CYPRESS CREEK BASIN FISCAL YEAR 2006-2007
Quality Assurance Project Plan

Northeast Texas Municipal Water District
P.O. Box 955
Hughes Springs, Texas 75656

Clean Rivers Program
Monitoring Operations Division
Texas Commission on Environmental Quality
P.O. Box 13087, MC 165
Austin, Texas 78711-3087

Effective Period: 1 September 2005 through 31 August 2007

Questions concerning this Quality Assurance Project Plan should be directed to:

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A1 APPROVAL PAGE

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Monitoring Operations Division

____
Steve Spaw, Director Date
Monitoring Operations Division

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Patrick Roques, Manager Date
Water Quality Monitoring & Assessment Section

____
Laurie Curra Date
Program Manager, Clean Rivers Program

____
Jennifer Delk Date
Project Manager, Clean Rivers Program

Compliance Support Division

____
Jose A. Franco, Director Date
Compliance Support Division

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Stephen Stubbs Date
TCEQ Quality Assurance Manager

____
Sharon Coleman Date
Acting CRP Quality Assurance Specialist
Quality Assurance Section

CYPRESS CREEK BASIN PLANNING AGENCY
Northeast Texas Municipal Water District

____
Walt Sears, Jr., General Manager Date

____
Paul Price, Project Manager Date

____
Peggy Jones Date
Quality Assurance Officer/Data Manager

The Cypress Creek Basin Planning Agency will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in this quality assurance project plan and any amendments or added appendices of this plan. The Cypress Creek Basin Planning Agency will maintain this documentation as part of the project's quality assurance records, and will be available for review.

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LIST OF ACRONYMS

AVS	**Acid Volatile Sulfide**
AWRL	**Ambient Water Reporting Limit**
BMP	**Best Management Practices**
CAR	**Corrective Action Report**
CLI	**Caddo Lake Institute**
COC	**Chain-of Custody**
CRP	**Clean Rivers Program**
DM	**Data Manager**
DMP	**Data Management Plan**
DOC	**Demonstration of Capability**
DQO	**Data Quality Objective**
FCWD	**Franklin County Water District**
FY	**Fiscal Year**
HDR	**HDR Engineering, Inc.**
MDMA	**Monitoring Data Management & Analysis**
N/A	**Not Applicable**
NETMWD	**Northeast Texas Municipal Water District**
PM	**Project Manager**
QA	**Quality Assurance**
QM	**Quality Manual**
QAO	**Quality Assurance Officer**
QAPP	**Quality Assurance Project Plan**
QAS	**Quality Assurance Specialist**
QC	**Quality Control**
QMP	**Quality Management Plan**
RBP	**Rapid Bioassessment Protocol**
RL	**Reporting Limit**
RWA	**Receiving Water Assessment**
SC	**Sampling Coordinator**
SOP	**Standard Operating Procedure**
SWQM	**Surface Water Quality Monitoring**
TC	**Technical Coordinator**
TMDL	**Total Maximum Daily Load**
TCEQ	**Texas Commission on Environmental Quality**
TRACS	**TCEQ Regulatory Activities and Compliance System**
TSWQS	**Texas Surface Water Quality Standards**
VOA	**Volatile Organic Analytes**
WMT	**Watershed Management Team**

A3 DISTRIBUTION LIST

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P.O. Box 13087
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The Cypress Creek Basin Planning Agency will provide copies of this project plan and any amendments or appendices of this plan to each person on this list and to each sub-tier project participant, e.g., subcontractors, other units of government, laboratories. The Cypress Creek Basin Planning Agency will document distribution of the plan and any amendments and appendices, maintain this documentation as part of the project's quality assurance records, and will be available for review.

A4 PROJECT/TASK ORGANIZATION

Description of Responsibilities

TCEQ

Laurie Curra
CRP Program Manager

Responsible for TCEQ activities supporting the development and implementation of the Texas Clean Rivers Program. Responsible for verifying that the QMP is followed by CRP staff. Supervises TCEQ CRP staff. Reviews and responds to any deficiencies, nonconformances, or findings related to the area of responsibility. Oversees the development of QA guidance for the CRP. Reviews and approves all QA audits, corrective actions, reviews, reports, work plans, contracts, QAPPs, and program QMP. Enforces corrective action, as required, where QA protocols are not met. Ensures CRP personnel are fully trained.

Sharon Coleman
Acting CRP Lead Quality Assurance Specialist

Participates in the development, approval, implementation, and maintenance of written quality assurance standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Assists program and project manager in developing and implementing quality system. Serves on planning team for CRP special projects. Coordinates the review and approval of CRP QAPPs. Prepares and distributes annual audit plans. Conducts monitoring systems audits of Planning Agencies. Concurs with and monitors implementation of corrective actions. Conveys QA problems to appropriate management. Recommends that work be stopped in order to safeguard programmatic objectives, worker safety, public health, or environmental protection. Ensures maintenance of QAPPs and audit records for the CRP.

Jennifer Delk
CRP Project Manager

Responsible for the development, implementation, and maintenance of CRP contracts. Tracks deliverables. Participates in the development, approval, implementation, and maintenance of written quality assurance standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Assists CRP Lead QA Specialist in conducting Planning Agency audits. Verifies QAPPs are being followed by contractors and that projects are producing data of known quality. Coordinates project planning with the Planning Agency Project Manager. Reviews and approves data and reports produced by contractors. Notifies QA Specialists of circumstances which may adversely affect the quality of data derived from the collection and analysis of samples. Develops, enforces, and monitors corrective action measures to ensure contractors meet deadlines and scheduled commitments.

Eric Reese
CRP Data Manager

Responsible for coordination and tracking of CRP data sets from initial submittal through CRP Project Manager review and approval. Performs automated data validation routines and coordinates error correction. Provides quality assured data sets to TCEQ Information Resources in compatible formats for uploading to the statewide database. Generates reports to assist CRP Project Managers' data review. Provides training and guidance to CRP and Planning Agencies on technical data issues. Reviews and approves data-related portions of program QMP and project-specific QAPPs. Develops and maintains Standard Operating Procedures for CRP data management.

Laurie Curra
CRP Project Quality Assurance Specialist

Serves as liaison between CRP management and TCEQ QA management. Participates in the development, approval, implementation, and maintenance of written quality assurance standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Serves on planning team for CRP special projects. Coordinates documentation and implementation of corrective action for the CRP.

CYPRESS CREEK BASIN PLANNING AGENCY
Northeast Texas Municipal Water District

Walt Sears, Jr.
General Manager

Mr. Sears is the Executive Director of the Northeast Texas Municipal Water District (NETMWD) and is a member of the Steering Committee for the Cypress Creek Basin Clean Rivers Program. Mr. Sears will provide coordination and cooperation between the Cypress Creek Basin Steering Committee and HDR Engineering, Inc. (HDR).

HDR Engineering, Inc.

Paul Price
Cypress Creek Basin, Project Manager

As Project Manager, Mr. Price will be responsible for contact and coordination with NETMWD, TCEQ and other entities participating in the Cypress Creek Basin Clean Rivers Program activities. Mr. Price will be responsible for implementing and monitoring CRP requirements in contracts, QAPP's and QAPP amendments and appendices. Mr. Price will designate HDR Engineering, Inc. staff with subordinate responsibility, and will oversee task progress and deliverables. He will be responsible for Conference Calls, CRP Meetings, Workshops, initial Quality Assurance with the Technical Coordinator and amending the QAPP to reflect any updates. He will also be responsible in performing necessary data analysis and development of conclusions and recommendations in technical deliverables. Ms. Jones and Mr. Thomas will assist Mr. Price as necessary on behalf of the Cypress Creek Basin Cypress Creek Basin Planning Agency to ensure that 1) monitoring systems audits are conducted to verify that QAPP's are followed by the Cypress Creek Basin Planning Agency participants; 2) projects are producing data of known quality; 3) subcontractors are qualified to perform contracted work; 4) CRP project managers and/or QA Specialists are notified of deficiencies and nonconformances, and that issues are resolved; and 5) the validation of collected data are acceptable for reporting to the TCEQ.

Peggy Jones
Cypress Creek Basin Quality Assurance Officer/Data Manager

Ms. Jones will be responsible for coordinating the implementation of the Quality Assurance program that includes identifying, receiving, and maintaining project quality assurance records. This responsibility includes periodic contacts to obtain updates from the entities conducting monitoring or other activities relevant to the Cypress Creek Basin Clean Rivers Program, obtaining the results of water quality and biological analyses of samples collected by the Cypress Creek Basin field sampling personnel and coordinating with the TCEQ QAS to resolve QA-related issues. Ms Jones will be responsible for the determination and validation of all data collected to ensure the data quality objectives of the project are met and suitable for reporting to the TCEQ. Ms. Jones will notify Mr. Price of particular circumstances which may adversely affect the quality of data. Ms. Jones coordinates and monitors deficiencies, nonconformances and corrective action, coordinates and maintains records of data verification and validation, and coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. She will assist with the data management phase of the monitoring systems audit procedures for the Cypress Creek Basin Planning Agency.

As the Data Manager, Ms. Jones will be responsible for ensuring that field data are properly reviewed and verified. Ms. Jones will be responsible for the transfer of basin quality-assured water quality and biological data to the TCEQ in a format compatible with the SWQM portion of the TRACS database. The Data Manager will also document task progress and track labor and non-labor expenditures to produce the necessary reimbursement forms and progress reports specified in the CRP contract. Ms. Jones will coordinate with Ms. Riddington to provide current, readily available information for website use. Ms. Jones will be responsible for the basin Data Management Plan and assist Mr. Price and Mr. Thomas in their duties as necessary on behalf of the Cypress Creek Basin Cypress Creek Basin Planning Agency.

David Thomas
Cypress Creek Basin, Technical Coordinator

As Technical Coordinator, Mr. Thomas will be responsible for writing and maintaining the QAPP and monitoring its implementation that involves maintaining records of QAPP distribution (including appendices and amendments) and maintaining written records of sub-tier commitment to requirements specified in this QAPP. Mr. Thomas will be responsible for the supervision (through direct contact with the Sampling Coordinator) of all CRP field activities, including water quality and biological sampling and monitoring, and including equipment preparation, sampling, sample preservation, fieldwork, sample transport, and chain-of-custody maintenance in compliance with the approved QAPP. Mr. Thomas will be responsible for field direction of the biological monitoring efforts, analyzing samples, and producing both field and laboratory biological indices. Mr. Thomas will conduct a monitoring systems audit on the Cypress Creek Basin Planning Agency participants to verify and assure compliance specified in the QAPP. In cooperation with the Sampling Coordinator, Mr. Thomas will ensure that field staff is properly trained and that training records are maintained. Mr. Thomas will assist Mr. Price and Ms. Jones in their duties as necessary on behalf of the Cypress Creek Basin Planning Agency.

Christa Riddington
Cypress Creek Basin, Web Resources Manager

Ms. Riddington will be responsible for maintaining and updating the NETMWD (www.netmwd.com) website to ensure that all information, announcements, and materials remain current and relevant. The Web Resources Manager will communicate regularly with the Quality Assurance Officer/Data Manager to provide the public with easy access to detailed information regarding CRP activities.

Dr. Roy Darville
Caddo Lake Institute, Sampling Coordinator

Dr. Darville is a professor and chair of the Department of Biology at East Texas Baptist University and will be responsible for performing field sampling and data processing duties in accordance with standard operating procedures (SOP's), data quality objectives (DQO's) and this QAPP, reporting to the Technical Coordinator any deviation from SOP's or DQO's, maintaining proper documentation of sampling events, sample preservation, sample shipment, and field procedures at CRP designated stations. Dr. Darville will review data from monitoring events and provide data quality comments to the QAO. Dr. Darville will also participate in the training of local partners interested in participating in the monitoring plan sampling efforts to provide quality assured data for the CRP database and will oversee the work of the monitoring partners during the sampling events.

Cypress Creek Basin Sampling Staff

The sampling staff will be composed of various personnel provided by HDR Engineering, Inc., NETMWD, Franklin County Water District (FCWD), Caddo Lake Institute (CLI) and Titus County Fresh Water Supply District (TCFWSD). The primary responsibility will be to assist the technical and sampling coordinators in performing all field activities, including water quality and biological sampling and monitoring in compliance with the approved QAPP.

