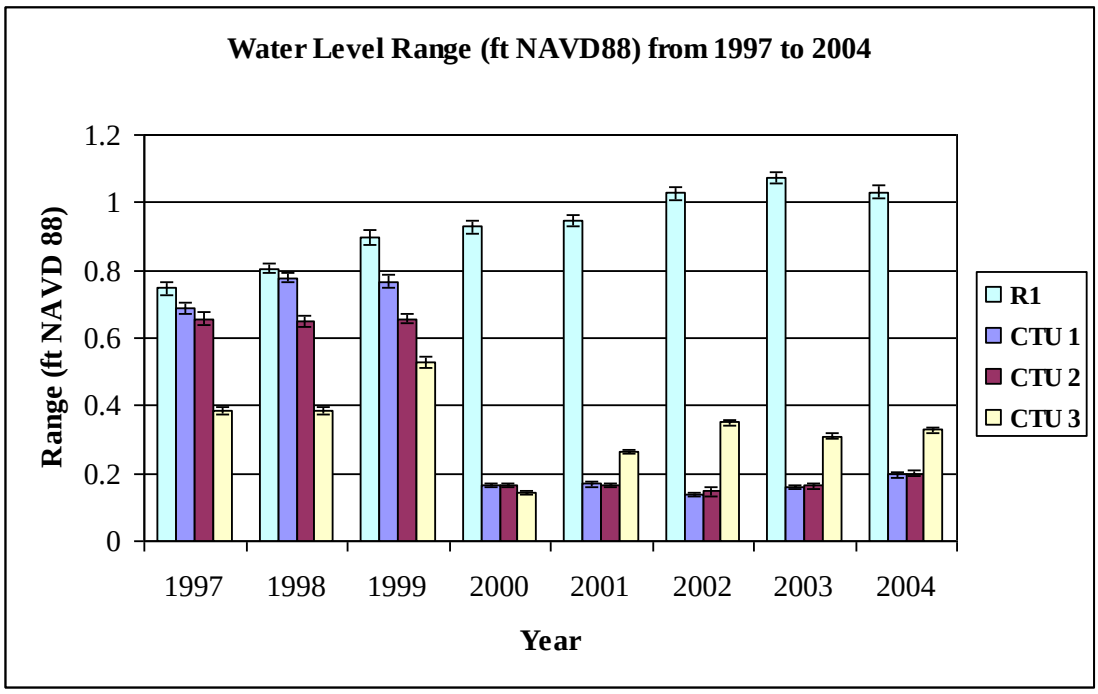


Figure 12. Yearly means of water level (ft NAVD 88) in the CS-21 Hwy 384 Project Area from 1997 to 2004.

Submerged Aquatic Vegetation

The project goal for SAV was to increase cover or frequency of occurrence. In 1996, 4.71% of stations in CTU 1 had SAV, the only species being an alga. Cover had increased to over 60% by 2002, the only species being *Ruppia maritima* (widgeongrass). In CTU 2, there was no SAV pre-construction and there was 85% *Ruppia* and 25% Algae post-construction. The other 8 species found in the project area were in CTU 3 (figure 13). Between 1996 and 2002, *Ruppia*, Alga, *Najas guadalupensis* (southern waternymph), and *Eleocharis parvula* (dwarf spikerush) declined while *Chara* sp. (muskweed), *Myriophyllum spicatum* (spike watermilfoil), and *Vallisneria americana* (water celery) increased. There was little to no SAV in the reference area before construction and 33.7% *Ruppia* with 1.2% *Myriophyllum* post-construction. Overall, cover increased in CTU 1, CTU 2, and the reference area (R 2) and remained near 100% in CTU 3 (figure 14).

Emergent Vegetation

The project goal for emergent vegetation was to increase cover in the project area. This goal specifically refers to intermediate marsh in CTU 2 and CTU 3 and brackish marsh in CTU 1. Visser et al. 2000 has seven marsh type classifications for the Chenier Plain. These classifications are useful in determining the effect of restoration projects whose goals include specific vegetative assemblages.

