STATE OF LOUISIANA

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT

QUALITY MANAGEMENT PLAN

for

LOUISIANA FISCAL YEAR 2008

Prepared: June 15, 2007
(Revised from April 30, 2003)

STATE OF LOUISIANA

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT

QUALITY MANAGEMENT PLAN

for

LOUISIANA FISCAL YEAR 2008

Prepared: June 15, 2007
(Revised from April 30, 2003)

Suggested reference citation:

Bass [1], A.S., M.J. Beck[2], C.F. Robertson[2], W.K. Rhinehart[2]. 2007. Office of Coastal Restoration and Management Quality Management Plan for Louisiana Fiscal Year 2008. Louisiana Department of Natural Resources, Baton Rouge, LA. 156 pp.

1. Conestoga-Rovers & Associates, 4915 S. Sherwood Forest Blvd., Baton Rouge, LA 70816.
2. Louisiana Department of Natural Resources, 617 North 3rd St, 10th fl., Baton Rouge, LA 70802.

PREFACE

The Louisiana Department of Natural Resources (LDNR) Office of Coastal Restoration and Management (OCRM) comprises three divisions- Coastal Engineering, Coastal Restoration, and Coastal Management.

This Quality Management Plan (QMP) is divided into three portions to reflect the functional roles of the OCRM. The first portion covers the Coastal Restoration Division (CRD), the second portion covers the Coastal Engineering Division (CED), and the third portion covers the Coastal Management Division (CMD). Each portion describes management practices, including quality assurance (QA) and quality control (QC) activities, used to ensure that the results of technical work are of the type and quality needed for their intended use. This QMP also illustrates the specific QA and QC practices employed by both internal and external LDNR OCRM staff and contractors for data generation and monitoring activities used in permitting and other regulatory activities.

Activities of the Coastal Engineering Division and the Coastal Restoration Division are closely related; in fact, prior to a reorganization in October, 2003, the engineering sections that make up the current CED were organizationally under the CRD. The combined duties of these two Divisions are to perform engineering, planning, and long-term monitoring functions relevant to developing and implementing wetland conservation and restoration plans and projects.

The Coastal Management Division uses its regulatory authority to protect, and when possible, restore and enhance coastal resources; it also implements and enforces the Coastal Wetlands Conservation Plan.

This QMP updates a previous document entitled the "Department of Natural Resources Office of Coastal Restoration and Management Fiscal Year 2007 Quality Management Plan" (Bass et al, 2006), which itself was based on a document entitled "Quality Management Plan for Coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program" (Steyer et al, 2000).

SUMMARY CONTENTS

QUALITY MANAGEMENT PLAN

TABLE OF CONTENTS

STATE OF LOUISIANA
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT

QUALITY MANAGEMENT PLAN

LIST OF FIGURES

Page

LIST OF TABLES

QUALITY MANAGEMENT PLAN IDENTIFICATION FORM

Document Title:	Quality Management Plan for LDNR/OCRM
Document Control Number:	QTRAK # 07-552
Organization Title:	Department of Natural Resources, Office of Coastal Restoration and Management
Organization Mailing Address:	P.O. Box 44027 Baton Rouge, LA 70804-4027
Office Physical Address:	Louisiana Dept. of Natural Resources Office of Coastal Restoration and Management 617 North Third Street, 10th Floor Baton Rouge, LA 70802-5428
Assistant Secretary of the Office of Coastal Restoration and Management:	Gerald M. Duszynski (Acting)
Quality Assurance Managers:	Chris Knotts, James Rives, Ed Haywood, Karim Belhadjali, and Chris Williams
Quality Assurance Officers:	Todd Folse, Glen Curole, Elaine Lear, Dona Weifenbach, Troy Barrilleaux, Mark Mouledous, John Troutman, Melissa Kay Hymel, Luke LeBas, Russ Joffrion, George Boddie, and Patrick Landry
Plan Coverage:	The Management Plan covers the activities of the Office of Coastal Restoration and Management

CONCURRENCES

Name: Gerald M. Duszynski
Title: Acting Assistant Secretary, OCRM
Phone: (225) 342-7267
FAX: (225) 242-3468
Signature: [signature]
Date: 8/30/07

Name: William K. Rhinehart
Title: Administrator
Coastal Restoration Division
Phone: (225) 342-2179
FAX: (225) 242-3635
Signature: [signature]
Date: 8/30/07

Name: Christopher P. Knotts
Title: Director
Coastal Engineering Division
QA Manager
Phone: (225) 342-6871
FAX: (225) 242-3542
Signature: [signature]
Date: 8/29/07

Name: James Rives
Title: Acting Administrator
Coastal Management Division
QA Manager
Phone: (225) 342-8921
FAX: (225) 242-3638
Signature: [signature]
Date: 8/29/07

Name: Chris Williams
Title: Engineer 7, Manager
Project Management Section
Coastal Engineering Division
QA Manager
Phone: (225) 342-7549
FAX: (225) 242-3723
Signature: [signature]
Date: 8-29-2007

Name: Karim Belhadjali
Title: Coastal Resources Scientist Manager
Restoration Technology Section
Coastal Restoration Division
QA Manager

Phone: (225) 342-4123
FAX: (225) 242-3406

Signature: [signature] Date: 8/29/07

Name: Edward Haywood
Title: Coastal Resources Scientist Manager
Monitoring Section
Coastal Restoration Division
QA Manager

Phone: (225) 342-9428
FAX: (225) 242- 3506

Signature: [signature] Date: 8/29/07

Name: Donald L. Johnson
Title: Quality Assurance Manager
U.S. EPA, Region 6

Phone: (214) 665-8343
FAX: (214) 665-7082

Signature: [signature] Date: 9/12/07

EPA QTRAK #:
07-522

INTRODUCTION TO THE COASTAL RESTORATION DIVISION

The Coastal Restoration Division (CRD) of the Office of Coastal Restoration and Management (OCRM) of the Louisiana Department of Natural Resources (LDNR), acting cooperatively with the Coastal Engineering Division (CED), is responsible for the planning, design, implementation, operation, and monitoring of coastal conservation and restoration projects in the twenty parishes (nineteen "coastal" parishes, plus Ascension Parish; LDNR 1999) comprising Louisiana's coastal wetlands. They also manage a varying number of technical feasibility studies, provide for the preparation and review of permit applications and review of environmental assessments (which may impact proposed or potential coastal restoration projects), and prepare comments for submittal to state and federal agencies.

Funding for the Division comes from several federal sources and from a dedicated trust fund.

The CRD is required to develop and submit a Quality Management Plan (QMP) to the EPA in accordance with guidelines established by the EPA. EPA document EPA QA/R-2 *EPA Requirements for Quality Management Plans* provided the guidance for preparation of this QMP. It is EPA policy that all Quality Systems (Quality Assurance Programs) must comply with EPA Order 5360.1, "Policy and Program Requirements to Implement the Mandatory Quality Assurance Program", which requires the preparation, submission, and approval of a Quality Management Plan. The process of planning, implementing, and assessing these management systems is called *quality management* and the product of the process is called the *Quality System*.

This QMP describes the roles & responsibilities, policies, and procedures associated with the LDNR/OCRM Quality System. Portions of this document are based on the previous LDNR/OCRM QMP (Bass et al, 2006, QTRACK No. 06-436) approved on August 14, 2006 by Donald Johnson, Region 6 Quality Assurance Manager, United States Environmental Protection Agency, Dallas, Texas.

1.0 CRD QUALITY MANAGEMENT AND ORGANIZATION

1.1 Mission

The Coastal Restoration Division, acting cooperatively with the Coastal Engineering Division, performs planning and long-term monitoring functions essential to successful development and implementation of wetland conservation and restoration plans and projects. Coastal restoration projects implemented by the CRD are funded through various federal (CWPPRA, WRDA, FEMA) and state (Wetland Trust Fund) sources.

The highest quality data are needed to ensure that these efforts are successful. Therefore our mission is to collect, analyze, and interpret high-quality ecological, hydrological, climatological, spatial, and engineering data. This mission will be realized by: (1) pragmatic data collection based on specific goals, using sound experimental design, (2) unbiased evaluation of data to determine the effectiveness of wetland projects, (3) documentation and dissemination of project data, and (4) the evaluation of program effectiveness as the knowledge and technology base expands. The fulfillment of our mission will result in appropriate management decisions to ultimately create, restore, protect, and enhance coastal wetlands in Louisiana.

1.2 Policy on Quality Assurance

The importance of a sound Quality Assurance (QA) program is acknowledged by the CRD and is addressed in overall program goals. It is the specific policy of the Division that all environmental measurements be of known and documented quality. This level of assurance is necessary because of the vast quantities of data collected by numerous entities. These data will ultimately assist in decisions regarding project and program-level effectiveness.

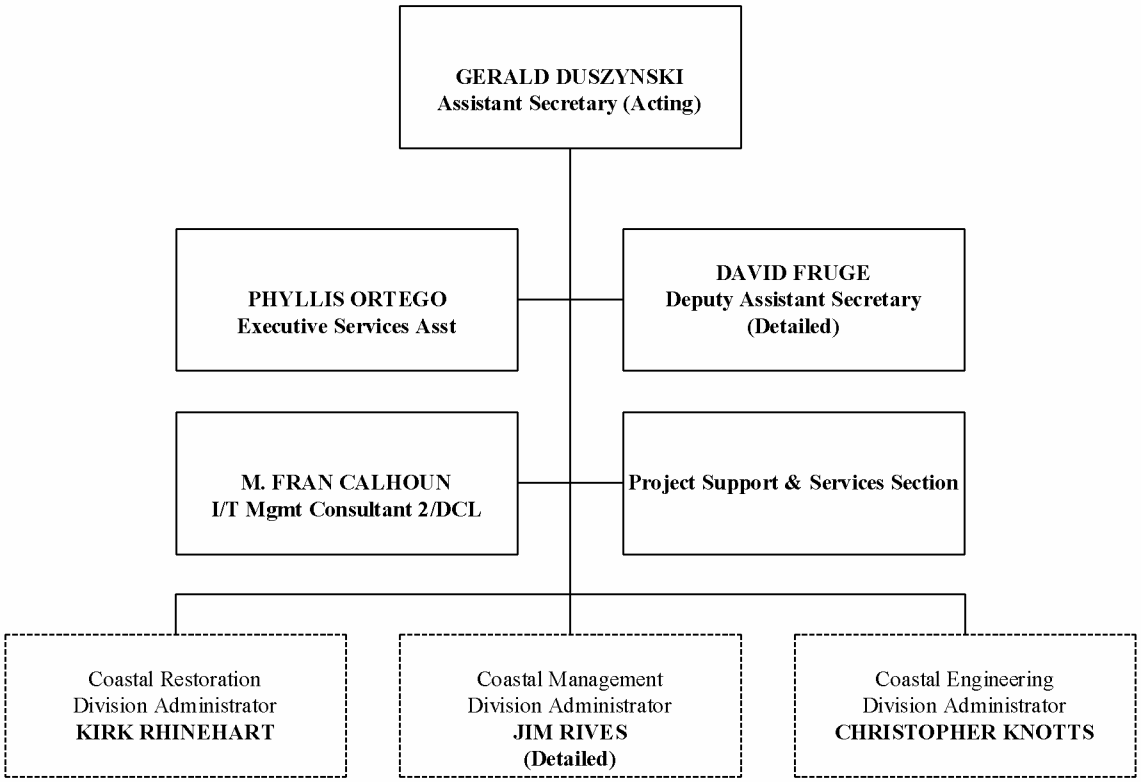
Necessary training and technical support will be afforded to meet program needs. Quality control checks have been provided throughout the program to safeguard data quality and integrity and to identify problems that could influence program implementation. Any situation that compromises data quality will be identified and addressed immediately.

Any changes to the QMP will be distributed to all individuals performing work under the QMP as the changes occur. Additionally, all changes that occur throughout the year will be reviewed during Field Methods training. If significant changes are made to the QMP, a revised version will be published and distributed. Quality assurance training and evaluation will be conducted periodically to assess the effectiveness of the Quality Management System, both organizationally and procedurally.

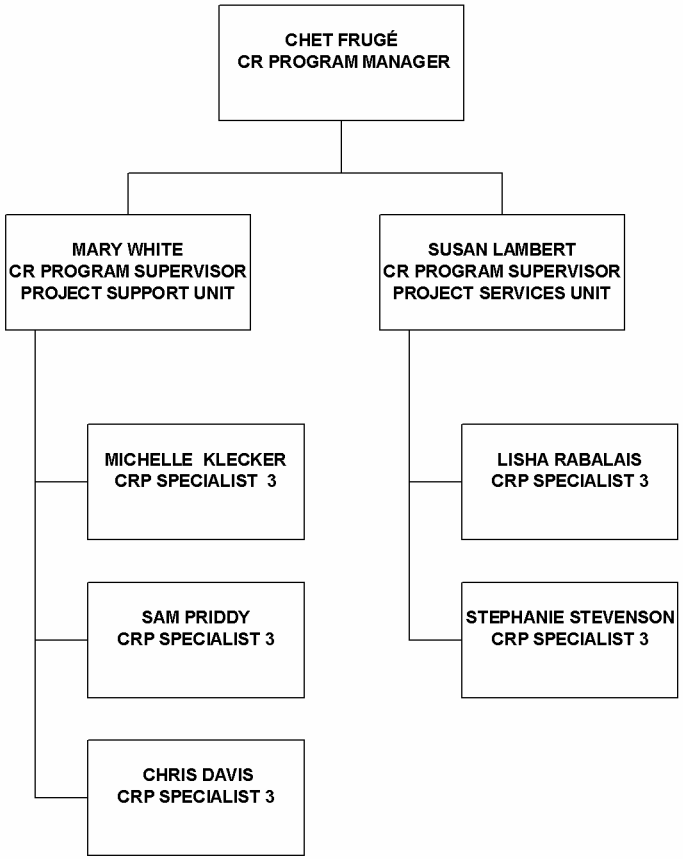
1.3 Organization Charts

The Coastal Resources Scientist Manager in the Restoration Technology Section is designated as the QA Manager of the CRD Quality Management Plan. The CRD Organizational Charts are shown as Figure 1 on pages 4 through 10

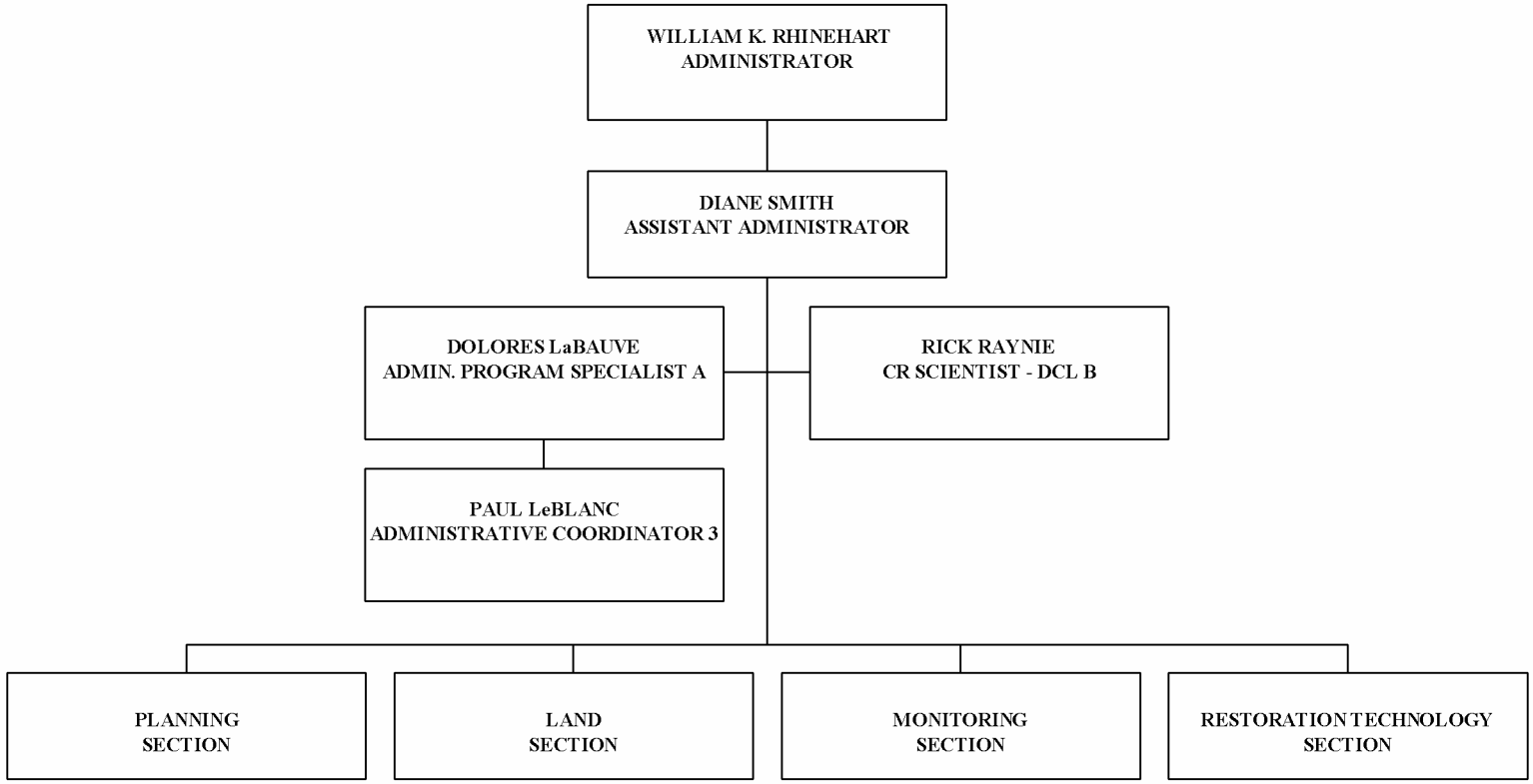
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION & MANAGEMENT
ASSISTANT SECRETARY'S OFFICE



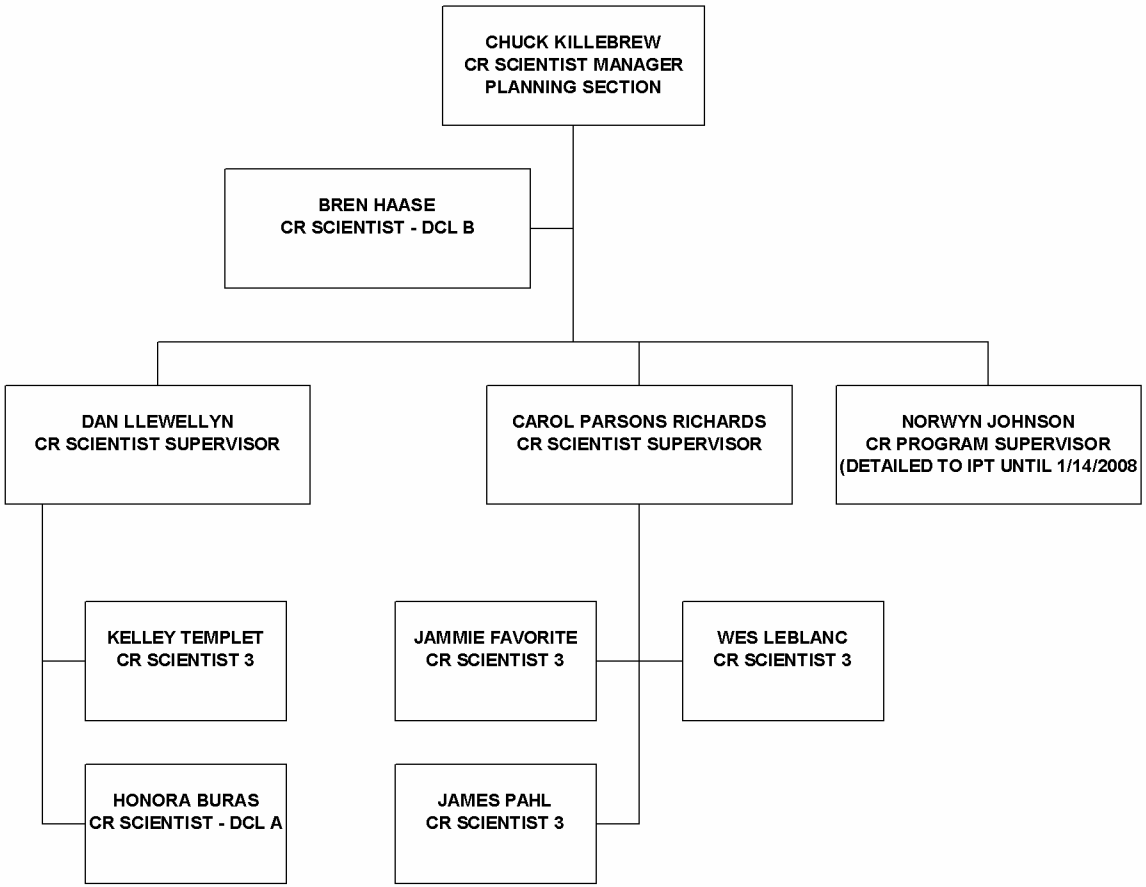
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
PROJECT SUPPORT & SERVICES SECTION



LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL RESTORATION DIVISION
OVERVIEW OF SECTIONS

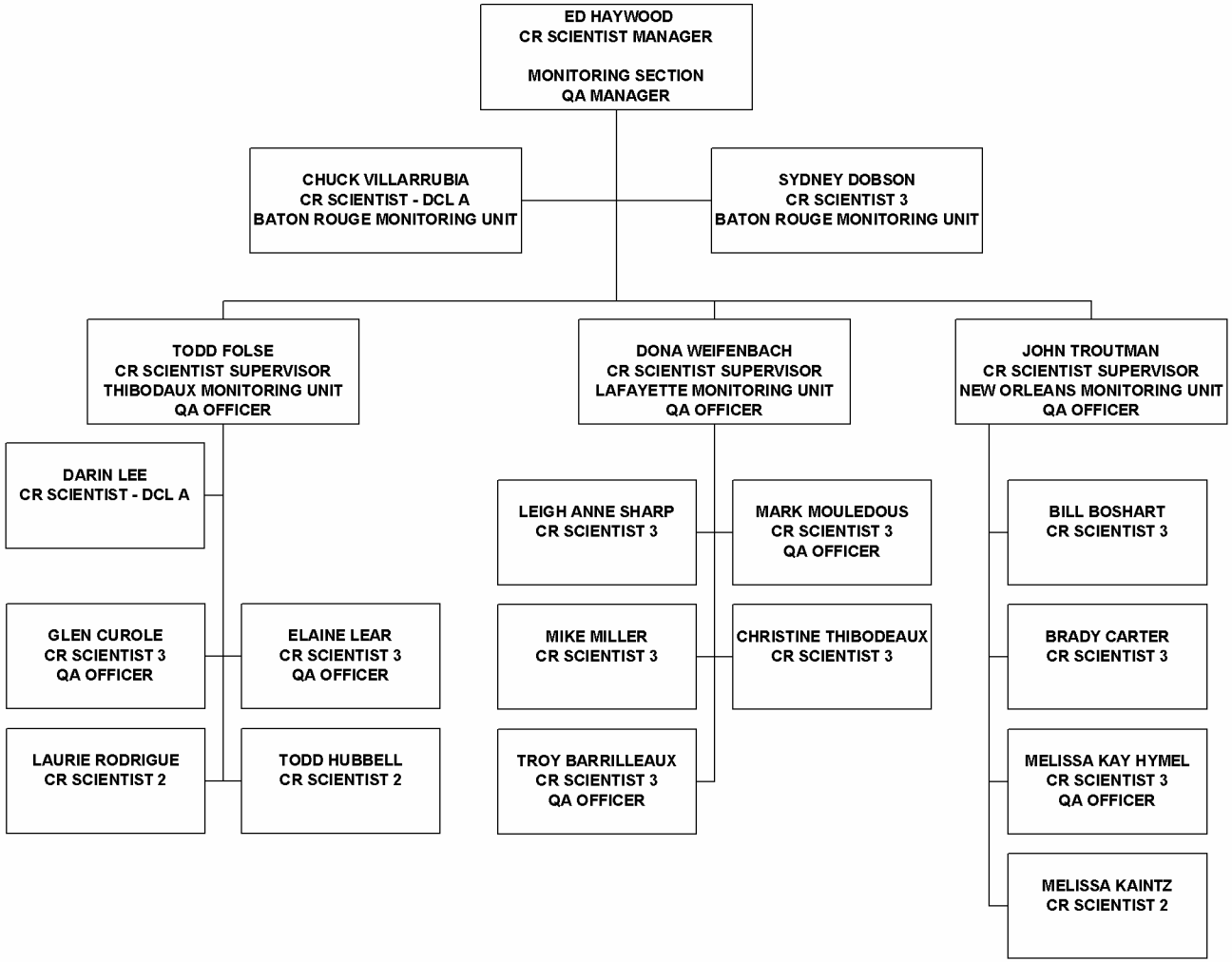


LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL RESTORATION DIVISION
PLANNING SECTION

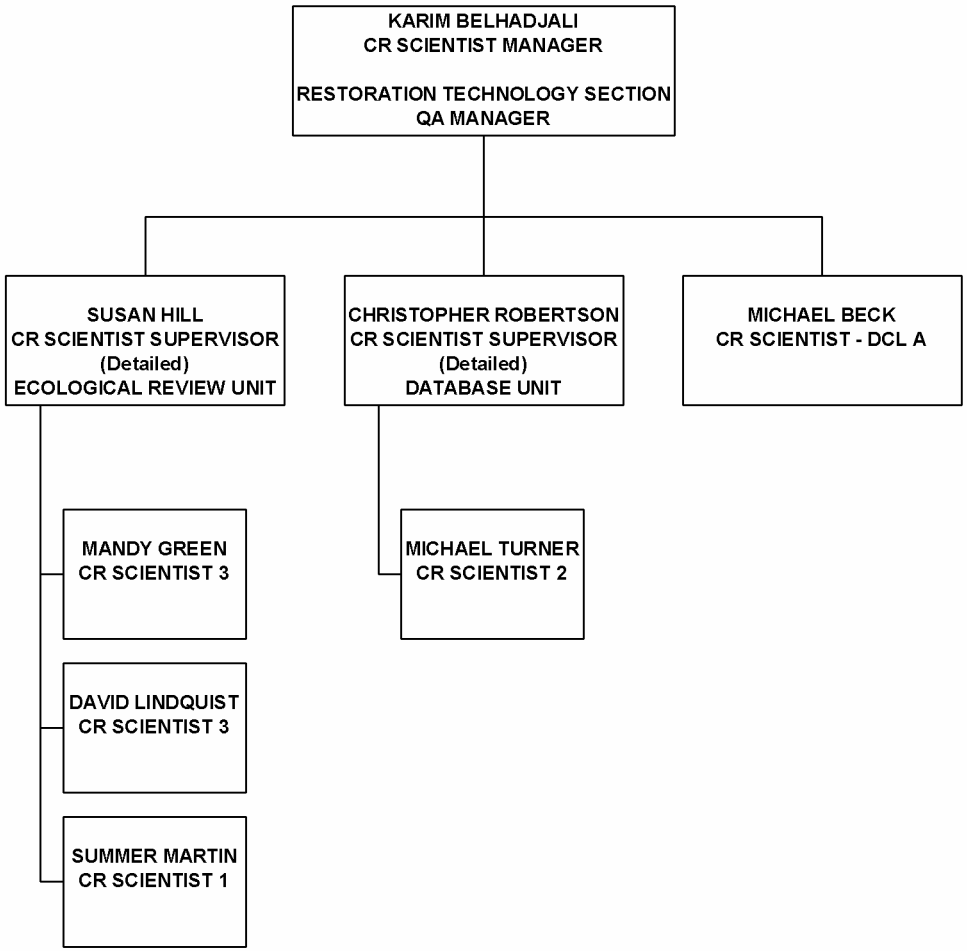


LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL RESTORATION DIVISION
LAND SECTION

LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL RESTORATION DIVISION
MONITORING SECTION



LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL RESTORATION DIVISION
RESTORATION TECHNOLOGY SECTION



1.4 Responsibilities and Authorities

The team responsible for the implementation of the Quality Management System (QMS) is identified in the organizational chart. QA responsibilities are dispersed throughout all levels of the Division. However, specific oversight and management of QA activities are carried out by three authorities: QA Officers (a senior Coastal Resources Scientist in each field office), QA Auditors (Contract Wetland Ecologist), and QA Managers (CRD Administrator, CRD Monitoring Section Manager, CRD Restoration Technology Section Manager).

The QA Officers are responsible for assuring compliance of daily QA activities and reporting problems immediately to a QA Manager. The QA Auditor performs an independent evaluation of QA activities periodically in order to provide management oversight to maximize the success of the QA activities. The QA Auditor reports directly to the QA Managers and provides a written quality assurance report to the QA Managers. The QA Managers report directly to the Assistant Secretary of the Louisiana Department of Natural Resources Office of Coastal Restoration and Management.

1.5 Programs Supported by the Quality System

LDNR/CRD consists of four Sections: Planning, Land, Monitoring, and Restoration Technology. The CRD is served by the OCRM Project Support and Services Section, and has field offices in Lafayette, New Orleans, and Thibodaux.

Office of Coastal Restoration and Management - Project Support & Services Section

The Project Support & Services Section (PSSS) performs technically-oriented administrative and management functions to the CRD, including the field offices. Staff members in this section are responsible for development, preparation and implementation of the CRD's state and federal program budgets. These activities include, but are not limited to, supervision, management and monitoring of all fiscal matters to include contract, cost share and grant activities; supervising and administering various computerized data and tracking systems; report writing; intra- and inter-agency coordination on negotiations for grants, contracts, cost share agreements, in-kind match charges, etc.; preparation of financial reporting documents; and limited outreach activities relating to the CRD. Support is provided to all CRD staff for all functions involving purchasing, requisitions, payment of invoices, telecommunications, all activities related to fleet management, and other administrative support services. In carrying out these functions, the PSSS works closely with the

DNR's Office of Management and Finance in processing final documents and information.

Coastal Restoration Division - Planning Section

The Planning Section (PS) provides a long-term, "big picture" perspective through which ecosystem restoration and management activities in Louisiana's Coastal Zone may be coordinated, and integrates the planning efforts of the various coastal restoration activities within the Office of Coastal Restoration and Management. One duty of the PS is the coordination of Adaptive Management activities and the re-analysis of applicable long-range plans; Adaptive Management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Additional duties of the PS include working with relevant federal and state agencies and academic personnel to ensure that restoration-related coastal zone activities are coordinated and complementary; identifying information needs and finding ways to fill the gaps in knowledge; and coordinating public outreach and involvement in plan formulation and implementation programs.

Coastal Restoration Division - Land Section

The Land Section (LS) completes all necessary actions that will allow full access to coastal restoration project lands. This includes drafting and negotiating servitude agreements, letter agreements, mineral operations use agreements, pipeline agreements, and rights of entry for construction that will provide all needed legal access to project areas. Land Section personnel also draft and coordinate memoranda of agreement, interagency agreements, and letter agreements with federal and other state agencies involved in coastal restoration projects. The LS personnel members act as coordinators/liaisons among state agencies, such as the State Land Office; among departments within the state government of Louisiana, such as Wildlife and Fisheries; among divisions within the LDNR, such as the General Counsel's Office, Mineral Resources, and the Office of Conservation; and among all CED and CRD sections. Land Section duties also include facilitating private landowner coordination and negotiation. Management of contracts for legal services is also a major function of this section. Contractor tasks and deliverables are defined and assigned, and contractor deliverables are reviewed for accuracy and quality.

Coastal Restoration Division - Monitoring Section

The Monitoring Section (MS) is responsible for the management of all monitoring activities. These include monitoring plan development, monitoring plan implementation, statistical analyses, quality control, data interpretation, and report writing. The MS also oversees data collection activities done by contractors. This includes training contractor personnel on adhering to the guidelines laid out in the Monitoring Section's SOP document (*A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products*, Folse and West 2005), evaluating data collected by contractors, assisting contractors in problem-solving, and managing work contracts and agreements relating to contractors.

These activities provide a scientific evaluation of the effectiveness of each coastal wetlands restoration project in achieving long-term solutions to the problem of coastal wetlands loss in Louisiana. Data are used 1) to determine the success or failure of existing projects, 2) in the modification of existing projects, 3) to support future decisions on selection of projects proposed for creating, restoring, protecting and enhancing Louisiana's coastal wetlands, and/or 4) for characterizing typical conditions within various habitat types for both project and non-project areas, providing a basis of comparison to evaluate differences in response to coastal restoration projects.

Coastal Restoration Division - Restoration Technology Section

The Restoration Technology Section (RTS) provides avenues of information exchange and transfer to the general public and other state and federal agencies on past, present, and future LDNR/CRD activities. Duties include development of Oracle and Geographical Information System (GIS) databases, development of information exchange and transfer, and production of information packages on coastal restoration projects for site visits (by LDNR officials, members of the Louisiana Legislature or U.S. Congressional Delegations, etc.) and for use in meetings with various legislative committees. This information is available on the official LDNR OCRM website at http://www.dnr.louisiana.gov/crm.