Bill Peery, Jr.,
Laboratory Manager, Ana-Lab Corporation

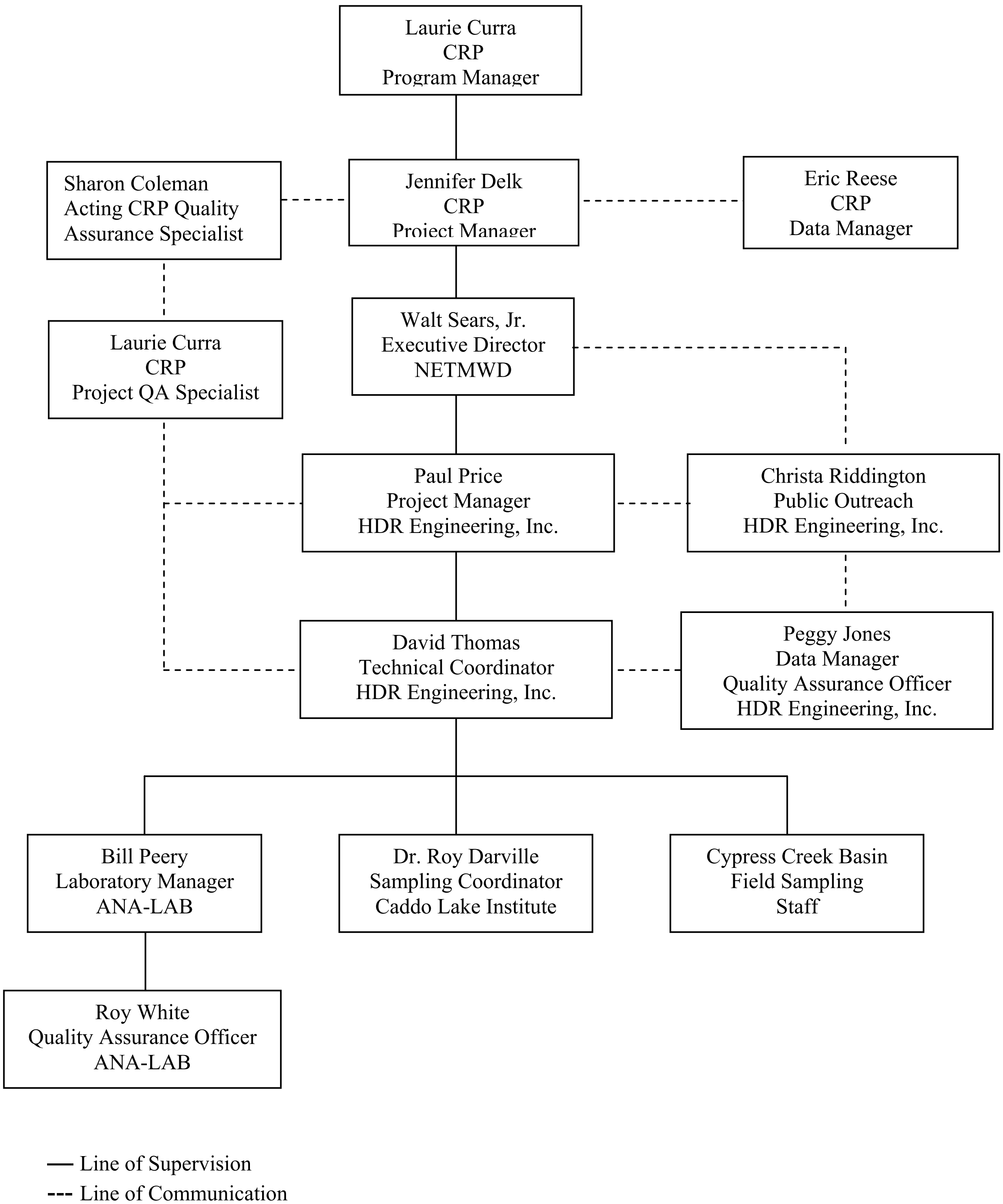
Mr. Peery will provide supervision for laboratory procedures and will serve as the primary point of contact for all laboratory activity conducted by Ana-Lab Corporation.

Roy White
Quality Assurance Officer, Ana-Lab Corporation

Mr. White will provide supervision for laboratory procedures, provide laboratory quality assurance/quality control and will be responsible for updating the laboratory's QAP.

PROJECT ORGANIZATION CHART

Figure A4.1. Organization Chart - Lines of Communication



A5 PROBLEM DEFINITION/BACKGROUND

In 1991, the Texas Legislature passed the Texas Clean River Act (Senate Bill 818) in response to growing concerns that water resource issues were not being pursued in an integrated, systematic manner. The Act requires that ongoing water quality assessments be conducted for each river basin in Texas, an approach that integrates water quality issues from a watershed or basin management perspective through the Texas Clean Rivers Program (CRP). The Texas Commission on Environmental Quality (TCEQ) administers the CRP in partnership with river authorities, municipal water authorities, councils of government, and other regional entities for each of the 23 river basins and coastal basins in Texas. The CRP legislation mandates that "each river authority (or local governing entity) shall submit quality-assured data collected in the river basin to the commission." "Quality-assured data" in the context of the legislation means "data that comply with commission rules for surface water quality monitoring programs, including rules governing the methods under which water samples are collected and analyzed and data from those samples are assessed and maintained." Water quality data gathered for the CRP enables examination of current water quality, potential water quality concerns, and the assessment of possible causes of impairments. Examination and statistical analysis of long-term data allows comparisons of current and historical water quality data to detect trends in the improvement or degradation of water quality parameters.

This QAPP addresses the program developed between the Cypress Creek Basin Planning Agency and the TCEQ to carry out the activities mandated by the legislation. The QAPP was developed and will be implemented in accordance with provisions in the most recent version of the *Quality Management Plan for the Clean Rivers Program*.

The purpose of this QAPP is to clearly delineate Cypress Creek Basin Planning Agency QA policy, management structure, and procedures which will be used to implement the QA requirements necessary to verify and validate the surface water quality data collected. The QAPP is reviewed by the TCEQ to help ensure that data generated for the purposes described above are scientifically valid and legally defensible. This process will ensure that data collected under this QAPP and submitted to the statewide database have been collected and managed in a way that guarantees its reliability and therefore can be used in water quality assessments and other programs deemed appropriate by the TCEQ. Project results will be used to support the achievement of Clean Rivers Program objectives as contained in the *Clean Rivers Program Guidance and Reference Guide FY 2006 -2007*.

The Cypress Creek Basin, shown in Figure A5.1, is located in Northeast Texas, between the Sulphur River Basin on the north and the Sabine River Basin on the west and south. Big Cypress Creek and its tributaries drain the 2,933 square mile watershed. Big Cypress Creek is itself a tributary of the Red River, which it joins near Shreveport, Louisiana where it is known as Twelve-Mile Bayou.

The Cypress Creek Basin in Texas has a palmate organization, with three major watersheds converging at the lowermost segment of Big Cypress Creek (Segment 0402). The four largest reservoirs in the basin are Caddo Lake (Segment 401), Lake O' the Pines (Segment 403), Lake Bob Sandlin (Segment 408) and Lake Cypress Springs (Segment 405). These four reservoirs are impoundments of Big Cypress Creek and are designated for use as public water supplies. Four smaller reservoirs (Monticello, Welch, Ellison Creek, and Johnson Creek) have been constructed on tributary streams to be used primarily as cooling ponds for steam-electric power plants. While shoreline development has been permitted only around Lake Cypress Springs, recreational and retirement housing construction continues within the small watersheds draining directly into Lake Bob Sandlin, Lake O' the Pines and Caddo Lake.

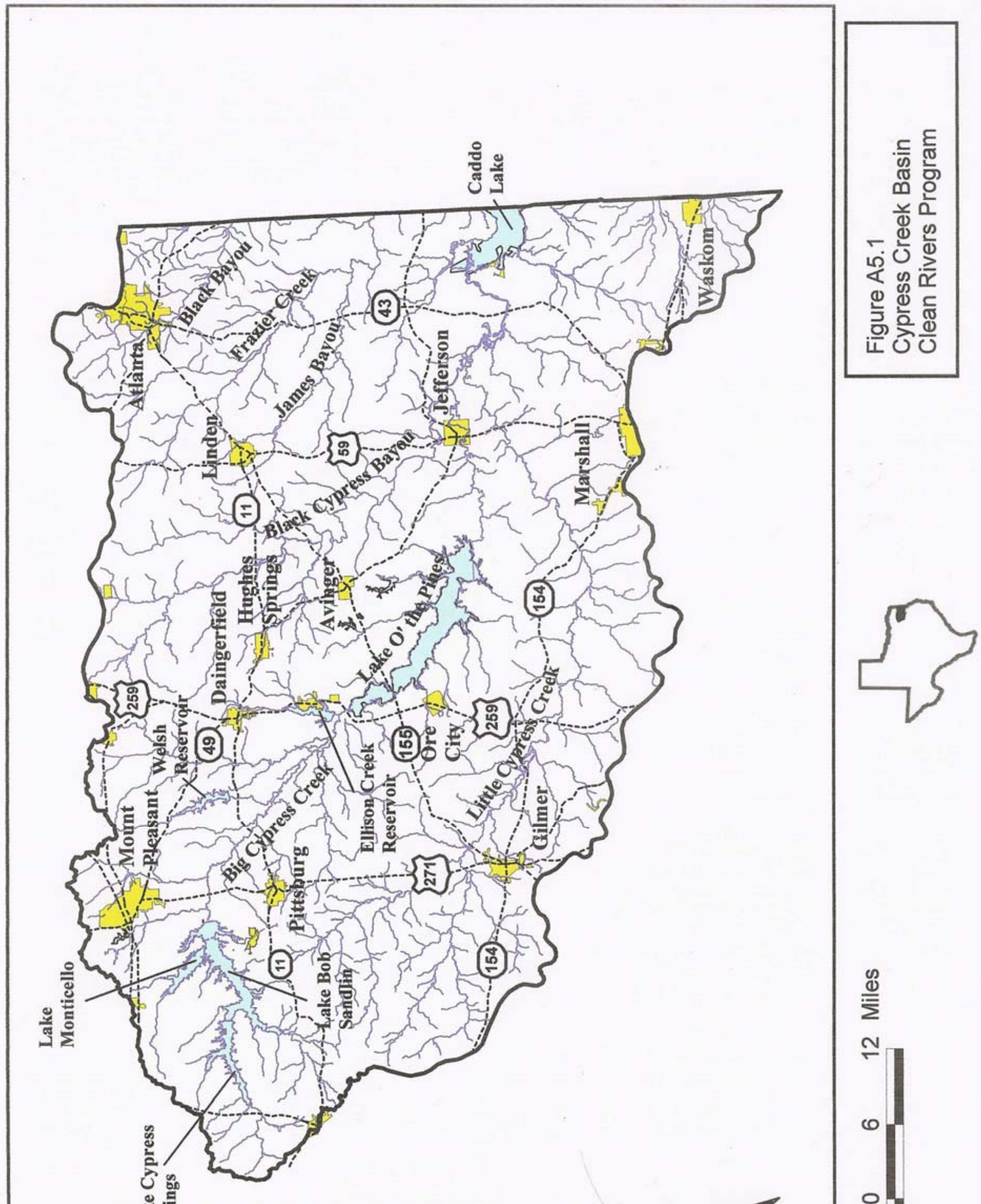


Figure A5.1
Cypress Creek Basin
Clean Rivers Program

Major tributaries of Big Cypress Creek include Little Cypress Creek (Segment 409), Black Cypress Bayou (unclassified), James Bayou (Segment 407) and Black Bayou (Segment 406). Little Cypress Creek and the Black Cypress Bayou confluence with Big Cypress Creek just east of the city of Jefferson, while James Bayou enters Caddo Lake and Black Bayou enters Twelve-Mile Bayou in Louisiana. Major population centers within the Basin include the Cities of Marshall, Mount Pleasant, Atlanta, Gilmer, Pittsburg, Winnsboro, Daingerfield, Hughes Springs, Linden, and Waskom.

The Cypress Creek Basin water quality monitoring program has been established to collect surface water samples within the Basin and to continue to produce water quality data for continuing evaluation of water quality in the Basin. Previous efforts of other monitoring agencies have established reliable and useful data for evaluation under the CRP water quality screening procedures. Monitoring data has been collected at gage locations within each of the nine segments of the Cypress Creek Basin since 1981. Although there exists a large database of valuable water quality information on the Cypress Creek Basin through previous efforts of monitoring agencies, assessments made as part of the CRP have determined a need to reorganize data collection efforts. Inconsistent sampling through time and locations, changes in detection limits, and, in many cases, lack of sampling, are the principal reasons for creating this basin-wide water quality monitoring plan.

Low dissolved oxygen concentrations occur in stream and marginal reservoir habitats throughout the Cypress Creek Basin. All the segments, except 0405 and 0408 (Lake Cypress Springs and Lake Bob Sandlin), have reaches on the Draft 2004 303(d) list, or for which concerns with low dissolved oxygen concentrations are expressed in the Draft 2004 Texas Water Quality Inventory. In most locations, the low dissolved oxygen concentrations are associated with low flow conditions and with high levels of photosynthesis and respiration. This does not appear to be the case in Little Cypress Creek (Segment 0409), or in marginal and backwater habitats in Caddo Lake, which exhibit only very limited changes in dissolved oxygen concentrations over 24-hour monitoring periods.

Except for ammonia, nutrient concentrations in streams rarely exceed TCEQ screening levels. However, total phosphorus and total nitrogen concentrations in streams throughout the Cypress Creek Basin are usually at levels that can result in excessive algal growth under low flow conditions, or in impoundments. The heaviest loads have been observed originating from the Tankersley Creek watershed, and to a lesser extent, from other tributary watersheds in the upper part of the basin, for example, Prairie and Lilly Creeks, and the tributaries to Lake Cypress Springs and Lake Bob Sandlin. The Southwest wastewater treatment plant in Mount Pleasant, which processes wastewater from the Pilgrim's Pride Corporation poultry processing facility, is the source of a large proportion of the nitrogen and phosphorus load in Segment 0404 of Big Cypress Creek. Some phosphorus and a large proportion of the nitrogen load is lost during transport in Big Cypress Creek from the vicinity of Mount Pleasant and Pittsburg to the headwaters of Lake O' the Pines, presumably through biological activity and trapping in the floodplain.

The upper reservoirs on Big Cypress Creek are continuing to assimilate the phosphorus loads entering them. The stations immediately downstream of Lake Bob Sandlin and Lake O' the Pines exhibit much lower total phosphorus concentrations than the inflowing waters with comparable, or lower, flows. However, Lake O' the Pines appears to be a net exporter of nitrogen with respect to inflowing and out flowing waters. Atmospheric deposition of nitrates may be significant, as may fixation of atmospheric nitrogen by blue-green, which are common members of the algal assemblage in Lake O' the Pines. Although the total phosphorus load entering Caddo Lake from Big Cypress Creek appears to be only about half that entering Lake O' the Pines, and the load from James Bayou is unlikely to be as much as that, the lack of water quality data from Twelve Mile Bayou precludes any firm conclusions concerning nutrient assimilation in that water body.