According to surveys performed pre-construction in 1997, CTU 1 was primarily dominated by *Juncus roemerianis* (needlegrass rush) with some *Spartina patens* (marshhay cordgrass) and some more saline species present including *Spartina alterniflora* (smooth cordgrass) and *Symphyotrichum tenuifolium* (saltmarsh aster). These species would fit into either the Oligohaline Wiregrass or Mesohaline Mixture classifications. Since the salinities were within the brackish range for that year, the marsh should probably be classified as Oligohaline Wiregrass. The 2002 survey showed an increase in *Spartina patens* and the presence of *Distichlis spicata* (seashore saltgrass). The CTU 1 area remained as Oligohaline Wiregrass and the FQI score increased post-construction from 56.8 to 84.9 which are in accordance with the project goal of increasing cover of brackish marsh. Vegetation data was discontinued in CTU 1 after the 2002 Survey. (Figure15).

Pre-construction in 1997, CTU 2 was dominated by *Spartina patens* and *Juncus roemerianis*. In 2002 and 2005 several more species were present including *Paspalum vaginatum* (seashore Paspalum), *Iva frutescens* (Jesuit's bark), *Distichlis spicata* (seashore saltgrass) and other intermediate marsh species. The 1997 composition is consistent with the Visser et al. (2000) classification of Oligohaline Wiregrass due to the dominance of *Spartina patens*. The 2002 and 2005 surveys indicated that while the marsh was still classified as Oligohaline Wiregrass, several indicator species revealed that the classification was changing. The additional species and the decrease in FQI scores also indicate change is occurring. The effects of Hurricane Rita in 2005 are evident in that the dominant species changed to *Paspalum vaginatum* and *Iva*

frutescens along with several other species including *Pluchea camphorata* (camphorweed). In 2007 and 2008 the dominant species changed to *Spartina patens* and *Paspalum vaginatum* along with several other species including *Iva frutescens, Distichlis spicata, Juncus roemerianis* and *Pluchea camphorata*. The 2007-2008 species compositions are now consistent with the Visser et al. (2000) classification of an Oligohaline Mixture. The FQI scores also increased from 60.0 to 73.3 indicating that the area was recovering from the effects of Hurricane Rita. (Figure 15)

Pre-construction in 1997, CTU 3 was dominated by *Sagitaria lancifolia* (bulltounge) *Spartina patens* and *Juncus roemerianis*. In 2002 the unit was dominated by *Spartina patens, Juncus roemerianis* and *Typha latifolia* (cattail), several more species were present including Sagitaria lancifolia, Schenoplectus californicus and *Paspalum vaginatum*. The 2002 species composition was consistent with an Oligohaline Wiregrass classification. In 2005 the unit was dominated by *Spartina patens* and Distichlis spicata and remained as an Oligohaline Wiregrass classification. The effects of Hurricane Rita in the 2006, 2007 and 2008 data where not as prominent as in CTU 2. In 2007-2008 the dominant species changed to *Spartina patens* and *Paspalum vaginatum* along with several other species including *Phragmites australis* (Roseau cane) and *Iva frutescens*. The FQI scores also increased from 61.5 to 70.5 indicating that the area was recovering from the effects of Hurricane Rita. The species compositions after the hurricane are now consistent with the Visser et al. (2000) classification of an Oligohaline Mixture (figure 15).

The reference areas showed little change from 1997 to 2008, being dominated by *Juncus roemerianis* and *Spartina patens* with co-dominant species of *Spartina alterniflora* and *Distichlis spicata* scattered throughout the years. The Visser classification for the reference unit is Oligohaline Wiregrass. Total FQI scores increased from 61.0 in 1997 to 83.3 in 2008. The reference area has showed little change in plant species or FQI scores over time which helps to substantiate the effects of the project goals in CTU-2 and CTU-3 (figure 15).