The RTS also conducts Ecological Reviews for all CWPPRA projects. The Ecological Review process was initiated in August 2000 to improve the likelihood of restoration project success. This is a process whereby each restoration project's biotic benefits, goals, and strategies are evaluated during the engineering and design phase prior to the authorization of construction. This evaluation utilizes environmental data and engineering information, as well as applicable scientific literature, to assess whether or not, and to what degree, the proposed project features will cause the desired ecological response.

1.6 Implementation

The CRD implements applicable elements of the Quality System in all activities under their responsibility. Management creates a work environment in which all personnel work together to ensure that the quality assurance program produces the type and quality of results expected.

1.7 Approval Page

Refer to Concurrences, QMP Pages xiii and xiv.

2.0 QUALITY SYSTEM COMPONENTS

2.1 Quality Management System

The LDNR/CRD manages a quality system by utilizing a series of checks and balances inherent in each individual section, as described below. The LDNR/CRD has developed and implemented the QMP according to EPA guidance.

2.1.1 Monitoring and Restoration Technology Sections

The MS and RTS jointly administer the Quality Management System of the CRD. At the largest scale, coastal restoration project quality is increased by the Project Selection Process; i.e., only projects with a high likelihood of success and large increases in wetland function relative to cost are selected for implementation.

Monitoring is more critical to the success of CRD restoration projects than to traditional mitigation programs. Large spatial scales and uncertainty regarding the status of the wetlands at any given time preclude the use of repeated trial and error, which is allowed in the Clean Water Act, Section 404, process. Instead, monitoring plans prepared by the CRD are designed with the expectation that some projects will be less effective than others, thus facilitating learning from all projects, regardless of their success. This monitoring philosophy is a departure from traditional monitoring programs in which documenting effectiveness of a project is the goal, and understanding why and how a project was effective (or not) is of minor importance. Thus, the monitoring philosophy behind the CRD monitoring program is based on adaptive management (Boesch et al. 1994, Steyer and Llewellyn 2000) and feedback monitoring (Gray and Jensen 1993). Consequently, the monitoring program not only detects unsuccessful projects, but also provides a basis for improved project design and operation.

Determining the effectiveness of projects in creating, restoring, protecting, and enhancing coastal wetlands in Louisiana is a daunting task because spatial and temporal variability cause differences between reference and project areas that hinder traditional experimental design and statistical techniques (Underwood 1994). The temporal variability and large spatial variability across the Louisiana coastal zone in wetland loss rates not only reduce the value of traditional experimental design and statistical techniques but also require a monitoring approach with a high degree of flexibility if the effectiveness of management actions under different environmental conditions are to be detected (Boesch et al. 1994). Thus, the monitoring program is designed not only to detect unsuccessful projects, but also to provide a basis for improved project designs and operation. The data generated from the monitoring program are used to refine

decision criteria and improve the level of accepted decision error. This improves the quality of results and confidence in management decisions.

Management of all monitoring activities is the responsibility of the CRD; however, QC responsibilities (i.e., verifying that all decisions and practices will result in quality data) are shared by all senior staff members. QC is consolidated under the QA Managers, who have final QC authority.

2.1 Tools For Implementation

2.2.1 Monitoring and Restoration Technology Sections

A technical audit is conducted periodically by a consulting wetland ecologist (QA Auditor) from the academic community. The primary focus of the technical audit is to verify that instructions laid out in the monitoring plans are being followed. Field data collection methods, data handling methods, data analyses methods, and prepared project reports are audited.

A program audit is conducted annually by the QA Manager. The purpose of this audit is to verify that the management decisions made by the Program Manager advance the goals of the Division. This audit uses the benefit of hindsight to determine if policies should be re-evaluated. The Program Manager uses the technical and program audits to revise monitoring activities when necessary.

An accessible database of temporal and spatial data, maintained by the State of Louisiana, encourages the publication of project results so that the ecosystem management techniques developed in Louisiana can be made available to the public and be peer reviewed by a national and international audience. Peer review provides a final verification to confirm that monitoring plans provide the data necessary to determine the effectiveness of projects.

2.3 Measurement Quality Objectives

The Standard Operating Procedures for each method are treated in detail in *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005). This section presents only general QA considerations.

Measurement quality objectives are determined from manufacturer specifications, analytical methods, and the judgment of experts (if required). The five general quality objectives are discussed below.

2.3.1 Accuracy

Accuracy is assessed through the use of standards (manufacturer-supplied) whenever such standards exist. Internal standards are devised for methods where a commercially available standard does not exist. Accuracy is also ensured by field training to be sure that all personnel follow the same procedures.

2.3.2 Precision

Precision in the field is assessed by replicate measurements. Laboratory method precision is estimated by repeating measurements of a sample standard. The sample precision is estimated by repeated measurement of a sample or sample split.

2.3.3 Representativeness

Representativeness is assessed by the use of replicate samples. *In the laboratory*, multiple subsamples are used, and each of the subsamples is analyzed in order to determine its variability. This allows for the calculation of the number of laboratory subsamples needed to adequately describe the field sample.

In contrast, representativeness *of the environment* can only be assessed by examining both the temporal and spatial variability in a given project area. Environmental variability is usually estimated by collecting replicate samples (randomly chosen) over space and time, but randomly selected samples may not adequately characterize a study area unless a large number of replicates are collected. Where spatial variation within a study area is evident, stratified random sampling is employed. Temporal variation is accounted for by restricting sampling to comparable time periods.

2.3.4 Comparability

Comparability (the degree of confidence with which data sets may be compared) is ensured for laboratory analyses through the use of standard methods for which there is a known accuracy and precision. Comparability of field data sets is accomplished by ensuring that the same procedures are followed by all sampling personnel. This is accomplished through the use of SOPs and proper training in field and laboratory techniques.

2.3.5 Completeness

Completeness, [the ratio of the amount of valid data obtained to the amount expected (Stanley and Verner 1985, Smith et al. 1988)] is used as an overall index for the program. If the completeness is not high enough, the evaluation of a project may be compromised. Completeness for an individual project is defined as the amount of data and samples actually collected as a percentage of the amount of data and samples assigned to the effort when data collection begins.

2.4 Quality Assurance Goals

The quality assurance goals are summarized in Table 1, which serves as the overall guideline for the monitoring program by presenting, for each variable to be monitored, the accuracy, precision, and completeness goals as well as the expected range of values to be encountered. The variables monitored and the exact method by which each of these goals is met for an individual project is outlined in the project monitoring plan. Individual project plans must demonstrate that the goals listed in Table 1 are met. Monitoring plans provide a means of scientifically evaluating the effectiveness of each coastal wetlands restoration project. The data collected are used to determine the success or failure of projects. More importantly, the data are used as a basis for making design modifications and management strategies for current and future projects.

Table 1. Quality Assurance Goals and expected ranges. Accuracy is in absolute units where possible; precision is based on the difference between replicated measurements. Percentages in the accuracy and precision goal columns represent tolerable error. The precision goal refers to individual measurements as well as between sampling crews. Data collected outside the expected range may be real but should be verified.

Type of Measurement	Units	Accuracy Goal	Precision Goal	Completeness Goal	Expected Range
1. Habitat Mapping					
Photointerpretation	habitat	7%	NA	100%	NA
Photoregistration	m	15 m	NA	NA	NA
2. Meteorological and Hydrologic Sampling					
Precipitation	cm/h	0.1 cm/h	5%	85%	0–15
Wind Speed	m/s	0.7 m/s	0.5 m/s	85%	0–67
Wind Direction	degrees	5 degrees	5 degrees	85%	0–360
Water Level (Stage)	m	0.06 m	0.06 m	85%	-3–6
Water Depth	cm	1 cm	1 cm	85%	0-305
Salinity	ppt	0.5 ppt	0.5 ppt	85%	0–36
Specific Conductance	microsiemens	5%	1000µS	85%	0–55,000
Temperature	centigrade	0.5 C	0.2 C	85%	0–35
pH	pH units	0.2	0.1	85%	6–8.5
Discharge					
Current Speed	m/s	0.1 m/s	0.1 m/s	85%	0–3
Cross-Sectional Area	m^2	5%	5%	85%	NA
Suspended Sediments	mg/L	2 mg/L	2 mg/L	85%	0–200
Bathymetry	cm	4.0	4.0	85%	-200–0
Topography	cm	4.0	4.0	85%	-90–90
3. Soil/Sediment Sampling					
Redox	mV	20 mV	20%	85%	-450–400
Percent Organic Matter	%	10%	15%	85%	0–100
Bulk Density	g/cm^3	0.05 g/cm^3	15%	85%	0.01–0.90
Percent Water	%	10%	15%	85%	0–100
Salinity	ppt	0.5 ppt	0.5 ppt	85%	0–36
Sulfides	ppm	1 ppm	25%	85%	0–150
Grain Size	microns	NA	30%	85%	0.2–500
4. Surveying (horizontal)					
GPS	m	1 m	1 m	85%	NA
Conventional	m	0.3 m	0.3 m	85%	NA

Type of Measurement	Units	Accuracy Goal	Precision Goal	Completeness Goal	Expected Range
5. Vertical Accretion and Subsidence					
Feldspar	cm	0.1 cm	30%	85%	0–2
SET Table	cm	0.1 cm	30%	85%	0–2
6. Marsh Erosion and Soil Creation					
Large Scale	m	2 m	2 m	85%	0–100
Small Scale	cm	5 cm	5 cm	85%	0–200
7. Vegetation Health					
Species Composition and relative abundance					
Taxonomic ID	species	NA	NA	85%	NA
Percent Cover	%	10%	10%	85%	0–100
Number of Stems	#/m^2	10/m^2	10%	85%	1–2,000
Aboveground Biomass					
Clip Plots	g/m^2	10 g/m^2	20%	85%	0–2,000
Stem Length	cm	1 cm	20%	85%	1–300
8. Herbivory	%	10%	10%	85%	0–100
9. Fisheries Sampling					
Taxonomic ID	species	NA	NA	85%	NA
Organism Counts	numbers	10%	10%	85%	NA
Size	mm	1 mm	1 mm	85%	NA

2.5 Data Review, Validation, Verification, and Analysis

The data review, validation, verification, and analysis components of the LDNR CRD QA/QC program are conducted jointly by the MS and RTS.

2.5.1 Data Validation and Verification

Routine Procedures

The guidelines for data collection and laboratory analysis are listed in the SOPs for each field method (*A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products*, Folse and West, 2005).

Data are entered into the central LDNR database from field or laboratory data sheets and digital files or directly from electronic dataloggers. Data are entered after all field data have been collected. Each data set contains header information that describes the data set as well as the variable names on the data set. Data are sorted, merged (if needed), and calibration factors are applied along with any corrections necessary to put the data into proper units for analysis.

Data files are to be saved to disk and a backup copy made as soon as the data from an individual station have been entered. Thus, in the event of a system failure, only data from a single station will have to be reentered.

Final Data Editing Procedures

After the data have been entered, the data files are printed and the data file contents are checked against the data sheets to ensure the proper values have been entered. Any corrections to data entry are made at this time. The person verifying and correcting the data initials and dates the printout when verification and corrections are made. When the complete data file has been entered and verified, the data set characterization is changed to indicate that it is a final data set ready for analysis.

The data are then analyzed to produce the following information:

1. Plots of the distribution
2. Lists of the extreme values
3. Frequency tables
4. Tests for normality

These summary or preliminary type statistics, which are performed on all of the variables as well as the QC data sets, are the first analyses performed and constitute the basis of the field data reports.

Outliers and/or suspicious values (values outside of the expected range, Table 1) that are detected during the data entry and editing procedures are flagged in the data set. Thus, the analysts know that these are actual measured values as opposed to data entry errors. Outliers remain in the data set for preliminary analysis but are addressed in final analysis. Should an outlier be removed during analysis, it is noted and the reasons for doing so are given.

2.5.2 Data Analysis

General Guidelines for Projects

The actual statistical techniques employed for the analysis of the data collected for an individual project are developed as part of the project monitoring plan. General guidelines are addressed in further detail in the Standard Operating Procedures found in Section 8. Additionally, the following rules are observed:

1. The techniques to be employed must be statistically valid and verified by a biostatistician.
2. All data analysis techniques are to be fully documented.

General Analysis Procedures

The general techniques employed include (but are not limited to) the following types of analyses:

1. Data distribution (i.e., cumulative distribution plots, histograms)
2. Univariate statistics (means, standard deviation, etc.)
3. Regression
4. Trend analysis
5. Time series analysis
6. ANOVA
7. Testing of Statistical Assumptions

The exact procedures employed on any given project are decided upon by the biostatistician assigned to the project.

2.5.3 Statistical and Ecological Evaluation

2.5.3.1 Program Goals

Periodic statistical and ecological evaluation is required to ensure that individual project monitoring plans are yielding results that allow for the determination of project effectiveness. This is accomplished by periodic reviews of the data (that data being collected and analyzed) done by a biostatistician and wetland ecologist. These reviews may also involve the use of statisticians and ecologists from the academic community and also supply an opportunity for modifying the procedures being used to allow for the use of new and/or different approaches.

2.5.3.2 Evaluation of Statistical Techniques Employed

The statistical techniques being employed are evaluated on a periodic basis by the monitoring managers in conjunction with statisticians from the academic community. These reviews ensure that all techniques are being properly applied to the data being collected.

This review also is used to keep an updated timetable of the statistical analysis process for each of the projects. This timetable lists, for each project, the techniques being employed with an indication of the status of the analysis (e.g., complete, in progress, etc.). This timetable is then used to keep track of any problems that may have developed during the data analysis process.

2.5.3.3 Evaluation of Interpretation of Ecological Significance

The determination of statistical significance alone may not necessarily provide a correct ecological interpretation of the monitoring data. For example, a statistically significant difference in salinities may be so small as to have little or no impact on plant communities. Therefore the statistical procedures used and the results of the statistical analyses will be reviewed by the ecologist in light of their ecological interpretations and meaning.

2.5.4 Standard Operating Procedures

Standard Operating Procedures (SOPs) for all CRD data collection and analysis are outlined in a separate document titled *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005). SOPs for surveying activities are located in a separate document titled *A Contractor's Guide to Minimum Standards,* developed by the CED.

2.6 Technical Assessments

A technical audit is conducted periodically by a consulting wetland ecologist (QA auditor) from the academic community who verifies that instructions laid out in the monitoring plans are being followed. Field collection methods, data handling methods, data analyses methods, and prepared project monitoring reports are audited.

A program audit, conducted annually by the QA Managers, verifies that the management decisions made by the Program Manager advance the goals of the two Divisions. This audit uses the benefit of hindsight to determine if policies should be

re-evaluated. The Program Manager uses the technical and program audits to revise monitoring activities.

2.6.1 Data Quality Assessments

The LNDR CRD provides an accessible database of temporal and spatial monitoring information. This database encourages the publication of monitoring results so that the ecosystem management techniques developed in Louisiana can be made available to the public and be peer reviewed by a national and international audience.

3.0 Personnel Qualifications and Training

3.1 Certifications Required and Qualifications

It is the policy of the LDNR CRD that personnel involved in projects requiring QA shall be qualified to perform assigned work. Those qualifications are assured by requisite minimum levels of education and internal training procedures.

3.1.1 Quality Assurance Personnel Qualifications

The QA Managers and Officers have, as a minimum, a Bachelor of Science degree in biological sciences, environmental sciences, engineering, or a related field plus five years of professional level experience in a coastal resource, engineering, or related program. CRD Section Managers typically serve as the QA Managers.

3.1.2 Technical Personnel

CRD personnel have the requisite education and experience to conduct assigned functions. Technical personnel are typically classified into the Coastal Resources Scientist job series established by the Louisiana Department of Civil Service. The minimum qualification for each position has been established by the State of Louisiana, Department of Civil Service. These qualifications can be found at the Louisiana Department of Civil Service website's page of job specifications at http://www.dscs.state.la.us/classpay/jobspecs/csjobspc.htm.

The broad range of data collected by the two Divisions requires a diversity of expertise in the collection, analysis, and interpretation of such data. Personnel have specialties in the following areas: estuarine ecology, wetland ecology, coastal processes, wildlife and fisheries science, plant and soil taxonomy, hydrology, water quality, geography, and statistics. Most personnel have graduate degrees. All personnel who conduct data collection are familiar with basic wetland ecology or biology.

3.2 Training Requirements for Personnel

The CRD provides continuing training and development to equip employees to perform particular tasks within a job assignment, deal with new technical developments, develop additional work capabilities, and increase their level of work competence. Training available to CRD personnel include courses offered by external sources as well as in-house training. It is the role, responsibility, and authority of the QA Officers in each of the field offices and the Managers of each section to identify training needs of CRD employees.

The CRD identifies training needs on a regular and continuing basis, and satisfies needs for all personnel involved in QA activities through the training programs described in this management plan. Training priorities are established and satisfied based on the needs of individual projects. Quality-related training is documented in personnel files maintained for each employee. These files are routinely updated and accessible to the QA Officers and the Section Managers.

3.2.1 Field Methods

Field data required by project monitoring plans are collected by Coastal Resources Scientists stationed at regional field offices of the Monitoring Section of the CRD. Qualifications for those positions are located at the Louisiana Department of Civil Service website's page of job specifications at
http://www.dscs.state.la.us/classpay/jobspecs/csjobspc.htm.

All Coastal Resources Scientists receive on-the-job training conducted by the field office supervisor or senior staff during routine field work. All Coastal Resources Scientist field staff attend periodic Field Methods training seminars where personnel members practice standardized techniques to ensure adequate competence. Personnel familiarize themselves with all field gear including, but not limited to, GPS, continuous data recorders, dissolved oxygen meters, velocity meters, soil redox electrodes, soil coring devices, salinometers, staff gauges, and transit levels. Personnel also practice collection and handling techniques of biomass plots, soil samples, water samples, and fishery samples, and accustom themselves to performing species identification of all common emergent and submerged plant species and visually estimating distance and cover. The training seminars are conducted over 3–5 days and are developed and directed by the Coastal Resources Scientist Manager with assistance from the Coastal Resources Scientist Supervisors and the academic community. The Coastal Resources Scientist Manager identifies academic trainers and appropriately certified instructors and is responsible for ensuring that all instructors and materials are current for any particular training before that training is administered. Training is verified by testing at the conclusion of the Field Methods meeting and via Louisiana Civil Service evaluations. The course is evaluated by Coastal Resources Scientists and comments are provided to training personnel as part of the quality improvement process.

3.2.2 Laboratory Methods

All personnel members- of the CRD and of contractor entities- who conduct laboratory procedures (i.e., soil bulk density, dry weight of soil and vegetation, soil organic matter

content, and preparation of spiked samples) attend a laboratory procedures training session annually.

3.2.3 Data Processing and Analysis Training

All personnel who conduct data processing and analysis will attend training in the use of relevant software packages.

Spatial data are processed by the National Wetlands Research Center (NWRC) personnel via a cooperative agreement with the CRD. Their training is described in a standard operating procedures (SOP) document of their own agency (NWRC, unpublished material).

Non-spatial data are processed by the Monitoring Section of the CRD. Data are processed and analyzed by Coastal Resources Scientists trained in the use of Oracle, Excel, Word, Powerpoint, and SAS software. In-house training is developed and directed by senior Coastal Resources Scientists and contracted academicians.

3.2.4 Safety Training

Safety training is a critical component of the CRD, especially with field personnel due to exposure to potential hazards on land, at sea, and in the air. All personnel are required to attend safety training every 3 years. The following is a list of types of training required in this program:

Water safety and boat handling: U.S. Coast Guard approved boat safety training required of all field personnel involved in boat operation.

Airboat training: Eight hours of airboat training, including operation, conducted by a qualified airboat operator.

First aid and CPR: Mandatory for field personnel and encouraged for office personnel.

All-terrain vehicle (ATV): Eight hours training by a certified instructor in the safety and use of an ATV before operation.

3.3 Professional Development

All personnel are encouraged and solicited to make presentations at scientific and professional meetings. Personnel are required to stay current in the scientific literature and are encouraged to seek additional scientific/academic training. Professional

development is also maintained through the state of Louisiana's Certified Public Training Program. In an effort to encourage employees to continue professional development, the OCRM reimburses 50% of membership dues in a relevant professional society, up to a maximum reimbursement of $150.00 per year.

4.0 PROCUREMENT OF ITEMS AND SERVICES

4.1 Applicability

Section Managers have the responsibility of acquiring services needed to fulfill all the obligations and requirements of the program. The CRD has administrative staff members that are responsible for administering contracts and legally binding agreements through which the two Divisions acquire or render all goods (deliverables) and/or services.

4.2 Contract and Purchasing Procedures

LDNR purchasing, individually and in conjunction with other state entities, operates under various statutes (Louisiana Revised Statutes (LRS)); administrative codes (Louisiana Administrative Codes (LAC)); and Executive Orders. The documents pertinent to procurement of equipment, services, and supplies include, but are not limited to:

a. LRS 39, Chapter 17, Louisiana Procurement Code

b. LAC 34, Part I, Rules and Regulations

c. Executive Order MJF 98-20 as amended by Executive Order No. MJF 00-29 (Small Purchases)

d. LRS 38:2211 et al., Chapter 10 (Construction/Public Works-Letting Bids)

The administrative staff have extracted and simplified these documents to provide in-house guidelines (unpublished Policy and Procedural Memoranda) that identify procedures to be followed to adequately track and manage contracts. The completed codification of procedures, however, appears in the above listed documents. Specific guidelines include, but are not limited to: (1) Requests for Contracts and Amendments, (2) Billing and Invoices, (3) Selection of Vendor, (4) Contracting Party Requirements, and (5) Purchasing Process. Checklists are provided to ensure submission and routing of appropriate information to minimize contracting and purchasing problems. The administrative staff are expected to:

1. Review and track all significant paperwork, including: project narrative; scope of services; budget; request for contracts and amendments or proposals; purchase and change orders; invoices; payments; ensure dual sign-off where needed for technical and administrative review; and ensure all commitments/requests of any kind are in writing and by the appropriate persons.
2. Ensure complete documentation and filing of all significant documents, correspondence, and other information.

3. Coordinate, develop, or initiate correspondence, written alternatives, recommendations, responses, and preventative actions to project concerns/problems.
4. Prepare post-assignment reports on all projects and contracts when completed.
5. Inquire and arrange for orderly transfer of project/contract management responsibilities.
6. Ensure that minority/disadvantaged business enterprises have the maximum opportunity to compete for and perform contracted services.
7. Personally inspect all purchases and deliverables and verify whether they are satisfactory and in keeping with the terms and conditions of the contract. Authorization or payment of invoices should not be processed until deliverables are in-hand or documented.
8. In the case of contracted facilities or laboratories, monitoring reports are provided by the contractor at the time of invoicing and reviewed by CRD Program Managers for compliance and provided to the administrative staff. The CRD Section Managers complete performance evaluation forms at the end of the contract period and provide this to the administrative staff. The review of the contractor includes evaluating compliance with CRD standards and the contract conditions and deliverables.

5.0 QUALITY DOCUMENTATION AND RECORDS

5.1 Documents/Records Handling System

Project management and monitoring require the collection, analysis, and interpretation of environmental data from which project operation, maintenance, and management decisions can be made. The following procedures ensure that any document (including all raw or transformed data or information not compiled into a finished report) or report is prepared in a timely fashion, reviewed, approved, used, revised, disseminated, and maintained. All documents and records are maintained in the LaSalle building in Baton Rouge. All final Monitoring Plans and reports are published on the internet at the "Document Search" link of the OCRM website at http://www.dnr.louisiana.gov/crm.

5.2 Data Entry and Editing

Monitoring Manager Responsibilities

1. Make one copy of discrete data sheets and continuous recorder calibration sheets. Place originals in the field office's main Project Monitoring File in the common area.
2. Load continuous data into Oracle. Enter continuous recorder calibration sheets into Oracle and shift data, if necessary. The acceptance criteria for data drift over a month is 10%. Ensure electronic shift is conducted properly. Graph shifted specific conductance, raw depth, and temperature data. Review data for gaps and out-of-range or suspicious values and void, if necessary. Any voided data must be explained and initialed in comments box.
3. Shift depth data in Excel or other capable software. Ensure electronic shift is conducted properly.
4. Ensure discrete data sheets entered into Oracle. Check 100% of values for accuracy and completion and make necessary changes; validate data. (Make sure checks are not conducted by same person entering data). If Oracle cannot accept data sheets, ensure data entered in appropriate digital format.
5. Generate field trip report in Oracle and send copy to Field Office Supervisor for editorial review and approval. (At discretion of Field Office Supervisor, attached to the field trip report will be summary statistics of continuous depth and salinity data).
6. Provide QA officer packet that includes the following information for each project visited during field trip: a) QA/QC Data Checklist, b) CRD Discrete Data Sheets, c) CRD Continuous Recorder Calibration Sheets, d) any electronic data files from field trip not accessible in Oracle, and e) field trip report if not accessible in Oracle.

QA Officer Responsibilities

1. Ensure that discrete data were entered into Oracle and were verified by the monitoring manager. (If monitoring manager enters data into Oracle, QA officer will perform 100% data verification).
2. Ensure electronic shift was conducted properly on continuous data and verify against CRD Continuous Recorder Calibration Sheet. Graph shifted specific conductance, raw depth, and temperature data (will graph "shifted depth" data when proficient with Oracle) and review for outliers and suspicious values. Look at transitional periods at the beginning and end of each data record to ensure proper continuity. Any questionable data values will be discussed with monitoring manager, and voided if necessary. Decisions regarding changes or voiding of data will be documented in comments section and initialed by monitoring manager and QA officer.
3. QA/QC Data Checklist is completed by QA officer. Any questions not answered affirmatively are discussed with the monitoring manager. As specific issues are resolved, the QA officer will initial and date in the appropriate location on the QA/QC Data Checklist. When all issues are resolved, the QA officer initials and dates in the bottom right-hand corner indicating that the entire QA/QC Data Checklist has been completed. If any issues are left unresolved, or are to be resolved at a later date, this is noted in the appropriate comments section. The QA officer provides the original checklist to the monitoring manager for placement in the monitoring folder. The QA officer also returns datasheets to the monitoring manager.

Instantaneous data from a network of data collection platform DCPs are input directly into Oracle via the USGS Water Resources Division Data Server. An Oracle report form displays the number of data points successfully transmitted, maxima, minima, mean, times of missing data, and a graphical display of data used to determine the presence of outliers and times of poor data quality. Reports are referenced by DCP serial number and platform number. The reports are reviewed by the Coastal Resources Scientist Supervisor and any problems are reported to the Coastal Resources Scientist Manager and corrected. The DCP data are also accessed by USGS via the web. USGS personnel service the equipment in the field and provide the CRD with field inspection sheets. If it is found that the instrument used in the field has drifted between calibrations, the data may be shifted according to algorithms determined by USGS as outlined in Novak (1985). An annual data report is published by USGS that includes all shifted data summaries. The Oracle report form and annual data reports are periodically inspected by the QA officer.

External data such as that supplied by outside agencies or contractors are supplied in ASCII format on diskette with all fields identified and codes supplied. The monitoring manager for a particular project inspects all data received for completeness and

accuracy. All reports summarizing data are kept in both project and monitoring files. Data on diskette are kept by the monitoring manager and a master copy is archived.

5.3 Filing

The CRD monitoring program files are located at each of the three field offices. These files contain project files, reports, reprints, aerial photography, personnel information and other pertinent monitoring information.

5.3.1 Monitoring Plans

Monitoring plans are developed following a standardized format. Hard copies of monitoring plans are kept in the monitoring project files. The plans are put into the folders by the monitoring managers and periodically inspected by the Coastal Resources Scientist Supervisor to ensure adherence to form and the latest updates. Finalized monitoring plans are maintained in the field offices and in the main MS files in Baton Rouge, and are available via the "Document Search" link of the OCRM homepage at http://www.dnr.louisiana.gov/crm.

5.3.2 Monitoring Files

Monitoring files are maintained on each project. Each file has six sections: (1) monitoring plan, WVA, permits, operational scheme; (2) chronology of all events/meeting notes and field trip reports; (3) correspondence, phone conversations; (4) scopes of services, budgets; (5) data summary, graphs, tables; and (6) data summary, miscellaneous. These files are maintained by the designated monitoring manager and are reviewed at a minimum of every six months by the Coastal Resources Scientist Supervisor for completeness.

5.3.3 Photography

Aerial photography of project areas is maintained on the 11th floor of the LaSalle building in Baton Rouge and at the NWRC office in Lafayette, LA. Digital files of flightlines are stored in the Regional GIS Database. A spreadsheet of projects flown is located with the photographs and is updated annually.

Photographs (35mm) taken of the project areas are stored in the miscellaneous data section of the project monitoring files. A copy of slides and prints is maintained in a filing system alphabetically by project.

5.3.4 Reports

Summary Data and Graphics

Summary Data and Graphics are written by monitoring managers on an annual basis for all projects that have been constructed. These reports are updated annually by March 31st and contain summary results of all monitoring data collected for each project. These reports follow a standard format, are maintained in the project monitoring files in the field offices, in Baton Rouge, and are available via the "Document Search" link of the OCRM homepage at http://www.dnr.louisiana.gov/crm.

Comprehensive Reports

Prior to 2003, Comprehensive Reports were written by monitoring managers for completed projects every 3 years and followed a standard scientific format. Final copies of reports are maintained in an open-file report index and are available via the "Document Search" link of the OCRM homepage at
http://www.dnr.louisiana.gov/crm.

Beginning in 2003, these reports were combined into a Coastwide Comprehensive Report, to be compiled by monitoring managers, contracted academia, and interested partners, every 3 years to report on the effectiveness of the individual projects, collective impacts on a hydrologic basin, and the impacts of the wetland restoration program on the entire Louisiana coast. Final copies of all reports are maintained in an open-file report index and are available via the "Document Search" link of the OCRM homepage at http://www.dnr.louisiana.gov/crm.

Field Trip Reports

After each field trip a standard report is filled out by the field trip leader (Coastal Resources Scientist) to include auxiliary information such as vegetation appearance, unusual events, etc. These field trip reports are given to the Coastal Resources Scientist Supervisor for review and comment. Approved field trip reports are filed in the monitoring project files and auxiliary information is incorporated into the central LDNR database. Project file folders are reviewed at six-month intervals by the Coastal Resources Scientist Supervisors for completeness, and any missing reports are replaced.

5.3.5 Data

The Strategic Online Natural Resource Information System (SONRIS) Database was designed to include enough space for at least one year of data from all stations in the system now and for those planned in the future. The system is also capable of holding a shifted data set of equal space. Data must be archived every year after the original, and shifted data sets are inspected by the monitoring manager and approved by the Coastal Resources Supervisor.

5.4 Tracking

5.4.1 Project Time Lines

"Monitoring Responsibility Spreadsheets," identifying monitoring and management personnel as well as construction and monitoring plan status, are updated continuously via networked computers. These forms include the TAG Responsibility Tracking Sheet and the Project Monitoring Responsibility Sheet. These sheets keep all active participants in the Monitoring Program informed on all project time lines.

5.4.2 Field and Laboratory Samples

The labeling scheme for field and laboratory samples is determined by the project monitoring manager and Coastal Resources Scientist Supervisor prior to field sampling initiation. Field sample tracking sheets are filled out by the project monitoring manager and signed by any subsequent personnel transporting the samples to an approved laboratory.

5.4.3 Data and Records

Data and record tracking is an important aspect of information control and utilization. The term *tracking* in this section refers to the compilation and organization of data and records in a format that identifies its contents and location in order to make the data and records easily accessible to users.

Proper data and record tracking entails collecting all information relative to a particular project and organizing this material to enable users to locate and utilize the findings. Management strategy includes a filing system for all records and gives directions as to where other information relating to the project can be found. All number streams are compiled in spreadsheet files with corresponding reports generated from this information. The tracking system will allow the user to follow data from its raw form through spreadsheets, analysis and reports.

5.4.3.1 Hard Copy

All data, documents, and records kept in the project files or the monitoring project files are labeled upon entry into the file and tracked. Tracking codes will include basin, project number, type of file, file section, and document number. A Pro-cite database is maintained by the Monitoring Section and periodically inspected by the Coastal Resources Scientist Supervisors and manager.

5.4.3.2 Electronic

All monitoring data are stored on a CD-ROM. They are initially stored on diskette and are later copied into the central LDNR SONRIS database or the Regional GIS Database and archived to tape. All data sets in spreadsheets are identified by project (basin and project number), the type of data, and dates. A master file containing the names and locations of all data files is maintained by the Coastal Resources Scientist Supervisor and is periodically inspected by the Coastal Resources Scientist Manager.