Marginal and backwater habitats in Caddo Lake, as in Lake O' the Pines, occasionally exhibit dissolved oxygen concentrations below the segment standard for support of aquatic life. However, these episodes are not generally accompanied by large daily changes in dissolved oxygen concentrations, and often reflect relatively constant, low concentrations throughout a 24-hour sample period. This is consistent with a lower nutrient load entering Caddo Lake than is the case in Lake O' the Pines, and which consequently does not support similarly intense algal production during summer conditions. It is more likely that in Caddo Lake we are observing an intense oxygen demand from the sediments during summer conditions, primarily from decomposition of rooted plant mass-produced with nutrients from the sediments.

Despite the widespread occurrence of low dissolved oxygen concentrations, elevated nutrient levels and other water quality problems, biological communities in streams throughout the Cypress Creek Basin continue to exhibit the abundance, trophic structure (i.e., the mixture of herbivores, detritivores and predators), and diversity appropriate to, or better than, that expected based on the quality of the habitat at those locations. To the extent that low dissolved oxygen concentrations are associated with low flow conditions, it is likely that aquatic communities in the Cypress Creek Basin are, to some extent, adapted to tolerate conditions that occur at least occasionally during summer conditions even in minimally disturbed streams.

Locally, low pH values, toxicity in water and sediments, and mercury in fish tissues appear to be phenomena associated with the lower portion of the Cypress Creek Basin. The lower basin coincides with a predominantly acid soils and forested watersheds that result in "soft", acid waters of relatively low buffering capacity. Those conditions, coupled with the intense biological activity associated with a warm, shallow, eutrophic environment are thought to be conducive to the mobilization of heavy metals (e.g., mercury) into aquatic food chains

The primary goal of the Cypress Creek Basin Clean Rivers Program is to provide the appropriate, quality assured data to allow continuing assessment and management of water quality in the Cypress Creek Basin. Objectives of this monitoring program include local participation in the collection and submittal of quality-assured data to assist the TCEQ in attaining reliable information concerning water quality conditions within the basin. Solid assessment of accurate information provides valuable insight into the nature and source of water quality problems. These assessments, along with sound decisions based on Texas Surface Water Quality Standards help in the evaluation of permit requirements with respect to water quality conditions and trends to specific water bodies in the basin. These evaluations, in addition to historical data are used to support the development of cost-effective water quality management programs.

A6 PROJECT/TASK DESCRIPTION

Assessment and management of water quality within the Cypress Creek Basin is dependent on appropriate and accurate data. Water quality monitoring and data collection is an integral part of the Clean Rivers Program. Water quality monitoring is made possible through a cooperative program directed by Northeast Texas Municipal Water District (NETMWD). Program participants assisting NETMWD in planning, data collection, analysis, and reporting of water quality data include HDR Engineering, Inc. (HDR), the Texas Commission on Environmental Quality (TCEQ), the Clean Rivers Program Steering Committee members, basin partners Caddo Lake Institute (CLI) and affiliates, Pilgrims Pride Corporation, Franklin County Water District (FCWD), the City of Marshall, the City of Longview, Titus County Fresh Water District #1, Lone Star Steel, Texas Utilities (TXU) and AEP SWEPCO.

The monitoring program has been divided into two areas: (1) Routine station monitoring; and (2) Systematic monitoring. Both monitoring programs are reviewed each year to consider revisions in every aspect of the programs. Routine (RT) station monitoring is primarily used to maintain and expand the long-term water quality database. Analyses of physical, chemical bacteriological and biological parameters are conducted at the RT stations. Station locations provide ongoing monitoring at locations that have previously been sampled. This monitoring improves the ability to follow trends and to identify water quality changes in the major sub-basins of the Cypress Creek Basin. Intensive/Systematic (IS) monitoring stations are primarily located on smaller, unclassified streams. This additional monitoring program complements the existing RT station monitoring by providing information on the many subwatersheds not covered by RT sampling. The IS monitoring schedule was originally based on a five-year-cycle, with one group of stations monitored in close proximity during each of the five years, and complete coverage of the basin accomplished at the end of the rotation. The design and site selection approach taken over the last few years, however, has focused attention on watersheds and waterbodies known or suspected to have water quality issues based either on local public concern or river segment assessment unit information contained in the *Monitoring Priorities for Concerns and Non Supporting Parameters Based on the DRAFT 2004 Texas Water Quality Inventory*. The IS monitoring uses biological screening studies in combination with RT physical and chemical parameters to provide data on the health of aquatic life and long-range water quality protection. The IS monitoring also involves field investigations in subwatersheds that contain very little historical or no water quality data. Reservoir monitoring usually occurs near the dam or in the major arms that receive contributory surface inflow from rivers and streams. Monitoring of reservoir aquatic habitat can serve as indicators of upstream problems and possible nearshore impacts. Different sub-watershed areas of the basin and their stations are sampled four times within the period of a year to provide information on water quality conditions in those areas.

The locations of the Routine and Systematic monitoring stations recommended here reflect the need for continued monitoring at locations which have been sampled historically, to focus on those segments which were determined to be of most concern through the segment evaluation and ranking procedure found in the *Monitoring Priorities for Concerns and Non Supporting Parameters Based on the DRAFT 2004 Texas Water Quality Inventory*, and to eventually provide water quality data and analysis for the entire basin.

See Appendix A for the project-related work plan tasks and schedule of deliverables for a description of work defined in the FY2006-2007 QAPP. See Appendix B for sampling design and monitoring pertaining to this QAPP.

Amendments to the QAPP

Revisions to the QAPP may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, schedules, objectives, and methods. Requests for amendments will be directed from the Cypress Creek Basin Technical Coordinator to the CRP Project Manager electronically. They are effective immediately upon approval by the Cypress Creek Planning Agency Project Manager, the Cypress Creek Planning Agency QAO/DM, the Cypress Creek Planning Agency Technical Coordinator, the CRP Project Manager, the CRP Lead QA Specialist, and the CRP Project QA Specialist. They will be distributed by the Cypress Creek Basin Planning Agency Technical Coordinator and incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list. The Cypress Creek Basin Planning Agency Technical Coordinator will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in each amendment to the QAPP. The Cypress Creek Basin Planning Agency will maintain this documentation as part of the project's quality assurance records, and will be available for review.

Special Project Appendices

Projects requiring QAPP appendices will be planned in consultation with the Cypress Creek Basin Planning Agency and the TCEQ Project Manager and TCEQ technical staff. Appendices will be written in an abbreviated format and will reference the Basin QAPP where appropriate. In some circumstances, special project appendices will be written in a more "stand-alone" format as determined during the project planning phase. Appendices will be approved by the Cypress Creek Basin Planning Agency Project Manager, the Cypress Creek Basin Planning Agency QAO, the CRP Project Manager, the CRP Project QA Specialist, the CRP Lead QA Specialist and other TCEQ personnel as appropriate. Copies of approved QAPPs appendices will be distributed by the Cypress Creek Basin Planning Agency to project participants before data collection activities commence. The Cypress Creek Basin Planning Agency Technical Coordinator will secure written documentation from each sub-tier project participant (e.g., subcontractors, other units of government, laboratories) stating the organization's awareness of and commitment to requirements contained in each special project appendix to the QAPP. The Cypress Creek Basin Planning Agency will maintain this documentation as part of the project's quality assurance records, and will be available for review.

A7 QUALITY OBJECTIVES AND CRITERIA

The purpose of routine water quality monitoring is to collect surface water quality data needed for conducting water quality assessments in accordance with TCEQ's *Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data*. These water quality data and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be subsequently reconciled for use and assessed by the TCEQ.

Systematic watershed monitoring is defined by sampling that is planned for a short duration (1 to 2 years) and is designed to: screen waters that would not normally be included in the routine monitoring program, monitor at sites to check the water quality situation, and investigate areas of potential concern. An additional objective is to collect information on the biological communities at various stream locations and provide data to evaluate the aquatic communities since limited biological data exists. The biological community data gathered may provide a framework for studies to more fully characterize the aquatic communities in the James Bayou, Big Cypress Creek and Little Cypress Creek watersheds, if needed. Twenty four-hour continuous recording dissolved oxygen monitoring instruments will provide critical data to determine stream standards compliance. Due to the limitations regarding these data (e.g., not temporally representative, limited number of samples, biological sampling does not meet the specimen vouchering requirements), the data will be used to determine whether any locations have values exceeding the TCEQ's water quality criteria and/or screening levels (or in some cases values elevated above normal). The Cypress Creek Basin Planning Agency will use this information to determine future monitoring priorities.

The measurement performance specifications to support the project objectives for a minimum data set are specified in Table A7.1 and in the text following.

Table A7.1 - Measurement Performance Specifications

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	Lab Reporting Limit (RL)	RECOVERY AT THE RLs	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
FIELD PARAMETERS										
pH - Field	pH(s.u.)	Water	EPA 150.1 and TCEQ SOP, V1	00400	NA*	NA	NA	NA	NA	CRP Sampling Staff
Maximum Daily pH	pH(s.u.)	Water	TCEQ SOP, V1	00215	NA*	NA	NA	NA	NA	CRP Sampling Staff
Minimum Daily pH	pH(s.u.)	Water	TCEQ SOP, V1	00216	NA*	NA	NA	NA	NA	CRP Sampling Staff
24-hr pH	# meas.	Water	TCEQ SOP, V1/	00223	NA*	NA	NA	NA	NA	CRP Sampling Staff
Dissolved Oxygen (D.O.)	mg/L	Water	EPA 360.1 and TCEQ SOP, V1	00300	NA*	NA	NA	NA	NA	CRP Sampling Staff
24-Hr D.O. Average	mg/L	Water	TCEQ SOP, V1	89857	NA*	NA	NA	NA	NA	CRP Sampling Staff
24-Hr D.O. # of measurements	# meas.	Water	TCEQ SOP, V1	89858	NA*	NA	NA	NA	NA	CRP Sampling Staff
Maximum Daily D.O.	mg/L	Water	TCEQ SOP, V1	89856	NA*	NA	NA	NA	NA	CRP Sampling Staff
Minimum Daily D.O.	mg/L	Water	TCEQ SOP, V1	89855	NA*	NA	NA	NA	NA	CRP Sampling Staff
Conductivity	uS/cm	Water	EPA 120.1 and TCEQ SOP, V1	00094	NA*	NA	NA	NA	NA	CRP Sampling Staff
24-Hr Average Conductivity	uS/cm	Water	TCEQ SOP, V1/ Calculation	00212	NA*	NA	NA	NA	NA	CRP Sampling Staff
Maximum Daily Conductivity	uS/cm	Water	TCEQ SOP, V1/	00213	NA*	NA	NA	NA	NA	CRP Sampling Staff
Minimum Daily Conductivity	uS/cm	Water	TCEQ SOP, V1/	00214	NA*	NA	NA	NA	NA	CRP Sampling Staff
24-hr conductivity # of measurements	#	Water	TCEQ SOP, V1/ Calculation	00222	NA*	NA	NA	NA	NA	CRP Sampling Staff
Water Temperature	C°	Water	EPA 170.1 and TCEQ SOP, V1	00010	NA*	NA	NA	NA	NA	CRP Sampling Staff
24-Hr Average Temperature	C°	Water	TCEQ SOP, V1/ Calculation	00209	NA*	NA	NA	NA	NA	CRP Sampling Staff
Maximum Daily Temperature	C°	Water	TCEQ SOP, V1/	00210	NA*	NA	NA	NA	NA	CRP Sampling Staff
Minimum Daily Temperature	C°	Water	TCEQ SOP, V1/	00211	NA*	NA	NA	NA	NA	CRP Sampling Staff
24-hr water temperature # of measurements	# meas.	Water	TCEQ SOP, V1/ Calculation	00221	NA*	NA	NA	NA	NA	CRP Sampling Staff
Secchi Depth	meters	Water	TCEQ SOP, V1	00078	NA*	NA	NA	NA	NA	CRP Sampling Staff
Days since last significant rainfall	days	NA	TCEQ SOP, V1	72053	NA*	NA	NA	NA	NA	CRP Sampling Staff
Maximum pool width***	meters	Water	TCEQ SOP, V2	89864	NA*	NA	NA	NA	NA	CRP Sampling Staff
Maximum pool depth***	meters	Water	TCEQ SOP, V2	89865	NA*	NA	NA	NA	NA	CRP Sampling Staff
Pool length***	meters	Water	TCEQ SOP, V2	89869	NA*	NA	NA	NA	NA	CRP Sampling Staff
% pool coverage***	%	Water	TCEQ SOP, V2	89870	NA*	NA	NA	NA	NA	CRP Sampling Staff
Total water depth	meters	Water	TCEQ SOP, V2	82903	NA*	NA	NA	NA	NA	CRP Sampling Staff
Flow	cfs	Water	TCEQ SOP, V1	00061	NA*	NA	NA	NA	NA	CRP Sampling Staff
Flow Estimate	cfs	Water	TCEQ SOP, V1	74069	NA*	NA	NA	NA	NA	CRP Sampling Staff