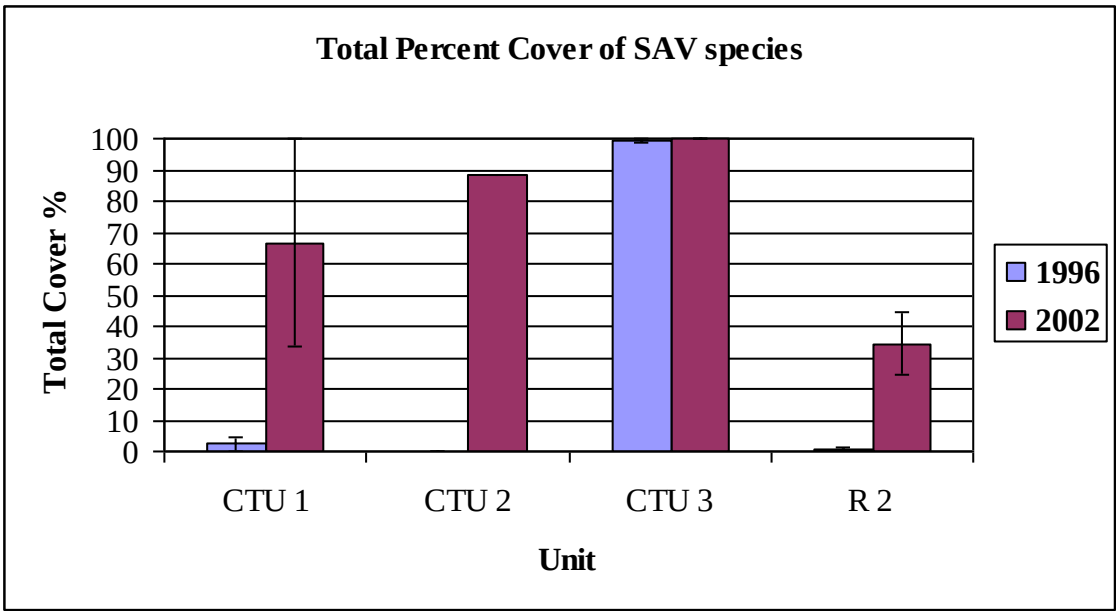


Figure 13. Frequency of Occurrence of SAV species in the project area (CTUs 1, 2 and 3 combined). Note that the majority of the occurrences were from CTU 3.

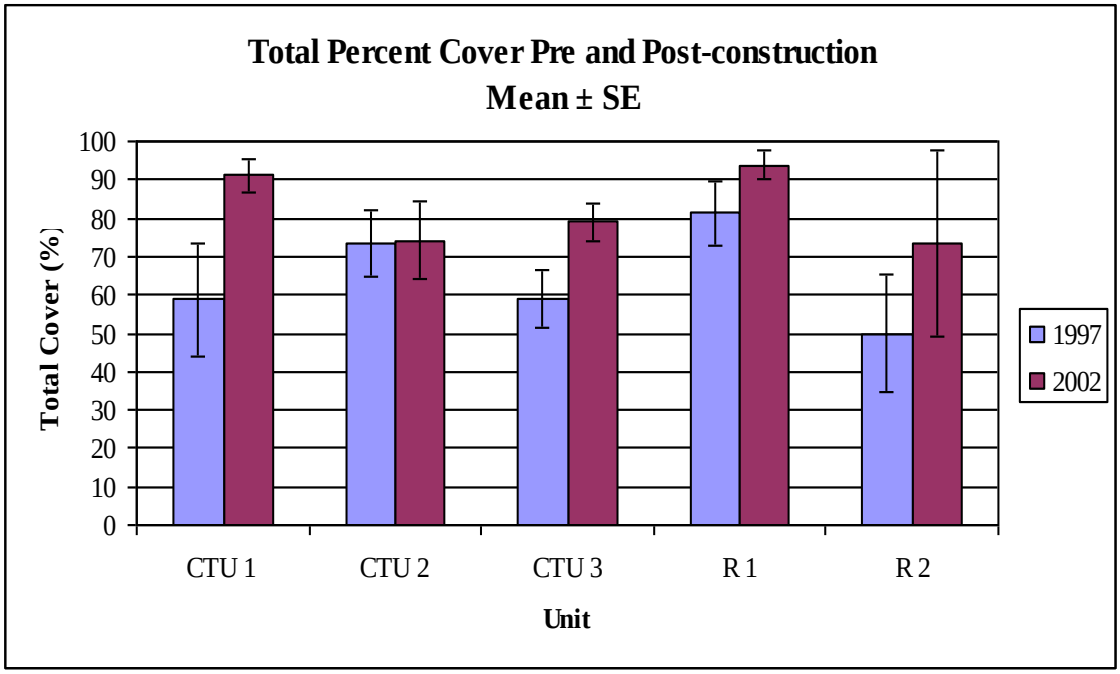


Figure 14. Total % Cover of SAV species in the CS-21 project and reference areas pre and post-construction.