6.0 COMPUTER HARDWARE AND SOFTWARE

6.1 Policy

It is a Quality Assurance Management Objective of the CRD that data collected, analyzed, processed, and maintained in all processing systems in support of the two Divisions be accurate and of sufficient integrity to support effective accounting, engineering, design, construction, monitoring, and evaluation of all CRD restoration activities.

6.2 Computer Hardware and Software Requirements

The LDNR database is designed to efficiently handle the need for data acquisition, organization, and storage of biological, hydrological, climatological, geographical, and engineering data. It has been carefully designed to meet the need for optimal storage capacity, multi-user capability, and user friendliness. The primary function of this system is to provide a centralized database for all information necessary to aid in project planning, to document the effectiveness of restoration projects, and to assist in the day-to-day operation of projects.

6.3 Database System

The LDNR database uses Oracle as its relational database management system. The system is a component of the SONRIS 2000 (Strategic Online Natural Resources Information System) initiative within the LDNR. It is web-enabled, so that users within and outside of LDNR can access and utilize the system via the internet. The system server is upgraded regularly and is capable of storing all data types collected by the two Divisions.

6.4 Real-Time Data Acquisition System

The CRD maintains a real-time data acquisition system in order to facilitate active management of specified projects. Data collection platforms (DCPs), located throughout the Louisiana coastal zone, transmit data via a geostationary operational environmental satellite to a Wallops Island, Virginia, down-link. The data are demodulated there and transmitted via a domestic satellite to the USGS computer center receive station in Baton Rouge, Louisiana. The USGS receive station is designed for continuous operation; however, in the case of a power failure or other incidents that would cause a lapse in data, the Wallops Island down-link automatically retransmits data not received. In the event of a DCP malfunction, a field crew is dispatched to investigate and repair the DCP that same day, minimizing data loss. When the data reach the USGS computer center, it is quality checked and transmitted via T-1 line to LDNR where the data are stored in the SONRIS database.

6.5 Personal Computers

Each LDNR CRD employee is supplied with a personal computer (PC) and has access to a laser printer. On average, these PCs are replaced or upgraded about once every 3 years to ensure that the two Divisions maintain a high level of technological advancement. All PCs are connected via a Local Area Network, operated in a Microsoft Windows environment, and contain the latest word processing, spreadsheet, statistical, GIS, graphical, and presentation software. These PCs can communicate both within and outside of the LDNR via e-mail and/or the internet. The CRD also has several laptop computers that are used to collect data from field recorders, to serve as mobile work stations while staff are traveling, and to connect with LCD projectors for use in graphical presentations.

6.6 Maintenance Agreements and Upgrades

The CRD holds maintenance and service agreements on all hardware and licenses, and on all software applications to ensure that repairs are made quickly and software remains updated.

6.7 Information Security

It is important that LDNR information resources are protected from potential loss and misuse from a variety of accidental and deliberate causes. Therefore, all information resources are safeguarded to prevent such loss or misuse. Appropriate procedures have been developed by the two Divisions and are currently in place.

6.8 Documents

For proper implementation and maintenance of the CRD program computer system, the CRD relies on policies and procedures of the LDNR Information Services Division (IS) as well as any published literature provided by hardware and software vendors.

6.9 Personnel

Personnel involved in computer data collection systems, hardware and software, have adequate education, training, and experience to perform the assigned system functions.

7.0 QUALITY PLANNING

Monitoring plans for projects are developed based on the minimum monitoring variables necessary to provide sufficient information to determine if project goals and objectives are being met. The essential variables category illustrates those variables that generally will be measured for each project type. However, due to the limited availability of funds, all of the highest priority variables may not be monitored. The CRD/MS has determined, by project type, which variables are essential in judging project effectiveness and which additional variables may need to be monitored based on project objectives and possible impacts. This list does not preclude other variables from being monitored if determined necessary by the MS. However, project-specific goals and objectives may dictate that some of these variables may be non-essential. Additionally, monitoring budgets may be insufficient to measure all essential variables.

Monitoring costs were standardized for each project type. However, these costs vary considerably depending upon the size and complexity of projects and site-specific concerns within the project area. The MS determined that monitoring costs cannot be set at a fixed percentage of project cost due to varying project goals and objectives and project sizes. They did, however, generate an initial estimate of an average annual cost (below) necessary to adequately monitor each type of wetland restoration project. This cost estimate was subsequently reduced by 40%.

Average annual monitoring costs for each project type will not exceed the following:

Project Type	Average Annual Cost (1998)
Freshwater Diversion	$ 29,291
Marsh Management	$ 29,291
Hydrologic Restoration	$ 29,291
Outfall Management	$ 29,291
Sediment Diversion	$ 9,764
Vegetative Planting	$ 4,896
Beneficial Use of Dredged Material	$ 4,896
Barrier Island Restoration	$ 4,896
Sediment/Nutrient Trapping	$ 4,896
Shoreline Protection	$ 2,434

Freshwater diversion, marsh management, hydrologic restoration and outfall management project costs are pro-rated based on project size as follows:

area of project (in acres)		percentage (of average annual cost listed above)
less than 1,000	=	60%
1,000–5,000	=	70%
5,000–15,000	=	80%
15,000–60,000	=	100%

In addition, those projects that require continuous data recorders for active management are allowed (if necessary) to be funded at 100% of the average annual cost limit, regardless of project size. Monitoring costs for any given project do not exceed 100% of the original, fully-funded monitoring cost estimate. Monitoring costs for any given project do not exceed 50% of the fully-funded project cost without monitoring.

Project-specific exemptions to the preceding monitoring costs are mutually agreed upon by the State of Louisiana and the federal cost-share sponsor, if any. Monitoring costs are included as a component of the fully funded project cost using the above average annual monitoring cost guidelines. In situations where monitoring costs must be added to a previously approved project, such an addition should not cause the previously approved fully funded project cost to be exceeded by more than 25%. If the cost is exceeded, approval must be obtained from committees comprising the federal partners, if applicable.

Once budgets have been determined and project engineering and design has reached 30%, monitoring plan development is initiated. A Coastal Resources Scientist from the Restoration Technology Section initiates the Ecological Review and works with the Monitoring Manager to better define project goals and strategies. Once project boundaries have been finalized, these boundaries are incorporated into the Regional GIS Database. In order to obtain photography for preconstruction conditions in the project area, these boundaries are mapped and preflight planning is initiated. Flight lines are reviewed by the CRD before the photography is flown.

Monitoring plans undergo a thorough development and review process prior to finalization and acceptance. The following steps are initiated in completing a monitoring plan:

1. The monitoring manager (CRD Coastal Resources Scientist) makes initial contact with the project manager (from the CED), CRD Restoration Technology Section representative, and the lead federal agency representative (if there is a federal co-sponsor) for acquisition of historical data, research reports, feasibility studies, WVA analyses, etc., in order to develop project objectives, goals, reference areas,

monitoring elements, null hypotheses, and anticipated statistical analyses. The CRD monitoring manager develops the preliminary monitoring plan. The following documents are used as templates in preparing the plan: standardized monitoring plan format; standardized null hypotheses and statistical analyses; and the LDNR monitoring proposal. A plan-view map of the project area should be developed during this stage. If known, sampling stations, transect lines, etc., are included on the plan-view map. Once this plan is developed, it is then reviewed by the monitoring supervisor and program manager, then sent to the lead federal agency representative for refinement. A site visit, travel or meetings may be necessary with the lead federal agency representative (when applicable) in order to develop a mutually agreeable preliminary plan. Once a mutually agreeable preliminary plan is completed, a preliminary budget is prepared by the monitoring manager.

2. Monitoring managers initially mail out the preliminary monitoring plan and budget, project description report, and Wetland Value Assessment (WVA) analysis, at a minimum to a National Wetland Research Center (NWRC) representative, contracted ecologist, and statistician that provide technical assistance in the development of the monitoring plan. This mail-out is completed at least three weeks prior to scheduled technical advisory group meetings. Other data or information requested should be supplied unless it is too bulky or large to copy. Otherwise, all other project information, documents, drawings, etc., should be brought to the technical meeting.

3. All comments at the technical advisory group meetings are noted by the monitoring manager. All areas of consensus, conflict, changes, and tasks to be completed, by whom and when, must be noted. It is the responsibility of the monitoring manager to type up these notes and have them sent, via FAX mail, to the technical representatives within two days.

4. The goal of the technical advisory group meeting is to finalize a monitoring plan and budget; however, it may not be finalized after one meeting. Additional telephone calls, fax mail, and/or meetings may be necessary. If major changes are made during the process, then all members of technical advisory group receive copies of the revised document. Some projects require a field trip by members of the representatives either before or after the technical advisory group meeting.

5. Other agency personnel are able to attend the technical advisory group meetings on a voluntary basis. Their input is considered but they are not voting members.

6. Once a monitoring plan is finalized by the technical advisory or other supervisory group (as applicable), it is sent to the representatives of various federal agencies (if applicable) for a two-week review. The advisory or supervising group must consider comments received back by the monitoring manager, and must give justification for not incorporating specific recommendations into the monitoring plan.

7. After review comments are incorporated, the final monitoring plan is sent to the chairman of a committee consisting of representatives of participating federal

and state agencies for final approval. Attached to the final plan are all comments received during review, a written response to comments, and a proposed budget.

8. Once a monitoring plan is developed, it is the responsibility of the CRD to implement the plan following the procedures outlined in this Quality Management Plan (QMP).

The implementation of the monitoring plan is dependent on project construction timetables. In cases where a project is delayed due to unforeseen causes, the monitoring activities timetable are adjusted accordingly.

7.1 Quality Assurance Goals For Sampling Protocols

Specific protocols for variables measured are necessary to meet the accuracy, precision, and completeness goals outlined in Table 2. These protocols are used to supplement the Standard Operating Procedures included within the QMP. All of the following protocols address the accuracy and precision concerns for each of the types of variables measured within the biological monitoring program. Completeness goals for each variable are based on the amount of data collected over a one year period.

Water Level - At deployment and retrieval, the continuous recorder is calibrated to zero while out of water. The continuous recorder is checked out of water to ensure that the instrument was properly calibrated. Additionally, periodically (every six months in January and July) at least three discrete measurements are taken of the same sample with the continuous recorder to determine instrument precision. For instruments that utilize pressure sensors to determine water depth, the sensor is checked for accuracy at multiple known water depths (minimum of three) once every year.

Specific Conductance, discrete - At the beginning of each sampling day, the instrument is calibrated to a standard. The instrument is then checked against the standard to ensure that the instrument was properly calibrated. At the end of each sampling day, the instrument is checked with a standard to ensure that the instrument is still in calibration. Multiple measurements (minimum of three) of one sample are taken on each sampling day to determine instrument precision.

Specific Conductance, continuous - At deployment, the continuous recorder is calibrated to a standard. The continuous recorder is then checked against the standard to ensure that the instrument was properly calibrated. At retrieval, the specific conductance of the continuous recorder and a second calibrated instrument are noted. The continuous recorder is then cleaned and specific conductance is checked again against the calibrated instrument. If necessary, the continuous recorder is calibrated to a standard before redeployment. Additionally, periodically (every six months in January and July) at least

three discrete measurements are taken of the same sample with the continuous recorder to determine instrument precision.

Salinity, discrete and continuous - By following the accuracy and precision protocols as outlined for the Specific Conductance variable, Salinity is accounted for.

Temperature, discrete - At the beginning of each sampling day, the discrete recording instrument is checked against a precision thermometer. If a difference greater than 1° C between the precision thermometer and the discrete instrument occurs, it is noted and the instrument's thermistor is serviced. Multiple measurements (minimum of three) of one sample are taken on each sampling day to determine instrument precision.

Temperature, continuous - At deployment and retrieval, the continuous recording instrument is checked against the discrete recording instrument or a precision thermometer. If a difference greater than 1° C is noted, the instrument's thermistor is serviced. Additionally, periodically (every six months in January and July) at least three discrete measurements are taken of the same sample with the continuous recorder to determine instrument precision.

pH - At the beginning of each sampling day, the instrument is calibrated to a pH 4 and pH 10 buffer solution. The instrument is then checked against the standard to ensure that the instrument was properly calibrated. At the end of the sampling day, the instrument is checked against the standards to ensure that the instrument is still in calibration. Multiple measurements (minimum of three) of one sample should be taken on each sampling day to determine instrument precision.

Suspended Sediments - Suspended sediment samples containing a known sediment concentration in the expected range of the unknown samples are analyzed with any samples sent to a laboratory for analysis. This is used as a measurement of accuracy. At least three samples within the same site are taken during sampling and included with the samples sent to the laboratory for analysis. This is used to determine the precision of the sampling method and suspended sediment analysis protocol.

Bathymetry - When a fathometer is used to determine bathymetric profiles, the fathometer accuracy is checked at the beginning and end of each sampling day. This is accomplished by a poling method. The depth of water is checked using an incremented poling device and compared to the depth reading on the fathometer. Additionally, three or more samples are taken at the same location during the sampling day to determine instrument precision.

Surveying, topography, GPS, conventional - At the beginning and end of each sampling day, a known benchmark is surveyed to determine instrument accuracy. Additionally, on each sampling day, a minimum of three samples is conducted at the same point location to determine the precision of the surveying technique.

Soil Redox Potential - Prior to sampling, all platinum electrodes are cleaned and tested in a quinhydrone/pH buffer solution to determine the accuracy of the electrodes. During sampling, five or more measurements at the same location (including the same depth of soil) are conducted to determine the precision of the electrodes.

Soil Organic Matter Content - Soil samples containing a known amount of organic matter in the expected range of the unknown samples are analyzed with any samples sent to a laboratory for analysis. This is used as a measurement of accuracy. At least three samples within the same site are taken during sampling and included with the samples sent to the laboratory for analysis. This is used to determine the precision of the sampling method and soil analysis protocol.

Soil Bulk Density - Soil samples with a known bulk density in the expected range of the unknown samples are analyzed with any samples sent to a laboratory for analysis. This is used as a measurement of accuracy. Three or more bulk density samples within the same site are taken during a sampling trip to determine the precision of the sampling method and soil analysis protocol.

Interstitial Salinity - See Salinity, discrete and continuous for accuracy and precision protocol.

Interstitial Sulfide - A series of standards is used to determine sulfide concentration in soil porewater. The 10 ppm standard is run every ten samples to determine the accuracy of the electrodes and meter. Additionally, at least one sample is measured a minimum of three times to determine precision.

Feldspar Marker Horizon - Prior to sampling, the calipers are checked against a calibrated ruler for accuracy. Once during the sampling day, three measurements of the same core are taken to determine sampling precision.

Sediment Erosion Table (SET) - Prior to sampling, the rods are checked against a new rod to ensure that they have not been damaged or warped. This is the test for accuracy. During sampling, a minimum of three measurements with the same rod at the same location are conducted to determine precision.

Percent Plant Cover - During sampling, at least two independent estimates are made of the plant community to determine method accuracy. If a dramatic change in the plant community structure occurs (e.g., change from freshwater to brackish marsh community) then the independent estimates are repeated in the new plant community. Additionally, three estimates of plant cover at the same station and plot are conducted once during each sampling to determine precision of the method.

Number of Plant Stems - During sampling, at least two independent counts of plant stems within a plot are made to determine method accuracy. Additionally, three replicate counts of the same site are conducted once during each sampling to determine precision of the method.

Vegetation Clip Plots - Whenever sampling involves taking clip plots smaller than 1 m^2, a larger sampling is conducted to determine the accuracy of the determination. The smaller clip plot is harvested first and then the rest of the material surrounding the smaller clip plot within 1 m^2 is taken and processed with the samples. A comparison between the smaller clip plots and the 1 m^2 clip plot is conducted to determine the accuracy of extrapolating the data. Additionally, three replicate clip plots of the same site are conducted once during each sampling to determine precision of the method.

Stem Length - During sampling, at least two independent measurements of stem length within a plot are made to determine method accuracy. Additionally, three replicate measurements of the same stem are conducted once during each sampling to determine precision of the method.

Herbivory - See Percent Plant Cover for accuracy and precision protocol.

Water Quality Sampling - Water quality samples containing a known concentration in the expected range of the unknown samples are included with those unknown samples, and all are then sent together to a laboratory for analysis. This is used as a measurement of accuracy. At least three water quality samples within the same site are taken once during sampling and included with the samples sent to the laboratory for analysis. This is used to determine the precision of the sampling method and analysis protocol.

8.0 IMPLEMENTATION OF WORK PROCESSES

Implementation of work processes is primarily the responsibility of the CED/EDS and the CRD/MS. Following project selection, the chronological development of a typical coastal restoration project includes the following phases:

- Development of engineering/design scope of services
- Development of monitoring plan
- Selection of contractor to provide engineering/design services
- Engineering/Design Study
- Construction
- Post-construction evaluation
- Post-construction monitoring

QA/QC occurs at each of these phases.

8.1 Development of Engineering/Design Scope of Services

The CRD/MS and the CED/EDS work jointly to develop a scope of work that incorporates the biological components as well as the engineering/design components required to design and implement a restoration project that achieves its intended goals. A representative from the CED/EDS serves as the Project Contract Manager.

8.2 Development of Monitoring Plan

See Section 7.0.

8.3 Engineering/Design Study

A review of the quality assessment protocols for engineering/design studies and the corrective action is provided in Section 9.

8.4 Contractor Selection

The EDS is responsible for the initial screening of prospective engineering contractors. All engineering/design contractors must meet specific requirements including professional engineering and surveying certifications as established in the LAC 21 §2103 (Louisiana Administrative Code 1999). Final contractor selection is the responsibility of the Secretary of LDNR.

8.5 Construction

Construction oversight is provided by the Project Manager from the CED/FES. It is the responsibility of the CED/EDS Project Manager to ensure that all construction-related activities meet the specifications established in the scope of work.

8.6 Post-Construction Evaluation

The CED/FES Project Manager is responsible for conducting the post-construction evaluation. Tools for post-construction evaluation include a project As-Built Plan Report and a Completion Report. QA/QC activities associated with post-construction evaluation are discussed further in Section 9.

8.7 Post-Construction Monitoring

8.7.1 Introduction

The development and implementation of monitoring plans require a significant amount of management oversight and inspection. CRD Monitoring managers (Coastal Resources Scientists) meet with their supervisors on a monthly basis to discuss individual projects, job performance, quality control procedures, and to plan for the following month. Each employee then provides his supervisor with a list of items that were agreed to in the meeting, which is subsequently used as a guide throughout the month. This list of agreed-upon items is then used as an outline in the subsequent meeting to ensure that issues raised in the previous meeting were addressed during the month. Field trip reports are generated for each field trip which addresses both logistical and biological components of the field trip and identify any problems encountered. Field procedures and any quality control items are also discussed during monthly meetings with supervisors to ensure that each employee is familiar with standard operating procedures and that problems encountered in the field are not recurring. Inspection oversight is conducted by the Coastal Resources Scientist Manager and the QA Auditor.

Procedures for field and office protocols within the CRD Monitoring Section (MS) have been developed and implemented through the issuance of an MS Policies and Procedures Manual compiled by the Coastal Resources Scientist Manager. Standard office protocols for the CRD are utilized where applicable and specialized protocols have been developed under the direct supervision of Coastal Resources Scientist Manager. Specialized policies are developed when certain procedures become frequent enough to warrant the Coastal Resources Scientist Managers' attention. Departmental policies that are periodically updated by upper management and new policies that are

developed by Coastal Resources Scientist managers are introduced and reviewed at monthly staff meetings.

8.7.2 Approach

The CRD develops monitoring plans and collects data on individual projects based on specific project goals and objectives. The framework on which the plans are developed is based on a basin-level approach. All monitoring efforts are coordinated within each hydrologic basin in order to adequately address secondary or cumulative effects of projects.

8.7.3 Standard Operating Procedures

The document entitled *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005) provides established methods that are used in the development and implementation of project-specific monitoring plans and programmatic monitoring activities. SOPs regarding the selection of reference areas, statistical analyses, and data collection are also provided in this manual. These SOPs are reviewed and revised annually (if necessary) by the Coastal Resources Scientist Supervisors upon approval by the QA manager.

8.7.3.1 Field Data

A coding scheme will be used to identify the type of project, the project name, the type of data, the date the data were collected, and the location where the data were collected for each sample. The location will be provided in either latitude/longitude or UTM coordinates. These steps are needed to ensure that sufficient documentation exists for verification of data accuracy. Data coding is the responsibility of Coastal Resources Scientists, and oversight verifies that all data are properly coded to ensure compatibility with the LDNR databases.

8.7.3.2 Spatial Data

All spatial data conform to a U.S.G.S. Executive Order dated 11 April 1994, describing standardized methods of data acquisition and access. The proper coding of spatial data will be the responsibility of the Supervisory Geographer and GIS Specialist to ensure compatibility with the LDNR Regional GIS Database.

8.7.4 Routine QA Procedures

8.7.4.1 Field

The equipment is checked and calibrated prior to departure from the LDNR or from the NWRC. Proper storage and stowage must be practiced to prevent damage. At each site, equipment is given a routine check and, if necessary, calibrated before field use.

The entry of data onto a data sheet is done accurately and neatly. The following general guidelines are observed and checked by the QA officer.

1. Correct data are entered in the correct place on the proper data sheet.
2. Sample numbers and station location ID codes are double-checked when collecting data.
3. If data are entered in a nonstandard location on the data sheet, the reason for doing so is documented.
4. All data are recorded in pencil.
5. All entries are printed legibly, and similar numbers (e.g., 5s, 8s, and 2s) are made distinguishable.
6. All entries on the data sheets are double-checked.
7. Neither erasures nor paper correction fluid are used; entries are crossed out and the corrected number is written nearby and the cross-out is initialed. If there is not room to write the new number, it is written in the margin or at the bottom of the page. All such entries are annotated.

Upon completion of sampling but before departing from a site, the monitoring manager examines all data forms for completeness and legibility. All samples are checked for proper identification and storage. If data are missing or incomplete, the monitoring manager attempts to collect it before leaving the site. If the situation cannot be corrected, it is fully documented.

In the case of data readings that are outside the expected measurement bounds (Table 1), an attempt is made to determine the cause of the problem. The SOP is checked for the method to be sure that the correct procedures are being followed, and the field equipment is rechecked to be sure that it is functioning properly. If the field equipment is functioning properly, data are collected, and a note as to what was done is written. This helps ensure that any outliers on the data set are real values, and not due to sampling error. This procedure is also followed on laboratory analyses.

8.7.4.2 Laboratory

Standard operating procedures for routine laboratory analysis are contained in *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005).

8.7.4.3 QA Procedure Updates

Procedures for appropriate routine, standardized, special or critical activities are reviewed annually by the QA Officers and modified, developed and/or implemented as necessary.

8.7.5 Deliverables

The CRD generate data on all implemented projects. Results from these projects are published in comprehensive reports every three years and in evaluation reports to the U.S. Congress and Louisiana Legislature not less than three years after the completion and submission of the restoration plan, and at least every three years thereafter.

9.0 QUALITY ASSESSMENT AND RESPONSE

The Coastal Engineering Division's (CED's) Engineering & Design Section (EDS) and Project Management Section (PMS) are primarily responsible for quality assessment and response at the engineering and design stage of CED & CRD projects. QA at the engineering and design phases ensures that projects are designed according to the defined scope of work by contractors. The CED's Field Engineering Section (FES) provides quality assessment and response during the construction phase of each project. Biological monitoring determines the overall effectiveness of coastal restoration projects in achieving the desired restoration objectives and provides a basis for making adaptive management decisions during the life of the project.

9.1 Engineering and Design Quality Assessment

Initial quality assessment is conducted on the engineering and design phase of individual projects at frequencies established in the project scope of work. Data quality is assessed jointly by the CED/EDS and the CED/PMS upon receipt of project deliverables and prior to issuance of contractor invoices. Tools used to assess the quality of project deliverables include "Review of Deliverables" reports provided by the contractors (and which include monitoring reports and invoices) and periodic Design Reviews, which are typically conducted at the 30 percent and 95 percent completion stages of the engineering and design phase. Design Reviews are collaborative efforts among the CED/EDS, CED/FES, CED/PMS, CRD/PS, CRD/MS, CRD/RTS, CRD/LS, federal agency partners on the project (if any), and private contractors involved in preparation and design of the project.

9.2 Field Engineering Section

The CED/FES uses Coastal Use permits prepared by the CED/EDS and issued by the U.S. Army Corps of Engineers and/or the LDNR Coastal Management Division (CMD), and Project Monitoring Plans prepared by the CRD/MS, to ensure that the construction and operations & maintenance activities conducted on projects are done in accordance with applicable laws, regulations, and the intentions of the project sponsors. The CED/FES develops "Construction Plans and Specifications" documents to guide the work of contractors, and then develops Inspection Reports, Construction Completion Reports, and As-Built Plans to describe and document the outcome of the construction process. Operation and Maintenance Plans are also developed by the CED/FES to describe and document the manner in which project structures are operated and maintained. All of these documents are reviewed by the CED/FES QA officer, who can turn to the CED/FES QA manager (the FE section manager) for assistance when necessary.

9.3 Corrective Action

Corrective action may take place at any stage of the project and quality assessment is a joint effort among the different sections within the CRD & CED. However, the primary point of contact is the individual project manager within the CED/PMS. This single point of contact for contractors provides a clear line of communication between the two Divisions and the contractor. This enables the CED and the CRD to identify and address potential quality issues in a timely manner. Prompt corrective action by the contractor is ensured by coordination between the project manager and the contract manager within the OCRM's Project Support and Services Section. The contract manager issues invoices for professional services only upon approval by the project manager. In the event that deliverables do not meet the specifications established in the scope of services, the project manager has full authority to withhold invoices until all project deliverables are satisfied. The project manager documents all actions taken to address any QA issues with respect to contractor deliverables from project initiation to closure.

The CED has standard procedures in place to address changes in project scope for construction or engineering services while in the field. The procedure for implementing these changes include:

1. The contractor and the project construction engineer or contract manager discuss the issue on-site and concur on what changes are necessary.
2. The CED's construction engineer and design engineer discuss various options.
3. The contractor submits a proposal outlining changes to costs and tasks to the construction and design engineers for concurrence.
4. After successfully negotiating a price, a change order is issued authorizing modification.
5. As-built plans reflect the actual construction that took place.

9.4 Monitoring Data Quality Assessment

Periodic QC checks are necessary to ensure that all measurements made are reliable. Such checks are performed throughout all stages of field sampling, laboratory preparation, and data analysis. Internal checks are made on no less than 10% of the samples taken, or measurements or estimates recorded. Field QC checks consist of discussions with the sampling personnel to ensure that all personnel are following the standard field procedures. Each individual must demonstrate consistency and accuracy for the measurement technique during training. Sufficient training of each individual

ensures comparability among individuals and sample sites. In addition, replication of field sampling allows for an estimate of precision of the field and laboratory procedures.

The formulas discussed below outline the basic methodology for the calculation of each of the five QA objectives. It should be pointed out that these are not the only means that will be employed in assessing the QA objectives. The monitoring plan for each individual project may outline alternate methods of assessing the QA objectives, depending upon project type. In all cases, the methods used are reviewed to ensure that they are statistically valid.

1. Accuracy can be assessed by the relative percent difference between the measured value and the true value, as set by a standard, using the following formula:

   $$\% \text{ difference} = \frac{| \text{ true value - measured value } |}{\text{true value}} \times 100$$

   In cases where more than two samples are involved (multiple readings of a standard), the relative standard deviation (RSD) that is the coefficient of variation (CV) expressed as a percentage can be used (Taylor 1988):

   CV = standard deviation / mean

   RSD = CV x 100

2. Precision, Representativeness, and Comparability, when based on analysis of replicate samples, involves using the following formula for comparing two samples (or two subsamples of a given sample) as A and B:

   $$\% \text{ difference} = \frac{| \text{ A - B } |}{(A + B) / 2} \times 100$$

   In cases where there are more than two replicates, the coefficient of variation can be used.

3. Completeness is assessed by the percent of data collected as a percentage of the number of proposed samples to be collected and is determined by the following formula:

   $$\% \text{ complete} = \frac{| \text{ samples collected - proposed samples } |}{\text{proposed samples}} \times 100$$

   Data quality is assessed using the above general principles along with the Quality Assurance Goals. During analysis, the Coastal Resources Scientist or laboratory analyst keeps track of the standard, blank, and replicate readings each time samples are measured to ensure that the values fall within the guidelines. If values fall

outside the guidelines, a decision is made by the Coastal Resources Scientist in consultation with the Coastal Resources Scientist Supervisor regarding the acceptability of the error.

Success of the Monitoring Program is determined at three basic levels: (1) sampling success, (2) project success, and (3) program success. Sampling success involves both measurement quality and data quality. Project success is determined by reviewing measured data at periodic intervals to determine if the project is meeting its original goals and objectives. Statistical and ecological reviews of results assist in the evaluation of success. Program success is determined by the accomplishment of deliverables and by maintaining a high standard of quality throughout all program elements as discussed in the QMP.

9.5 Data Quality

Data quality is the responsibility of all personnel involved in the Restoration program to ensure that all data collected are valid. Assurance of good quality data is necessary to determine whether project goals and objectives are met, to compare data among projects, and to assist in the design of future projects. Data quality is ensured by management overview and audits throughout the process of data entry, quality control, transfer, reporting, and evaluation.

Data download and storage generally follow the guidelines established in *Good Automated Laboratory Practices* (EPA 1995). The Coastal Resources Scientist Supervisor oversees all monitoring data download and storage activities and facilities. This individual ensures that the SOP for Computer Systems is followed and implemented correctly. Other daily, monthly, and periodic audits of data (discrete, continuous, and instantaneous) have been outlined in Documentation and Records.

When it is determined by the Coastal Resources Scientist Supervisor or the Coastal Resources Scientist Manager that data do not meet expected standards, then corrective action is taken. The Coastal Resources Scientist Supervisor has the authority to suspend or stop work upon notification by the appropriate assessment personnel. In the case of health/safety matters, the assessment personnel have the authority to suspend work. The Coastal Resources Scientist Supervisor identifies whether the problem is a personnel, equipment, data entry, data storage, data retrieval, or analysis error, and devises a corrective action plan with the Coastal Resources Scientist Manager for immediate implementation. The Coastal Resources Scientist Supervisor notifies the Coastal Resources Scientist Manager and monitors both the identified problem and the corrective measure taken to ensure that the problems are resolved. The Coastal Resources Scientist Manager is notified when the problem has been corrected.

9.5.1 Field Data Quality

Since field data from projects are the basis for decision making, it is very important to ensure that documents related to field work are of high quality and are audited. To assure that all data collected in the monitoring process are valid and comparable, the Coastal Resources Scientist Manager and Supervisors are responsible for standardizing methods of data collection and handling. The SOP manual (*A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance / Quality Control, Storage, and Products*, Folse and West 2005) is strictly adhered to and all monitoring personnel are trained in the procedures.

All Coastal Resources Scientists are accountable for data collected and generated for each of their respective projects. They are responsible for inspecting the boat, vehicle, and equipment checklists and calibration sheets prior to every field trip. Should any boat, vehicle, or equipment failure occur, it is brought to the attention of the Coastal Resources Scientist Supervisor and documented in the written field trip report. Following each field investigation, all data are reviewed by the Coastal Resources Scientist and QA officer for completeness and validity. Monthly meetings are held between the Coastal Resources Scientist and Coastal Resources Scientist Supervisors and the Engineers and Engineer Supervisors to discuss any problems or concerns and to provide additional training, if necessary. Overall adherence to protocol and accepted procedures as outlined in the SOPs for fieldwork is audited by the QA officer and the Coastal Resources Scientist Supervisor. Any deviations from SOP procedures are corrected at the time of the occurrence or brought to the attention of the Coastal Resources Scientist Manager.

9.5.2 Laboratory Data Quality

The CRD contracts out virtually all laboratory analyses for monitoring. Scopes of services for necessary analyses are prepared by the monitoring manager and approved by the Coastal Resources Scientist Manager. The monitoring manager audits the work completed under the contract to ensure consistency with the standards and procedures taught at the annual laboratory training session referred to in section 3.2.2, and fills out a Performance Evaluation for every laboratory contract. This form assesses quality, quantity, and timeliness of work completed. The QA officer reviews quality assurance guidelines provided by the contract laboratory to ensure compliance with SOPs.

9.5.3 Personnel Quality

The CRD assures personnel quality through minimum requirements for employment, training, and performance appraisals. Specific education and experience criteria are required for personnel to participate in the Coastal program. These requirements establish the necessary knowledge base, and training provides the specific guidance mandatory for implementation of the program.

Training is provided to all personnel as needed to perform to the quality standards described in this QMP (Section 3.2). Necessary training is evaluated by the Supervisors and the QA auditor.

Annual performance evaluations are conducted on all personnel to provide an indicator of job knowledge, technical skills and ability, performance of duties, communication skills, interpersonal skills, and management skills and abilities. Areas that need improvement and specific training or skills are identified to assist in the quality improvement process.