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	Lab Reporting Limit (RL)	RECOVERY AT RLs	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
FIELD PARAMETERS (cont'd)										
Flow measurement method	1-gage 2-electric 3-mechanical 4-weir/flume 5-doppler	Water	TCEQ SOP, V1	89835	NA*	NA	NA	NA	NA	CRP Sampling Staff
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	Water	TCEQ SOP, V1	01351	NA*	NA	NA	NA	NA	CRP Sampling Staff
Present Weather	1-clear 2-partly cloudy 3-cloudy 4-rain	NA	NA	89966	NA*	NA	NA	NA	NA	CRP Sampling Staff
Wind Intensity	1-calm 2-slight 3-moderate 4-strong	NA	NA	89965	NA*	NA	NA	NA	NA	CRP Sampling Staff
Water Surface	1-calm 2-ripples 3-waves	NA	NA	89968	NA*	NA	NA	NA	NA	CRP Sampling Staff
CONVENTIONAL AND BACTERIOLOGICAL PARAMETERS										
TSS	mg/L	Water	EPA 160.2	00530	4	4	NA	20	NA	Ana-Lab
TDS, dried at 180 degrees C	mg/L	Water	EPA 160.1	70300	10	10	NA	20	NA	Ana-Lab
Sulfate	mg/L	Water	EPA 300.0	00945	10	10	75-125	20	80-120	Ana-Lab
Chloride	mg/L	Water	EPA 300.0	00940	10	10	75-125	20	80-120	Ana-Lab
Chlorophyll-a, fluorometric method	ug/L	Water	EPA 445.0	70953	5	5	75-125	20	NA	Ana-Lab
Pheophytin, fluorometric method	ug/L	Water	EPA 445.0	32213	3	3	75-125	20	NA	Ana-Lab
E. coli, IDEXX Colilert (Bacteria)	MPN/100mL	Water	SM 9223-B	31699	1	1	NA	0.5****	NA	CRP Sampling Staff
Ammonia-N, total	mg/L	Water	EPA 350.1	00610	0.02	0.02	75-125	20	80-120	Ana-Lab
Alkalinity, total	mg/L	Water	EPA 310.1	00410	10	10	NA	20	80-120	Ana-Lab
Hardness, total (as CaC03)	mg/L	Water	EPA 130.2	00900	5	5	NA	20	80-120	Ana-Lab
Nitrite-N	mg/L	Water	EPA 300.0	00615	0.02	0.02	75-125	20	80-120	Ana-Lab
Nitrate-N, total	mg/L	Water	EPA 300.0	00620	0.02	0.02	75-125	20	80-120	Ana-Lab
Total phosphate-P	mg/L	Water	EPA 365.2	00665	0.06	0.06	75-125	20	80-120	Ana-Lab

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	Lab Reporting Limit (RL)	RECOVERY AT RLs	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
CONVENTIONAL AND BACTERIOLOGICAL PARAMETERS (cont'd)										
TOC	mg/L	Water	SM 5310C	00680	2.0	2.0	75-125	20	80-120	Ana-Lab
Total Kjeldahl N	mg/L	Water	EPA 351.2	00625	0.2	0.2	75-125	20	80-120	Ana-Lab
TSWQS Dissolved Metals In Water										
Aluminum, dis.	ug/L	Water	EPA 200.8	01106	200	200	75-125	20	75-125	Ana-Lab
Arsenic, dis.	ug/L	Water	EPA 200.8	01000	5.0	5.0	75-125	20	75-125	Ana-Lab
Chromium, dis.	ug/L	Water	EPA 200.8	01030	10.0	10.0	75-125	20	75-125	Ana-Lab
Copper, dis.	ug/L	Water	EPA 200.8	01040	1 for waters <50 mg/L hardness 3 for waters ≥50 mg/L hardness	1	75-125	20	75-125	Ana-Lab
Barium, dis.	ug/L	Water	EPA 200.8	01005	1000	1000	75-125	20	75-125	Ana-Lab
Molybdenum, dis.	ug/L	Water	EPA 200.8	01060	10	10	75-125	20	75-125	Ana-Lab
Nickel, dis.	ug/L	Water	EPA 200.8	01065	10.0	10	75-125	20	75-125	Ana-Lab
Silver, dis.	ug/L	Water	EPA 200.8	01075	0.5	0.5	75-125	20	75-125	Ana-Lab
Zinc, dis.	ug/L	Water	EPA 200.8	01090	5.0	5.0	75-125	20	75-125	Ana-Lab
TSWQS Total Metals In Water										
Calcium, total	mg/L	Water	EPA 200.7	00916	0.5	0.5	75-125	20	80-120	Ana-Lab
Iron, total	ug/L	Water	EPA 200.7	01045	300	300	75-125	20	75-125	Ana-Lab
Manganese, total	ug/L	Water	EPA 200.8	01055	50	50	75-125	20	75-125	Ana-Lab
Selenium, total	ug/L	Water	EPA 200.8	01147	2	2	75-125	20	75-125	Ana-Lab
SEDIMENT PARAMETERS										
Aluminum	mg/kg	Solid	EPA 6020A	01108	N/A**	0.625	75-125	25	70-130	Ana-Lab
Arsenic	mg/kg	Solid	EPA 6020A	01003	7.0	7.0	75-125	25	70-130	Ana-Lab
Barium	mg/kg	Solid	EPA 6020A	01008	200.0	200.0	75-125	25	70-130	Ana-Lab
Cadmium	mg/kg	Solid	EPA 6020A	01028	0.6	0.6	75-125	25	70-130	Ana-Lab
Chromium	mg/kg	Solid	EPA 6020A	01029	21.0	21.0	75-125	25	70-130	Ana-Lab
Copper	mg/kg	Solid	EPA 6020A	01043	14.0	14.0	75-125	25	70-130	Ana-Lab
Lead	mg/kg	Solid	EPA 6020A	01052	20.0	20.0	75-125	25	70-130	Ana-Lab
Manganese	mg/kg	Solid	EPA 6020A	01053	NA**	0.5	75-125	25	70-130	Ana-Lab
Mercury	mg/kg	Solid	EPA 7471A	71921	0.1	0.1	75-125	25	70-130	Ana-Lab

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	Lab Reporting Limit (RL)	RECOVERY AT RLs	PRECISION (RPD of LCS/LCS dup)	BIAS (%Rec. of LCS)	Lab
SEDIMENT PARAMETERS (cont'd)										
Molybdenum	mg/kg	Solid	EPA 6020A	01063	NA**	1.5	75-125	25	70-130	Ana-Lab
Nickel	mg/kg	Solid	EPA 6020A	01068	15.0	15.0	75-125	25	70-130	Ana-Lab
Selenium	mg/kg	Solid	EPA 6020A	01148	1.0	1.0	75-125	25	70-130	Ana-Lab
Silver	mg/kg	Solid	EPA 6020A	01078	0.5	0.5	75-125	25	70-130	Ana-Lab
Zinc	mg/kg	Solid	EPA 6020A	01093	64.0	64.0	75-125	25	70-130	Ana-Lab
Total Phosphorus	mg/kg	Solid	EPA 6010B	00668	NA**	5.0	75-125	25	70-130	Ana-Lab
TOC	mg/kg	Solid	Walkley Black 90.3*****	81951	NA**	100	75-125	25	70-130	Ana-Lab
TKN	mg/kg	Solid	EPA 351.2 Mod******	00627	NA**	1.0	75-125	25	70-130	Ana-Lab
%Clay	% of Dry Weight	Solid	TCEQ Lab SOP 160	82009	NA**	N/A	N/A	N/A	N/A	Ana-Lab
%Gravel	% of Dry Weight	Solid	TCEQ Lab SOP 160	80256	NA**	N/A	N/A	N/A	N/A	Ana-Lab
%Sand	% of Dry Weight	Solid	TCEQ Lab SOP 160	89991	NA**	N/A	N/A	N/A	N/A	Ana-Lab
%Silt	% of Dry Weight	Solid	TCEQ Lab SOP 160	82008	NA**	N/A	N/A	N/A	N/A	Ana-Lab
Oil and Grease	mg/kg	Solid	EPA 9071B	00557	NA**	500	70-130	25	70-130	Ana-Lab
AVS	mmol/kg	Solid	EPA Draft*******	50088	NA**	25	70-130	25	70-130	Ana-Lab
Solids in Sediment	% of Dry Weight	Solid	APHA 18^{th} 2540 G	81373	NA**	N/A	N/A	N/A	N/A	Ana-Lab

Benthics - Freshwater - RBA (Qualitative)

PARAMETER	UNITS	MATRIX	METHOD	STORET	LAB
Biological Data Reporting Units	1= number of individuals from sub-sample; 2 = number of individuals/ft^2; 3 = number of individuals/m^2; 4 = total number in kicknet	Water	TCEQ SOP, V2	89899	CRP Sampling Staff
Kicknet Effort, area kicked	m^2	Water	TCEQ SOP, V2	89903	CRP Sampling Staff
Kicknet Effort, minutes kicked	minutes	Water	TCEQ SOP, V2	89904	CRP Sampling Staff
Snags and Shoreline Sampling Effort, minutes picked	minutes	Water	TCEQ SOP, V2	89905	CRP Sampling Staff
Number of individuals in benthic RBA sub-sample (± 100)	#	Water	TCEQ SOP, V2	89906	CRP Sampling Staff
Benthic Sampler	1=Surber, 2=Ekman, 3=kicknet, 4=Peterson, 5=Hester-Dendy	Water	TCEQ SOP, V2	89950	CRP Sampling Staff
Undercut bank at sample point	%	Water	TCEQ SOP, V2	89921	CRP Sampling Staff
Overhanging brush at sample point	%	Water	TCEQ SOP, V2	89922	CRP Sampling Staff
Gravel substrate at sample point	%	Water	TCEQ SOP, V2	89923	CRP Sampling Staff
Sand substrate at sample point	%	Water	TCEQ SOP, V2	89924	CRP Sampling Staff
Soft bottom at sample point	%	Water	TCEQ SOP, V2	89925	CRP Sampling Staff

Benthics - Freshwater - RBA (Qualitative) (cont'd)					
PARAMETER	**UNITS**	**MATRIX**	**METHOD**	**STORET**	**LAB**
Macrophyte bed at sample point	%	Water	TCEQ SOP, V2	89926	CRP Sampling Staff
Snags and brush at sample point	%	Water	TCEQ SOP, V2	89927	CRP Sampling Staff
Bedrock at sample point	%	Water	TCEQ SOP, V2	89928	CRP Sampling Staff
Benthic Organisms, None Present	NA	Water	TCEQ SOP, V2	90005	CRP Sampling Staff
Mesh Size, any net or sieve, average bar (diagonal measurement) for benthic collection	cm	NA	TCEQ SOP, V2	89946	CRP Sampling Staff
Stream Order	#	NA	TCEQ SOP, V1	84161	CRP Sampling Staff
Ecoregion (Texas Ecoregion Code)	#	NA	TCEQ SOP, V1	89961	CRP Sampling Staff
Total Taxa Richness, Benthos	#	Water	TCEQ SOP, V2	90055	CRP Sampling Staff
EPT Index, Abundance	#	Water	TCEQ SOP, V2	90008	CRP Sampling Staff
Biotic Index (HBI)	NA	Water	TCEQ SOP, V2	90007	CRP Sampling Staff
Chironomidae	%	Water	TCEQ SOP, V2	90062	CRP Sampling Staff
Dominant Taxon, Benthos	%	Water	TCEQ SOP, V2	90042	CRP Sampling Staff
Dominant FFG	%	Water	TCEQ SOP, V2	90010	CRP Sampling Staff
Predators	%	Water	TCEQ SOP, V2	90036	CRP Sampling Staff
Ration of Intolerant:Tolerant taxa	NA	Water	TCEQ SOP, V2	90050	CRP Sampling Staff
Total Trichoptera as Hydropsychidae	%	Water	TCEQ SOP, V2	90069	CRP Sampling Staff
Non-insect taxa	#	Water	TCEQ SOP, V2	90052	CRP Sampling Staff
Mesh Size, any net or sieve, average bar (diagonal measurement) for benthic collection	cm	NA	TCEQ SOP, V2	89946	CRP Sampling Staff
Collector-gatherers	%	Water	TCEQ SOP, V2	90025	CRP Sampling Staff
Total number as Elmidae	%	Water	TCEQ SOP, V2	90054	CRP Sampling Staff
Nekton- Freshwater					
Nekton, none captured	NA	Water	TCEQ SOP, V2	98005	CRP Sampling Staff
Electrofishing effort, duration of shocking	Seconds	Water	TCEQ SOP, V2	89944	CRP Sampling Staff
Seining effort	# of Hauls	Water	TCEQ SOP, V2	89947	CRP Sampling Staff
Combined length of seine hauls	meters	Water	TCEQ SOP, V2	89948	CRP Sampling Staff
Seining effort, duration	minutes	Water	TCEQ SOP, V2	89949	CRP Sampling Staff
Seined Minimum Mesh Size, net average bar (diagonal measurements) for nekton collection	in	Water	TCEQ SOP, V2	89930	CRP Sampling Staff
Seine Maximum Mesh Size, net average bar (diagonal measurements) for nekton collection	in	Water	TCEQ SOP, V2	89931	CRP Sampling Staff
Net length	meters	Water	TCEQ SOP, V2	89941	CRP Sampling Staff

Nekton- Freshwater (cont'd)

PARAMETER	UNITS	MATRIX	METHOD	STORET	LAB
Electrofishing method	1 = boat 2 = backpack 3=tote barge	Water	TCEQ SOP, V2	89943	CRP Sampling Staff
Area seined	m^2	Water	TCEQ SOP, V2	89976	CRP Sampling Staff
Stream Order	#	NA	TCEQ SOP, V1	84161	CRP Sampling Staff
Ecoregion (Texas Ecoreigon Code)	#	NA	TCEQ SOP, V1	89961	CRP Sampling Staff
Total number fish species	#	Water	TCEQ SOP, V2	98003	CRP Sampling Staff
Total Individuals, seine	#	Water	TCEQ SOP, V2	98039	CRP Sampling Staff
Individuals/seine haul	#	Water	TCEQ SOP, V2	98062	CRP Sampling Staff
Total Individuals, Electroshock	#	Water	TCEQ SOP, V2	98040	CRP Sampling Staff
Individuals/minute electroshocking	#	Water	TCEQ SOP, V2	98069	CRP Sampling Staff
Total sunfish species (except bass)	#	Water	TCEQ SOP, V2	98008	CRP Sampling Staff
Total native cyprinid species, fish	#	Water	TCEQ SOP, V2	98032	CRP Sampling Staff
Total benthic invertivore species, fish	#	Water	TCEQ SOP, V2	98052	CRP Sampling Staff
Total benthic species, fish	#	Water	TCEQ SOP, V2	98053	CRP Sampling Staff
Total intolerant fish species	#	Water	TCEQ SOP, V2	98010	CRP Sampling Staff
Tolerant individuals (excluding Western Mosquitofish), fish	%	Water	TCEQ SOP, V2	98070	CRP Sampling Staff
Omnivore individuals, fish	%	Water	TCEQ SOP, V2	98017	CRP Sampling Staff
Insectivore individuals, fish	%	Water	TCEQ SOP, V2	98021	CRP Sampling Staff
Piscivore individuals, fish	%	Water	TCEQ SOP, V2	98022	CRP Sampling Staff
Individuals as non-native species	%	Water	TCEQ SOP, V2	98033	CRP Sampling Staff
Individuals w/ disease/anomalies	%	Water	TCEQ SOP, V2	98030	CRP Sampling Staff