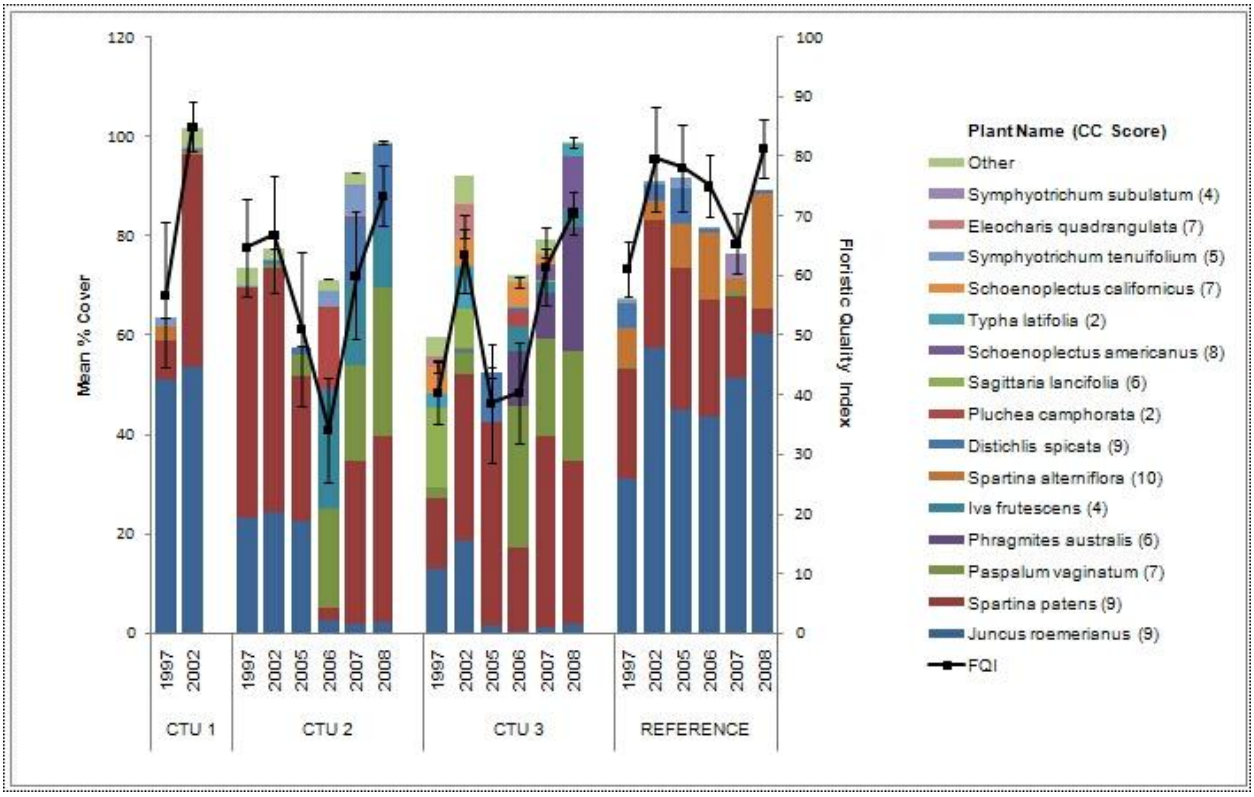


Figure 15. Floristic Quality Index (FQI) and mean % cover of plant species within CTUs 1-3 and the reference area from 1997 to 2008.

Soil Characteristics

Soil characteristics were originally collected in 1997. Soil characteristics are consistent with brackish type marshes (table 2) (Palmisano 1972). Post-construction samples which were to be collected in conjunction with the vegetative sampling were not collected in 2005.

Table 2. Pre-construction (1997) soil characteristic data for La. Highway 384 Hydrologic Restoration (CS-21) project and reference areas.

Unit	Percent (%) Organic Matter (%)	Bulk Density (oven) (g/cm3)	Percent (%) Water (Moisture) (%)	Pore Water Salinity (ppt)	Organic Matter Density (oven) (g/cm3)	Mineral Matter Density (oven) (g/cm3)
CTU 1	0.20	0.68	0.72	17.65	0.13	0.54
CTU 2	0.21	0.70	0.71	18.32	0.12	0.58
CTU 3	0.12	0.85	0.49	12.63	0.09	0.75
Reference 1	0.26	0.49	0.75	18.53	0.12	0.37
Reference 2	0.11	0.81	0.63	17.10	0.39	0.72