If it is determined by the Coastal Resources Scientist and Engineer Supervisors and Managers, Assistant Administrator, Administrator, and Assistant Secretary of the two Divisions that there is a failure to perform adequately by CRD personnel, then corrective action is taken following Civil Service Rules, chapter 12 (Department of Civil Service n.d.).

9.5.4 Program Quality

A program audit is conducted periodically by the QA Manager to ensure adequate staff and facilities to perform necessary program obligations. Reports on general management issues are kept by the QA Manager. Annual performance reviews and supervisor/project manager monthly review meetings conducted by the Coastal Resources Scientist Supervisors are evaluated as part of this audit. An independent, professionally recognized wetland ecologist contracted from the academic community verifies whether management decisions made by monitoring managers and the program manager advance the goals of the CRD. A technical and management audit is conducted periodically by a contracted wetland ecologist. This audit not only identifies problem areas, but also identifies any noteworthy practices. The contracted wetland ecologist may conduct an interim review of problem areas to ensure that problems have been resolved. Monitoring plans, field collection methods, data handling and analysis methods, and project monitoring reports are reviewed and an audit report is prepared. The Coastal Resources Scientist Supervisor has the authority to suspend or stop work

upon notification of audit results. Appropriate actions are taken to alleviate any problem areas identified in the program and technical audits.

9.5.5 Management Systems And Peer Review

Multiple QA and QC checks are performed at all phases of program implementation, as addressed in each section of this QMP, to prevent and/or detect quality problems. Since most activities are monitored by at least two hierarchical levels of supervision, problems are identified quickly and corrective action is employed promptly. Management is constantly informed of the quality process and has made a commitment to quality improvement activities. Management is fully aware that restoration science is a new field and that many avenues exist for improving technologies and the associated quality system. Evaluation of such technologies is encouraged as part of the quality improvement process. It is further understood that peer review is an essential component of this program, which leads to the development of better products and services.

10.0 QUALITY IMPROVEMENT

10.1 Quality Improvement Responsibilities

The specific quality improvement responsibilities of appropriate components within the CRD are addressed below.

10.1.1 LDNR CRD

The Division, is conjunction with the CED, is responsible for planning, implementing and evaluating the effectiveness of all quality improvement activities associated with coastal restoration project development, data collection and storage, statistical analyses, quality control criteria, data interpretation, and report generation. Assessments of these activities is conducted through audits, performance evaluations, peer reviews, and technical reviews. The QA Manager has the responsibility for informing the management hierarchy on the assessment process.

10.1.2 Contractors and Partners

All agencies and groups outside of the CRD who provide data and services in support of the Division's coastal restoration efforts are responsible for planning, implementing and evaluating the effectiveness of all quality improvement activities associated with related projects as deemed appropriate by the Division for each project or program, and in adherence with the guidelines described in *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005). The QA Manager has the responsibility for informing the management hierarchy on the assessment process.

10.2 Corrective Action Program

Whenever the procedures and guidelines established in this program are not successful in assuring the quality of work of CRD programs, corrective action is required to ensure that conditions adverse to quality are identified promptly and corrected as soon as is practicable. Corrective actions shall include the identification of root causes of problems, determination of whether the problem is unique or has more general implications, and recommendations for preventing the recurrence of the problem. Corrective action is initiated if variances from proper protocol are noted. Reporting to the program manager will ensure that early and effective corrective action will be taken when actions of Division programs fail to meet acceptable standards. The responsibility to oversee and implement the required corrective actions is carried out by the program manager. The

CRD Administrator, and the QA Managers are informed of such activities. Follow-up evaluations are conducted by the QA Managers to ensure effectiveness of the corrective action.

The corrective action plan includes taking recommended actions and making changes to eliminate or correct problems with quality. Variances which require correction action include but are not limited to failure to include resource/regulatory comments in making permit/mitigation decisions; errors in data entry in permit, mitigation, and/or consistency databases; protracted processing review times, failure to provide local programs with needed programmatic information; and file mismanagement. However, a formal correction action program is difficult to establish that would cover all possible items.

10.2.1 Process for Corrective Action

The general process for corrective action includes the following steps:

1. Any staff member of the Divisions can begin the corrective action process. Upon identification of a potential problem, staff meets with all involved parties and the appropriate levels of management to discuss the problem identified or any tasks that may relate to or affect the quality of the function of the particular program. Management and the QA Manager determine if a problem exists, and what it is, through the meeting process. Additional information may be required to determine the nature and extent of the problem. If so, that information is obtained and evaluated by the parties involved.
2. Once a problem has been identified, procedures are modified or revised to correct the problem.
3. Retraining or provision of additional training is carried out as necessary to ensure that staff are aware of problems and revised procedures are in place to correct the problems.
4. Follow-up evaluations are conducted by the QA Manager to ensure the effectiveness of the corrective action. A QA Manager, in coordination with the CED Director or the CRD Administrator, determines if any more action is required and may make any recommendations for preventing the occurrence of the problem.

INTRODUCTION TO THE COASTAL ENGINEERING DIVISION

The Coastal Engineering Division (CED) of the Office of Coastal Restoration and Management (OCRM) of the Louisiana Department of Natural Resources (LDNR) works cooperatively with the Coastal Restoration Division (CRD). Together they are responsible for the planning, design, implementation, construction, operation & maintenance, and monitoring of coastal conservation and restoration projects in the twenty parishes (nineteen "coastal" parishes, plus Ascension Parish; LDNR 1999) comprising Louisiana's coastal wetlands. They also manage a varying number of technical feasibility studies, provide for the preparation and review of permit applications and review of environmental assessments (which may impact proposed or potential coastal restoration projects), and prepare comments for submittal to state and federal agencies.

Funding for the Division comes from several federal sources and from a dedicated trust fund.

The CED is required to develop and submit a Quality Management Plan (QMP) to the EPA in accordance with guidelines established by the EPA. EPA document EPA QA/R-2, *EPA Requirements for Quality Management Plans,* provided the guidance for preparation of this QMP. It is EPA policy that all Quality Systems (Quality Assurance Programs) must comply with EPA Order 5360.1, "Policy and Program Requirements to Implement the Mandatory Quality Assurance Program", which requires the preparation, submission, and approval of a Quality Management Plan. The process of planning, implementing, and assessing these management systems is called *quality management* and the product of the process is called the *Quality System*.

The CED is also required to update, as needed, the programmatic Quality Assurance Project Plan (QAPP). The QAPP is prepared in accordance with the following documents:

EPA QA/R-5, *Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5* (EPA 2001)

EPA QA/G-5, *Guidance for Quality Assurance Project Plans* (EPA 2002)

EPA QA/G-5M, *Guidance for Quality Assurance Project Plans for Modeling* (EPA 2002)

EPA QA/G-4, *Guidance for the Data Quality Objectives Process* (EPA 2000)

The purpose of a Quality Assurance Project Plan (QAPP) is to document planning efforts for the collection and analysis of environmental data and to provide a guide for the type and quality of data needed for a specific decision or use. This general QAPP describes the quality assurance and quality control processes the Louisiana Department of Natural Resources (LDNR) Coastal Engineering Division (CED) follows in developing and implementing wetland conservation and restoration plans and projects, as directed by the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA).

This QMP describes the roles & responsibilities, policies, and procedures associated with the LDNR/OCRM Quality System. Portions of this document are based on the previous LDNR/OCRM QMP (Bass et al, 2006, QTRACK No. 06-436) approved on August 14, 2006 by Donald Johnson, Region 6 Quality Assurance Manager, United States Environmental Protection Agency, Dallas, Texas.

11.0 CED QUALITY MANAGEMENT AND ORGANIZATION

11.1 Mission

The Louisiana Department of Natural Resources Coastal Engineering Division, acting cooperatively with the Coastal Restoration Division, performs engineering and planning functions essential to successful development and implementation of wetland conservation and restoration plans and projects. Coastal restoration projects implemented by the CED are funded through various federal (CWPPRA, WRDA, FEMA) and state (Wetland Trust Fund) sources.

The highest quality data are needed to ensure that these efforts are successful. Therefore our mission is to collect, analyze, and interpret high-quality hydrological, climatological, spatial, and engineering data. This mission will be realized by: (1) pragmatic data collection based on specific goals, using sound experimental design, (2) unbiased evaluation of data to determine the effectiveness of wetland projects, (3) documentation and dissemination of project data, and (4) the evaluation of program effectiveness as the knowledge and technology base expands. The fulfillment of our mission will result in appropriate management decisions to ultimately create, restore, protect, and enhance coastal wetlands in Louisiana.

11.2 Policy on Quality Assurance

The importance of a sound Quality Assurance (QA) program is acknowledged by the CED and is addressed in overall program goals. It is the specific policy of the Division that all measurements are of known and documented quality. This level of assurance is necessary because of the vast quantities of data collected by numerous entities. These data will ultimately assist in a decision regarding project and program-level effectiveness.

Necessary training and technical support will be afforded to meet program needs. Quality control checks have been provided throughout the program to minimize impacts on data quality and integrity and to identify problems that could influence program implementation. Any situation that compromises data quality will be identified and addressed immediately.

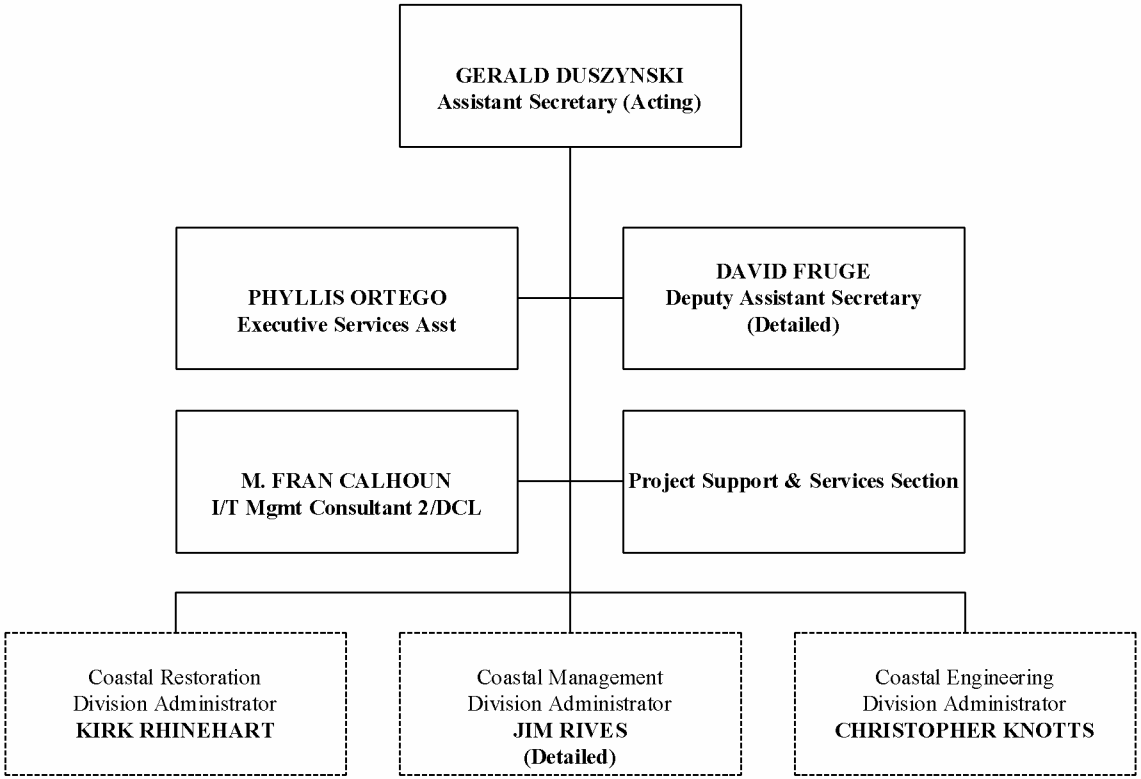
Any changes to the QMP will be distributed to all individuals performing work under the QMP as the changes occur, and all changes that occur throughout the year will be reviewed during Field Methods training. If significant changes are made to the QMP, a revised version will be published and distributed. Quality assurance training and evaluation will be conducted periodically to assess the effectiveness of the Quality

Management System, both organizationally and procedurally. Additionally, for every project approved for engineering and design, a project-specific QAPP is written to specifically outline the project.

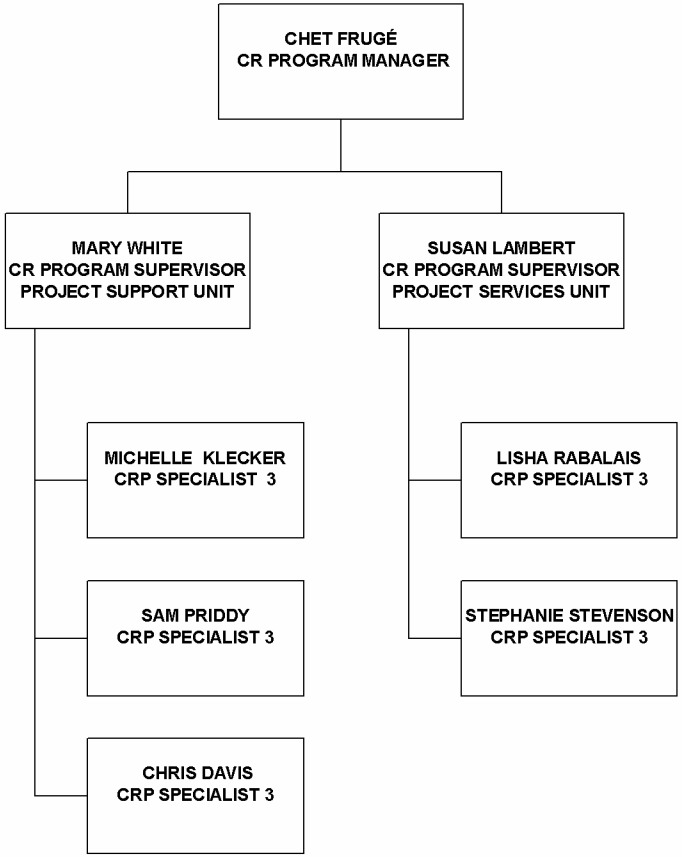
11.3 Organization Charts

The Director of the Coastal Engineering Division is designated as the QA Manager of the CED Quality Management Plan. The CED Organizational Chart is shown as Figure 1 on pages 65 through 70.

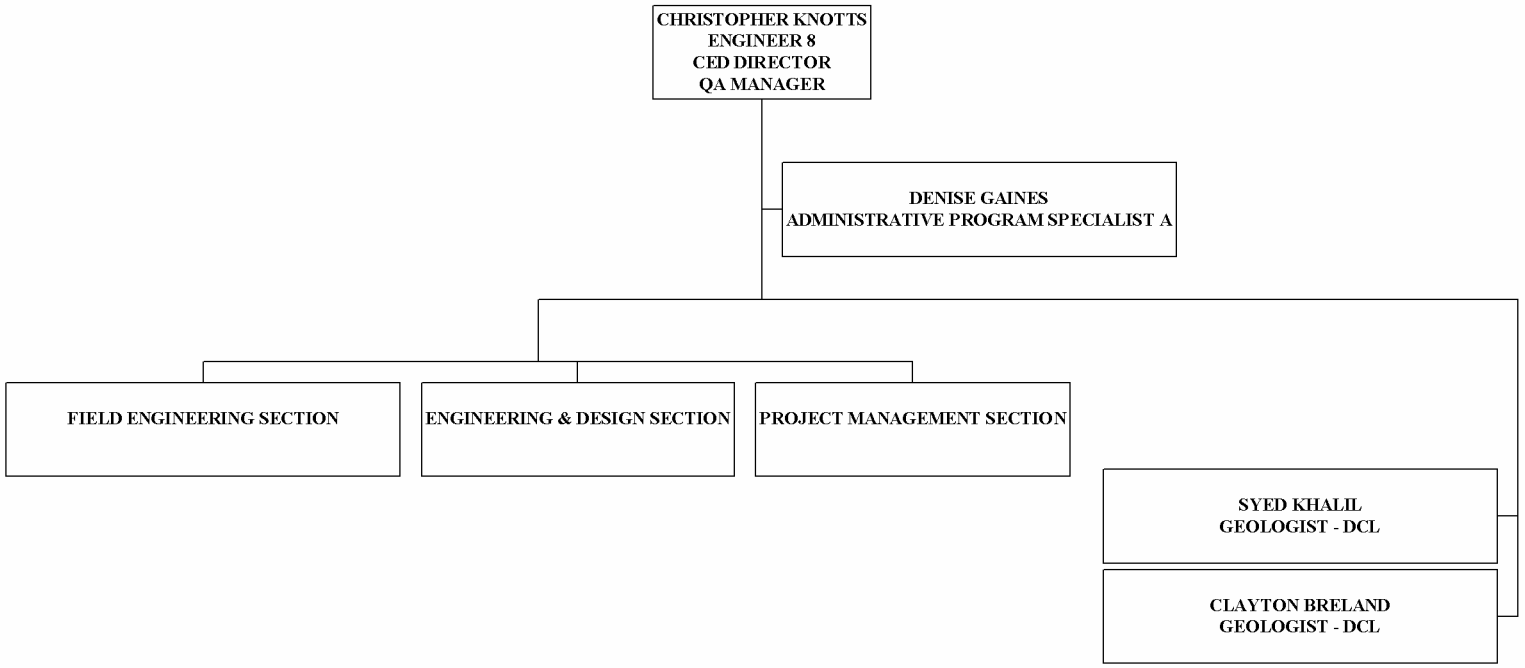
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION & MANAGEMENT
ASSISTANT SECRETARY'S OFFICE



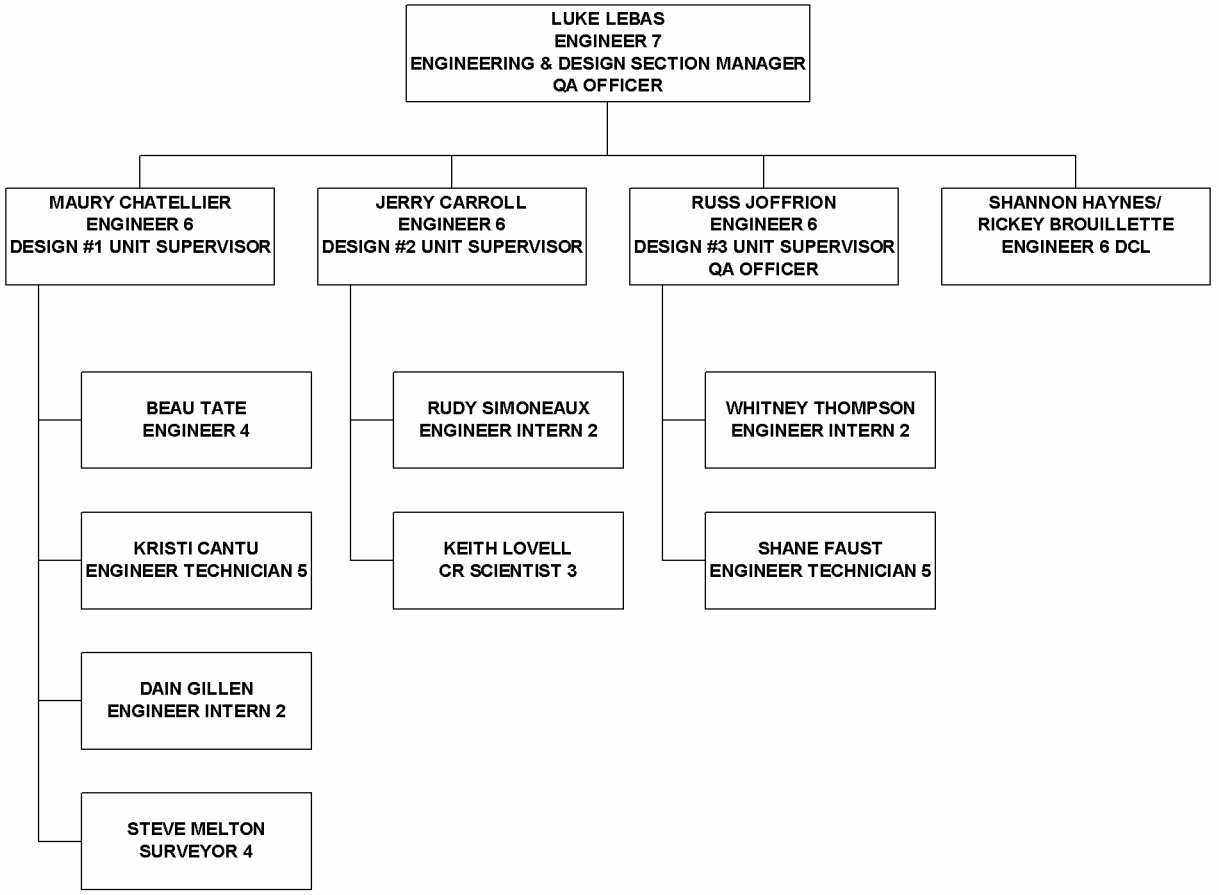
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
PROJECT SUPPORT & SERVICES SECTION



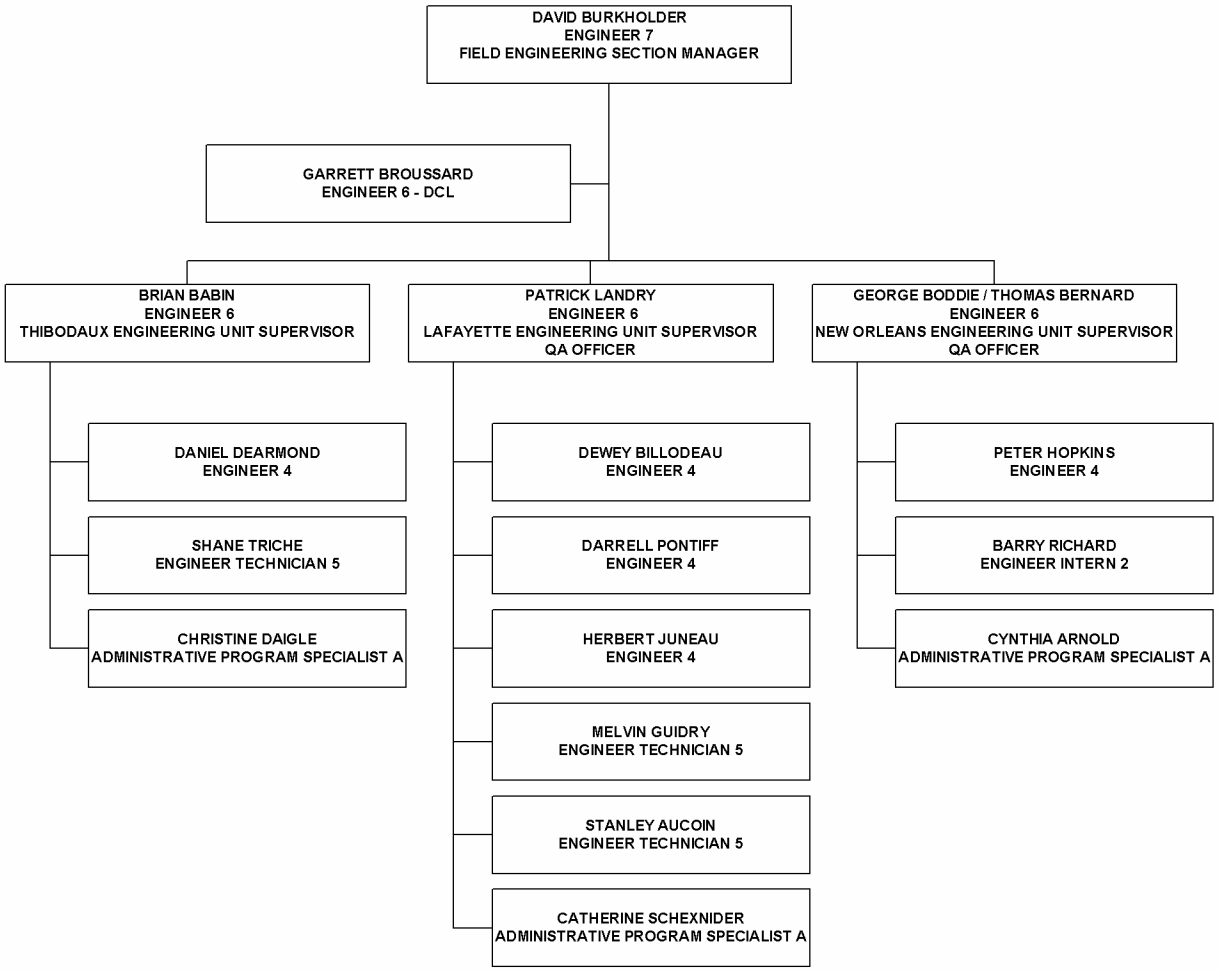
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL ENGINEERING DIVISION
OVERVIEW OF SECTIONS



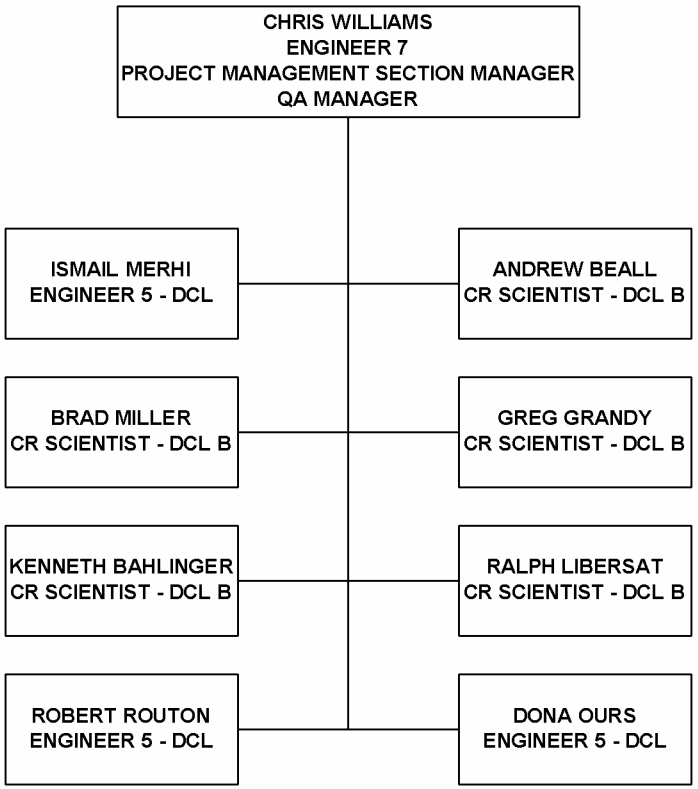
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL ENGINEERING DIVISION
ENGINEERING & DESIGN SECTION



LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL ENGINEERING DIVISION
FIELD ENGINEERING SECTION



LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL ENGINEERING DIVISION
PROJECT MANAGEMENT SECTION



11.4 Responsibilities and Authorities

The team responsible for the implementation of the Quality Management System (QMS) is identified in the organizational chart. QA responsibilities are dispersed throughout all levels of the Division. However, specific oversight and management of QA activities are carried out by three authorities: QA Officers (a senior Coastal Resources Engineer in each field office), QA Auditors (Contract Wetland Ecologist), and QA Managers (CED Director, CED Project Management Section Manager).

The QA Officers are responsible for assuring compliance of daily QA activities and reporting problems immediately to a QA Manager. The QA Auditor performs an independent evaluation of QA activities periodically in order to provide management oversight to maximize the success of the QA activities. The QA Auditor reports directly to the QA Managers and provides a written quality assurance report to the QA Managers. The QA Managers report directly to the Assistant Secretary of the Louisiana Department of Natural Resources Office of Coastal Restoration and Management.

11.5 Programs Supported by the Quality System

LDNR/CED consists of three sections: Engineering & Design, Field Engineering, and Project Management. The CED is served by the OCRM Project Support and Services Section, and has field offices in Lafayette, New Orleans, and Thibodaux.

Office of Coastal Restoration and Management - Project Support & Services Section

The Project Support & Services Section (PSSS) performs technically-oriented administrative and management functions to the CED, including the field offices. Staff members in this section are responsible for development, preparation and implementation of the CED's state and federal program budgets. These activities include, but are not limited to, supervision, management and monitoring of all fiscal matters to include contract, cost share and grant activities; supervising and administering various computerized data and tracking systems; report writing; intra- and inter-agency coordination on negotiations for grants, contracts, cost share agreements, in-kind match charges, etc.; preparation of financial reporting documents; and limited outreach activities relating to the CED. Support is provided to all CED staff for all functions involving purchasing, requisitions, payment of invoices, telecommunications, all activities related to fleet management, and other administrative support services. In carrying out these functions, the PSSS works closely with the DNR's Office of Management and Finance in processing final documents and information.

Coastal Engineering Division - Engineering & Design Section

The Engineering & Design Section is responsible for the design of coastal restoration projects. On EPA, NMFS and some US Fish & Wildlife Service projects, the section's staff members perform the engineering design, prepare plans, prepare specifications, and prepare bid packages. They also advertise the projects for bids and conduct the pre-construction conferences. On projects sponsored by other federal partners, section staff members serve as technical advisors for the development and review of project designs. An additional Engineering & Design Section responsibility is the management of professional (engineering, surveying, geotechnical, hydrodynamic modeling, etc.) consultant service contracts, both project-specific and indefinite delivery/indefinite quantity in nature.

Coastal Engineering Division - Field Engineering Section

The Field Engineering Section is responsible for construction, administration & inspection, and operations & maintenance of all CWPPRA and state coastal restoration projects. The Field Engineering Section staff prepares construction close-out reports and as-built plans. They also prepare annual inspection reports for all completed projects. The CED currently has FES staff in the Lafayette, Thibodaux, and New Orleans Field Offices.

Coastal Engineering Division - Project Management Section

The Project Management Section (PMS) manages CED and CRD coastal restoration projects. The staff members in this section act as the points of contact, coordinators/facilitators, and technical experts for assigned projects. Projects are generally categorized based on which federal agency is involved (for federally-funded projects) and by the type of project (for state projects). With guidance from the CED and CRD administrations, the staff oversees all activities associated with the projects and coordinates the activities of all other CED and CRD staff involved in the projects. Work includes, but is not limited to, administrating & updating the scheduling of project tasks; developing and managing project budgets and amendments; preparing (or managing the preparation of) detailed technical reports on the projects, and/or making verbal reports as requested; preparing (or managing the preparation of) technical scopes of service for projects; providing guidance and recommendations to LDNR management and executive staff, federal agencies, and other entities interested in CED and CRD activities; and overseeing the input and quality assurance of data regarding all aspects of a project, from authorization through construction.

A secondary responsibility of the PMS is to provide for the preparation and/or review of permit applications, environmental assessments, and comments for submittal to state and federal agencies.

11.6 Implementation

The CED implements applicable elements of the Quality System in all activities under their responsibility. Management creates a work environment in which all personnel work together to ensure that the quality assurance program produces the type and quality of results expected.

11.7 Approval Page

Refer to Concurrences, QMP Pages xiii and xiv.

12.0 QUALITY SYSTEM COMPONENTS

12.1 Quality Management System

The LDNR CED manages a quality system by utilizing a series of checks and balances inherent in each individual section. The CED/PMS oversees the input and quality assurance of data regarding all aspects of the CED projects, from project authorization to completion of construction. QA/QC also occurs within the CED/EDS, as reflected in the organization of this document. The CED has developed and implemented the QMP according to EPA guidance.

12.1.1 Monitoring and Restoration Technology Sections of the CRD (as related to Quality Management in the CED)

The Monitoring and Restoration Technology Sections of the CRD jointly administer the Quality Management System of the CED. At the largest scale, coastal restoration project quality is increased by the Project Selection Process; i.e., only projects with a high likelihood of success and large increases in wetland function relative to cost are selected for implementation.

Monitoring is more critical to the success of restoration projects than to traditional mitigation programs because large spatial scales and uncertainty regarding the status of the wetlands at any given time preclude the use of repeated trial and error, which is allowed in the Clean Water Act, Section 404, process. Instead, monitoring plans prepared by the CRD are designed with the expectation that some projects will be less effective than others, thus facilitating learning from all projects, regardless of their success. This monitoring philosophy is a departure from traditional monitoring programs in which documenting effectiveness of a project is the goal, and understanding why and how a project was effective (or not) is of minor importance. Thus, the monitoring philosophy behind the CRD monitoring program (which monitors coastal restoration projects executed by the CED) is based on adaptive management (Boesch et al. 1994, Steyer and Llewellyn 2000) and feedback monitoring (Gray and Jensen 1993). Consequently, the monitoring program not only detects unsuccessful projects, but also provides the CED/EDS with a basis for improved project design and operation.

Determining the effectiveness of CED projects in creating, restoring, protecting, and enhancing coastal wetlands in Louisiana is a daunting task because spatial and temporal variability cause differences between reference and project areas that hinder traditional experimental design and statistical techniques (Underwood 1994). The temporal

variability and large spatial variability across the Louisiana coastal zone in wetland loss rates not only reduce the value of traditional experimental design and statistical techniques but also require a monitoring approach with a high degree of flexibility if the effectiveness of management actions under different environmental conditions are to be detected (Boesch et al. 1994). Thus, the monitoring program is designed not only to detect unsuccessful projects, but also to provide a basis for improved project designs and operation. The data generated from the monitoring program are used to refine decision criteria and improve the level of accepted decision error. This improves the quality of results and confidence in management decisions.