Physical Habitat

PARAMETER	UNITS	METHOD	PARAMETER CODE	LAB
Streambed slope over evaluated reach (from USGS map)	NA	TCEQ SOP, V2	72052	CRP Sampling Staff
Approximate drainage area above the most downstream transect from USGS map	km^2	TCEQ SOP, V2	89859	CRP Sampling Staff
Stream Order	#	TCEQ SOP, V2	84161	CRP Sampling Staff

Physical Habitat (cont'd)				
PARAMETER	**UNITS**	**METHOD**	**PARAMETER CODE**	**LAB**
Length of stream	km	TCEQ SOP, V2	89860	CRP Sampling Staff
Lateral transects made	#	TCEQ SOP, V2	89832	CRP Sampling Staff
Average stream width	meters	TCEQ SOP, V2	89861	CRP Sampling Staff
Average stream depth	meters	TCEQ SOP, V2	89862	CRP Sampling Staff
Instantaneous stream flow	cfs	TCEQ SOP, V2	00061	CRP Sampling Staff
Flow measurement method	1=gage 2= electric 3= mechanical 4=weir/flume	TCEQ SOP, V2	89835	CRP Sampling Staff
Channel Flow Status	1=no flow 2=low 3=moderate 4=High	TCEQ SOP, V2	89848	CRP Sampling Staff
Maximum pool width at time of study	meters	TCEQ SOP, V2	89864	CRP Sampling Staff
Maximum pool depth in study area	meters	TCEQ SOP, V2	89865	CRP Sampling Staff
Total stream bends	#	TCEQ SOP, V2	89839	CRP Sampling Staff
Well-defined stream bends	#	TCEQ SOP, V2	89840	CRP Sampling Staff
Moderately defined stream bends	#	TCEQ SOP, V2	89841	CRP Sampling Staff
Poorly defined stream bends	#	TCEQ SOP, V2	89842	CRP Sampling Staff
Riffles	#	TCEQ SOP, V2	89843	CRP Sampling Staff
Dominant substrate	1=clay, 2=silt, 3=sand, 4=gravel, 5=cobble, 6=boulder, 7=bedrock, 8=other	TCEQ SOP, V2	89844	CRP Sampling Staff
Avg, % of substrate gravel >2mm	%	TCEQ SOP, V2	89845	CRP Sampling Staff
Avg. % instream cover	%	TCEQ SOP, V2	84159	CRP Sampling Staff
Stream Cover Types	#	TCEQ SOP, V2	89929	CRP Sampling Staff
Avg % stream bank erosion potential	%	TCEQ SOP, V2	89846	CRP Sampling Staff
Avg. stream bank angle	degrees	TCEQ SOP, V2	89847	CRP Sampling Staff
Avg. width natural riparian vegetation	meters	TCEQ SOP, V2	89866	CRP Sampling Staff
Avg. % trees as riparian vegetation	%	TCEQ SOP, V2	89849	CRP Sampling Staff
Avg. % shrubs as riparian vegetation	%	TCEQ SOP, V2	89850	CRP Sampling Staff
Avg. % grasses and forbes as riparian vegetation	%	TCEQ SOP, V2	89851	CRP Sampling Staff
Avg. % cultivated fields as riparian vegetation	%	TCEQ SOP, V2	89852	CRP Sampling Staff
Avg. % other as riparian vegetation	%	TCEQ SOP, V2	89853	CRP Sampling Staff
Avg.% tree canopy coverage	%	TCEQ SOP, V2	89854	CRP Sampling Staff

Physical Habitat (concluded)				
PARAMETER	**UNITS**	**METHOD**	**PARAMETER CODE**	**LAB**
Overall Aesthetics	1= wilderness, 2= natural 3= common, 4= offensive	TCEQ SOP, V2	89867	CRP Sampling Staff
Texas Ecoregion Code	#	TCEQ SOP, V2	89961	CRP Sampling Staff
Land development impact	1=unimpacted, 2=low, 3=moderate, 4=high	TCEQ SOP, V2	89962	CRP Sampling Staff

* Reporting to be consistent with SWQM guidance and based on measurement capability.
** No AWRLs have been established by the TCEQ.
*** To be routinely reported when collecting data from perennial pools.
**** Based on a range statistic as described in Standard Methods, 20th Edition, Section 9020-B, Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines. This criterion applies to bacteriological duplicates with concentrations >10 MPN/100mL or 10 organisms/100mL.
***** Section 29-3.5.1, *Methods of Soil Analysis, Part 2, Chemical and Microbiological Properties,* Second Edition, 1965.
****** EPA method 351.2 is a modified method. The method is modified by weighing 1 gram of sample, and dissolving in a set amount of water so that the result can be read in mg/kg rather than mg/L.
******* Draft Analytical Method for the determination of AVS in sediment (Allen, Fu, Boothman, Di Toro, and Mahoney, December 2, 1991)

References for Table A7.1:

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998. *(Note: (The 21st edition may be cited if it becomes available.)*
American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol. 11.02
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue. 2003 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data, 2005 (RG-416).
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
USEPA Manual #EPA-821-R-9S-027

Ambient Water Reporting Limits (AWRLs)

The AWRL establishes the reporting specification at **or below** which data for a parameter must be reported to be compared with freshwater screening criteria. The AWRLs specified in Table A7.1 are the program-defined reporting specifications for each analyte and yield data acceptable for routine water quality monitoring. The reporting limit is the lowest concentration at which the laboratory will report quantitative data within a specified recovery range. The laboratory will meet two requirements in order to report meaningful results to the Clean Rivers Program:

- The laboratory's reporting limit for each analyte will be at **or below** the AWRL.
- The laboratory will demonstrate and document on an ongoing basis the laboratory's ability to quantitate at its reporting limits.

Acceptance criteria are an explanation of how the AWRL requirement applies to water, sediment, and tissue sample matrices are provided in Section B5.

Precision

Precision is a statistical measure of the variability of a measurement when a collection or an analysis is repeated and includes components of random error. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions.

Field splits are used to assess the variability of sample handling, preservation, and storage, as well as the analytical process, and are prepared by splitting samples in the field. Control limits for field splits are defined in Section B5.

Laboratory precision is assessed by comparing replicate analyses of laboratory control standards in the sample matrix (e.g., deionized water, sand, commercially available tissue) or sample/duplicate pairs in the case of bacterial analysis. Precision results are plotted on quality control charts which are based on historical data and used during evaluation of analytical performance. Program-defined measurement performance specifications for laboratory control standard/laboratory control standard duplicate pairs are defined in Table A7.1.

Bias

Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is determined through the analysis of laboratory control standards prepared with verified and known amounts of all target analytes in the sample matrix (e.g., deionized water, sand, commercially available tissue) and by calculating percent recovery. Results are plotted on quality control charts which are calculated based on historical data and used during evaluation of analytical performance. Program-defined measurement performance specifications for laboratory control standards are specified in Table A7.1.

Representativeness

Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TCEQ SOPs, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Routine data collected under the Clean Rivers Program for water quality assessments are considered to be spatially and temporally representative of routine water quality conditions. At a minimum, samples are collected over at least two seasons (to include inter-seasonal variation) and over two years (to include inter-year variation) to include some data collected during an index period (March 15- October 15). Although data may be collected during varying regimes of weather and flow, the data sets will not be biased toward unusual conditions of flow, runoff, or season. The goal for meeting total representation of the water body will be tempered by the potential funding for complete representativeness.

Comparability

Confidence in the comparability of routine data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and in TCEQ SOPs. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Ideally, 100% of the data should be available. However, the possibility of unavailable data due to accidents, insufficient sample volume, broken or lost samples, etc. is to be expected. Therefore, it will be a general goal of the project(s) that 90% data completion is achieved.

A8 SPECIAL TRAINING/CERTIFICATION

New field personnel receive training in proper sampling and field analysis. Before actual sampling or field analysis occurs, they will demonstrate to the QA Officer (or designee) their ability to properly calibrate field equipment and perform field sampling and analysis procedures. Field personnel training is documented and retained in the personnel file and will be available during a monitoring systems audit.

Laboratory analysts have a general knowledge of laboratory operations, test methods, and quality assurance. They also have a combination of education, experience, skill, and training to perform their specific function. Laboratory management maintains records of qualifications and training on each employee.

A9 DOCUMENTS AND RECORDS

Field Documentation

Field documentation will involve recording all instrument calibration/standards records, field measurements, and site characteristics on the forms supplied. There are separate forms for wet-chemistry, and biological monitoring (See Appendix C).

All field notes (including those used by monitors other than NETMWD and HDR staff) will be kept, along with the forms, in a bound notebook. Once the sampling trip concludes, these notebooks will be stored with the data at NETMWD and HDR.

Any difficulties or unusual events encountered during sampling will be so noted and reviewed by the Cypress Creek Basin QAO during their review.

Laboratory Documentation

Laboratory documentation actually begins in the field with the Chain of Custody (COC) forms (See Appendix D). There are separate COC forms for wet-chemistry and biological monitoring, which will accompany the sample set to its final destination. Documentation then carries over into the laboratory with sample custody and storage to analysis. Laboratory documentation will be the responsibility of the laboratory staff and will be kept in a bound notebook. The COC copies will be stored at Ana-Lab as well as NETMWD and HDR.

Documentation for sampling and analytical data is kept on file at the laboratory. These are always available and are reviewed during audits by the TCEQ CRP Quality Assurance Specialist. These records include chain-of-custody records, analyst's comments on the condition of the sample and progress of the analysis, raw data, instrument printouts, results of calibration, QC checks, external and internal standards records, and SOP’s. The results of routine laboratory analysis will be reported within a one month time frame. The results and problems encountered during analysis, including preservation problems, interference, and analytical difficulties will be reviewed by the Cypress Creek Basin Quality Assurance Officer.

Data Maintenance

All hard copy records will be maintained by NETMWD and HDR until they are destroyed after ten years. This will include paper copies of all analytical data, field data forms, field notebooks, and field instrument calibration notebooks. All data results will be maintained electronically as determined by the CRP Data Management guidelines (See Section B10). All field and laboratory audit results and corrective action reports will be maintained by NETMWD.

Laboratory Test Reports

Test reports from the laboratory will document the test results clearly and accurately. The test report will include the information necessary for the interpretation and validation of data and will include the following:

- Title of report and unique identifiers on each page
- Name and address of the laboratory
- Name and address of the client
- A clear identification of the sample(s) analyzed
- Date and time of sample receipt
- Identification of method used
- Identification of samples that did not meet QA requirements and why (e.g., holding times exceeded)
- Sample results
- Clearly identified subcontract laboratory results (as applicable)
- A name and title of person accepting responsibility for the report
- Project-specific quality control results to include field split results (as applicable); equipment, trip, and field blank results (as applicable); and RL confirmation (% recovery)
- Narrative information on QC failures or deviations from requirements that may affect the quality of results or is necessary for verification and validation of data.

Electronic Data

Data will be submitted electronically to the TCEQ in the Event/Result file format described in the CRP Guidance. A completed Data Summary (see Data Errors and Loss in Section B10) will be provided with each data submittal.

The documents and records that describe, specify, report, or certify activities are listed in Table A9.1.

Table A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TCEQ/NETMWD/HDR	10	Paper
Field SOPs	NETMWD/HDR	10	Paper
Laboratory QA Manuals	ANA-LAB/HDR	5	Paper
Laboratory SOPs	ANA-LAB/HDR	5	Paper
QAPP distribution documentation	NETMWD/HDR	10	Paper
QAPP Commitment Letters	NETMWD/HDR	10	Paper
Field staff training records	NETMWD/HDR	10	Paper
Field equipment calibration/maintenance logs	NETMWD/HDR/ETBU	10	Paper
Field instrument printouts	NETMWD/HDR	10	Paper
Field notebooks or data sheets	NETMWD/HDR/ETBU	10	Paper
Chain of custody records	NETMWD/HDR	10	Paper
Laboratory calibration records	ANA-LAB	5	Paper
Laboratory instrument printouts	ANA-LAB	5	Paper
Laboratory data reports/results	NETMWD/HDR/ANA-LAB	10	Paper
Laboratory equipment maintenance logs	ANA-LAB	5	Paper
Laboratory staff training records	ANA-LAB	5	Paper
Corrective Action Documentation	NETMWD/HDR/ANA-LAB	5	Paper

B1 SAMPLING PROCESS DESIGN

See Appendix B for sampling process design information and monitoring tables associated with data collected under this QAPP.

B2 SAMPLING METHODS

Field Sampling Procedures

Field sampling use in collecting CRP monitoring data will be conducted according to procedures documented in the TCEQ *Surface Water Quality Monitoring Procedures Volumes 1 & 2.* Methods for measuring field parameters are detailed in the 2003 TCEQ *Surface Water Quality Monitoring Procedures Manual, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, (RG-415).* Procedures for fecal coliform sampling and analysis, surface water sample collection from streams and reservoirs for the analysis of conventional chemical parameters (nutrients, major inorganic constituents, chlorophyll *a*), metals and organic compounds in water ("clean" procedures) and sediment sample collection for conventional parameters, metals and organic compounds will also follow the sampling and sample handling guidelines presented in the 2003 SWQM Procedures Manual. The procedures for *Escherichia coli* (*E. coli*) sampling and analysis will follow *Standard Methods for the Examination of Water and Wastewater*, 20th Edition, 9223 B. Enzyme Substrate Test.