V. Conclusions

a. Project Effectiveness

Land loss has been prevented in the project area, salinities were maintained within the target range except during drought years, and water level variability was effectively decreased in the project area as per the project goals. Likewise SAV cover increased and intermediate marsh vegetation was maintained. Vegetation recovered from Hurricane Rita impacts.

b. Recommended Improvements

Overall, the Hwy. 384 Hydrologic Restoration Project is in good condition and functioning as designed with only minor problems noted. The hyacinth fence that was installed during the maintenance project of June 2002 as well as the rock reinforcement of the bank line is performing well and should be incorporated into all structures of this type in the future. The access road repair with recycled concrete material turned out well and was economical. The two Portable Multi-Parameter Water Quality Troll 9500 units used for operation of this project are working very well and should be considered for future projects. A maintenance event is planned during 2009/2010 for the items listed below.

- Structure No. 1 – install bird excluder device on solar panel, replace staff gage, and remove trash from outside of the hyacinth fence.
- Structure No. 12 – replace metal pile cap covers, install bird excluder device on solar panel.
- Structure No. 8 (Rock Plug) – install staff gauges both lake and marsh sides.

The structures have proven effective in achieving the goals of the project except during extreme weather conditions such as the drought in 2000. A revision to the permitted structure operations was recommended by CED and CRD jointly in late 2005, to provide increased control, restricting high salinity water from entering the project area from the GIWW, particularly CTU 1 and 2. This revision is also designed to increase the flow of freshwater into CTU 1 and 2 when freshwater is available. A permit modification of the original operating procedures mandating closure of the sluice gates at Structure #1 when salinities exceed 7 ppt, was approved and enacted in early 2006, reflecting these recommendations. Ongoing structure operations on salinities and high water thresholds are necessary in maintaining the project area to a healthy and sustainable ecosystem.

c. Lessons Learned

The access road repair with recycled concrete material turned out well and was economical in comparison to limestone aggregate.

No salinity data was available for the GIWW during the design phase of this project. It was assumed that the Calcasieu Locks prevented high salinity water from entering the GIWW from Calcasieu Lake. Data gathered since construction of the project proved this assumption to be erroneous. CTU 3, the intermediate marsh adjacent to the GIWW, is particularly vulnerable to elevated salinity flow from the GIWW, as no provisions were made to restrict this flow through this portion of the project area. Future designs should be based on actual information gathered at specific locations.

Debris buildup occurs naturally over time at each of the structures. Routine maintenance of debris removal from the structures is critical in maintaining flows in and out of the project area.

VI. Literature Cited

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APPENDICES

APPENDIX A
(Inspection Photographs)

Photo No. 1, Structure No.1, inlet side.

Photo No. 2, Structure No.1, trash along fence.

Photo No.3, Structure No.1, outlet side.

Photo No. 4, Structure No. 12, inlet side.

Photo No. 5, Structure No. 12, outlet side.

Photo No. 6, Structure No. 8, rock plug showing accretion occurring on lake side.

APPENDIX B
(Three Year Budget Projection)

HWY 384/ CS-21 / PPL 2

Three-Year Operations & Maintenance Budgets 07/01/2010 - 06/30/2013

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Pat Landry	*Dewey Billodeau*	*NRCS*	*Dewey Billodeau*

	2010/2011	2011/2012	2012/2013
Maintenance Inspection	$ 5,909.00	$ 6,086.00	$ 6,269.00
Structure Operation	$ 10,600.00	$ 11,600.00	$ 12,600.00
Administration	$ 2,000.00		$ -
Maintenance/Rehabilitation			

10/11 Description: Replace staff gages at Str. # 8 and # 1, pile cap covers and bird excluder devices.

Note: E & D includes $15,000 for staff gage replacement.

E&D	$ 20,500.00
Construction	$ 15,000.00
Construction Oversight	$ 1,000.00
Sub Total - Maint. And Rehab.	$ 36,500.00

11/12 Description:

E&D	$ -
Construction	
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ -

12/13 Description:

E&D	$ -
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ -

	2010/2011	2011/2012	2012/2013
Total O&M Budgets	**$ 55,009.00**	**$ 17,686.00**	**$ 18,869.00**

O &M Budget (3 yr Total)	**$ 91,564.00**
Unexpended O & M Budget	**$ 40,930.00**
Remaining O & M Budget (Projected)	**$ (50,634.00)**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2010-06/30/2011

HWY 384 HR / PROJECT NO. CS-21 / PPL NO. 2

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$5,909.00	**$5,909.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$5,500.00	**$5,500.00**
Operations Contract	LUMP	1	$10,600.00	**$10,600.00**
Construction Oversight	LUMP	1	$1,000.00	**$1,000.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$1,000.00	$1,000.00
FEDERAL SPONSOR Admin.	LUMP	1	$1,000.00	$1,000.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$2,000.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION: Replace staff gage at Structure No. 1, replace two staff gages at Structure No. 8

Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	3	$5,000.00	$15,000.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$15,000.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:

Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION: Replace metal pile cap covers at Structure No. 12, install bird excluder devices at Structures No. 1 & 12.