Management of all monitoring activities is the responsibility of the CRD; however, QC responsibilities (i.e., verifying that all decisions and practices will result in quality data) are shared by all senior staff members. QC is consolidated under the QA Managers, who have final QC authority.

12.1.2 Engineering and Design Section

All engineering work performed by the CED/EDS or by contractors is performed under the direct supervision of a registered professional engineer holding a current license from the State of Louisiana Engineering Board. All land surveying work performed by the EDS or by contractors is performed under the direct supervision of a registered land surveyor licensed in Louisiana.

EDS personnel act as project managers and contract managers when work is conducted by outside consultants or professional service contractors. The initial QA/QC role that EDS has is performed via their review and rating of Statements of Interest and Qualifications (SIQs) submitted by consulting firms for specific engineering and design projects. A selection committee composed of EDS personnel rates the SIQs based on general criteria such as specialized experience (firm and key personnel), professional qualifications, and capability of firm. As project managers, EDS personnel provide project oversight QA/QC functions by reviewing construction plans, specifications, and bid documents to ensure that these products meet standards established in the scope of work.

To ensure quality, consistency and accuracy when performing Global Positioning System (GPS) surveys on projects, the CED established standard operating procedures (SOPs) in *A Contractor's Guide to Minimum Standards* (LDNR/CRD 2004). This manual was developed for contractors performing static GPS surveys and establishing GPS derived orthometric heights.

12.2 Tools For Implementation

12.2.1 Monitoring and Restoration Technology Sections of the CRD (as related to the tools for implementation of Quality Management by the CED)

A technical audit is conducted periodically by a consulting wetland ecologist (QA Auditor) from the academic community. The primary focus of the technical audit is to verify that instructions laid out in the monitoring plans are being followed. Field data collection methods, data handling methods, data analyses methods, and prepared project reports are audited.

A program audit is conducted annually by the QA Manager. The purpose of this audit is to verify that the management decisions made by the Program Manager advance the goals of the Division. This audit uses the benefit of hindsight to determine if policies should be re-evaluated. The Program Manager uses the technical and program audits to revise monitoring activities when necessary.

An accessible database of temporal and spatial data, maintained by the State of Louisiana, encourages the publication of project results so that the ecosystem management techniques developed in Louisiana can be made available to the public and be peer reviewed by a national and international audience. Peer review provides a final verification to confirm that monitoring plans provide the data necessary to determine the effectiveness of projects.

12.2.2 Engineering and Design Section

Project management QA/QC functions are provided by the CED/EDS on a project-by-project basis. Specific project deliverables are established in the LDNR scope of services for each individual project. The CED/EDS personnel review deliverables to ensure that they are of the specified quality established in the contract. All deliverables must contain the stamped approval of a Louisiana State Board Registered Professional Engineer and/or Land Surveyor. Additional CED personnel, as well as representatives of other state and federal agencies, also provide technical oversight at various stages of the project. For example, a typical engineering and design scope of work provides all interested parties an opportunity to review and comment on a particular project by structuring a timeline of deliverables according to the following schedule (the components of this timeline also constitute the technical and data quality assessments done by the CED/EDS):

A. Project Initiation Meeting

B. Data Collection Review and Analysis (20% Complete Design)
C. Preliminary Design Review (30% Complete Design)
D. Final Design Review (95% Complete Design)

Additional tools used to ensure that engineering and design deliverables meet or exceed standards established in the contract scope of services include Engineering Evaluation Reports and Engineering Closure Reports (As-Built Construction Phase Reports).

12.3 Measurement Quality Objectives

The Standard Operating Procedures for each method are discussed in detail in *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005). This section presents only general QA considerations.

Measurement of quality objectives are determined from manufacturer specifications, analytical methods, and the judgment of experts (if required). The five general quality objectives are discussed below.

12.3.1 Accuracy

Accuracy is assessed through the use of standards (manufacturer supplied) whenever such standards exist. Internal standards are devised for methods where a commercially available standard does not exist. Accuracy is also ensured by field training to be sure that all personnel follow the same procedures.

12.3.2 Precision

Precision in the field is assessed by replicate measurements. Laboratory method precision is estimated by repeating measurements of a sample standard. The sample precision is estimated by repeated measurement of a sample or sample split.

12.3.3 Representativeness

Representativeness is assessed by the use of the replicate samples. In the laboratory, multiple subsamples are used, and each of the subsamples is analyzed in order to determine its variability. This allows for the calculation of the number of laboratory subsamples needed to adequately describe the field sample.

Representativeness of the environment can only be assessed by examining both the temporal and spatial variability on a given project area. Environmental variability is

usually estimated by collecting replicate samples (randomly chosen) over space and time. However, randomly selected samples may not adequately characterize a study area unless a large number of replicates are collected. Where spatial variation within a study area is evident, stratified random sampling is employed. Temporal variation is accounted for by restricting sampling to comparable time periods.

12.3.4 Comparability

Comparability (the degree of confidence with which data sets may be compared) is ensured for laboratory analyses through the use of standard methods for which there is a known accuracy and precision. Comparability of field data sets is accomplished by ensuring that the same procedures are followed by all sampling personnel. This is accomplished through the use of SOPs and proper training in field and laboratory techniques.

12.3.5 Completeness

Completeness, [the ratio of the amount of valid data obtained to the amount expected (Stanley and Verner 1985, Smith et al. 1988)] is used as an overall index for the program. If the completeness is not high enough, the evaluation of a project may be compromised. Completeness for an individual project is defined as the amount of data and samples actually collected as a percentage of the amount of data and samples assigned to the effort when data collection begins.

12.4 Quality Assurance Goals

The quality assurance goals are summarized in Table 1, which serves as the overall guideline for the coastal wetlands restoration project monitoring program by presenting, for each variable to be monitored, the accuracy, precision, and completeness goals as well as the expected range of values to be encountered. The variables monitored and the exact method by which each of these goals is met for an individual project is outlined in the project monitoring plan. Individual project plans must demonstrate that the goals listed in Table 1 are met. Monitoring plans provide a means of scientifically evaluating the effectiveness of each coastal wetlands restoration project. The data collected is used to determine the success or failure of existing projects. More importantly, the data are used as a basis for making design modifications and management strategies for current and future projects.

Table 1. Quality Assurance Goals and expected ranges. Accuracy is in absolute units where possible; precision is based on the difference between replicated measurements. Percentages in the accuracy and precision goal columns represent tolerable error. The precision goal refers to individual measurements as well as between sampling crews. Data collected outside the expected range may be real but should be verified.

Type of Measurement	Units	Accuracy Goal	Precision Goal	Completeness Goal	Expected Range
1. Habitat Mapping					
Photointerpretation	habitat	7%	NA	100%	NA
Photoregistration	m	15 m	NA	NA	NA
2. Meteorological and Hydrologic Sampling					
Precipitation	cm/h	0.1 cm/h	5%	85%	0–15
Wind Speed	m/s	0.7 m/s	0.5 m/s	85%	0–67
Wind Direction	degrees	5 degrees	5 degrees	85%	0–360
Water Level (Stage)	m	0.06 m	0.06 m	85%	-3–6
Water Depth	cm	1 cm	1 cm	85%	0-305
Salinity	ppt	0.5 ppt	0.5 ppt	85%	0–36
Specific Conductance	microsiemens	5%	1000µS	85%	0–55,000
Temperature	centigrade	0.5 C	0.2 C	85%	0–35
pH	pH units	0.2	0.1	85%	6–8.5
Discharge					
Current Speed	m/s	0.1 m/s	0.1 m/s	85%	0–3
Cross-Sectional Area	m^2	5%	5%	85%	NA
Suspended Sediments	mg/L	2 mg/L	2 mg/L	85%	0–200
Bathymetry	cm	4.0	4.0	85%	-200–0
Topography	cm	4.0	4.0	85%	-90–90
3. Soil/Sediment Sampling					
Redox	mV	20 mV	20%	85%	-450–400
Percent Organic Matter	%	10%	15%	85%	0–100
Bulk Density	g/cm^3	0.05 g/cm^3	15%	85%	0.01–0.90
Percent Water	%	10%	15%	85%	0–100
Salinity	ppt	0.5 ppt	0.5 ppt	85%	0–36
Sulfides	ppm	1 ppm	25%	85%	0–150
Grain Size	microns	NA	30%	85%	0.2–500
4. Surveying (horizontal)					
GPS	m	1 m	1 m	85%	NA
Conventional	m	0.3 m	0.3 m	85%	NA

Type of Measurement	Units	Accuracy Goal	Precision Goal	Completeness Goal	Expected Range
6. Vertical Accretion and Subsidence					
Feldspar	cm	0.1 cm	30%	85%	0–2
SET Table	cm	0.1 cm	30%	85%	0–2
6. Marsh Erosion and Soil Creation					
Large Scale	m	2 m	2 m	85%	0–100
Small Scale	cm	5 cm	5 cm	85%	0–200
7. Vegetation Health					
Species Composition and relative abundance					
Taxonomic ID	species	NA	NA	85%	NA
Percent Cover	%	10%	10%	85%	0–100
Number of Stems	#/m^2	10/m^2	10%	85%	1–2,000
Aboveground Biomass					
Clip Plots	g/m^2	10 g/m^2	20%	85%	0–2,000
Stem Length	cm	1 cm	20%	85%	1–300
8. Herbivory	%	10%	10%	85%	0–100
9. Fisheries Sampling					
Taxonomic ID	species	NA	NA	85%	NA
Organism Counts	numbers	10%	10%	85%	NA
Size	mm	1 mm	1 mm	85%	NA

12.5 Data Review, Validation, Verification, and Analysis

The data review, validation, verification, and analysis components of the LDNR CED and CRD QA/QC program are conducted jointly by the MS and RTS of the CRD.

12.5.1 Data Validation and Verification

Routine Procedures

The guidelines for data collection and laboratory analysis are listed in the SOPs for each field method (*A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products*, Folse and West, 2005).

Data are entered into the central LDNR database from field or laboratory data sheets and digital files or directly from electronic dataloggers. Data are entered after all field data have been collected. Each data set contains header information that describes the data set as well as the variable names on the data set. Data are sorted, merged (if needed), and calibration factors are applied along with any corrections necessary to put the data into proper units for analysis.

Data files are to be saved to disk and a backup copy made as soon as the data from an individual station have been entered. Thus, in the event of a system failure, only data from a single station will have to be reentered.

Final Data Editing Procedures

After the data have been entered, the data files are printed and the data file contents are checked against the data sheets to ensure the proper values have been entered. Any corrections to data entry are made at this time. The person verifying and correcting the data initials and dates the printout when verification and corrections are made. When the complete data file has been entered and verified, the data set characterization is changed to indicate that it is a final data set ready for analysis.

The data are then analyzed to produce the following information:

1. Plots of the distribution
2. Lists of the extreme values
3. Frequency tables
4. Tests for normality

These summary or preliminary type statistics, which are performed on all of the variables as well as the QC data sets, are the first analyses performed and constitute the basis of the field data reports.

Treatment of outliers and/or suspicious values (values outside of the expected range, Table 1) that are detected during the data entry and editing procedures are flagged in the data set. Thus, the analysts know that these are actual measured values as opposed to data entry errors. Outliers remain in the data set for preliminary analysis but are addressed in final analysis. Should an outlier be removed during analysis, it is noted and the reasons for doing so are given.

12.5.2 Data Analysis

General Guidelines for Projects

The actual statistical techniques employed for the analysis of the data collected for an individual project are developed as part of the project monitoring plan. General guidelines are addressed in further detail in the Standard Operating Procedures found in Section 18. Additionally, the following rules are observed:

1. The techniques to be employed must be statistically valid and verified by a biostatistician.
2. All data analysis techniques are to be fully documented.

General Analysis Procedures

The general techniques employed include (but are not limited to) the following types of analyses:

1. Data distribution (i.e., cumulative distribution plots, histograms)
2. Univariate statistics (means, standard deviation, etc.)
3. Regression
4. Trend analysis
5. Time series analysis
6. ANOVA
7. Testing of Statistical Assumptions

The exact procedures employed on any given project are decided upon by the biostatistician assigned to the project.

12.5.3 Statistical and Ecological Evaluation

12.5.3.1 Program Goals

Periodic statistical and ecological evaluation is required to ensure that individual project monitoring plans are yielding results that allow for the determination of project effectiveness. This is accomplished by periodic reviews of the data (that data being collected and analyzed) done by a biostatistician and wetland ecologist. These reviews may also involve the use of statisticians and ecologists from the academic community and also supply an opportunity for modifying the procedures being used to allow for the use of new and/or different approaches.

12.5.3.2 Evaluation of Statistical Techniques Employed

The statistical techniques being employed are evaluated on a periodic basis by the monitoring managers of the CRD in conjunction with statisticians from the academic community. These reviews ensure that all techniques are being properly applied to the data being collected.

This review also is used to keep an updated timetable of the statistical analysis process for each of the projects. This timetable lists, for each project, the techniques being employed with an indication of the status of the analysis (e.g., complete, in progress, etc.). This timetable is then used to keep track of any problems that may have developed during the data analysis process.

12.5.3.3 Evaluation of Interpretation of Ecological Significance

The determination of statistical significance alone may not necessarily provide a correct ecological interpretation of the monitoring data. For example, a statistically significant difference in salinities may be so small as to have little or no impact on plant communities. Therefore the statistical procedures used and the results of the statistical analyses will be reviewed by the ecologist in light of their ecological interpretations and meaning.

12.5.4 Standard Operating Procedures

Standard Operating Procedures (SOPs) for all CED and CRD data collection and analysis are outlined in a separate document titled *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005). SOPs for surveying activities are located in a separate document titled *A Contractor's Guide to Minimum Standards,* developed by the CED.

12.6 Technical Assessments

A technical audit is conducted periodically by a consulting wetland ecologist (QA auditor) from the academic community who verifies that instructions laid out in the monitoring plans are being followed. Field collection methods, data handling methods, data analyses methods, and prepared project monitoring reports are audited.

A program audit, conducted annually by the QA Managers, verifies that the management decisions made by the Program Manager advance the goals of the Division. This audit uses the benefit of hindsight to determine if policies should be

re-evaluated. The Program Manager uses the technical and program audits to revise monitoring activities.

Technical assessments conducted by the CED Engineering and Design Section are discussed in Section 12.2.2.

12.6.1 Data Quality Assessments

The LNDR CED and CRD provide an accessible database of temporal and spatial monitoring information. This database encourages the publication of monitoring results so that the ecosystem management techniques developed in Louisiana can be made available to the public and be peer reviewed by a national and international audience.

Data quality assessments conducted by the CED Engineering and Design Section are discussed in Section 12.2.2.

13.0 PERSONNEL QUALIFICATIONS AND TRAINING

13.1 Certifications Required and Qualifications

It is the policy of the LDNR CED that personnel involved in projects requiring QA shall be qualified to perform assigned work. Those qualifications are assured by requisite minimum levels of education and internal training procedures.

13.1.1 Quality Assurance Personnel Qualifications

The QA Managers and Officers have, as a minimum, a Bachelor of Science degree in biological sciences, environmental sciences, engineering, or a related field plus five years of professional level experience in a coastal resource, engineering, or related program. CED Section Managers typically serve as the QA Managers.

13.1.2 Technical Personnel

Staff personnel working in all sections of the CED have the requisite education and experience to conduct assigned functions. Technical personnel working within the Division typically fall into either the Engineer (includes Engineer Technician and Engineer Intern) or Coastal Resources Scientist job series established by the Louisiana Department of Civil Service. The minimum qualification for each position has been established by the State of Louisiana, Department of Civil Service. These qualifications can be found at the Louisiana Department of Civil Service website's page of job specifications at http://www.dscs.state.la.us/classpay/jobspecs/csjobspc.htm.

13.2. Training Requirements for Personnel

It is the policy of the CED to provide continuing training and development to equip employees to perform particular tasks within a job assignment, deal with new technical developments, develop additional work capabilities, and increase their level of work competence. Training available to CED personnel include courses offered by external sources as well as in-house training. It is the role, responsibility, and authority of the QA Officers in each of the field offices and the Managers of each section to identify training needs of CED employees.

The Division identifies training needs on a regular and continuing basis, and satisfies needs for all personnel involved in QA activities through the training programs described in this management plan. Training priorities are established and satisfied based on the needs of individual projects. Quality-related training is documented in

personnel files maintained for each employee. These files are routinely updated and accessible to the QA Officers and the Section Managers.

13.2.1 Field Methods

Field data required by project monitoring plans are collected by Coastal Resources Scientists stationed at regional field offices of the Monitoring Section of the CRD. See Section 3.2.1.

13.2.2 Laboratory Methods

All personnel members- of both the CED and of contractor entities- who conduct laboratory procedures (i.e., soil bulk density, dry weight of soil and vegetation, soil organic matter content, and preparation of spiked samples) attend a laboratory procedures training session annually.

13.2.3 Data Processing and Analysis Training

All personnel who conduct data processing and analysis will attend training in the use of relevant software packages.

Spatial data are processed by the National Wetlands Research Center (NWRC) personnel via a cooperative agreement with the DNR. Their training is described in a standard operating procedures (SOP) document of their own agency (NWRC, unpublished material).

Non-spatial data are processed by the Monitoring Section of the CRD. Data are processed and analyzed by Coastal Resources Scientists trained in the use of Oracle, Excel, Word, Powerpoint, and SAS software. In-house training is developed and directed by senior Coastal Resources Scientists and contracted academicians.

13.2.4 Safety Training

Safety training is a critical component of the CED, especially with field personnel due to exposure to potential hazards on land, at sea, and in the air. All personnel are required to attend safety training every 3 years. The following is a list of types of training required in this program:

Water safety and boat handling: U.S. Coast Guard approved boat safety training required of all field personnel involved in boat operation.

Airboat training: Eight hours of airboat training, including operation, conducted by a qualified airboat operator.

First aid and CPR: Mandatory for field personnel and encouraged for office personnel.

All-terrain vehicle (ATV): Eight hours training by a certified instructor in the safety and use of an ATV before operation.

13.3 Professional Development

All personnel are encouraged and solicited to make presentations at scientific and professional meetings. Personnel are required to stay current in the scientific literature and are encouraged to seek additional scientific/academic training. Professional development is also maintained through the state of Louisiana's Certified Public Training Program.

14.0 PROCUREMENT OF ITEMS AND SERVICES

14.1 Applicability

CED Section Managers have the responsibility of acquiring services needed to fulfill all the obligations and requirements of the program. The CED has administrative staff members that are responsible for administering contracts and legally binding agreements through which the Division acquires or renders all goods (deliverables) and/or services.

14.2 Contract and Purchasing Procedures

LDNR purchasing, individually and in conjunction with other state entities, operates under various statutes (Louisiana Revised Statutes (LRS)); administrative codes (Louisiana Administrative Codes (LAC)); and Executive Orders. The documents pertinent to procurement of equipment, services, and supplies include, but are not limited to:

a. LRS 39, Chapter 17, Louisiana Procurement Code

b. LAC 34, Part I, Rules and Regulations

c. Executive Order MJF 98-20 as amended by Executive Order No. MJF 00-29 (Small Purchases)

d. LRS 38:2211 et al., Chapter 10 (Construction/Public Works-Letting Bids)

The administrative staff have extracted and simplified these documents to provide in-house guidelines (unpublished Policy and Procedural Memoranda) that identify procedures to be followed to adequately track and manage contracts. The completed codification of procedures, however, appears in the above listed documents. Specific guidelines include, but are not limited to: (1) Requests for Contracts and Amendments, (2) Billing and Invoices, (3) Selection of Vendor, (4) Contracting Party Requirements, and (5) Purchasing Process. Checklists are provided to ensure submission and routing of appropriate information to minimize contracting and purchasing problems. The administrative staff are expected to:

1. Review and track all significant paperwork, including: project narrative; scope of services; budget; request for contracts and amendments or proposals; purchase and change orders; invoices; payments; ensure dual sign-off where needed for technical and administrative review; and ensure all commitments/requests of any kind are in writing and by the appropriate persons.
2. Ensure complete documentation and filing of all significant documents, correspondence, and other information.

3. Coordinate, develop, or initiate correspondence, written alternatives, recommendations, responses, and preventative actions to project concerns/problems.
4. Prepare post-assignment reports on all projects and contracts when completed.
5. Inquire and arrange for orderly transfer of project/contract management responsibilities.
6. Ensure that minority/disadvantaged business enterprises have the maximum opportunity to compete for and perform contracted services.
7. Personally inspect all purchases and deliverables and verify whether they are satisfactory and in keeping with the terms and conditions of the contract. Authorization or payment of invoices should not be processed until deliverables are in-hand or documented.
9. In the case of contracted facilities or laboratories, monitoring reports are provided by the contractor at the time of invoicing and reviewed by CED Program Managers for compliance and provided to the administrative staff. The CED Section Managers complete performance evaluation forms at the end of the contract period and provide this to the administrative staff. The review of the contractor includes evaluating compliance with CED standards and the contract conditions and deliverables.

15.0 QUALITY DOCUMENTATION AND RECORDS

15.1 Documents/Records Handling System

Project management and monitoring require the collection, analysis, and interpretation of environmental data from which project operation, maintenance, and management decisions can be made. The following procedures ensure that any document (including all raw or transformed data or information not compiled into a finished report) or report is prepared in a timely fashion, reviewed, approved, used, revised, disseminated, and maintained. All documents and records are maintained in the LaSalle building in Baton Rouge. All final Monitoring Plans and reports are published on the internet at the "Document Search" link of the OCRM website at http://www.dnr.louisiana.gov/crm.

15.2 Data Entry and Editing

Monitoring Manager Responsibilities

1. Make one copy of discrete data sheets and continuous recorder calibration sheets. Place originals in the field office's main Project Monitoring File in the common area.
2. Load continuous data into Oracle. Enter continuous recorder calibration sheets into Oracle and shift data, if necessary. The acceptance criteria for data drift over a month is 10%. Insure electronic shift is conducted properly. Graph shifted specific conductance, raw depth, and temperature data (will graph shifted depth data when Oracle proficient). Review data for gaps and out-of-range or suspicious values and void, if necessary. Any voided data must be explained and initialed in comments box.
3. Shift depth data in Excel or other capable software. Insure electronic shift conducted properly.
4. Insure discrete data sheets entered into Oracle. Check 100% of values for accuracy and completion and make necessary changes; validate data. (Make sure checks are not conducted by same person entering data). If Oracle cannot accept data sheets, insure data entered in appropriate digital format.
5. Generate field trip report in Oracle and send copy to Field Office Supervisor for editorial review and approval. (At discretion of Field Office Supervisor, attached to the field trip report will be summary statistics of continuous depth and salinity data).
6. Provide QA officer packet that includes the following information for each project visited during field trip: a) QA/QC Data Checklist, b) CRD Discrete Data Sheets, c) CRD Continuous Recorder Calibration Sheets, d) any electronic data files from field trip not accessible in Oracle, and e) field trip report if not accessible in Oracle.

QA Officer Responsibilities

1. Insure that discrete data were entered into Oracle and were verified by the monitoring manager. (If monitoring manager enters data into Oracle, QA officer will perform 100% data verification).
2. Insure electronic shift was conducted properly on continuous data and verify against CRD Continuous Recorder Calibration Sheet. Graph shifted specific conductance, raw depth, and temperature data (will graph "shifted depth" data when proficient with Oracle) and review for outliers and suspicious values. Look at transitional periods at the beginning and end of each data record to insure proper continuity. Any questionable data values will be discussed with monitoring manager, and voided if necessary. Decisions regarding changes or voiding of data will be documented in comments section and initialed by monitoring manager and QA officer.
3. QA/QC Data Checklist is completed by QA officer. Any questions not answered affirmatively are discussed with the monitoring manager. As specific issues are resolved, the QA officer will initial and date in the appropriate location on the QA/QC Data Checklist. When all issues are resolved, the QA officer initials and dates in the bottom right-hand corner indicating that the entire QA/QC Data Checklist has been completed. If any issues are left unresolved, or are to be resolved at a later date, this is noted in the appropriate comments section. The QA officer provides the original checklist to the monitoring manager for placement in the monitoring folder. The QA officer also returns datasheets to the monitoring manager.

Instantaneous data from a network of data collection platforms (DCPs) are input directly into Oracle via the USGS Water Resources Division Data Server. An Oracle report form displays the number of data points successfully transmitted, maxima, minima, mean, times of missing data, and a graphical display of data used to determine the presence of outliers and times of poor data quality. Reports are referenced by DCP serial number and platform number. The reports are reviewed by the Coastal Resources Scientist Supervisor and any problems are reported to the Coastal Resources Scientist Manager and corrected. The DCP data are also accessed by USGS via the web. USGS personnel service the equipment in the field and provide the CED and CRD with field inspection sheets. If it is found that the instrument used in the field has drifted between calibrations, the data may be shifted according to algorithms determined by USGS as outlined in Novak (1985). An annual data report is published by USGS that includes all shifted data summaries. The Oracle report form and annual data reports are periodically inspected by the QA officer.

External data such as that supplied by outside agencies or contractors are supplied in ASCII format on diskette with all fields identified and codes supplied. The monitoring manager for a particular project inspects all data received for completeness and

accuracy. All reports summarizing data are kept in both project and monitoring files. Data on diskette are kept by the monitoring manager and a master copy is archived.

15.3 Filing

The monitoring program files are located at each of the three field offices. These files contain project files, reports, reprints, aerial photography, personnel information and other pertinent monitoring information.

15.3.1 Monitoring Plans

Monitoring plans are developed following a standardized format. Hard copies of monitoring plans are kept in the monitoring project files. The plans are put into the folders by the monitoring managers and periodically inspected by the Coastal Resources Scientist Supervisor to ensure adherence to form and the latest updates. Finalized monitoring plans are maintained in the field offices and in the main MS files in Baton Rouge, and are available via the "Document Search" link of the OCRM homepage at http://www.dnr.louisiana.gov/crm.

15.3.2 Monitoring Files

Monitoring files are maintained on each project. Each file has six sections: (1) monitoring plan, WVA, permits, operational scheme; (2) chronology of all events/meeting notes and field trip reports; (3) correspondence, phone conversations; (4) scopes of services, budgets; (5) data summary, graphs, tables; and (6) data summary, miscellaneous. These files are maintained by the designated monitoring manager and are reviewed at a minimum of every six months by the Coastal Resources Scientist Supervisor for completeness.

15.3.3 Photography

Aerial photography of project areas is maintained on the 11th floor of the LaSalle building in Baton Rouge and at the NWRC office in Lafayette, LA. Digital files of flightlines are stored in the Regional GIS Database. A spreadsheet of projects flown is located with the photographs and is updated annually.

Photographs (35mm) taken of the project areas are stored in the miscellaneous data section of the project monitoring files. A copy of slides and prints is maintained in a filing system alphabetically by project.

15.3.4 Reports

Summary Data and Graphics

Summary Data and Graphics are written by monitoring managers on an annual basis for all projects that have been constructed. These reports are updated annually by March 31st and contain summary results of all monitoring data collected for each project. These reports follow a standard format, are maintained in the project monitoring files in the field offices, in Baton Rouge, and are available via the "Document Search" link of the OCRM homepage at http://www.dnr.louisiana.gov/crm.

Comprehensive Reports

Prior to 2003, Comprehensive Reports were written by monitoring managers for completed projects every 3 years and followed a standard scientific format. Final copies of reports are maintained in an open-file report index and are available via the "Document Search" link of the OCRM homepage at
http://www.dnr.louisiana.gov/crm.

Beginning in 2003, these reports were combined into a Coastwide Comprehensive Report, to be compiled by monitoring managers, contracted academia, and interested partners, every 3 years to report on the effectiveness of the individual projects, collective impacts on a hydrologic basin, and the impacts of the wetland restoration program on the entire Louisiana coast. Final copies of all reports are maintained in an open-file report index and are available via the "Document Search" link of the OCRM homepage at http://www.dnr.louisiana.gov/crm.

Field Trip Reports

After each field trip a standard report is filled out by the field trip leader (Coastal Resources Scientist) to include auxiliary information such as vegetation appearance, unusual events, etc. These field trip reports are given to the Coastal Resources Scientist Supervisor for review and comment. Approved field trip reports are filed in the monitoring project files and auxiliary information is incorporated into the central LDNR database. Project file folders are reviewed at six-month intervals by the Coastal Resources Scientist Supervisors for completeness, and any missing reports are replaced.

15.3.5 Data

The Strategic Online Natural Resource Information System (SONRIS) Database was designed to include enough space for at least one year of data from all stations in the system now and for those planned in the future. The system is also capable of holding a shifted data set of equal space. Data must be archived every year after the original, and shifted data sets are inspected by the monitoring manager and approved by the Coastal Resources Supervisor.

15.4 Tracking

15.4.1 Project Time Lines

"Monitoring Responsibility Spreadsheets," identifying monitoring and management personnel as well as construction and monitoring plan status, are updated continuously via networked computers. These forms include the TAG Responsibility Tracking Sheet and the Project Monitoring Responsibility Sheet. These sheets keep all active participants in the Monitoring Program informed on all project time lines.

15.4.2 Field and Laboratory Samples

The labeling scheme for field and laboratory samples is determined by the project monitoring manager and Coastal Resources Scientist Supervisor prior to field sampling initiation. Field sample tracking sheets are filled out by the project monitoring manager and signed by any subsequent personnel transporting the samples to an approved laboratory.

15.4.3 Data and Records

Data and record tracking is an important aspect of information control and utilization. The term *tracking* in this section refers to the compilation and organization of data and records in a format that identifies its contents and location in order to make the data and records easily accessible to users.

Proper data and record tracking entails collecting all information relative to a particular project and organizing this material to enable users to locate and utilize the findings. Management strategy includes a filing system for all records and gives directions as to where other information relating to the project can be found. All number streams are compiled in spreadsheet files with corresponding reports generated from this information. The tracking system will allow the user to follow data from its raw form through spreadsheets, analysis and reports.

15.4.3.1 Hard Copy

All data, documents, and records kept in the project files or the monitoring project files are labeled upon entry into the file and tracked. Tracking codes will include basin, project number, type of file, file section, and document number. A Pro-cite database is maintained by the Monitoring Section and periodically inspected by the Coastal Resources Scientist Supervisors and manager.

15.4.3.2 Electronic

All monitoring data are stored on a CD-ROM. They are initially stored on diskette and are later copied into the central LDNR SONRIS database or the Regional GIS Database and archived to tape. All data sets in spreadsheets are identified by project (basin and project number), the type of data, and dates. A master file containing the names and locations of all data files is maintained by the Coastal Resources Scientist Supervisor and is periodically inspected by the Coastal Resources Scientist Manager.

16.0 COMPUTER HARDWARE AND SOFTWARE

16.1 Policy

It is a Quality Assurance Management Objective of the CED that data collected, analyzed, processed, and maintained in all processing systems in support of the Division be accurate and of sufficient integrity to support effective accounting, engineering, design, construction, monitoring, and evaluation of all CED restoration activities.

16.2 Computer Hardware and Software Requirements

The LDNR database is designed to efficiently handle the need for data acquisition, organization, and storage of biological, hydrological, climatological, geographical, and engineering data. It has been carefully designed to meet the need for optimal storage capacity, multi-user capability, and user friendliness. The primary function of this system is to provide a centralized database for all information necessary to aid in project planning, to document the effectiveness of restoration projects, and to assist in the day-to-day operation of projects.

16.3 Database System

The LDNR database uses Oracle as its relational database management system. The system is a component of the SONRIS 2000 (Strategic Online Natural Resources Information System) initiative within the LDNR. It is web-enabled, so that users within and outside of LDNR can access and utilize the system via the internet. The system server is upgraded regularly and is capable of storing all data types collected by the two Divisions.

16.4 Real-Time Data Acquisition System

The DNR maintains a real-time data acquisition system in order to facilitate active management of specified projects. Data collection platforms (DCPs) located throughout the Louisiana coastal zone, transmit data via a geostationary operational environmental satellite to a Wallops Island, Virginia, down-link. The data are demodulated there and transmitted via a domestic satellite to the USGS computer center receive station in Baton Rouge, Louisiana. The USGS receive station is designed for continuous operation; however, in the case of a power failure or other incidents which would cause a lapse in data, the Wallops Island down-link automatically retransmits data not received. In the event of a DCP malfunction, a field crew is dispatched to investigate and repair the DCP that same day, minimizing data loss. When the data reach the USGS computer center, it is quality checked and transmitted via T-1 line to LDNR where the data are stored in the SONRIS database.