Biological community assessments (including, but not limited to, habitat, nekton and benthic invertebrates) will be conducted using the standardized sampling gear, collecting techniques, and analytical procedures presented in the 2005 TCEQ *Surface Water Quality Monitoring Procedures Manual, Volume 2: Methods for Collecting and Analyzing Biological Community and Habitat Data* (*RG-416).* Additional aspects outlined in Section B below reflect specific requirements for sampling under the Clean Rivers Program and/or provide additional clarification. Sample volume, container types, minimum sample volume, preservation requirements, and holding time requirements are presented in Table B2.1.

Table B2.1 Sample Storage, Preservation and Handling Requirements

Parameter	Matrix	Container*	Preservation**	Sample Volume	Holding Time
Escherichia coli	Water	Presterilized Styrene	Cool to 4^{o}C; Sodium thiosulfate	100 ml	6 hours
TDS	Water	New Plastic or New Cubitainer	Cool to 4^{o}C, dark	250 ml	7 days
TSS	Water			400 ml	7 days
Alkalinity	Water			100 ml	14 days
Sulfate	Water			100 ml	28 days
Chloride	Water			100 ml	28 days
Nitrate and Nitrite (N)	Water			150 ml	48 hrs
Ammonia	Water	New Plastic or New Cubitainer	1-2 ml conc. H_2SO_4 to pH <2 and cool to 4^{o}C, dark	150 ml	28 days
Total Phosphorus	Water			150 ml	28 days
TKN	Water			200 ml	28 days
TOC	Water			100 ml	28 days
Chlorophyll-a/ Pheophytin	Water	New Amber Glass	Dark and ice before filtration; Dark and frozen after filtration	1000 ml	≤ 48 h Unfiltered 28 days Filtered
Benthic Macroinvertebrates	Water	Plastic or Glass (recycled)	70% ethyl or isopropyl alcohol, keep away from light and extreme temp.	variable	5 years
Nekton (Fish)	Water	Plastic or Glass (recycled)	10% formalin, after 1 week wash and preserve in 70% ethyl alcohol, keep away from light and extreme temp.	variable	5 years
Total Hardness	Water	New Plastic or New Cubitainer	Cool to 4^{o}C, dark	250 ml	48 hours
Dissolved Metals	Water	HNO_3 new plastic bottle	Filter at sample site with 0.45 micron in-line filter into ultra-pure HNO_3 preacidified container to pH<2	1000 ml	6 months
Total Metals (Ca, Fe, Mn and Se)	Water	HNO_3 new plastic bottle	Preacidified container with 5 ml ultra-pure HNO3 to pH<2	1000 ml	6 months
Sediment Metals	Sediment	New 1 liter glass jar with Teflon lined lid	Cool to 4^{o}C, dark	500 grams	28 days***
Sediment Conventionals (TOC, TKN, % grain size, AVS, Total Solids, and Oil and Grease)	Sediment	New 1 liter glass jar with Teflon lined lid	Cool to 4^{o}C, dark	500 grams	14 days ****

* All plastic and glass containers used for lab analyses are new and used only one-time; Biological collection bottles are recycled.
** Preservation is performed within 15 minutes of collection.
*** Holding time for mercury in sediment is 28 days. Other metals in sediment is 180 days.
**** Holding time for AVS is 14 days. Other conventionals in sediment is 28 days.

Sample Containers

Sample containers will include Cubitainers^{TM}, glass bottles and plastic bottles. Cubitainers^{TM} are purchased pre-cleaned for conventional parameters and are disposable. All glassware and plasticware provided by Ana-Lab for water and sediment are new and will not be reused. Ana-Lab provides new polypropylene containers preserved with metals grade nitric acid. The sample containers for metals are new plastic bottles that are disposed of after analysis is completed. Amber glass bottles are used for the quarterly chlorophyll and pheophytin samples. Sterile, styrene 100 ml and 250 ml Colilert sample bottles containing sodium thiosulfate are used for *E. coli* analyses and are used once.

Processes to Prevent Contamination

Procedures outlined in the 2003 TCEQ *Surface Water Quality Monitoring Procedures* outline the necessary steps to prevent contamination of samples. These include: direct collection into sample containers, when possible; clean sampling techniques for metals; and certified containers for organics. Field QC samples (identified in Section B5) are collected to verify that contamination has not occurred.

Documentation of Field Sampling Activities

Field sampling activities are documented on field data sheets as presented in Appendix C. For all visits, station ID, location, sampling time, sampling date, and sampling depth and sample collector's name/signature are recorded. Values for all measured field parameters along with the type and quantity of sample preservative added are recorded. Detailed observational data are recorded including water appearance, weather conditions, the number of days since last significant rainfall and flow severity. Other applicable observational data may include type and extent of biological activity, pertinent observations related to water quality such as exceptionally poor water quality conditions/standards not met or stream uses such as swimming, boating, fishing, irrigation pumps, etc, watershed or instream activities that may have an impact on water quality such as bridge construction or livestock watering upstream, unusual odors, specific sample information and missing scheduled parameters.

Recording Data

For the purposes of this section and subsequent sections, all field and laboratory personnel follow the basic rules for recording information as documented below:

1. Legible writing in indelible ink with no modifications, write-overs or cross-outs;
2. Correction of errors with a single line followed by an initial and date;
3. Close-out on incomplete pages with an initialed and dated diagonal line.

Deficiencies, Nonconformances and Corrective Action Related to Sampling Requirements

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to sampling methods requirements include, but are not limited to, such things as sample container, volume, and preservation variations, improper/inadequate storage temperature, holding-time exceedances, and sample site adjustments.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the Cypress Creek Basin Technical Coordinator. The Cypress Creek Basin Technical Coordinator will notify the Cypress Creek Basin QAO of the potential nonconformance. The Cypress Creek Basin QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The Cypress Creek Basin Technical Coordinator, in consultation with the Cypress Creek Basin QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore, is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed.

If it is determined a nonconformance does exist, the Cypress Creek Basin Technical Coordinator in consultation with Cypress Creek Basin QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the contractor QAO by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TCEQ immediately both verbally and in writing.

In the event of equipment failure (e.g. multiparameter probe, stream velocity meter, fish electroshocker, etc.), back-up equipment will be used if available. If no back-up equipment is available, alternate methods of sampling will be employed. In the event of lost or late water or sediment samples, those stations will be re-visited to replace the samples, where feasible. In the event of sample contamination, the source of contamination will be identified and corrected before re-sampling can occur. Corrective Action Documentation will be maintained in a notebook and retained by NETMWD, PPA and Ana-Lab.

B3 SAMPLE HANDLING AND CUSTODY

Chain-of-Custody

Proper sample handling and custody procedures ensure the custody and integrity of samples beginning at the time of sampling and continuing through transport, sample receipt, preparation, and analysis.

A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. The COC form is used to document sample handling during transfer from the field to the laboratory and among subcontract laboratories. The following information concerning the sample is recorded on the COC form (See Appendix D). The following list of items matches the COC form in Appendix D. All COC forms to be used in the project are included in Appendix D for the TCEQ's review.

1. Date and time of collection
2. Site identification
3. Sample matrix
4. Number of containers
5. Preservative used or if the sample was filtered
6. Analyses required
7. Name of collector
8. Custody transfer signatures and dates and time of transfer

Sample Labeling

Samples are labeled on the container label with an indelible marker. Label information includes the site identification, the date and time of sampling, the preservative added, if applicable, designation of "field filtered" for metals as applicable, and sample type as defined in the monitoring schedule in Appendix B.

Sample Handling

The Cypress Creek Basin Sampling Coordinator will notify Ana-Lab prior to a sampling event with information regarding the expected sampling date and number of sample containers required. Ana-Lab will deliver all sample containers, ice chests, and appropriate chain-of-custody forms to the Cypress Creek Basin Sampling Coordinator at a pre-determined location prior to the sampling event. The containers used will be provided by Ana-Lab, will be pre-cleaned with proper techniques, supplied with correct preservatives, and labeled accordingly. Quality control for sample containers will be provided by Ana-Lab.

The Cypress Creek Basin Sampling Coordinator will be responsible for collection of the samples using approved TCEQ methods. A Chain-of-Custody form will be filled out by the Cypress Creek Basin Sampling Coordinator (or person under supervision) for each sample taken during the sampling event. Ana-Lab will pick up the samples from the Cypress Creek Basin Sampling Coordinator from a pre-determined location after each day's sampling event is completed to assure that the chain-of-custody forms are correctly filled out and signed. The Ana-Lab transfer custodian will also see that the samples arrive within holding time constraints. Ana-Lab will have a sample custodian who examines all arriving samples for proper documentation, and proper preservation. This custodian will accept delivery by signing the final portion of the chain-of-custody form. The sample custodian will log and monitor the progress of the samples through the analysis stage. Internal sample handling, custody, and storage procedures is described in Ana-Lab's Quality Manual(s)

Deficiencies, Nonconformances and Corrective Action Related to Chain-of-Custody

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to chain-of-custody include but are not limited to delays in transfer, resulting in holding time violations; incomplete documentation, including signatures; possible tampering of samples; broken or spilled samples, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the Cypress Creek Basin Technical Coordinator. The Cypress Creek Basin Technical Coordinator will notify the Cypress Creek Basin QAO of the potential nonconformance. The Cypress Creek Basin QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The Cypress Creek Basin Technical Coordinator, in consultation with Cypress Creek Basin QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore, is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the Cypress Creek Basin Technical Coordinator in consultation with the Cypress Creek Basin QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the Cypress Creek Basin QAO by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TCEQ immediately both verbally and in writing.

B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratories are listed in Table A7.1 of Section A7. The authority for analysis methodologies under the Clean Rivers Program is derived from the TSWQS (§§307.1 - 307.10) in that data generally are generated for comparison to those standards and/or criteria. The Standards state that "Procedures for laboratory analysis will be in accordance with the most recently published edition of *Standard Methods for the Examination of Water and Wastewater*, the latest version of the *TCEQ Surface Water Quality Monitoring Procedures*, 40 CFR 136, or other reliable procedures acceptable to the Agency."

Laboratories collecting data under this QAPP are compliant with ISO/IEC Standard 17025, at a minimum. Copies of laboratory Quality Assurance Manuals (QMs) and SOPs are retained by NETMWD, HDR and Ana-Lab and are available for review by the TCEQ. Laboratory SOPs are consistent with EPA requirements as specified in the method.

Standards Traceability

All standards used in the field and laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained in a standards log book. Each documentation includes information concerning the standard identification, starting materials, including concentration, amount used and lot number; date prepared, expiration date and preparer's initials/signature. The reagent bottle is labeled in a way that will trace the reagent back to preparation.

Analytical Method Modification

Only data generated using approved analytical methodologies as specified in this QAPP will be submitted to the TCEQ. Requests for method modifications will be documented on form TCEQ-10364, the TCEQ Application for Analytical Method Modification, and submitted for approval to the TCEQ Quality Assurance Section. Work will begin only after the modified procedures have been approved.

Approval must be obtained from the CRP Program Manager prior to submittal of an application for analytical method modification.

Deficiencies, Nonconformances and Corrective Action Related to Analytical Methods

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP or other applicable documents. Nonconformances are deficiencies which affect quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to field and laboratory measurement systems include but are not limited to instrument malfunctions, blank contamination, quality control sample failures, etc.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the Cypress Creek Basin Planning Agency Technical Coordinator. Cypress Creek Basin Planning Agency Technical Coordinator will notify the Cypress Creek Basin Planning Agency QAO of the potential nonconformance. The Cypress Creek Basin Planning Agency QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The Cypress Creek Basin Planning Agency Technical Coordinator, in consultation with Cypress Creek Basin Planning Agency QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore, is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the Cypress Creek Basin Planning Agency Technical Coordinator in consultation with the Cypress Creek Basin Planning Agency QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the Cypress Creek Basin Planning Agency QAO by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TCEQ immediately both verbally and in writing.

The TCEQ has determined that analyses associated with the remark codes "holding time exceedance," "sample received unpreserved," "estimated value," etc. may have unacceptable measurement uncertainty associated with them. This will immediately disqualify analyses from submittal to TRACS. Therefore, data with these types of problems should not be reported to the TCEQ.

B5 QUALITY CONTROL

Sampling Quality Control Requirements and Acceptability Criteria

The minimum Field QC Requirements are outlined in the 2003 TCEQ *Surface Water Quality Monitoring Procedures Manual, Volume 1.* Specific requirements are outlined below. Field QC sample results are submitted with the laboratory data report (see Section A9.).

Field equipment blank - Field equipment blanks are required for metals-in-water samples when collected using sampling equipment. A field equipment blank is a sample of reagent water poured into or over a sampling device or pumped through a sampling device. It is collected in the same type of container as the environmental sample, preserved in the same manner and analyzed for the same parameter. The analysis of field equipment blanks should yield values lower than the reporting limit, or, when target analyte concentrations are very high, blank values must be less than 5% of the lowest value of the batch, or corrective action will be implemented. Equipment blanks will be prepared for metals sampling every ten samples or whenever a new batch of filters is used.