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0		$60.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$12.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$15,000.00	$15,000.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$15,000.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$55,009.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2011-06/30/2012

HWY 384 HR / PROJECT NO. CS-21 / PPL NO. 2

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,086.00	**$6,086.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$11,600.00	**$11,600.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:	Replace staff gage at Structure No. 1				
	Secondary Monument	EACH	0	$0.00	$0.00
	Staff Gauge / Recorders	EACH	1	$0.00	$0.00
	Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
	TBM Installation	EACH	0	$0.00	$0.00
	OTHER				$0.00
				TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
	Borings	EACH	0	$0.00	$0.00
	OTHER				$0.00
				TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:	Replace metal pile cap covers at Structure No. 12, install bird excluder devices at Structures No. 1 & 12.				
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0		$60.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$12.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$17,686.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2012 - 06/30/2013

HWY 384 HR / PROJECT NO. CS-21 / PPL NO. 2

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,269.00	**$6,269.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$12,600.00	**$12,600.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSOR Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION: Replace miscellaneous hardware at Structure No. 1 & 12.

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0		$60.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$12.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$18,869.00**

APPENDIX C
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: CS-21 Hwy. 384

Date of Inspection: November 12, 2009 Time: 11:10 am

Structure No. 1

Inspector(s): Dewey Billodeau, Darrell Pontiff, Pat Landry -(OCPR)
Dale Garber - NRCS

Structure Description: 3-24" Culverts

Water Level: Inside Outside 1.65

Type of Inspection: Annual

Weather Conditions: Sunny and mild

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Flapgates/Outlet Pipe	Good			2	2 of 3 flaps locked open with small nails.
Stop Logs	N/A				
Hardware/Sluicegates	Good			1	
Hyacinth Fence	Fair			1	Trash accumulating on outside of hyacinth fence.
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Cables	N/A				
Signage /Supports	N/A				
Staff Gages	Poor				Staff gage outlet side of structure not readable.
Rip Rap (fill)	Good				
WQ Troll 9500 - 29r	Good				Currently not working, will be checked out.
Earthen Embankment Access Roadway	Good				

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: CS-21 Hwy. 384

Date of Inspection: November 12, 2009 Time: 10:50 am

Structure No. 8

Inspector(s): Dewey Billodeau, Darrell Pontiff, Pat Landry -(OCPR)
Dale Garber - NRCS

Structure Description: Rock plug

Water Level: Inside Outside

Type of Inspection: Annual

Weather Conditions: Sunny and mild

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Cables	N/A				
Signage /Supports	N/A				
Staff Gages	Poor				Outside staff gage missing, inlet staff gage not readable.
Rip Rap (fill) (foreshore dike)	Good			6	The plug appears to be in good shape.
Earthen Embankment					The earthen levee that was rebuilt as part of the May '02 maintenance is in excellent condition beyond the limits of the channel.

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: CS-21 Hwy. 384

Date of Inspection: November 12, 2009 Time: 10:25 am

Structure No. 12

Inspector(s): Dewey Billodeau, Darrell Pontiff, Pat Landry -(OCPR)
Dale Garber - NRCS

Structure Description: 2-48" Culverts

Water Level: Inside Outside

Type of Inspection: Annual

Weather Conditions: Sunny and mild

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	Good			4	
Stop Logs	Good				
Hardware/Flapgates	Good				
Timber Piles	Good				
Timber Wales	N/A				
Galv. Pile Caps	Fair			5	Pile caps on outlet structure are corroded and will eventually need to be replaced.
Cables	N/A				
Signage /Supports Staff Gages	N/A Fair				
Rip Rap (fill) WQ Troll 9500 - 15r	Good Good				
Earthen Embankment Access Roadway	Good				

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?