16.5 Personal Computers

Each LDNR CED employee is supplied with a personal computer (PC) and has access to a laser printer. On average, these PCs are replaced or upgraded about once every 3 years to insure that the two Divisions maintain a high level of technological advancement. All PC's are connected via a Local Area Network, operated in a Microsoft Windows environment, and contain the latest word processing, spreadsheet, statistical, GIS, graphical, and presentation software. These PC's can communicate both within and outside of the LDNR via e-mail and/or the internet. The CED also has laptop computers that are used to collect data from field recorders, to serve as mobile work stations while staff are traveling, and to connect with LCD projectors for use in graphical presentations.

16.6 Maintenance Agreements and Upgrades

The CED holds maintenance and service agreements on all hardware and licenses, and on all software applications to ensure that repairs are made quickly and software remains updated.

16.7 Information Security

It is important that LDNR information resources are protected from potential loss and misuse from a variety of accidental and deliberate causes. Therefore, all information resources are safeguarded to prevent such loss or misuse. Appropriate procedures have been developed by the two Divisions and are currently in place.

16.8 Documents

For proper implementation and maintenance of the CED program computer system, the two Division relies on policies and procedures of the LDNR Information Services Division (IS) as well as any published literature provided by hardware and software vendors.

16.9 Personnel

Personnel involved in computer data collection systems, hardware and software, have adequate education, training, and experience to perform the assigned system functions.

17.0 QUALITY PLANNING

Monitoring plans for projects are developed based on the minimum monitoring variables necessary to provide sufficient information to determine if project goals and objectives are being met. The essential variables category illustrates those variables that generally will be measured for each project type. However, due to the limited availability of funds, all of the highest priority variables may not be monitored. The CRD/MS has determined, by project type, which variables are essential in judging project effectiveness and which additional variables may need to be monitored based on project objectives and possible impacts. This list does not preclude other variables from being monitored if determined necessary by the MS. However, project-specific goals and objectives may dictate that some of these variables may be non-essential. Additionally, monitoring budgets may be insufficient to measure all essential variables.

Monitoring costs were standardized for each project type. However, these costs vary considerably depending upon the size and complexity of projects and site-specific concerns within the project area. The MS determined that monitoring costs cannot be set at a fixed percentage of project cost due to varying project goals and objectives and project sizes. They did, however, generate an initial estimate of an average annual cost (below) necessary to adequately monitor each type of wetland restoration project. This cost estimate was subsequently reduced by 40%.

Average annual monitoring costs for each project type will not exceed the following:

Project Type	Average Annual Cost (1998)
Freshwater Diversion	$ 29,291
Marsh Management	$ 29,291
Hydrologic Restoration	$ 29,291
Outfall Management	$ 29,291
Sediment Diversion	$ 9,764
Vegetative Planting	$ 4,896
Beneficial Use of Dredged Material	$ 4,896
Barrier Island Restoration	$ 4,896
Sediment/Nutrient Trapping	$ 4,896
Shoreline Protection	$ 2,434

Freshwater diversion, marsh management, hydrologic restoration and outfall management project costs are pro-rated based on project size as follows:

area of project (in acres)		percentage (of average annual cost listed above)
less than 1,000	=	60%
1,000–5,000	=	70%
5,000–15,000	=	80%
15,000–60,000	=	100%

In addition, those projects that require continuous data recorders for active management are allowed (if necessary) to be funded at 100% of the average annual cost limit, regardless of project size. Monitoring costs for any given project do not exceed 100% of the original, fully-funded monitoring cost estimate. Monitoring costs for any given project do not exceed 50% of the fully-funded project cost without monitoring.

Project-specific exemptions to the preceding monitoring costs are mutually agreed upon by the State of Louisiana and the federal cost-share sponsor, if any. Monitoring costs are included as a component of the fully funded project cost using the above average annual monitoring cost guidelines. In situations where monitoring costs must be added to a previously approved project, such an addition should not cause the previously approved fully funded project cost to be exceeded by more than 25%. If the cost is exceeded, approval must be obtained from committees comprised of the federal partners, if applicable.

Once budgets have been determined and project engineering and design has reached 30%, monitoring plan development is initiated. A Coastal Resources Scientist from the Restoration Technology Section initiates the Ecological Review and works with the Monitoring Manager to better define project goals and strategies. Once project boundaries have been finalized, these boundaries are incorporated into the Regional GIS Database. In order to obtain photography for preconstruction conditions in the project area, these boundaries are mapped and preflight planning is initiated. Flight lines are reviewed by the CED before the photography is flown.

Monitoring plans undergo a thorough development and review process prior to finalization and acceptance. The following steps are initiated in completing a monitoring plan:

1. The monitoring manager (CRD Coastal Resources Scientist) makes initial contact with the project manager (from the CED), CRD Restoration Technology Section representative, and the lead federal agency representative (if there is a federal co-sponsor) for acquisition of historical data, research reports, feasibility studies, WVA analyses, etc., in order to develop project objectives, goals, reference areas,

monitoring elements, null hypotheses, and anticipated statistical analyses. The CRD monitoring manager develops the preliminary monitoring plan. The following documents are used as templates in preparing the plan: standardized monitoring plan format; standardized null hypotheses and statistical analyses; and the LDNR monitoring proposal. A plan-view map of the project area should be developed during this stage. If known, sampling stations, transect lines, etc., are included on the plan-view map. Once this plan is developed, it is then reviewed by the monitoring supervisor and program manager, then sent to the lead federal agency representative for refinement. A site visit, travel or meetings may be necessary with the lead federal agency representative (when applicable) in order to develop a mutually agreeable preliminary plan. Once a mutually agreeable preliminary plan is completed, a preliminary budget is prepared by the monitoring manager.

2. Monitoring managers initially mail out the preliminary monitoring plan and budget, project description report, and Wetland Value Assessment (WVA) analysis, at a minimum to a National Wetland Research Center (NWRC) representative, contracted ecologist, and statistician that provide technical assistance in the development of the monitoring plan. This mail-out is completed at least three weeks prior to scheduled technical advisory group meetings. Other data or information requested should be supplied unless it is too bulky or large to copy. Otherwise, all other project information, documents, drawings, etc., should be brought to the technical meeting.

3. All comments at the technical advisory group meetings are noted by the monitoring manager. All areas of consensus, conflict, changes, and tasks to be completed, by whom and when, must be noted. It is the responsibility of the monitoring manager to type up these notes and have them sent, via FAX mail, to the technical representatives within two days.

4. The goal of the technical advisory group meeting is to finalize a monitoring plan and budget; however, it may not be finalized after one meeting. Additional telephone calls, fax mail, and/or meetings may be necessary. If major changes are made during the process, then all members of technical advisory group receive copies of the revised document. Some projects require a field trip by members of the representatives either before or after the technical advisory group meeting.

5. Other agency personnel are able to attend the technical advisory group meetings on a voluntary basis. Their input is considered but they are not voting members.

6. Once a monitoring plan is finalized by the technical advisory or other supervisory group (as applicable), it is sent to the representatives of various federal agencies (if applicable) for a two-week review. The advisory or supervising group must consider comments received back by the monitoring manager, and must give justification for not incorporating specific recommendations into the monitoring plan.

7. After review comments are incorporated, the final monitoring plan is sent to the chairman of a committee consisting of representatives of participating federal

and state agencies for final approval. Attached to the final plan are all comments received during review, a written response to comments, and a proposed budget.

8. Once a monitoring plan is developed, it is the responsibility of the CRD to implement the plan following the procedures outlined in this Quality Management Plan (QMP).

The implementation of the monitoring plan is dependent on project construction timetables. In cases where a project is delayed due to unforeseen causes, the monitoring activities timetable are adjusted accordingly.

17.1 Quality Assurance Goals For Sampling Protocols

Specific protocols for variables measured are necessary to meet the accuracy, precision, and completeness goals outlined in Table 2. These protocols are used to supplement the Standard Operating Procedures included within the QMP. All of the following protocols address the accuracy and precision concerns for each of the types of variables measured within the biological monitoring program. Completeness goals for each variable are based on the amount of data collected over a one year period.

Water Level - At deployment and retrieval, the continuous recorder is calibrated to zero while out of water. The continuous recorder is checked out of water to ensure that the instrument was properly calibrated. Additionally, periodically (every six months in January and July) at least three discrete measurements are taken of the same sample with the continuous recorder to determine instrument precision. For instruments that utilize pressure sensors to determine water depth, the sensor is checked for accuracy at multiple known water depths (minimum of three) once every year.

Specific Conductance, discrete - At the beginning of each sampling day, the instrument is calibrated to a standard. The instrument is then checked against the standard to ensure that the instrument was properly calibrated. At the end of each sampling day, the instrument is checked with a standard to ensure that the instrument is still in calibration. Multiple measurements (minimum of three) of one sample are taken on each sampling day to determine instrument precision.

Specific Conductance, continuous - At deployment, the continuous recorder is calibrated to a standard. The continuous recorder is then checked against the standard to ensure that the instrument was properly calibrated. At retrieval, the specific conductance of the continuous recorder and a second calibrated instrument are noted. The continuous recorder is then cleaned and specific conductance is checked again against the calibrated instrument. If necessary, the continuous recorder is calibrated to a standard before redeployment. Additionally, periodically (every six months in January and July) at least

three discrete measurements are taken of the same sample with the continuous recorder to determine instrument precision.

Salinity, discrete and continuous - By following the accuracy and precision protocols as outlined for the Specific Conductance variable, Salinity is accounted for.

Temperature, discrete - At the beginning of each sampling day, the discrete recording instrument is checked against a precision thermometer. If a difference greater than one degree celsius between the precision thermometer and the discrete instrument occurs, it is noted and the instrument's thermistor is serviced. Multiple measurements (minimum of three) of one sample are taken on each sampling day to determine instrument precision.

Temperature, continuous - At deployment and retrieval, the continuous recording instrument is checked against the discrete recording instrument or a precision thermometer. If a difference greater than one degree celsius is noted, the instrument's thermistor is serviced. Additionally, periodically (every six months in January and July) at least three discrete measurements are taken of the same sample with the continuous recorder to determine instrument precision.

pH - At the beginning of each sampling day, the instrument is calibrated to a pH 4 and pH 10 buffer solution. The instrument is then checked against the standard to ensure that the instrument was properly calibrated. At the end of the sampling day, the instrument is checked against the standards to ensure that the instrument is still in calibration. Multiple measurements (minimum of three) of one sample should be taken on each sampling day to determine instrument precision.

Suspended Sediments - Suspended sediment samples containing a known sediment concentration in the expected range of the unknown samples are analyzed with any samples sent to a laboratory for analysis. This is used as a measurement of accuracy. At least three samples within the same site are taken during sampling and included with the samples sent to the laboratory for analysis. This is used to determine the precision of the sampling method and suspended sediment analysis protocol.

Bathymetry - When a fathometer is used to determine bathymetric profiles, the fathometer accuracy is checked at the beginning and end of each sampling day. This is accomplished by a poling method. The depth of water is checked using an incremented poling device and compared to the depth reading on the fathometer. Additionally, three or more samples are taken at the same location during the sampling day to determine instrument precision.

Surveying, topography, GPS, conventional - At the beginning and end of each sampling day, a known benchmark is surveyed to determine instrument accuracy. Additionally, on each sampling day, a minimum of three samples is conducted at the same point location to determine the precision of the surveying technique.

Soil Redox Potential - Prior to sampling, all platinum electrodes are cleaned and tested in a quinhydrone/pH buffer solution to determine the accuracy of the electrodes. During sampling, five or more measurements at the same location (including the same depth of soil) are conducted to determine the precision of the electrodes.

Soil Organic Matter Content - Soil samples containing a known amount of organic matter in the expected range of the unknown samples are analyzed with any samples sent to a laboratory for analysis. This is used as a measurement of accuracy. At least three samples within the same site are taken during sampling and included with the samples sent to the laboratory for analysis. This is used to determine the precision of the sampling method and soil analysis protocol.

Soil Bulk Density - Soil samples with a known bulk density in the expected range of the unknown samples are analyzed with any samples sent to a laboratory for analysis. This is used as a measurement of accuracy. Three or more bulk density samples within the same site are taken during a sampling trip to determine the precision of the sampling method and soil analysis protocol.

Interstitial Salinity - See Salinity, discrete and continuous for accuracy and precision protocol.

Interstitial Sulfide - A series of standards is used to determine sulfide concentration in soil porewater. The 10 ppm standard is run every ten samples to determine the accuracy of the electrodes and meter. Additionally, at least one sample is measured a minimum of three times to determine precision.

Feldspar Marker Horizon - Prior to sampling, the calipers are checked against a calibrated ruler for accuracy. Once during the sampling day, three measurements of the same core are taken to determine sampling precision.

Sediment Erosion Table (SET) - Prior to sampling, the rods are checked against a new rod to insure that they have not been damaged or warped. This is the test for accuracy. During sampling, a minimum of three measurements with the same rod at the same location are conducted to determine precision.

Percent Plant Cover - During sampling, at least two independent estimates are made of the plant community to determine method accuracy. If a dramatic change in the plant community structure occurs (e.g., change from freshwater to brackish marsh community) then the independent estimates are repeated in the new plant community. Additionally, three estimates of plant cover at the same station and plot are conducted once during each sampling to determine precision of the method.

Number of Plant Stems - During sampling, at least two independent counts of plant stems within a plot are made to determine method accuracy. Additionally, three replicate counts of the same site are conducted once during each sampling to determine precision of the method.

Vegetation Clip Plots - Whenever sampling involves taking clip plots smaller than 1 m^2, a larger sampling is conducted to determine the accuracy of the determination. The smaller clip plot is harvested first and then the rest of the material surrounding the smaller clip plot within 1 m^2 is taken and processed with the samples. A comparison between the smaller clip plots and the 1 m^2 clip plot is conducted to determine the accuracy of extrapolating the data. Additionally, three replicate clip plots of the same site are conducted once during each sampling to determine precision of the method.

Stem Length - During sampling, at least two independent measurements of stem length within a plot are made to determine method accuracy. Additionally, three replicate measurements of the same stem are conducted once during each sampling to determine precision of the method.

Herbivory - See Percent Plant Cover for accuracy and precision protocol.

Water Quality Sampling - Water quality samples containing a known concentration in the expected range of the unknown samples are included with those unknown samples, and all are then sent together to a laboratory for analysis. This is used as a measurement of accuracy. At least three water quality samples within the same site are taken once during sampling and included with the samples sent to the laboratory for analysis. This is used to determine the precision of the sampling method and analysis protocol.

18.0 IMPLEMENTATION OF WORK PROCESSES

Implementation of work processes is primarily the responsibility of the CED/EDS and the CRD/MS. Following project selection, the chronological development of a typical coastal restoration project includes the following phases:

- Development of engineering/design scope of services
- Development of monitoring plan
- Selection of contractor to provide engineering/design services
- Engineering/Design Study
- Construction
- Post-construction evaluation
- Post-construction monitoring

QA/QC occurs at each of these phases.

18.1 Development of Engineering/Design Scope of Services

The CRD/MS and the CED/EDS work jointly to develop scopes of work that incorporates the biological components as well as the engineering/design components required to design and implement a restoration project that achieves its intended goals. A representative from the CED/EDS serves as the Project Contract Manager.

18.2 Development of Monitoring Plan

See Section 17.0.

18.3 Engineering/Design Study

A review of the quality assessment protocols for engineering/design studies and the corrective action is provided in Section 19.

18.4 Contractor Selection

The EDS is responsible for the initial screening of prospective engineering contractors. All engineering/design contractors must meet specific requirements including professional engineering and surveying certifications as established in the LAC 21 §2103 (Louisiana Administrative Code 1999). Final contractor selection is the responsibility of the Secretary of LDNR.

18.5 Construction

Construction oversight is provided by the Project Manager from the CED/FES. It is the responsibility of the CED/EDS Project Manager to ensure that all construction-related activities meet the specifications established in the scope of work.

18.6 Post-Construction Evaluation

The CED/FES Project Manager is responsible for conducting the post-construction evaluation. Tools for post-construction evaluation include a project As-Built Plan Report and a Completion Report. QA/QC activities associated with post-construction evaluation are discussed further in Section 19.

18.7 Post-Construction Monitoring

18.7.1 Introduction

The development and implementation of monitoring plans require a significant amount of management oversight and inspection. CRD Monitoring managers (Coastal Resources Scientists) meet with their supervisors on a monthly basis to discuss individual projects, job performance, quality control procedures, and to plan for the following month. Each employee then provides his supervisor with a list of items that were agreed to in the meeting, which is subsequently used as a guide throughout the month. This list of agreed-upon items is then used as an outline in the subsequent meeting to ensure that issues raised in the previous meeting were addressed during the month. Field trip reports are generated for each field trip which addresses both logistical and biological components of the field trip and identify any problems encountered. Field procedures and any quality control items are also discussed during monthly meetings with supervisors to ensure that each employee is familiar with standard operating procedures and that problems encountered in the field are not recurring. Inspection oversight is conducted by the Coastal Resources Scientist Manager and the QA Auditor.

Procedures for field and office protocols within the CRD Monitoring Section (MS) have been developed and implemented through the issuance of an MS Policies and Procedures Manual compiled by the Coastal Resources Scientist Manager. Standard office protocols for the CED and the CRD are utilized where applicable and specialized protocols have been developed under the direct supervision of Coastal Resources Scientist Manager. Specialized policies are developed when certain procedures become frequent enough to warrant the Coastal Resources Scientist Managers' attention. Departmental policies which are periodically updated by upper management and new

policies that are developed by Coastal Resources Scientist managers are introduced and reviewed at monthly staff meetings.

18.7.2 Approach

The CRD develops monitoring plans and collects data on individual projects based on specific project goals and objectives, as agreed upon with the CED. The framework on which the plans are developed is based on a basin-level approach. All monitoring efforts are coordinated within each hydrologic basin in order to adequately address secondary or cumulative effects of projects.

18.7.3 Standard Operating Procedures

The document entitled *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005) provides established methods that are used in the development and implementation of project-specific monitoring plans and programmatic monitoring activities. SOPs regarding the selection of reference areas, statistical analyses, and data collection are also provided in this manual. These SOPs are reviewed and revised annually (if necessary) by the Coastal Resources Scientist Supervisors upon approval by the QA manager.

18.7.3.1 Field Data

A coding scheme will be used to identify the type of project, the project name, the type of data, the date the data were collected, and the location where the data were collected for each sample. The location will be provided in either latitude/longitude or UTM coordinates. These steps are needed to ensure that sufficient documentation exists for verification of data accuracy. Data coding is the responsibility of Coastal Resources Scientists, and oversight verifies that all data are properly coded to ensure compatibility with the LDNR databases.

18.7.3.2 Spatial Data

All spatial data conform to a U.S.G.S. Executive Order dated 11 April 1994, describing standardized methods of data acquisition and access. The proper coding of spatial data will be the responsibility of the Supervisory Geographer and GIS Specialist to ensure compatibility with the LDNR Regional GIS Database.

18.7.4 Routine QA Procedures

18.7.4.1 Field

The equipment is checked and calibrated prior to departure from the LDNR or from the NWRC. Proper storage and stowage must be practiced to prevent damage. At each site, equipment is given a routine check and, if necessary, calibrated before field use.

The entry of data onto a data sheet is done accurately and neatly. The following general guidelines are observed and checked by the QA officer.

1. Correct data are entered in the correct place on the proper data sheet.
2. Sample numbers and station location ID codes are double-checked when collecting data.
3. If data are entered in a nonstandard location on the data sheet, the reason for doing so is documented.
4. All data are recorded in pencil.
5. All entries are printed legibly, and similar numbers (e.g., 5s, 8s, and 2s) are made distinguishable.
6. All entries on the data sheets are double-checked.
7. Neither erasures nor paper correction fluid are used; entries are crossed out and the corrected number is written nearby and the cross-out is initialed. If there is not room to write the new number, it is written in the margin or at the bottom of the page. All entries are annotated.

Upon completion of sampling but before departing from a site, the monitoring manager examines all data forms for completeness and legibility. All samples are checked for proper identification and storage. If data are missing or incomplete, the monitoring manager attempts to collect it before leaving the site. If the situation cannot be corrected, it is fully documented.

In the case of data readings that are outside the expected measurement bounds (Table 1), an attempt is made to determine the cause of the problem. The SOP is checked for the method to be sure that the correct procedures are being followed, and the field equipment is rechecked to be sure that it is functioning properly. If the field equipment is functioning properly, data are collected, and a note as to what was done is written. This helps ensure that any outliers on the data set are real values, and not due to sampling error. This procedure is also followed on laboratory analyses.

18.7.4.2 Laboratory

Standard operating procedures for routine laboratory analysis are contained in *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005).

18.7.4.3 QA Procedure Updates

Procedures for appropriate routine, standardized, special or critical activities are reviewed annually by the QA Officers and modified, developed and/or implemented as necessary.

18.7.5 Deliverables

The CED generates data on all implemented projects. Results from these projects are published in comprehensive reports every three years and in evaluation reports to the U.S. Congress and Louisiana Legislature not less than three years after the completion and submission of the restoration plan, and at least every three years thereafter.

19.0 QUALITY ASSESSMENT AND RESPONSE

The CED/EDS and the CED/PMS are primarily responsible for quality assessment and response at the engineering and design stage of CED and CRD projects. QA at the engineering and design phases ensures that projects are designed according to the defined scope of work by contractors. The CED/FES provides quality assessment and response during the construction phase of each project. Biological monitoring determines the overall effectiveness of coastal restoration projects in achieving the desired restoration objectives and provides a basis for making adaptive management decisions during the life of the project.

19.1 Engineering and Design Quality Assessment

Initial quality assessment is conducted on the engineering and design phase of individual projects at frequencies established in the project scope of work. Data quality is assessed jointly by the CED/EDS and the CED/PMS upon receipt of project deliverables and prior to issuance of contractor invoices. Tools used to assess the quality of project deliverables include "Review of Deliverables" reports provided by the contractors (and which include monitoring reports and invoices) and periodic Design Reviews, which are typically conducted at the 30 percent and 95 percent completion stages of the engineering and design phase. Design Reviews are collaborative efforts among the CED/EDS, CED/FES, CED/PMS, CRD/PS, CRD/MS, CRD/RTS, CRD/LS, federal agency partners on the project (if any), and private contractors involved in preparation and design of the project.

19.2 Field Engineering Section

The CED/FES uses Coastal Use permits prepared by the CED/EDS and issued by the U.S. Army Corps of Engineers and/or the LDNR CMD, and Project Monitoring Plans prepared by the CRD/MS, to ensure that the construction and operations & maintenance activities conducted on projects are done in accordance with applicable laws, regulations, and the intentions of the project sponsors. The CED/FES develops "Construction Plans and Specifications" documents to guide the work of contractors, and then develops Inspection Reports, Construction Completion Reports, and As-Built Plans to describe and document the outcome of the construction process. Operation and Maintenance Plans are also developed by the CED/FES to describe and document the manner in which project structures are operated and maintained. All of these documents are reviewed by the CED/FES QA officer, who can turn to the CED/FES QA manager (the FE section manager) for assistance when necessary.

19.3 Corrective Action

Corrective action may take place at any stage of the project and quality assessment is a joint effort among the different sections within the two Divisions. However, the primary point of contact is the individual project manager within the CED/PMS. This single point of contact for contractors provides a clear line of communication between the two Divisions and the contractor. This enables the CED to identify and address potential quality issues in a timely manner. Prompt corrective action by the contractor is insured by coordination between the project manager and the contract manager within the OCRM's Project Support and Services Section. The contract manager issues invoices for professional services only upon approval by the project manager. In the event that deliverables do not meet the specifications established in the scope of services, the project manager has full authority to withhold invoices until all project deliverables are satisfied. The project manager documents all actions taken to address any QA issues with respect to contractor deliverables from project initiation to closure.

The CED has standard procedures in place to address changes in project scope for construction or engineering services while in the field. The procedure for implementing these changes include:

6. The contractor and the project construction engineer or contract manager discuss the issue on-site and concur on what changes are necessary.
7. The CED's construction engineer and design engineer discuss various options.
8. The contractor submits a proposal outlining changes to costs and tasks to the construction and design engineers for concurrence.
9. After successfully negotiating a price, a change order is issued authorizing modification.
10. As-built plans reflect the actual construction that took place.

19.4 Monitoring Data Quality Assessment

Periodic QC checks are necessary to ensure that all measurements made are reliable. Such checks are performed throughout all stages of field sampling, laboratory preparation, and data analysis. Internal checks are made on no less than 10% of the samples taken, or measurements or estimates recorded. Field QC checks consist of discussions with the sampling personnel to ensure that all personnel are following the standard field procedures. Each individual must demonstrate consistency and accuracy for the measurement technique during training. Sufficient training of each individual ensures comparability among individuals and sample sites. In addition, replication of field sampling allows for an estimate of precision of the field and laboratory procedures.

The formulas discussed below outline the basic methodology for the calculation of each of the five QA objectives. It should be pointed out that these are not the only means that will be employed in assessing the QA objectives. The monitoring plan for each individual project may outline alternate methods of assessing the QA objectives, depending upon project type. In all cases, the methods used are reviewed to ensure that they are statistically valid.

1. Accuracy can be assessed by the relative percent difference between the measured value and the true value, as set by a standard, using the following formula:

   $$\% \text{ difference} = \frac{| \text{ true value - measured value } |}{\text{true value}} \times 100$$

   In cases where more than two samples are involved (multiple readings of a standard), the relative standard deviation (RSD) that is the coefficient of variation (CV) expressed as a percentage can be used (Taylor 1988):

   CV = standard deviation / mean

   RSD = CV x 100

2. Precision, Representativeness, and Comparability, when based on analysis of replicate samples, involves using the following formula for comparing two samples (or two subsamples of a given sample) as A and B:

   $$\% \text{ difference} = \frac{| \text{ A - B } |}{(A + B) / 2} \times 100$$

   In cases where there are more than two replicates, the coefficient of variation can be used.

3. Completeness is assessed by the percent of data collected as a percentage of the number of proposed samples to be collected and is determined by the following formula:

   $$\% \text{ complete} = \frac{| \text{ samples collected - proposed samples } |}{\text{proposed samples}} \times 100$$

   Data quality is assessed using the above general principles along with the Quality Assurance Goals. During analysis, the Coastal Resources Scientist or laboratory analyst keeps track of the standard, blank, and replicate readings each time samples are measured to ensure that the values fall within the guidelines. If values fall outside the guidelines, a decision is made by the Coastal Resources Scientist in consultation with the Coastal Resources Scientist Supervisor regarding the acceptability of the error.

Success of the Monitoring Program is determined at three basic levels: (1) sampling success, (2) project success, and (3) program success. Sampling success involves both measurement quality and data quality. Project success is determined by reviewing measured data at periodic intervals to determine if the project is meeting its original goals and objectives. Statistical and ecological reviews of results assist in the evaluation of success. Program success is determined by the accomplishment of deliverables and by maintaining a high standard of quality throughout all program elements as discussed in the QMP.

19.5 Data Quality

Data quality is the responsibility of all personnel involved in the program. Assurance of good quality data is necessary to determine whether project goals and objectives are met, to compare data among projects, and to assist in the design of future projects. Data quality is ensured by management overview and audits throughout the process of data entry, quality control, transfer, reporting, and evaluation.

Data download and storage generally follow the guidelines established in *Good Automated Laboratory Practices* (EPA 1995). The Coastal Resources Scientist Supervisor oversees all monitoring data download and storage activities and facilities. This individual ensures that the SOP for Computer Systems is followed and implemented correctly. Other daily, monthly, and periodic audits of data (discrete, continuous, and instantaneous) have been outlined in Documentation and Records.

When it is determined by the Coastal Resources Scientist Supervisor or the Coastal Resources Scientist Manager that data do not meet expected standards, then corrective action is taken. The Coastal Resources Scientist Supervisor has the authority to suspend or stop work upon notification by the appropriate assessment personnel. In the case of health/safety matters, the assessment personnel have the authority to suspend work. The Coastal Resources Scientist Supervisor identifies whether the problem is a personnel, equipment, data entry, data storage, data retrieval, or analysis error, and devises a corrective action plan with the Coastal Resources Scientist Manager for immediate implementation. The Coastal Resources Scientist Supervisor notifies the Coastal Resources Scientist Manager and monitors both the identified problem and the corrective measure taken to ensure that the problems are resolved. The Coastal Resources Scientist Manager is notified when the problem has been corrected.

19.5.1 Field Data Quality

Since field data from projects are the basis for decision making, it is very important to ensure that documents related to field work are of high quality and are audited. To

assure that all data collected in the monitoring process are valid and comparable, the Coastal Resources Scientist Manager and Supervisors are responsible for standardizing methods of data collection and handling. The SOP manual (*A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance / Quality Control, Storage, and Products*, Folse and West 2005) is strictly adhered to and all monitoring personnel are trained in the procedures.

All Coastal Resources Scientists are accountable for data collected and generated for each of their respective projects. They are responsible for inspecting the boat, vehicle, and equipment checklists and calibration sheets prior to every field trip. Should any boat, vehicle, or equipment failure occur, it is brought to the attention of the Coastal Resources Scientist Supervisor and documented in the written field trip report. Following each field investigation, all data are reviewed by the Coastal Resources Scientist and QA officer for completeness and validity. Monthly meetings are held between the Coastal Resources Scientist and Coastal Resources Scientist Supervisors and the Engineers and Engineer Supervisors to discuss any problems or concerns and to provide additional training, if necessary. Overall adherence to protocol and accepted procedures as outlined in the SOPs for fieldwork is audited by the QA officer and the Coastal Resources Scientist Supervisor. Any deviations from SOP procedures are corrected at the time of the occurrence or brought to the attention of the Coastal Resources Scientist Manager.

19.5.2 Laboratory Data Quality

The LDNR contracts out virtually all laboratory analyses for monitoring. Scopes of services for necessary analyses are prepared by the monitoring manager and approved by the Coastal Resources Scientist Manager. The monitoring manager audits the work completed under the contract to ensure consistency with the standards and procedures taught at the annual laboratory training session referred to in section 3.2.2, and fills out a Performance Evaluation for every laboratory contract. This form assesses quality, quantity, and timeliness of work completed. The QA officer reviews quality assurance guidelines provided by the contract laboratory to ensure compliance with SOPs.

19.5.3 Personnel Quality

The CED assures personnel quality through minimum requirements for employment, training, and performance appraisals. Specific education and experience criteria are required for personnel to participate in the Coastal program. These requirements establish the necessary knowledge base, and training provides the specific guidance mandatory for implementation of the program.

Training is provided to all personnel as needed to perform to the quality standards described in this QMP (Section 3.2). Necessary training is evaluated by the Supervisors and the QA auditor.

Annual performance evaluations are conducted on all personnel to provide an indicator of job knowledge, technical skills and ability, performance of duties, communication skills, interpersonal skills, and management skills and abilities. Areas that need improvement and specific training or skills are identified to assist in the quality improvement process.

If it is determined by the Engineer Supervisors and Managers, Assistant Administrator, Administrator, and Assistant Secretary of the Division that there is a failure to perform adequately by CED personnel, then corrective action is taken following Civil Service Rules, chapter 12 (Department of Civil Service n.d.).

19.5.4 Program Quality

A program audit is conducted periodically by the QA Manager to ensure adequate staff and facilities to perform necessary program obligations. Reports on general management issues are kept by the QA Manager. Annual performance reviews and supervisor/project manager monthly review meetings are evaluated as part of this audit. An independent, professionally recognized wetland ecologist contracted from the academic community verifies whether management decisions made by monitoring managers and the program manager advance the goals of the CED. A technical and management audit is conducted periodically by a contracted wetland ecologist. This audit not only identifies problem areas, but also identifies any noteworthy practices. The contracted wetland ecologist may conduct an interim review of problem areas to ensure that problems have been resolved. Monitoring plans, field collection methods, data handling and analysis methods, and project monitoring reports are reviewed and an audit report is prepared. Appropriate actions are taken to alleviate any problem areas identified in the program and technical audits.

19.5.5 Management Systems And Peer Review

Multiple QA and QC checks are performed at all phases of program implementation, as addressed in each section of this QMP, to prevent and/or detect quality problems. Since most activities are monitored by at least two hierarchical levels of supervision, problems are identified quickly and corrective action is employed promptly. Management is constantly informed of the quality process and has made a commitment to quality improvement activities. Management is fully aware that restoration science is a new

field and that many avenues exist for improving technologies and the associated quality system. Evaluation of such technologies is encouraged as part of the quality improvement process. It is further understood that peer review is an essential component of this program, which leads to the development of better products and services.

20.0 QUALITY IMPROVEMENT

20.1 Quality Improvement Responsibilities

The specific quality improvement responsibilities of appropriate components within the CED are addressed below.

20.1.1 LDNR CED and CRD

The two Divisions are jointly responsible for planning, implementing and evaluating the effectiveness of all quality improvement activities associated with coastal restoration project development, data collection and storage, statistical analyses, quality control criteria, data interpretation, and report generation. Assessments of their activities is conducted through audits, performance evaluations, peer reviews, and technical reviews. The QA Manager has the responsibility for informing the management hierarchy on the assessment process.