Field Split - A field split is a single sample subdivided by field staff immediately following collection and submitted to the laboratory as two separately identified samples according to procedures specified in the *SWQM Procedures*. Split samples are preserved, handled, shipped, and analyzed identically and are used to assess variability in all of these processes. Field splits apply to conventional samples only and are collected on a 10% basis or one per batch whichever is greater. The precision of field split results is calculated by relative percent difference (RPD) using the following equation:

$$RPD = (X1-X2)/((X1+X2)/2))$$

A 30% RPD criteria will be used to screen field split results as a possible indicator of excessive variability in the sample handling and analytical system. If it is determined that elevated quantities of analyte (i.e., > 5 times the RL) were measured and analytical variability can be eliminated as a factor, than variability in field split results will primarily be used as a trigger for discussion with field staff to ensure samples are being handled in the field correctly. Some individual sample results may be invalidated based on the examination of all extenuating information. The information derived from field splits is generally considered to be event specific and would not normally be used to determine the validity of an entire batch; however, some batches of samples may be invalidated depending on the situation. Professional judgment during data validation will be relied upon to interpret the results and take appropriate action. The qualification (i.e., invalidation) of data will be documented on the Data Summary. Deficiencies will be addressed as specified in this section under Deficiencies, Nonconformances, and Correction Action related to Quality Control.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory quality manuals (QMs). The minimum requirements that all participants abide by are stated below. Lab QC sample results are submitted with the laboratory data report (see Section A9.).

<u>AWRL/Reporting Limit Verification – Water Samples</u>

The laboratory's reporting limit for each analyte will be at or below the AWRL. To demonstrate the ongoing ability to recover at the reporting limit, the laboratory will analyze a calibration standard (if applicable) at or below the reporting limit on each day Clean Rivers Program samples are analyzed. Two acceptance criteria will be met or corrective action will be implemented. First, calibrations including the standard at the reporting limit will meet the calibration requirements of the analytical method. Second, the instrument response (e.g., absorbance, peak area, etc.) for the standard at the reporting limit will be treated as a response for a sample by use of the calibration equation (e.g., regression curve, etc.) in calculating an apparent concentration of the standard. The calculated and reference concentrations for the standard will then be used to calculate percent recovery (%R) at the reporting limit using the equation:

$$\%R = CR/SA * 100$$

where CR is the calculated result and SA is reference concentration for the standard. Recoveries must be within 75-125% of the reference concentration.

When daily calibration is not required (e.g., EPA Method 624), or a method does not use a calibration curve to calculate results, the laboratory will analyze a check standard at the reporting limit on each day Clean Rivers Program samples are analyzed. The check standard does not have to be taken through sample preparation, but must be recovered within 75-125% of the reference concentration for the standard. The percent recovery of the check standard is calculated using the following equation in which %R is percent recovery, SR is the sample result, and SA is the reference concentration for the check standard:

$$\%R = SR/SA * 100$$

If the calibration (when applicable) or the recovery of the calibration or control standard is not acceptable, corrective actions (e.g., re-calibration) will be taken to meet the specifications before proceeding with analyses of CRP samples.

The laboratory will report results of quantitation checks with the data.

AWRL/Reporting Limit Verification - Sediment and Tissue Samples

The laboratory's reporting limit for each analyte will be at or below the AWRL. To demonstrate the ongoing ability to recover at the reporting limit, the laboratory will analyze a calibration standard (if applicable) at or below the reporting limit on each day Clean Rivers Program samples are analyzed. When considering reporting limits for solid samples and how they apply to results, two aspects of the analysis are considered: (1) the reporting limit of the sample, based on the "real-world" in which moisture content and interferences affect the result and (2) the reporting limit in the QAPP which is a value less than or equal to the AWRL based on an idealized sample with zero % moisture.

The reporting limit for a solid sample is based on the lowest non-zero calibration standard (as are those for water samples), the moisture content of the solid sample, and any sample concentration or dilution factors resulting from sample preparation or clean-up.

To establish solid-phase reporting limits to be listed in Table A7.1 of the QAPP, the laboratory should adjust the concentration of the lowest non-zero calibration standard for the amount of sample extracted, the final extract volume, and moisture content (assumed to be zero % moisture). Each calculated reporting limit is less than the AWRL on the dry-weight basis. This satisfies the AWRL requirement for sediment and tissue analyses. When data are reviewed for consistency with the QAPP, they are evaluated based on this requirement. Results may not "appear" to meet the AWRL requirement due to high moisture content, high concentrations of non-target analytes necessitating sample dilution, etc. These sample results will be submitted to the TCEQ with an explanation on the data summary as to why results do not appear to meet the AWRL requirement.

Two acceptance criteria for AWRLs will be met or corrective action will be implemented. First, calibrations including the standard at the reporting limit will meet the calibration requirements of the analytical method. Second, the instrument response (e.g., absorbance, peak area, etc.) for the standard at the reporting limit will be treated as a response for a sample by use of the calibration equation (e.g., regression curve, etc.) in calculating an apparent concentration of the standard. The calculated and reference concentrations for the standard will then be used to calculate percent recovery (%R) at the reporting limit using the equation:

$$\%R = CR/SA * 100$$

where CR is the calculated result and SA is reference concentration for the standard. Recoveries must be within 75-125% of the reference concentration.

When daily calibration is not required (e.g., Solid Waste Method 8260), or a method does not use a calibration curve to calculate results, the laboratory will analyze a check standard at the reporting limit on each day Clean Rivers Program samples are analyzed. The check standard does not have to be taken through sample preparation, but must be recovered within 75-125% of the reference concentration for the standard. The percent recovery of the check standard is calculated using the following equation in which %R is percent recovery, SR is the sample result, and SA is the reference concentration for the check standard:

$$\%R = SR/SA * 100$$

If the calibration (when applicable) or the recovery of the calibration or control standard is not acceptable, corrective actions (e.g., re-calibration) will be taken to meet the specifications before proceeding with analyses of CRP samples.

Laboratory Control Standard (LCS) - A LCS consists of a sample matrix (i.e., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analyte. The LCS is spiked into the sample matrix at a level less than or near the mid-point of the calibration curve for each analyte. In cases of test methods with very long lists of analytes, LCSs are prepared with all the target analytes and not just a representative number except in cases of organic analytes with multipeak responses.

The LCS is carried through the complete preparation and analytical process. The LCS is used to document the bias of the analytical process. LCSs are run at a rate of one per batch. A batch is defined as a set of environmental samples that are prepared and/or analyzed together within the same process using the same lot of reagents. Results of LCSs are calculated by percent recovery (%R), which is defined as 100 times the measured concentration, divided by the true concentration of the spiked sample.

The following formula is used to calculate percent recovery, where %R is percent recovery; SR is the measured result; and SA is the true result:

$$\%R = SR/SA * 100$$

Performance limits and control charts are used to determine the acceptability of LCS analyses. Project control limits are specified in Table A7.1.

Laboratory Duplicates - A laboratory duplicate is prepared in the laboratory by splitting aliquots of an LCS. Both samples are carried through the entire preparation and analytical process. LCS duplicates are used to assess precision and are performed at a rate of one per batch. A batch is defined as a set of environmental samples that are prepared and/or analyzed together within the same process using the same lot of reagents.

For most parameters, precision is calculated by the relative percent difference (RPD) of LCS duplicate results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X_1 and X_2, the RPD is calculated from the following equation:

$$RPD = (X_1 - X_2)/\{(X_1+X_2)/2\} * 100$$

A bacteriological duplicate is considered to be a special type of laboratory duplicate and applies when bacteriological samples are run in the field as well as in the lab. Bacteriological duplicate analyses are performed on samples from the sample bottle on a 10% basis. Results of bacteriological duplicates are evaluated by calculating the logarithm of each result and determining the range of each pair.

Performance limits and control charts are used to determine the acceptability of duplicate analyses. Project control limits are specified in Table A7.1. The specifications for bacteriological duplicates in Table A7.1 apply to samples with concentrations > 10 org./100mL.

Laboratory equipment blank - Laboratory equipment blanks are prepared at the laboratory where collection materials for metals sampling equipment are cleaned between uses. These blanks document that the materials provided by the laboratory are free of contamination. The QC check is performed before the metals sampling equipment is sent to the field. The analysis of laboratory equipment blanks should yield values less than the reporting limit. Otherwise, the equipment should not be used.

Matrix spike (MS) - A matrix spike is an aliquot of sample spiked with a known concentration of the analyte of interest. Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples processed, or one per batch whichever is greater. A batch is defined as a set of environmental samples that are prepared and/or analyzed together within the same process using the same lot of reagents. The MS is spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. Percent recovery (%R) is defined as 100 times the observed concentration, minus the sample concentration, divided by the true concentration of the spike.

The percent recovery of the matrix spike is calculated using the following equation in which %R is percent recovery, SSR is the observed spiked sample concentration, SR is the sample result, and SA is the reference concentration of the spike added:

$$\%R = (SSR - SR)/SA * 100$$

MS recoveries are plotted on control charts and used to control analytical performance. Measurement performance specifications for matrix spikes are not specified in this document.

Method blank - A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in the sample processing and analyzed with each batch. The method blank is carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the reporting limit. For very high-level analyses, the blank value should be less then 5% of the lowest value of the batch, or corrective action will be implemented.

Additional method-specific QC requirements - Additional QC samples are run (e.g., sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples) as specified in the methods. The requirements for these samples, their acceptance criteria, and corrective actions are method-specific.

Deficiencies, Nonconformances and Corrective Action Related to Quality Control

Deficiencies are defined as unauthorized deviations from procedures documented in the QAPP. Nonconformances are deficiencies which affect data quantity and/or quality and render the data unacceptable or indeterminate. Deficiencies related to quality control include but are not limited to field and laboratory quality control sample failures.

Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff and reported to the cognizant field or laboratory supervisor who will notify the Cypress Creek Basin Technical Coordinator. The Cypress Creek Basin Technical Coordinator will notify the Cypress Creek Basin Planning Agency QAO of the potential nonconformance. The Cypress Creek Basin Planning Agency QAO will initiate a Nonconformance Report (NCR) to document the deficiency.

The Cypress Creek Basin Technical Coordinator, in consultation with Cypress Creek Basin Planning Agency QAO (and other affected individuals/organizations), will determine if the deficiency constitutes a nonconformance. If it is determined the activity or item in question does not affect data quality and therefore, is not a valid nonconformance, the NCR will be completed accordingly and the NCR closed. If it is determined a nonconformance does exist, the Cypress Creek Basin Technical Coordinator in consultation with the Cypress Creek Basin Planning Agency QAO will determine the disposition of the nonconforming activity or item and necessary corrective action(s); results will be documented by the Cypress Creek Basin Planning Agency QAO by completion of a Corrective Action Report.

Corrective Action Reports (CARs) document: root cause(s); impact(s); specific corrective action(s) to address the deficiency; action(s) to prevent recurrence; individual(s) responsible for each action; the timetable for completion of each action; and, the means by which completion of each corrective action will be documented. CARs will be included with quarterly progress reports. In addition, significant conditions (i.e., situations which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data) will be reported to the TCEQ immediately both verbally and in writing.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the TCEQ *Surface Water Quality Monitoring Procedures*. Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QM(s). Testing and maintenance records are maintained and are available for inspection by the TCEQ. Instruments requiring daily or in-use testing include, but are not limited to, water baths, ovens, autoclaves, incubators, refrigerators, and laboratory-pure water. Critical spare parts for essential equipment are maintained to prevent downtime. Maintenance records are available for inspection by the TCEQ.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

Field equipment calibration requirements are contained in the TCEQ *Surface Water Quality Monitoring Procedures*. Post-calibration error limits and the disposition resulting from error are adhered to. Data not meeting post-error limit requirements invalidate associated data collected subsequent to the pre-calibration and are not submitted to the TCEQ.

Detailed laboratory calibrations are contained within the QM(s). The laboratory QM identifies all tools, gauges, instruments, and other sampling, measuring, and test equipment used for data collection activities affecting quality that must be controlled and, at specified periods, calibrated to maintain bias within specified limits. Calibration records are maintained, are traceable to the instrument, and are available for inspection by the TCEQ. Equipment requiring periodic calibrations include, but are not limited to, thermometers, pH meters, balances, incubators, turbidity meters, and analytical instruments.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

All materials used for collection will be obtained from Ana-Lab. Materials used for collection will be inspected both at the laboratory and by the person(s) collecting (See laboratory QM).

B9 NON-DIRECT MEASUREMENTS

This QAPP does not include the use of routine data obtained from non-direct measurement sources.

B10 DATA MANAGEMENT

Data Management Process

The existing database developed for the Cypress Creek Basin CRP (Clean Rivers Program) will be maintained and updated with data obtained from the Cypress Creek Basin CRP monitoring programs (routine and systematic stations, permit support monitoring, special studies, and flow studies). All data results will be maintained electronically in accordance with procedures and guidelines described in the *Cypress Creek Basin Clean Rivers Program Data Management Plan* revised on August 18, 2003. The process described below summarizes procedures and guidelines of the Plan.

Additional water quality data collected through this monitoring program will be introduced into the system by either manual entry, or digital electronic files by the Data Manager. In each case, the data will be screened to insure (1) transcription accuracy, and (2) that the data meets the quality criteria for that data type (e.g., were holding times exceeded, were reporting limits met) prior to its addition to the active database.

This data management process will be used as guidance for the collection, quality assurance and archiving of all data collected pursuant to the Clean Rivers Program (Figure B10-1). This plan has been developed after a full assessment of the human, data, and computer resource needs of the Clean Rivers Program as appropriate for the Cypress Creek Basin. It is anticipated that the types of data to be collected and archived in the future may change, as may future data retrieval, analysis and presentation needs. As circumstances dictate, this plan will be revised to adjust the procedures and methods necessary to reflect changes in CRP project focus, and to take advantage of opportunities for improvement of current procedures, hardware, and software.