20.1.2 Contractors and Partners

All agencies and groups outside of the CED and the CRD who provide data and services in support of the two Divisions' coastal restoration efforts are responsible for planning, implementing and evaluating the effectiveness of all quality improvement activities associated with related projects as deemed appropriate by the two Divisions for each project or program, and in adherence with the guidelines described in *A Standard Operating Procedures Manual for the Louisiana Department of Natural Resources Coastal Restoration Division: Methods for Data Collection, Quality Assurance/Quality Control, Storage, and Products* (Folse and West, 2005). The QA Manager has the responsibility for informing the management hierarchy on the assessment process.

20.2 Corrective Action Program

Whenever the procedures and guidelines established in this program are not successful in assuring the quality of work of CED programs, corrective action is required to ensure that conditions adverse to quality are identified promptly and corrected as soon as is practicable. Corrective actions shall include the identification of root causes of problems, determination of whether the problem is unique or has more general implications, and recommendations for preventing the recurrence of the problem. Corrective action is initiated if variances from proper protocol are noted. Reporting to the program manager will ensure that early and effective corrective action will be taken when actions of Division programs fail to meet acceptable standards. The responsibility to oversee and implement the required corrective actions is carried out by the program manager. The CED Directorand the other QA Managers are informed of such activities. Follow-up

evaluations are conducted by the QA Managers to ensure effectiveness of the corrective action.

The corrective action plan includes taking recommended actions and making changes to eliminate or correct problems with quality. Variances which require correction action include but are not limited to failure to include resource/regulatory comments in making permit/mitigation decisions; errors in data entry in permit, mitigation, and/or consistency databases; protracted processing review times, failure to provide local programs with needed programmatic information; and file mismanagement. However, a formal correction action program is difficult to establish that would cover all possible items.

20.2.1 Process for Corrective Action

The general process for corrective action includes the following steps:

5. Any staff member can begin the corrective action process. Upon identification of a potential problem, staff meets with all involved parties and the appropriate levels of management to discuss the problem identified or any tasks that may relate to or affect the quality of the function of the particular program. Management and the QA Manager determine if a problem exists, and what it is, through the meeting process. Additional information may be required to determine the nature and extent of the problem. If so, that information is obtained and evaluated by the parties involved.
6. Once a problem has been identified, procedures are modified or revised to correct the problem.
7. Retraining or provision of additional training is carried out as necessary to ensure that staff are aware of problems and revised procedures are in place to correct the problems.
8. Follow-up evaluations are conducted by the QA Manager to ensure the effectiveness of the corrective action. A QA Manager, in coordination with the CED Director, determines if any more action is required and may make any recommendations for preventing recurrence of the problem.

INTRODUCTION TO THE COASTAL MANAGEMENT DIVISION

The Louisiana Department of Natural Resources, Office of Coastal Restoration and Management, Coastal Management Division (LDNR/CMD) under the auspices of the State and Local Coastal Resources Management Act (SLCRMA) of 1978, as amended (LA. R.S. 49:214:21 – 214.41) seeks to protect, develop, and where feasible, restore or enhance the resources of the Louisiana Coastal Zone. The SLCRMA's broad intent is to encourage multiple uses of resources and adequate economic growth while minimizing adverse effects of one resource use upon another without imposing undue restrictions on any user.

21.0 CMD QUALITY MANAGEMENT AND ORGANIZATION

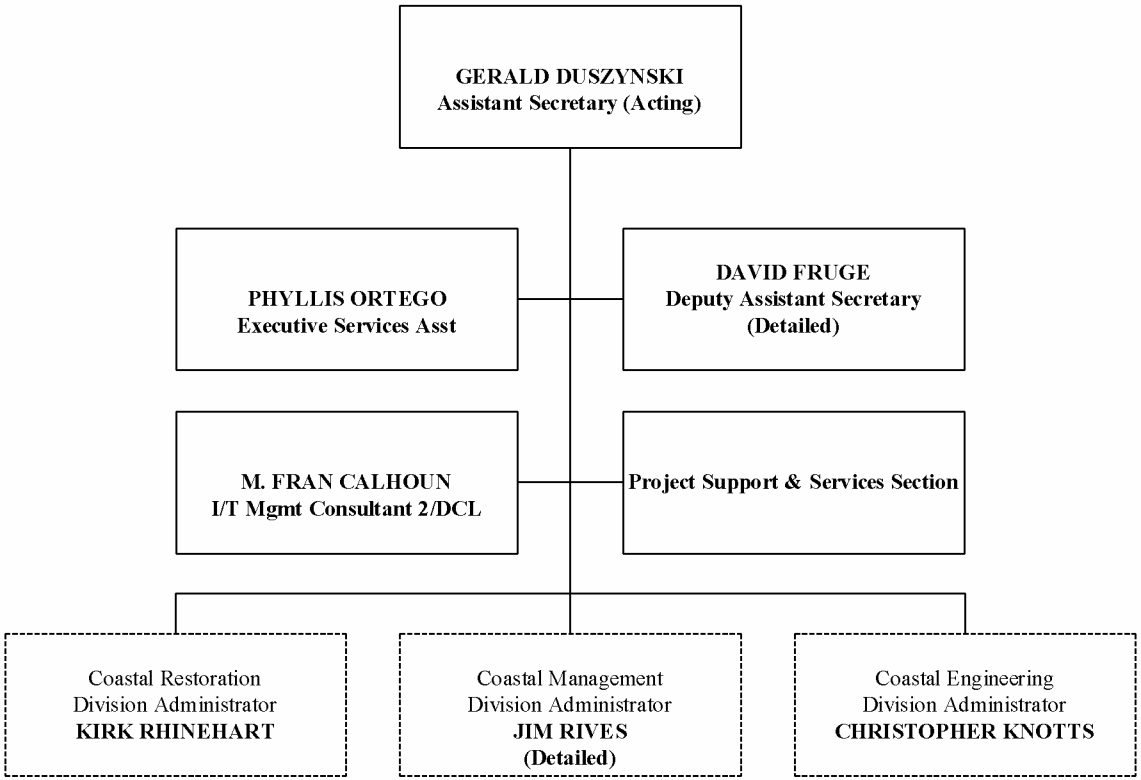
21.1 Policy on Quality Assurance

Quality Assurance (QA) is a management system that evaluates and documents the information used by decision-makers in making sound decisions. The Coastal Management Division of the Louisiana Department of Natural Resources, Office of Coastal Restoration and Management (LDNR/CMD) is hereby establishing and implementing an effective QA plan. The QA plan is documented in this EPA required Quality Management Plan (QMP). The QMP describes how LDNR/ CMD plans, executes, and assesses its Quality System for the three programmatic elements of the Division-- the Permit/Mitigation Program, the Interagency Affairs Program, and the Support Services Program-- as part of its mission.

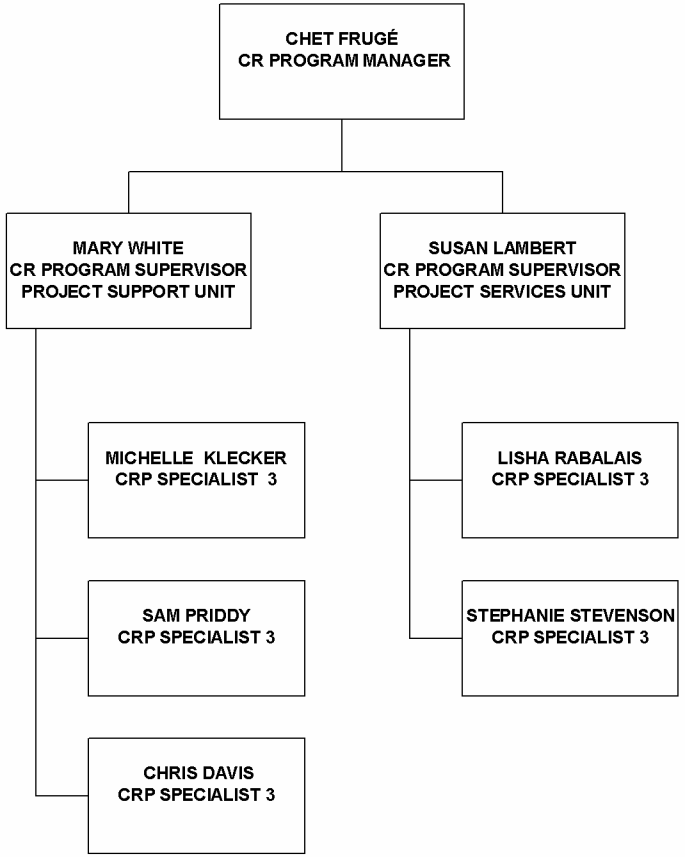
21.2 Organization Chart

The Assistant Administrator of LDNR/CMD is designated as the QA Manager of the CMD QMP. The LDNR and CMD Organization Charts are shown on pages 121 through 126 of this document.

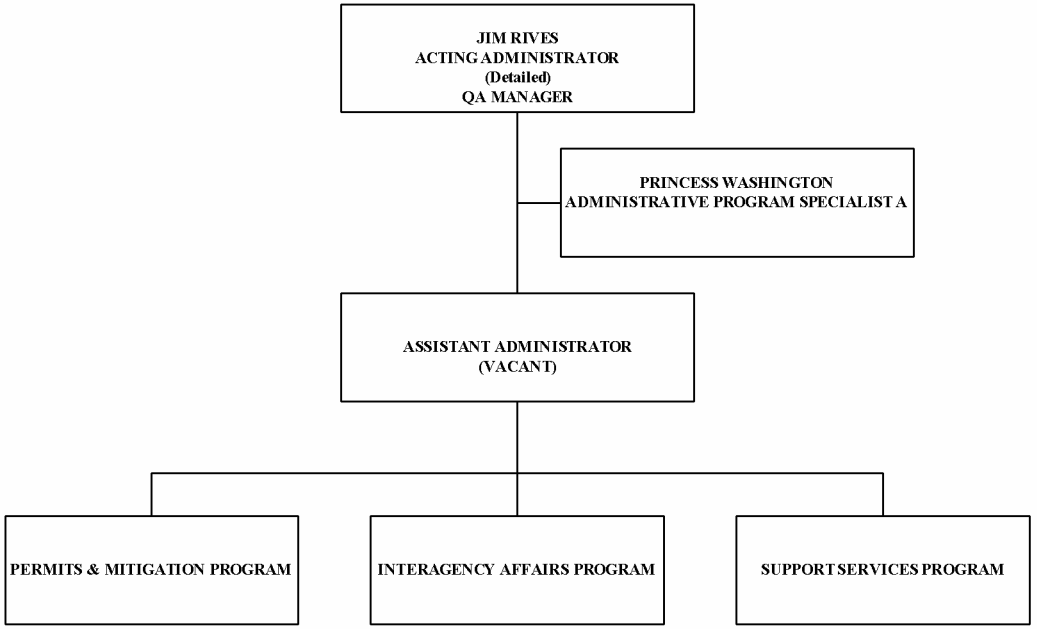
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION & MANAGEMENT
ASSISTANT SECRETARY'S OFFICE



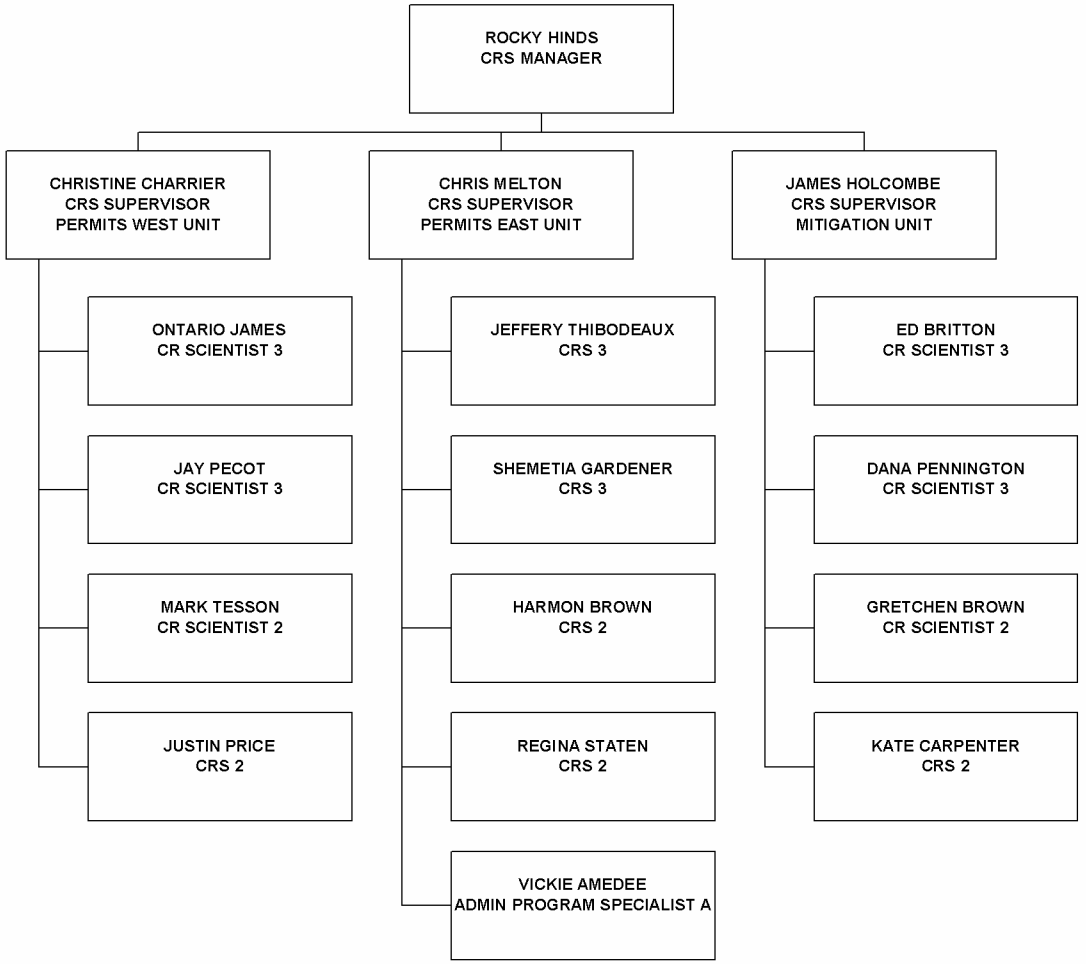
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
PROJECT SUPPORT & SERVICES SECTION



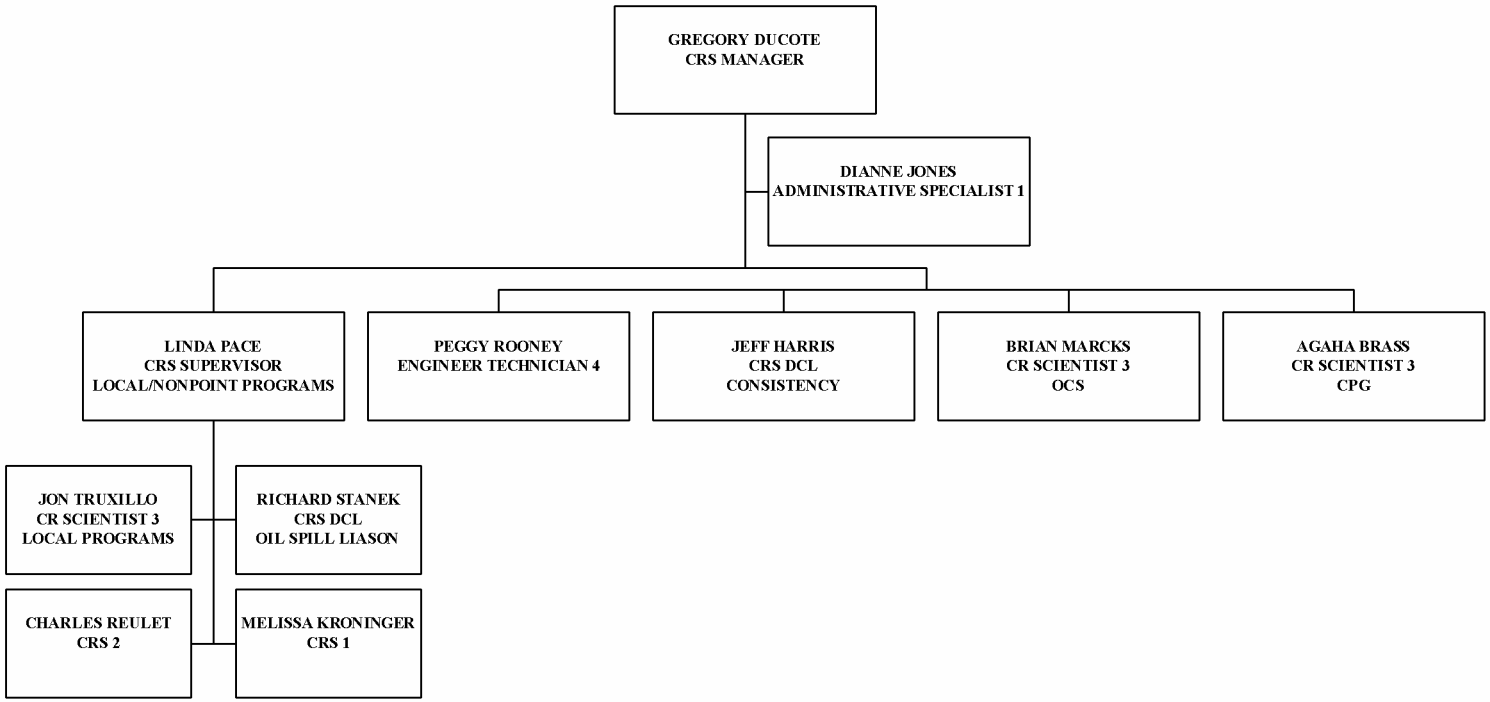
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL MANAGEMENT DIVISION
OVERVIEW OF SECTIONS



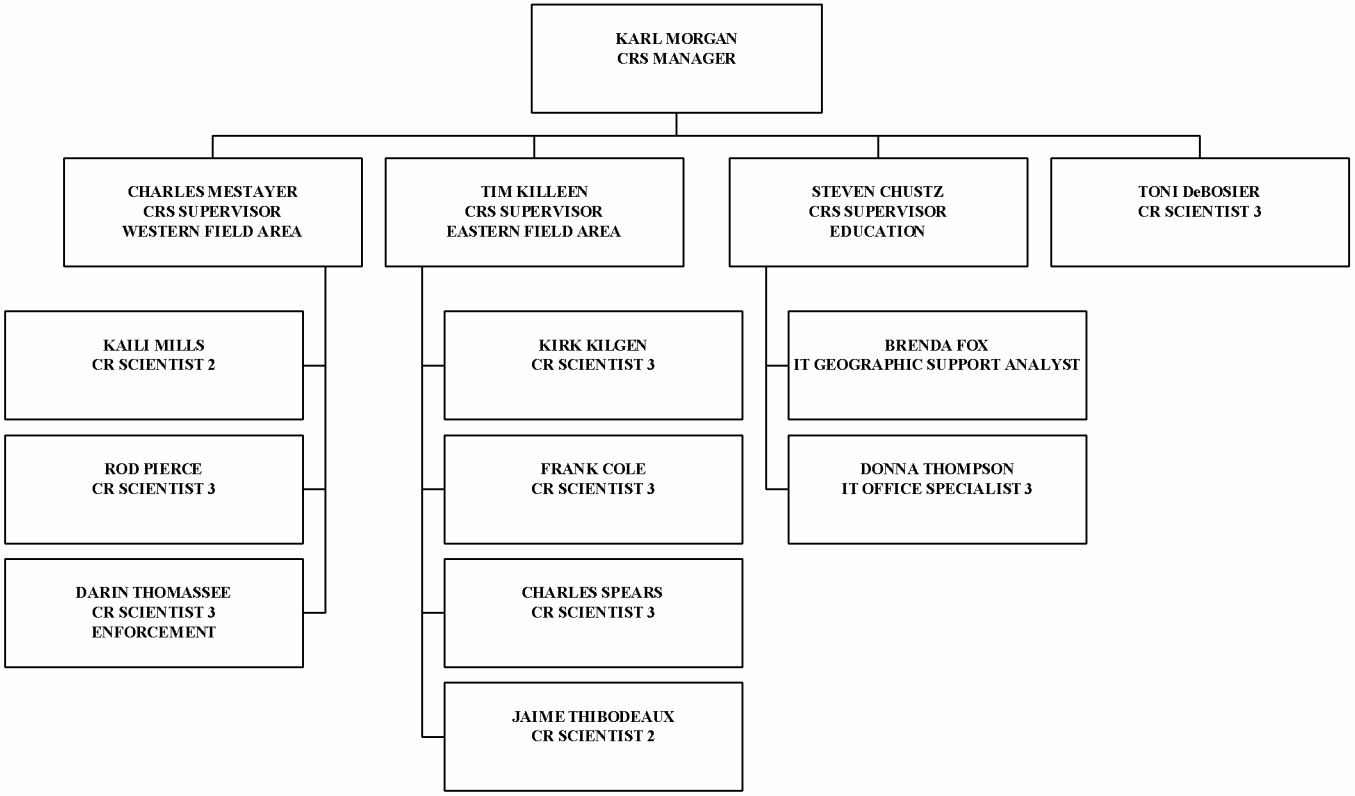
LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL MANAGEMENT DIVISION
PERMITS & MITIGATION PROGRAM



LOUISIANA DEPARTMENT OF NATURAL RESOURCE
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL MANAGEMENT DIVISION
INTERAGENCY AFFAIRS PROGRAM



LOUISIANA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF COASTAL RESTORATION AND MANAGEMENT
COASTAL MANAGEMENT DIVISION
SUPPORT SERVICES PROGRAM



21.3 Responsibilities and Authorities

The responsibilities of the QA Manager include the following:

- Keep informed of the latest QA developments;
- Updating CMD personnel on new QA policies and procedures;
- Coordinating with the three CMD Program Managers regarding EPA and LDNR/CMD QA policies;
- Acting as liaison between EPA Region 6 QA office and the CMD concerning LDNR/CMD QA issues.

The QA Manager reports directly to the Assistant Secretary of the Louisiana Department of Natural Resources Office of Coastal Restoration and Management.

21.4 Mission

The Coastal Management Division (CMD) of the Louisiana Department of Natural Resources (LDNR/CMD) is charged with implementing the LCRP under the authority of the State and Local Coastal Resources Management Act (SLCRMA) of 1978, as amended (LA. R.S. 49:214:21 – 214.41). The SLCRMA of 1978, as amended, declares that it is the public policy of the state:

- To protect, develop, and, where feasible, restore or enhance the resources of the state's coastal zone.
- To assure that, to the maximum extent feasible, constitutional and statutory authorities affecting uses of the coastal zone should be included within the Louisiana Coastal Management Program and that guidelines and regulations adopted pursuant thereto shall not be interpreted to allow expansion of governmental authority beyond those laws.
- To express certain regulatory and non-regulatory policies for the coastal zone management program. Regulatory policies are to form a basis for administrative decisions to approve or disapprove activities only to the extent that such policies are contained in the statutes of this state or regulations duly adopted and promulgated pursuant thereto. They are to be applicable to each governmental body only to the extent that each governmental body has jurisdiction and authority to enforce such policies. Other policies are non-regulatory. They are included in the Coastal Zone Management Plan to help set out priorities in administrative decisions and to inform the public and decision-makers of a coherent state framework, but such policies are not binding on private parties.
- To support and encourage multiple uses of coastal resources consistent with the maintenance and enhancement of renewable resource management and productivity, the need to provide for adequate economic growth and development

and the minimization of adverse effects of one resource use upon another, and without imposing any undue restriction on any user.

- To employ procedures and practices that resolve conflicts among competing uses within the coastal zone in accordance with the purpose of this Subpart and simplify administrative procedures.
- To develop and implement a coastal resources management program which is based on consideration of our resources, the environment, the needs of the people of the state, the nation, and of state and local government.
- To enhance opportunities for the use and enjoyment of the recreational values of the coastal zone.
- To develop and implement a reasonable and equitable coastal resources management program with sufficient expertise, technical proficiency, and legal authority to enable Louisiana to determine the future course of development and conservation of the coastal zone and to ensure that state and local governments have the primary authority for managing coastal resources.

21.5 Programs Supported by the Quality System

LDNR/CMD is divided among three separate and distinct programs that include the Permits/Mitigation Program (including the Joint Public Notice Coordinator System and State Coastal Wetlands Plan Coordination), the Interagency Affairs Program, and the Support Services Program. LDNR/CMD also maintains an Oil Spill Coordinator position (as part of the Governor's Office). The Permits/Mitigation Program is responsible for reviewing Coastal Use Permit applications for consistency with the Louisiana Coastal Resources Program (LCRP) and for coordinating compensatory mitigation efforts to offset unavoidable impacts resulting from permitted coastal uses. The Interagency Affairs Program is responsible for implementing four programmatic elements within the Division: Local Coastal Programs, Federal Consistency, Oil Spill Liaison, and the Coastal Nonpoint Pollution Control Program**.** The Support Services Program is comprised of the Enforcement and Monitoring Section, the Technical Services Section, and the Public Outreach Section.

21.5.1 Permits/Mitigation Program

Permits Section. LDNR/CMD administers the Coastal Use Permit (CUP) Program to determine if proposed coastal uses are consistent with the LCRP. The CUP is the basic regulatory tool of LDNR/CMD and is required for certain projects in the Coastal Zone. Permit application files and the concomitant data are living documents and are maintained at LDNR/CMD during application processing and after final disposition of the application. Data entry into the LDNR/CMD computer database is required for various aspects of the application. Documents from

commenting agencies, the public, and others that may affect final permit language are maintained in the files.

An example of internal QA/QC coordination within the Program is coordinator-level review of permit documents or other authorizations prior to final issuance by the Administrator. Two signatures, one by the permit analyst, the other by the coordinator, are required prior to submittal to the Administrator. Coordinator level personnel ensure comments received from external agencies are considered in the permit decision and that the rules, regulations, and policies of the LCRP are complied with. The Permits Section, generally at the coordinator level, coordinates with the Technical Services Section for permitting data entry, retrieval, and report generating and with the field personnel for project –specific work.

Mitigation Section. As part of the CUP application review, the permit staff works with applicants to ensure that impacts to coastal habitats are avoided and/or minimized, but in some instances development in the Coastal Zone causes unavoidable wetland impacts. In such cases, the LCRP's goal of no net wetland loss due to permitted activities cannot be accomplished without offsite habitat compensation. Using the U.S. Fish and Wildlife Service's Wetland Value Assessment Models, the Mitigation Section staff analyzes wetland impacts and develops a quantifiable wetland compensatory mitigation debt.

The Mitigation Section's internal QA/QC coordination involves working directly with permit analysts on projects with a compensatory mitigation element. Those project files are transmitted through the Mitigation Section coordinator who then assigns the project to Mitigation staff. The Mitigation staff works with members of the Permits staff and applicants during the permit application review process to develop a compensatory mitigation plan that will satisfy the compensatory mitigation debt for impacts associated with a proposed coastal use. Once the plan is developed the file is submitted for approval to the Mitigation Section coordinator for review.

Joint Public Notice Coordinator. The Joint Public Coordinator processes incoming coastal use permit applications, plots proposed coastal use locations on maps, and handles requests for additional information. Internal QA/QC coordination is handled by the Joint Public Notice contract manager who oversees the program and reports directly to the Permits Section Coordinator.

21.5.2 Interagency Affairs Program

The Interagency Affairs Program of CMD is responsible for implementing four programmatic elements within the Division: Local Coastal Programs, Federal Consistency, Oil Spill Liaison, and the Coastal Nonpoint Pollution Control Program.

Local Coastal Programs. The SCLRMA authorized the development, at the parish level, of local coastal management programs (LCP's). After the LCP has received federal and state approval, the parish becomes the permitting authority for coastal uses of local concern defined as "those uses which directly and significantly affect coastal waters and are in need of coastal management but are not uses of state concern and which should be regulated primarily at the local level if the local government has an approved program." The Local Coastal Programs (LCP) Section provides technical assistance, guidance and management to parishes in the development, approval, and implementation of local coastal programs. There are currently twelve parishes in the Coastal Zone with approved LCP's: Calcasieu, Cameron, Lafourche, Jefferson. St. Bernard, St. James, Orleans, Plaquemines, Terrebonne, and St. Tammany. Local programs for two additional parishes, St. Charles and St. John the Baptist, are in development.

QA/QC internal coordination in the administration and function of LCP's is designated in the Louisiana Administrative Code, title 43 Part I., Chapter 7, Title 43, *Subchapter D. Local Coastal Management Programs – Development, Approval, Modification, and Periodic Review of Local Coastal Management Programs*. Annual reports by each LCP describing its activities must be submitted to LDNR/CMD for review. LDNR/CMD conducts audits at least every two years of all approved LCP's to ensure consistency with the LCRP and the parish program. LDNR/CMD reviews and comments upon the reports. In connection with these meetings, Interagency Affairs (IA) holds a coastwide public meeting for comments on parish programs. IA also reviews parish activities and permits throughout the year for consistency with the LCRP through contract oversight.

Federal Consistency. The Consistency Section reviews proposed actions to determine if they are consistent with the Louisiana Coastal Resources Program. These actions include: actions by federal agencies (including any new policies or regulations) that may affect land use, water use, or the natural resources of the Coastal Zone; actions by private companies and/or individuals on federal properties such as National Wildlife Refuges; actions, even though occurring outside of the Louisiana Coastal Zone, which might affect land use, water use, or natural resources of the Coastal Zone; parish or local governments receiving federal

grants or loans such as HUD Block grants; and oil and gas exploration and production on the Outer Continental Shelf. The Consistency Section is fully funded through NOAA.

QA/QC internal coordination is accomplished by successive reviews of Consistency Determination requests- first by an analyst assigned to the project, then by coordinator-level personnel. A checklist showing required elements for Consistency review is completed. Two signatures on a review form for each Consistency request, signifying approval, are required prior to final issuance by the Administrator.

Oil Spill Liaison. The State, through LDNR, LOSCO (Louisiana Oil Spill Coordinator's Office), LDEQ, and LDWF (which are collectively referred to here as the "State Trustees"), is authorized to seek natural resource damages, including the reasonable costs to assess the damages, pursuant to Section 1002 of the Oil Pollution Act of 1990, 33 U.S.C. § 2702. The State is further authorized, pursuant to the Louisiana Constitution, article IX, sections 1 and 7, L.R.S. 36:601, et seq., L.R.S. 56:1, et seq., Louisiana Environmental Quality Act, L.R.S. 30:2001 et seq., the Louisiana Coastal Wetlands Conservation, Restoration, and Management Act, L.R.S. 49:213.1 et seq., and the Louisiana Oil Spill Prevention and Response Act, L.R.S. 30:2431 et seq., to recover damages for injury to natural resources caused by an Oil Spill.

The Trustees, through the Natural Resource Damage Assessment (NRDA) process, share responsibilities in assessing damages for injury to, destruction, loss, or lost use of natural resources and natural resource services resulting from, or potentially resulting from, oil spill incidents. The measure of damages to natural resources includes, but is not limited to, the cost of restoring, replacing, rehabilitating, or acquiring the equivalent of injured natural resources and/or services; interim lost uses pending recovery; reasonable costs incurred to assess such damages; and Trustee administrative oversight and procedural costs associated with planning, administering, implementing, and monitoring restoration actions. Consistent with their individual authorities and policies, the Trustees undertake a variety of actions in carrying out their responsibilities to assess injuries and achieve restoration objectives.

The Louisiana Natural Resource Trustees have begun a collaborative process with the public and industry to develop a Regional Restoration Planning (RRP) Program for oil spill incidents in the state. The goal of this effort is to streamline the NRDA process and to proactively identify and select feasible restoration projects prior to an oil spill incident, thereby shortening the damage assessment process. Implementing the RRP Program restores injured natural resources quickly for the public and does so at a lower cost to industry and the Trustees. The Oil Spill

Liaison acts as the lead LDNR representative in the development of the Louisiana RRP Program, providing departmental oversight of activities related to the development and implementation of the Program.

Coastal Nonpoint Pollution Control Program. The federal government has charged each coastal state with the responsibility of developing a program to prevent and reduce pollutants from nonpoint or widely diffuse sources that may impact the coastal waters. This program, pursuant to federal guidance, is a coordinated effort of the state's coastal and water quality agencies. The guidance stresses partnerships to reduce duplication and to improve results through close coordination of agency programs aimed at addressing nonpoint pollution. A statewide nonpoint source program, administered through the Louisiana Department of Environmental Quality (LDEQ), is currently in effect to protect the quality of streams, lakes, and groundwater. The two nonpoint programs have been coordinated and are linked through various efforts; one example is a Memorandum of Understanding, which delineates the responsibilities and geographic extent of each program. The coastal nonpoint program is currently conditionally approved by EPA.

The CNP program does not generate or collect its own data. Any data used by LDNR/CMD are collected from other partner agencies. The LDNR/CMD uses these data for reporting purposes only. Every effort is made to ensure that the data used are quality-controlled. Any reports that are generated by Coastal Resources Scientist staff personnel are reviewed by Coastal Resources Scientist Supervisors and Coastal Resources Scientist Program Managers.

21.5.3 Support Services Program

The Support Services Program is comprised of the Enforcement and Monitoring Section, the Technical Services Section, and the Public Outreach Section.

Enforcement and Monitoring. Enforcement and Monitoring Section personnel ensure that any unauthorized projects in the Coastal Zone are investigated and action is taken, in accordance with the LCRP, to resolve noncompliance issues. The program also monitors activities permitted by the CUP Program for adherence to permit conditions including mitigation activities. Activities not consistent with the Coastal Program may be considered a violation of the program. The entire coastal area is regularly monitored by the field investigative staff for compliance with permit conditions and unauthorized activities. The Enforcement Section also issues after-the-fact permits. LDNR/CMD has field offices in New Orleans, Houma,

Lafayette, and Lake Charles. There are two staff members in the New Orleans and Houma offices, one each in Baton Rouge, Lafayette and Lake Charles. Field staff conduct field inspections, support the Permit/Mitigation section, and provide assistance in Local Programs permitting.

QA/QC coordination for documents associated with enforcement actions within the section is accomplished by the requirement for review and signature at the coordinator level and again at the Program Manager level prior to issuance by the Administrator. Field personnel conducting follow-up field investigations to determine if permit conditions are adhered to submit inspection reports to the enforcement staff for review and, if necessary, coordinate with the Permit analyst. These investigations are reported using approved forms and include photographic documentation.

All permits that require monitoring of post-project obligations are entered into a database with a date for next action required. The staff produces reports from the database listing permits that require a follow-up inspection to ensure compliance.

Technical Services Section. The Technical Services Section is responsible for the Geographic Information Systems (GIS) databases and other information services for the Division. The basis of the LDNR/CMD GIS system is a database for each permit application, consistency determination request, and enforcement case. With the exception of the Enforcement database, these databases are available via the internet. Other GIS data sets created and maintained by LDNR/CMD include mitigation projects, mitigation areas, marsh management areas, and permitted pipelines and platforms. Over 25 data sets from other government agencies are incorporated into the LDNR/CMD GIS system. Using these systems, LDNR/CMD staff can conduct routine environmental impact studies before issuing permits and can provide research for most other programs. Additionally, for permit and consistency determinations, the Technical Services Section tracks habitat impacted by each coastal project and the habitat benefits (if any) of each project.

Public Outreach Section. LDNR/CMD's Outreach and Education program is designed to inform and educate the public, business, and industry about the Division's programs, policies, and functions. The Public Outreach Section publishes a series of brochures, a regular newsletter, and other printed materials that are made available for distribution to the public. The section also has teaching guides available for distribution with lesson plans for classroom use. The section makes available slide shows and videotapes on coastal and wetland issues. These media can be loaned or one of the staff will present to schools or other groups.

21.6 Implementation

LDNR/CMD assures that applicable elements of the Quality System are being implemented in all activities under its responsibility. Management creates a work environment in which all personnel work together to assure the quality assurance program produces the type and quality of the results expected.

21.7 Approval Page

Refer to Concurrences, QMP Pages xiii and xiv.

22.0 QUALITY SYSTEM COMPONENTS

22.1 Quality System Components

LDNR/CMD manages its quality system by utilizing a series of checks and balances inherent in its three programmatic elements. LDNR/CMD has developed and implemented the QMP according to EPA guidance. The QMP identifies the programmatic activities of the LDNR/CMD and describes the organizational structure, QA policies and procedures, functional responsibilities, levels of accountability and authority, and necessary interfaces.

22.1.1 Management Systems Reviews

CMD Management Systems Review consists of a series of reports including: a quarterly report to the Louisiana legislature that outlines permitted activities, impacts to wetlands, and compensatory mitigation for permitted wetland losses; a listing of permitting actions throughout the Coastal Zone.

22.1.2 Standard Operating Procedures

LDNR/CMD Standard Operating Procedures (SOP's) are, in general, found in various in-house manuals and policies and procedure memoranda. Examples of SOP's follow.

Permits/Mitigation Section. The Permits/Mitigation Program has developed a Permitting Manual as an instructional tool for permit analysts. The Permit Section also relies on internal policy and procedure memos for SOP's.

Joint Public Coordinator. The Joint Public Notice Coordinator has developed a manual for SOP's.

Federal Consistency. The Federal Consistency Section had developed a Consistency Manual for use by analysts. The Section also relies on internal policies and procedures memos for SOP's.

The QA Officer reviews and updates the SOP's and internal policies and procedures memoranda, if necessary, with the annual review of the QMP.

22.1.3 Technical Assessments

Periodic technical assessments are conducted by the LDNR/CMD Technical Services Section to determine the accuracy of data that is collected and entered into LDNR/CMD's computer databases.

22.1.4 Data Quality Assessments

Periodic assessments are conducted by the LDNR/CMD Technical Services Section to determine the quality of data collected and entered into the LDNR/CMD computer databases. LDNR/CMD strives for complete and accurate data in the applicable fields and databases using a series of data validation rules and queries built into the system. The data is reviewed and inconsistent data is corrected.

23.0 PERSONNEL QUALIFICATIONS AND TRAINING

23.1 Certifications Required and Qualifications

Personnel involved in projects requiring QA shall be qualified to perform assigned work. Those qualifications are assured by requisite minimum levels of education, as a qualification of initial hiring and internal training procedures.

23.1.1 Quality Assurance Officer Qualifications

The QA Officer is a working title, of which the incumbent must possess an acceptable knowledge of through education, training, and/or experience of the technical aspects of the QA program within his of her responsibility. The Officer must have as a minimum, a Bachelor of Science degree in one of the natural sciences fields and have accumulated at least four years of experience within his or her discipline. The Officer should possess general knowledge of all three of the programmatic elements of the LDNR/CMD. Additionally, the Officer should have sufficient administrative and professional status to deal effectively with project managers and organizational administrators and have an acceptable knowledge of the appropriate laws and regulations that govern the Louisiana Coastal Resources Program.

23.12 Technical Personnel

Staff personnel working in the three programmatic elements of LDNR/CMD must have the requisite education and experience to conduct assigned functions. Technical personnel within the LDNR/CMD are part of the Coastal Resources Scientist job series established by the Louisiana Department of Civil Service. The minimum qualifications for each position have been established by the State of Louisiana, Department of Civil Service. These qualifications can be found at the Louisiana Department of Civil Service website's page of job specifications at
http://www.dscs.state.la.us/classpay/jobspecs/csjobspc.htm.

23.2 Training Requirements for Personnel

Training programs will be administered, as necessary, to all personnel of LDNR/CMD who are deficient in skills required for their jobs. All personnel will be encouraged and solicited to attend and make presentations at professional meetings and to participate in meetings, workshops, and seminars that are relevant to the protection, development, and management of the state's coastal resources. Personnel are encouraged to identify and participate in external training and education opportunities that are pertinent to their realm of expertise. Personnel are expected to stay current on changes in the

Louisiana Coastal Resources Program as well as other changes in rules and regulations that affect Louisiana's coastal resources.

23.2.1 Training Needs

LDNR/CMD will identify training needs on a regular and continuing basis and will satisfy needs for all personnel involved in QA activities through the training programs described in this management plan. Training priorities will be established and satisfied based on the needs of individual projects.

23.2.2 Training Programs

LDNR/CMD provides continuing training and development to equip employees to perform particular tasks within a job assignment, deal with new regulatory or technical developments, develop additional work capabilities, and increase their level of work competence. Training available to LDNR/CMD personnel include course offered by external sources as well as in-house training.

External training courses, for example, those offered by the U.S. Geological Survey, National Wetland Research Center in Lafayette, Louisiana, that are pertinent to LDNR/CMD functions are made available to employees. Some of these courses include:

Corps of Engineers Wetland Delineation Certification Training
Introduction to Desktop GIS (ArcView) for Natural Resources
Introduction to GPS for Natural Resources
Introduction to ArcGIS I
National and Local Geospatial Data Availability: Data Mining
Introduction to the Identification of Wetland Forest Trees
Introduction to National Wetlands Inventory Classification System
Introduction to Desktop GIS (ArcView) for Natural Resources
Metadata for Geospatial and Biological Data
WETMAAP (Wetland Education through Maps and Aerial Photography)
Introduction to Wetland Remote Sensing and Mapping
Advance Wetland Photo-interpretation
LDNR/CMD employees are afforded the opportunity to attend periodic seminars, classes, and conferences as they become available

In-house training is required in all three programmatic elements of LDNR/CMD. Mentoring by senior level staff regarding day-to-day functions of the various sections, with gradual, systematic increase in complexity of work assignments is the standard

mode of training used throughout the programs. An example of in-house training in the Permits/Mitigation Program follows.

Entry level permit analysts are trained through a mentoring program whereby senior level staff are assigned to instruct new staff on the mechanics of processing Coastal Use Permit applications. Entry level staff are exposed to relatively simple proposed coastal uses/applications at the outset then are assigned more complex applications as their skills and expertise broaden. The training period is approximately six months before entry level personnel are placed in the general rotation of permit processing. Additionally, entry level permit analysts are required to review, with senior level staff, incoming permit applications for completeness.

Support Services has a training program consisting of review of regulations and guidelines with the Program Manager, assignment of new employees with each of the field investigators for training. Additionally, select members of the Permits/Mitigation and Interagency Affairs sections are scheduled for training sessions with the new employee.

Safety training is a critical component of LDNR/CMD, especially with field personnel due to exposure to potential hazards in land, sea, and air. All personnel will be required to attend safety training every 3 years. The following is a list of types of training required in this program:

Hazardous materials training (HAZMAT).

Water safety and boat handling: U.S. Coast Guard approved boat safety training required of all field personnel involved in boat operation.

First aid and CPR: Mandatory for field personnel and encouraged for office personnel.

All-terrain vehicle (ATV): Eight hours training by a certified instructor in the safety and use of an ATV before operation.

24.0 PROCUREMENT OF ITEMS AND SERVICES

24.1 Applicability

LDNR/CMD Program Managers have the responsibility of acquiring services needed to fulfill all the obligations and requirements of the Division. LDNR/CMD has an administrative staff that is responsible for administering contracts and legally binding agreements through which LDNR/CMD acquires or renders all goods (deliverables) and/or services.

24.2 QA Requirements

LDNR purchasing, individually and in conjunction with other state entities, operates under various statutes (Louisiana Revised Statutes (LRS)); administrative codes (Louisiana Administrative Codes (LAC)); and Executive Orders. The documents pertinent to procurement of equipment, services, and supplies include, but are not limited to:

a. LRS 39, Chapter 17, Louisiana Procurement Code
b. LAC 34, Part I, Rules and Regulations
c. Executive Order MJF 98-20 as amended by Executive Order No. MJF 00-29 (Small Purchases)
d. LRS 38:2211 et al, Chapter 10 (Construction/Public Works-Letting Bids)

The administrative staff have extracted and simplified these documents to provide in-house guidelines (unpublished Policy and Procedural Memoranda) that identify procedures to be followed to adequately track and manage contracts. The completed codification of procedures, however, appears in the above listed documents. Specific guidelines include, but are not limited to: (1) Requests for Contracts and Amendments, (2) Billing and Invoices, (3) Selection of Vendor, (4) Contracting Party Requirements, and (5) Purchasing Process. Checklists are provided to ensure submission and routing of appropriate information to minimize contracting and purchasing problems. The administrative staff are expected to, at a minimum:

1. Review and track all significant paperwork, including: project narrative; scope of services; budget; request for contracts and amendments or proposals; purchase and change orders; invoices; payments; ensure dual sign-off where needed for technical and administrative review; and ensure all commitments/requests of any kind are in writing and by the appropriate persons.
2. Ensure complete documentation and filing of all significant documents, correspondence, and other information.

3. Coordinate, develop, or initiate correspondence, written alternatives, recommendations, responses, and preventative actions to project concerns/problems.

4. Prepare post-assignment reports on all projects and contracts when completed.

5. Inquire and arrange for orderly transfer of project/contract management responsibilities.

6. Ensure that minority/disadvantaged business enterprises have the maximum opportunity to compete for and perform contracted services.

7. Personally inspect all purchases and deliverables and verify whether they are satisfactory and in keeping with the terms and conditions of the contract. Authorization or payment of invoices should not be processed until deliverables are in-hand or documented.

8. In the case of contracted facilities or laboratories, monitoring reports are provided by the contractor at the time of invoicing and reviewed by LDNR/CMD program managers for compliance and provided to the administrative staff. The LDNR/CMD program managers complete a performance evaluation form at the end of the contract period and provide this to the administrative staff. The review of the contractor includes evaluating compliance with LDNR/CMD standards and the contract conditions and deliverables.

25.0 QUALITY DOCUMENTATION AND RECORDS

25.1 Documents/Records Handling System

LDNR/CMD project management requires the collection and interpretation of environmental, regulatory, and project specific data from which permitting, mitigation, enforcement, and consistency decisions can be made. Proper document and record management are critical to ensuring that proposed coastal uses comply with the Louisiana Coastal Resources Program. The following procedures ensure that LDNR/CMD file documents (including comments from external resource and regulatory agencies) are maintained so that decisions affecting coastal users can be made in a well-informed and expedient fashion.

All documents and records are kept indefinitely, in either digital image, hardcopy or microfiche format, at the LDNR/CMD building in Baton Rouge. Permitting and consistency files have been maintained on the CMD computer database since 1990. Permit files from 1980 through 1988 have been converted to microfiche. Hardcopy files for 1990 through the present are maintained. Permit and consistency file information are also made available to the public via the CMD section of the OCRM website at http://www.dnr.louisiana.gov/crm and on the OCRM SONRIS database.

For every coastal use permit application, permit analysts enter permits and mitigation data onto code sheets that are, in turn, entered into the permits/mitigation database. Checks are made for data accuracy by the data entry technician. Periodic reports are run by the Technical Services Section, then reviewed by senior level personnel to detect obvious errors in the data. Consistency Section and Local Coastal Program databases are maintained in a similar manner. Enforcement databases are managed the same as the permit system, except habitat data are not tracked since if the work is allowed to remain it must be permitted and the permit record would capture the impacts, or the area must be restored.

25.2 Technical Guidance Documents (Preparation, Review, Approval, Issuance, Use, and Revision)

In-house technical guidance documents used by LDNR/CMD personnel include, but are not solely limited to, the Permits Manual, the Consistency Manual, the Joint Public Notice Coordinator Manual, in-house policies and procedures memoranda, and general permit conditions. These documents are periodically reviewed by the QA Officer for relevance and applicability within the dynamic framework of an evolving program. Upon determination of needed revisions, concurrence is obtained from the LDNR/CMD

Administrator and the revisions are finalized and implemented. All datasets released must be in conformance with Federal Metadata standards.

External technical guidance documents used by LDNR/CMD include:

The State and Local Coastal Resources Management Act (SLCRMA) of 1978, as amended (LA. R.S. 49:214.21-214.41);

The Louisiana Administrative Code, Title 43, Part I. Chapter 7; and

The Louisiana Coastal Resources Program Final Environmental Impact Statement (US Department of Commerce National Oceanic and Atmospheric Administration Office of Coastal Zone Management and Louisiana Department of Natural Resources Coastal Management Section 1980). (*This is the official program document for Federal approval pursuant to the Coastal Zone Management Act*).

In most cases, each staff member has copies of these documents. In some cases a designated individual acts as the keeper of the document(s).

25.3 Compliance Review/Record Retention

Coastal Use Permit applications in progress are periodically reviewed by the Program Manager and the Permit Section Coordinator to minimize permit processing delays. Compliance with laws, rules, and regulations and LDNR/CMD policies and procedures is ensured by having each permit document reviewed by at least two levels of supervisors (the Permit Section Coordinator or Permit/Mitigation Program Manager), then the Administrator.

26.0 COMPUTER HARDWARE AND SOFTWARE

26.1 Policy

It is a LDNR/CMD Quality Assurance Management Objective that data collected, analyzed, processed, and maintained in all processing systems, in support of environmental studies and data sets used to support the three programmatic elements of LDNR/CMD, be accurate and of sufficient integrity to support effective management of the Louisiana Coastal Resources Program.

26.2 Computer Hardware and Software Requirements

According to existing Department policy, the DNR Information Services Division (IS) provides assistance in determining whether or not the computer hardware and software used in LDNR/CMD meets EPA requirements.

The LDNR/CMD GIS databases and GIS data sets, located at the Louisiana Department of Natural Resources, Baton Rouge, Louisiana, is designed to efficiently handle the need for data acquisition, organization, and storage of permitting, consistency, enforcement, and coastal resources habitat data. The system has been designed to meet the need for optimal storage capacity, multiuser capability, and user friendliness. The primary function of this system is to provide a centralized data base for all information necessary to manage coastal use permit data, consistency data, enforcement data as well as to assist in the day-to-day operation of projects.

The LDNR/CMD database uses Filemaker Pro and ORACLE as its relational data base management system. The system is a component of the SONRIS 2000 (Strategic Online Natural Resources Information System) initiative within the LDNR. It is web enabled, so that users within and outside of LDNR can access and utilize the system via a thin client environment. The system server is a IBM Numa-Q which is capable of storing real-time, continuous, and discrete data.

Data base hardware components:

1. Local Processing Facility (IBM Numa-Q)—Stores the digital data sets, runs all necessary software.
2. Ethernet—Allows for the transfer of information between the local processing facility and the various pieces of hardware and software utilizing the TCP/IP protocol.
3. Novell/Windows NT Server Network—allows access to the data base from locations within the Baton Rouge LDNR building. Workstations are networked to electrostatic color plotters, color thermal printers, and LaserJet printers.

4. Tape Backup System—Allows the retrieval of data in the event of data loss. This system is equipped to with 10 DLT tape drives, 388 cartridge library.
5. External Modems—Versilar 8000 w/24 modems provide the means by which files can be imported and exported to and from the data base via remote access.
6. SGI O2 and Octane—These machines operate in a UNIX environment and house programs such as CPS-3, GIS, ARC/Info, Oracle, and Erdas, and permit large-scale data analysis functions.
7. Local Macintosh Network—Provides for desktop publishing, processing of GIS data, scanning images, producing slides, and other graphical media.

   Each employee at CMD is supplied with a Dell PC 586 or greater and has access to a networked LaserJet printer. These PCs are operated in a Windows NT environment with word processing done on Microsoft Word, spreadsheet analyses done on Excel 97 or Lotus 4.01, and statistics done on ESRI ArcGIS software. These PCs are networked and can communicate within LDNR and with the rest of the world via GroupWise 5.x, and Internet Explorer.

26.3 Information Security

It is important that the CMD information resources are protected from potential loss and misuse from a variety of accidental and deliberate causes. Therefore, all information resources are safeguarded to prevent such loss or misuse. Appropriate procedures have been developed by IS and are currently in place.

26.4 Documents

For proper implementation and maintenance of the LDNR/CMD program computer system, LDNR/CMD will rely on policies and procedures of the IS as well as any published literature provided by hardware and software vendors.

26.5 Personnel

Personnel involved in computer data collection systems, hardware and software, have adequate education, training, and experience to perform the assigned system functions.

27.0 QUALITY PLANNING

As a state regulatory agency, LDNR/CMD customers are federal resource and regulatory agencies, state, parish, and local governments and the public - comprising both industry and non-industry associated persons. Adherence to the tenets of the Louisiana Coastal Resources Program are of the foremost concern and QMP planning efforts are designed to meet that end.

The public expects LDNR/CMD to enforce the mandates enumerated in the Louisiana Coastal Resources Program in the public's overall interest. LDNR/CMD is expected to document its efforts through issuance of reports to EPA, the Louisiana state legislature, and to those federal agency partners associated with the State Wetland Conservation Plan.

28.0 IMPLEMENTATION OF WORK PROCESSES

28.1 Planned Work Procedures

Program managers will organize and plan activities to meet quality requirements consistently. Project plans will describe and include standard operation procedures. Implementation of these procedures will ensure that work is performed according to the Quality System.

28.2 Management Oversight and Personnel

28.2.1 Field Projects and Personnel

The follow-up reports submitted by the field investigators are reviewed by enforcement and monitoring staff and then forwarded to the permit staff for approval. Field investigations are submitted directly to the permit analyst for approval. Random reports are reviewed by the Program Manager for quality.

28.2.2 Scheduling

The level of management oversight and inspection from LDNR/CMD will be commensurate with the importance of the particular project and the intended use of the project results, and the QA Officer will periodically review programmatic procedures for acceptance.

28.2.3 Review of Procedures

Procedures for appropriate routine, standardized, special or critical activities will be reviewed annually by the QA Officer and be modified, developed and/or implemented as necessary.

28.2.4 Procedure Characterization

Procedures for programmatic operations will be devised and implemented as work plans, project plans, or more commonly, standard operating procedures. SOP's will be reviewed for adequacy by qualified personnel before they are implemented. Review, approval, and distribution and overall control of procedures are the responsibility of the QA Officer.

29.0 QUALITY ASSESSMENT AND RESPONSE

29.1 Scheduling of Assessments and Resource Allocation

Assessments of programmatic projects are planned, conducted, and evaluated to measure the effectiveness of the implemented quality system. Scheduling of assessments and allocation of resources are based on the status, risk, and complexity of the programmatic procedure or individual project. All assessments include an evaluation to determine whether the technical requirements of activities are being effectively met. Assessment planning may be done by either the LDNR/CMD Administrator, Assistant Administrator, or Program Manager.

29.2 Responsibility for Assessment Activities

The LDNR/CMD Administrator determines, during the planning process for each project, the type of assessment activity appropriate for each project. The QA Officer will assist the Administrator in determining the appropriate assessment tool and level of management responsible for evaluating particular activities.

29.3 Response to Assessments

The LDNR/CMD Administrator determines the appropriate action in response to the assessments. The QA Officer will determine the effectiveness of responses to assessments and maintain all documentation and correspondence relating to assessments and actions. Following any assessment event a written summation of needed changes will be prepared by the QA Officer and presented in a timely manner and documented. Project reports containing data or reporting the results of environmental data operations shall be reviewed through peer review. Final approval of such reports by the LDNR/CMD Administrator is required prior to distribution.

30.0 QUALITY IMPROVEMENT

30.1 Management Process and Responsibility

The LDNR/CMD system for detecting and preventing quality problems and for ensuring continuing quality improvement involves all levels of project and management staff. Those responsible for the day-to-day activities of LDNR/CMD have a duty to prevent the occurrence of problems that can affect the quality of the administration of the Louisiana Coastal Resources Program. Managers have the responsibility and authority to improve quality through revision of policy and procedures. The quality improvement system stems from and builds on the procedures described in Section 9.0, Quality Assessment and Response.

The system involves identification, planning, and implementation and evaluation of the effectiveness of quality management improvement activities. Evaluation of processes at the project level and of projects at the Program level is carried out on a regular basis. Quality management improvement activities are identified as assessment activities and the follow-up activities that are in response to the assessments carried out. This includes corrective actions described in the following sections. Specific corrective actions are identified and implemented at the time of the problem. Once a corrective action has taken place, the LDNR/CMD Administrator evaluates the effectiveness of the action. This is reported to the QA Officer, who makes the final evaluation of the corrective action, and any recommendations on further quality improvement needed.

All LDNR/CMD staff working on projects for which this document applies are responsible for identifying, planning, implementing and evaluating the effectiveness of quality improvement activities. Staff will report quality problems as they are detected to their supervisor or directly to the QA Officer.

30.2 Corrective Action Program

Whenever the procedures and guidelines established in this program are not successful in assuring the quality of work of the LDNR/CMD Programs, corrective action is required to ensure that conditions adverse to quality are identified promptly and corrected as soon as is practicable. Corrective actions shall include the identification of root causes of problems, determination of whether the problem is unique or has more general implications, and recommendations for preventing the recurrence of the problem. Corrective action must be initiated if variance from proper protocol is noted. Reporting to the program manager will ensure that early and effective corrective action will be taken when actions of the LDNR/CMD Programs fail to meet acceptable standards. The responsibility to oversee and implement the required corrective actions

will be carried out by the program manager. The LDNR/CMD Administrator and QA Officer will be informed of such activities. Follow up evaluations will be conducted by the QA Officer to ensure effectiveness of the corrective action.

The corrective action plan includes taking recommended actions and making changes to eliminate or correct problems with quality. Variances which require corrective action include but are not limited to failure to include resource/regulatory comments in making permit/mitigation decisions; errors in data entry in permit, mitigation, and/or consistency databases; unnecessary protracted processing review times, failure to provide local programs with needed programmatic information; and file mismanagement. However, a formal correction action program is difficult to establish that would cover all possible items in the three programs of LDNR/CMD.

30.2.1 Process for Corrective Action

The general process for corrective action includes the following steps:

1. Any staff member of LDNR/CMD can begin the corrective action process. Upon identification of a potential problem, staff meets with all involved parties and the appropriate levels of management to discuss the problem identified or any tasks that may relate to or affect the quality of the function of the particular Program. Management and the QA Officer determine if a problem exists, and what it is, through the meeting process. Additional information may be required to determine the nature and extent of the problem. If so, that information will be obtained and evaluated by the parties involved.
2. Once a problem has been identified, procedures may have to be modified or revised to correct the problem.
3. Retraining or provision of additional training will be carried out as necessary to ensure that staff are aware of the problem and revised procedures are in place to correct the problem.
4. Follow up evaluations will be conducted by the QA Officer to ensure the effectiveness of the corrective action. The QA Officer, in coordination with the LDNR/CMD Administrator, will determine if any more action is required and may make any recommendations for preventing the occurrence of the problem.

31.0 DEFINITIONS

LIST OF ACRONYMS

ANOVA	analysis of variance
ATV	all-terrain vehicle
CED	Coastal Engineering Division
CEI	Coastal Ecology Institute
CMD	Coastal Management Division
CPUE	catch per standard unit of effort
CRD	Coastal Restoration Division
CV	coefficient of variation
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
DAPS	data automatic processing system
DCP	data collection platforms
DOTD	Department of Transportation and Development (Louisiana)
GALP	general automated laboratory procedures
GIS	Geographic Information System
GOES	geostationary operational environmental satellite
GPS	Global Positioning Systems
LAC	Louisiana Administrative Codes
LAN	local area network
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LSU	Louisiana State University
LRS	Louisiana Revised Statutes
MS	Monitoring Section
NGSM	National Geodetic Survey Monuments
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NWI	National Wetlands Inventory
NWRC	National Wetlands Research Center
OCRM	Office of Coastal Restoration and Management
PC	personal computer
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
RDBMS	relational database management system
RSD	relative standard deviation
SAB	Spatial Analysis Branch
SET	sedimentation erosion table

SONRIS	Strategic Online Natural Resources Information. System (database created using ORACLE software)
SOP	standard operating procedure
TAG	Technical Advisory Group
TL	total length
TM	thematic mapper
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
WVA	wetland value assessment

Units Definitions

Prefix	Symbol	Units
pico	p	10^{-12}
nano	n	10^{-9}
micro	M	10^{-6}
milli	m	10^{-3}
centi	c	10^{-2}
deci	d	10^{-1}
kilo	k	10^{3}
mega	M	10^{6}
giga	G	10^{9}
tera	T	10^{12}

Conversion Table

multiply English Units by		to obtain metric units
inch (in)	25.4	millimeter (mm)
cubic inch (in^3)	16.39	cubic centimeter (cm^3)
square inch (in^2)	6.452	square cm (cm^2)
foot (ft)	0.3048	meter (m)
square foot (ft^2)	0.0929	square meter (m^2)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
mile (mi)	1.609	kilometers (km)
nautical mile	1.853	kilometers (km)
square mile (mi^2)	2.59	square kilometer (km^2)
mile per hour (mi/h)	1.609	kilometer per hour (km/h)
acre	0.4047	hectare (ha)
acre-foot (acre-ft)	1233	cubic meter (m^3)
fluid ounce (fl oz)	0.02957	liter (L)
gallon (gal)	3.785	liter (L)
gallon (gal)	0.003785	cubic meter (m^3)
pounds (lb)	453.59	grams (g)
knots (knots)	51.48	cm per second (cm/s)

Temperature Conversion

Degrees Fahrenheit = (1.8) x (degrees Celsius + 32)

32.0 SELECTED BIBLIOGRAPHY

Bass, A.S., C.F. Robertson, W.K. Rhinehart. 2006. *Office of Coastal Restoration and Management Fiscal Year 2007 Quality Management Plan*. Louisiana Department of Natural Resources, Baton Rouge, LA. 98pp.

Boesch, D.F., M.N. Josselyn, A.J. Mehta, J.T. Morris, W.K. Nuttle, C.A. Simenstad, and D.J. Swift 1994. Scientific assessment of coastal wetland loss, restoration and management in Louisiana. Journal of Coastal Research, Special Issue No. 20. 103 pp.

Day, John W. Jr., C.A.S. Hall, W.M. Kemp and A. Yanez-Arancibia 1989. *Estuarine Ecology*. New York: John Wiley and Sons. 558 pp.

Department of Civil Service 1992. Adverse Actions, Investigations and Resignations. Civil Service Rules, Chapter 12. Baton Rouge: State of Louisiana.

Folse, T. M. and J. L. West. 2005. A Standard Operating Procedures Manual for the Louisiana Department of Natural Resource's Coastal Restoration Division: Methods for Data Collection, Quality Assurance / Quality Control, Storage, and Products. Louisiana Department of Natural Resources, Baton Rouge, LA. 158 pp.

Gray, J.S., and K. Jensen. 1993. Feedback monitoring: a new way of protecting the environment. Trends in Evolution and Ecology 8(8):267-268.

Louisiana Administrative Code 1999. Professional and Occupational Standards. Chapter 21. Professional Conduct.

Louisiana Department of Natural Resources, 1999. *Coast 2050: Toward a Sustainable Coastal Louisiana- The Appendices: Appendix A- Federal/State/Local Partnership and Public Involvement*. Report of the Louisiana Coastal Wetlands Conservation and Restoration Task Force, and the Wetlands Conservation and Restoration Authority. 258 pp.

Louisiana Department of Natural Resources. 2004. A Contractor's Guide to Minimum Standards, Coastal Restoration Division.

Novak, Charles E. 1985. WRD Data Reports Preparation Guide. Reston Va.: U. S. Geological Survey, Water Resources Division. 300 pp.

Smith, F., S. Kulkarni, L.E. Myers and J.J. Messner 1988. Evaluating and presenting quality assurance sampling data. Pp. 157-168 in L.H. Keith, ed., *Principles of Environmental Sampling*. Washington, D.C.: American Chemical Society.

Stanley, T.W. and S.S. Verner 1985. The U. S. Environmental Protection Agency's quality assurance program. Pp. 12-19 in J.K. Taylor and T.W. Stannley, eds., *Quality Assurance for Environmental Measurements*. Philadelphia, Penn.: American Society for Testing and Materials STP 867.

Steyer, G.D. and D.W. Llewellyn. 2000. Coastal Wetlands Planning, Protection, and Restoration Act: A Programmatic Application of Adaptive Management. Ecological Engineering: The Journal of Ecotechnology. Submitted September 1998; accepted March 2000.

Steyer, G.D., R.C. Raynie, D.L. Steller, D. Fuller and E. Swenson. 2000. *Quality Management Plan for Coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program*. Open-file series no. 95-01 (Revised June 2000). Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97pp.

Taylor, J.K. 1988. *Quality Assurance of Chemical Measurements*. Chelsea, Mich.: Lewis Publishers. 328 pp.

Underwood, A.J. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecological Applications 4:3-15.

U.S. Environmental Protection Agency, 1995. *Good Automated Laboratory Practices: Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations, with Implementation Guidance*, EPA/2185, Office of Information Resources Management.

U.S. Environmental Protection Agency Order 5360.1 A2 (May 2000), Policy and Program Requirements for the Mandatory Quality Assurance Program, U.S. Environmental Protection Agency, Washington, DC.

U.S. Environmental Protection Agency, 2000. *Guidance for the Data Quality Objectives Process (QA/G-4),* EPA Office of Environmental Information

U.S. Environmental Protection Agency, 2001. *EPA Requirements for Quality Management Plans (QA/R-2)*, EPA/240/B-01/002, Office of Environmental Information.

U.S. Environmental Protection Agency, 2001. *Requirements for Quality Assurance Project Plans for Environmental Data Operations (QA/R-5)*, EPA Office of Environmental Information

U.S. Environmental Protection Agency, 2002. *Guidance for Quality Assurance Project Plans (QA/G-5)*, EPA Office of Environmental Information

U.S. Environmental Protection Agency, 2002. *Guidance for Quality Assurance Project Plans for Modeling (QA/G-5M)*, EPA Office of Environmental Information