With respect to the management of data generated in the Cypress Creek Basin CRP monitoring programs, the process begins with field sampling and ends with the data users with a typical line of transmission as follows:

1. Field Sampling
2. Sample Custodian
3. Lab Analyst
4. Lab Supervisor/Reporter
5. Database Manager
6. Quality Assurance Officer
7. Transfer of Data to TCEQ
8. Data User

The analytical laboratory supervisor is responsible for the management and submission of valid data from the laboratory analyses. The laboratory supervisor validates the analytical data by comparing the various quality control measurements and by recalculating a random selection of the results produced by each analyst submitting data. The laboratory services manager using the labs standard reporting format will provide results to the HDR (HDR Engineering, Inc.) Data Manager. The analytical laboratory will retain files of all quality assurance verifications for five years in accordance with NELAC and make them available for inspection on request.

After the data has been received from the lab analyst, the data management plan is implemented. Data will be screened to assure accuracy, and care will be taken that the data meets the quality criteria for that data type. Quality assurance and control is integrated at all points along this process, with sample field sheets, chain of custody forms, analyst's bench sheets, control charts, and lab reports.

Original field data sheets, copies of the Chain of Custody forms sent to the lab, field notes, and other data will be deposited with the HDR Engineering, Inc. Data Manager for data screening, quality assurance, and input to the CRP database. Once the data management procedures have been completed, copies of all information will be deposited with NETMWD (Northeast Texas Municipal Water District) and retained by NETMWD in the central office files for ten years. This information will be quality checked by the HDR Data Manager by comparing it with the appropriate CRP monitoring schedule to verify that the correct stations have been sampled, that the correct sets of measurements and samples have been collected, and that calibration procedures have been correctly applied. The HDR Data Manager will be responsible for the review of all field and laboratory generated data for consistency with QA criteria, for accuracy of the input operations, and for timely entry into the active database and transfer to TCEQ (Texas Commission on Environmental Quality). The data manager will also be responsible for assuring that all field activity reports, calibration records, and general information is maintained and properly filed according to particular investigations of the project.

The HDR Project Manager will be responsible for determining what data, if any, will be deleted from the database. The Project Manager and laboratory responsible for analysis will initially review any questions concerning analytical data. If a modification of the data originally reported is deemed necessary, documentation of the original data, the question concerning that data, and the modified data along with the copies of the data change will be entered in the Data Managers data log and saved in paper format. Data will only be deleted from the database files if it is determined to be erroneous, or is found to have been collected in a manner that does not follow the TCEQ guidelines for data procurement. The Data Manager will alert the Project Manager to any abnormalities or apparent outliers. The Project Manager will evaluate the data and determine if any statistical tests need to be performed to further evaluate the data. The Quality Assurance Officer will be responsible for reviewing a random 10% of the data for any problems such as exceeded holding times or exceeded precision/accuracy limits.

The future primary focus will be to provide this data to users through the NETMWD maintained Cypress Creek Basin homepage (http://www.netmwd.com). Public access to this information will be facilitated by the placement of all data accepted as final by TCEQ on the NETMWD/CRP webpage. These data files will be available to anyone with access to the World Wide Web. In addition, there is an e-mail link to PPA, which allows anyone desiring data to contact us directly to obtain TCEQ accepted data generated in public- funded programs. All data files collected under this QAPP are provided to TCEQ, which can also distribute them to interested parties. Paper copies of all data and reports are maintained both at the PPA offices in Austin, Texas and the NETMWD offices in Hughes Springs, Texas. Requests for data or reports can be made at either office.

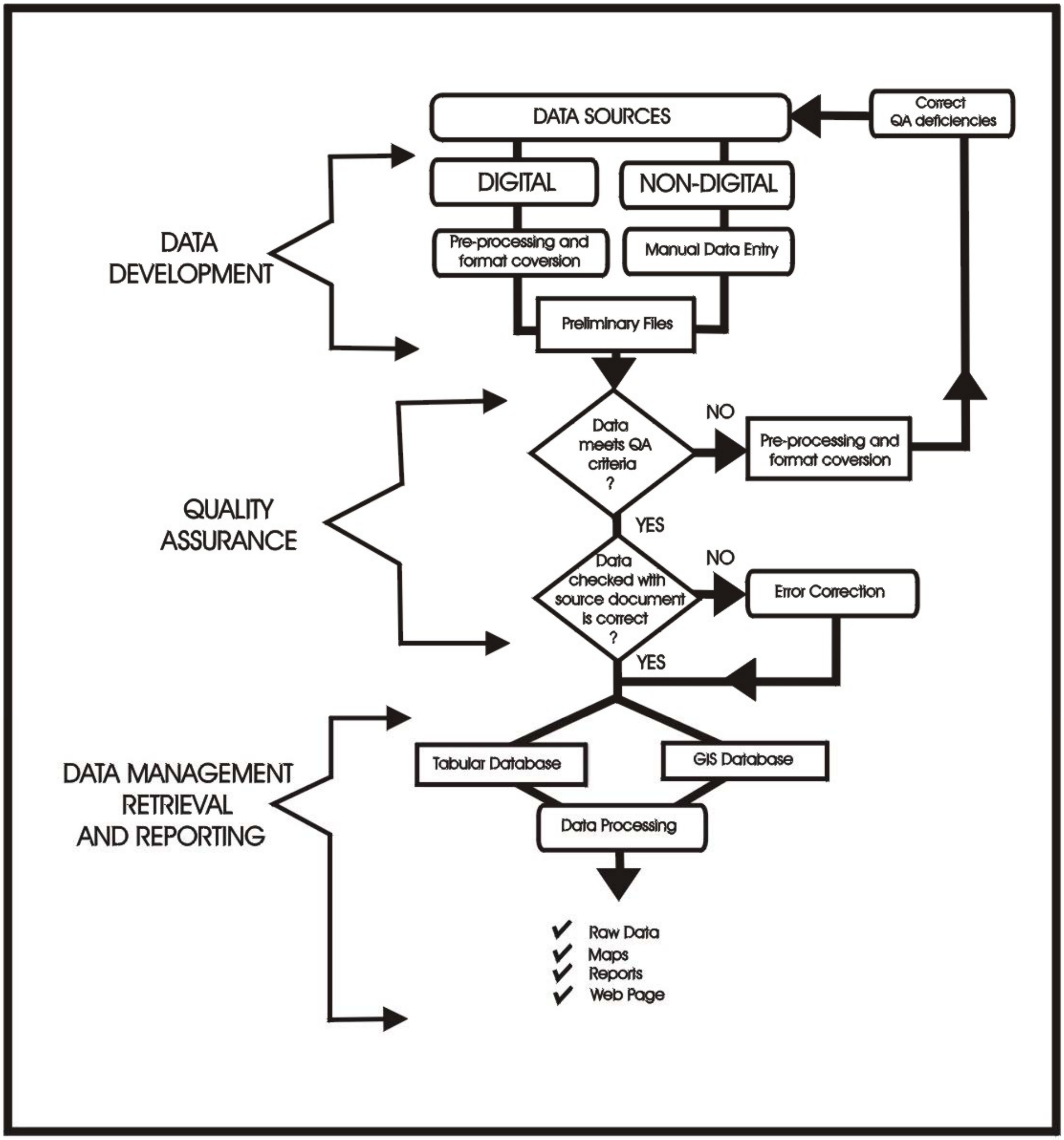


Figure B10-1
Data Management Process
Cypress Creek Basin
Clean Rivers Program

Data Errors and Loss

Data files are initially produced in Excel format, and transferred to the preferred text-delimited format before being submitted to TCEQ. The file format utilized involves the established event and result file formats that are provided by TCEQ. An automated review process has been produced and is utilized for the result data files. This automated review checks the values entered for data based on the established minimum, maximum, and AWRL limits set for each parameter by TCEQ. Changes to any of these values by TCEQ are updated to the review checklist as noted. Any values flagged by the automated review are first checked against the laboratory analysis files to see if they are transcription errors. If the values are correct, then an e-mail querying the validity of the value reported is sent to the laboratory that did the sample analysis. Values that are verified as correct by the laboratory are flagged as outliers within the data set. In addition to the automated review check, a minimum 10% check is done on all data sets, which are produced before their conversion to text files. A data summary form is included with the submittal of the completed data set (see exhibit 4B of the Texas CRP FY2006-2007 Guidance). This summary form includes data information and comments specific to the data set being submitted at that time.

File transfer protocols concerning conversion of Excel database files to other types of database files and their reconversion into the original format involves the import/export of files in both formats. However, care must be taken that all Excel files exported are in pipe delimited text format to ensure correct transfer of all information. After the conversion of any database files into another format, a ten-percent check of the transferred files occurs. File transfer and checking is initially a responsibility of the Quality Assurance Officer, and secondarily the Data Manager.

Development of data files is initially dependent on the use of forms and checklists appropriate to those specified in the QAPP. These documents include: 1) Field documentation which contains all instrument calibration/standards records, field measurements, and site characteristics (see Appendix C), 2) Field notes, 3) Laboratory documentation including Analyst's comments on the condition of the sample and progress of the analysis, raw data, instrument printouts, results of calibration, QA checks, external and internal standards records, and SOP's, 4) Chain of custody forms (see Appendix D), and 5) Data Verification/Validation Checklist (see Exhibit 2A of the Texas CRP FY2006-2007 Guidance).

Record Keeping and Data Storage

All data files and GIS data layers are stored on the HDR server. A full automated backup of all HDR files is produced on tape every Friday. In addition, differential backups are completed on Monday, Tuesday, Wednesday and Thursday on any files that have been modified since the last full backup. These files are stored in a fireproof server closet area at our offices. All files are kept active on the premises for three months, and are archived if not active after that time. Inactive archived files are kept off site in protected storage. No current project files or critical data are stored on the hard drive of any workstation. Copies of the final electronic and paper copies of data and reports are provided to NETMWD at the end of each quarter and stored at their offices. In addition, all data files and reports concerning the project are provided to the Project Manager at TCEQ.

The disaster recovery procedure consists of reinstalling the operation system and software either from the original software media, or from a disaster recovery CD that has been created and stored on site. Newer files would be replaced from either the weekly tape drive, or the daily differential backups files. Archived files would be replaced from the stored archive CD's.

Data Handling, Hardware, and Software Requirements

The data management program will interface with the data users to assure efficient retrieval and manipulation of screened, quality assured data. Staff with data management skills, who have sufficient understanding of database administration and operation to coordinate the data elements needed and manage the available resources, such as trend analysis, web page updates, or public presentation will provide direct support to the various data. Administrative and data management needs can be filled with the use of current staff that have already been given appropriate training. The need for staff at a more specialized skill level is only occasional, and may be met by the use of consultants.

The primary source of data used to satisfy the objectives of the Clean Rivers Program is the descriptive data collected on water quality and natural resources within the Cypress Creek Basin. This data must be collected by reliable personnel using the established methods described in the TCEQ Program Guidance and specifically adapted to Cypress Creek Basin CRP activities in the Quality Assurance Project Plan (QAPP). In addition, the CRP data will be supplemented by acquired data sets, which may be used to establish a regional context, or to evaluate possible correlations between identified water quality problems and their likely sources. These data sets must be screened and assessed for usefulness and credibility before being integrated into the basin assessment report.

The large amount of data involved will need to be readily updateable and efficiently managed. The data must be efficiently sorted and grouped for statistical analysis. The ability to present this data in both a graphic and tabular format may be necessary to effectively communicate both the results and basis for basin assessments to the public. This action requires the procurement and use of software that has the ability to produce both graphics and tables.

The recommended software and hardware required to meet the basic requirements of the program have been identified, and are being utilized by the Cypress Creek Basin Clean Rivers Program. Program requirements are continually evaluated by NETMWD and its consultants to insure that CRP dedicated hardware continue to be adequate to meet those requirements. Criteria for hardware will include performance capable of running anticipated software and potentially useful future software products, as well as storage capacity appropriate to maintain all program-related software, and numerous years of data. Criteria for software will include the capability to manipulate, evaluate, report, and manage data consistent with the basic requirements of the water quality assessments.

Data management procedures have been developed to screen and digitally store data, convert the data received in non-compatible formats to a format suitable for analysis, apply quality control and assurance procedures, provide data access for current and future users of the data, and support assessments of water quality conditions within the basin. These procedures utilize personal computer technology to manage the data associated with the individual tasks of the program.

Once the data has been entered, screened, and quality-checked it is submitted in TCEQ required format for use in the TCEQ Regulatory Activities and Compliance Systems (TRACS) database. The data is also be transmitted to NETMWD to be maintained for dissemination. The NETMWD computer system has a dedicated server with a zip-drive backup system. This network has five available workstations, all IBM compatible which should provide for future expandability.

HDR Engineering, Inc. maintains commercial software operating in the Microsoft Windows 2000 environment. Microsoft Office 2003, which includes Microsoft Word, Microsoft Excel, and Microsoft Access, is maintained for basic report preparation, data entry, and exploratory data analysis. For more complex data analysis, Sigma Stat and Statistical Ecology statistics programs are maintained. Once entered, screened, and quality checked, the data is converted into pipe delimited text files for database storage and transfer to TCEQ and NETMWD. ArcView 3.1, and Corel Draw 8.0 are maintained for GPS (Global Positioning System), GIS (Geographic Information Systems), and graphics support.

The NETMWD computer system is a Microsoft Windows based system with Microsoft Office maintained for general report production and correspondence. Additional software similar to that already available at PPA, but not currently maintained by NETMWD, may also need to be acquired in the future to facilitate data use and manipulation.

Information Resource Management Requirements

Applicable information resource management requirements for the planning agency are satisfied through the utilization of the process outlined in the previous Data Management sections. The TCEQ has the following data specification requirements: the *Surface Water Quality Monitoring Data Management Reference Guide, GIS Policy (TCEQ OPP 8.11)* and *GPS Policy (TCEQ OPP 8.12)*.

Data will be managed in accordance with the *TCEQ Surface Water Quality Monitoring Data Management Reference Guide* and applicable Planning Agency information resource management policies. The Clean Rivers Program grantees do not create TCEQ certified locational data using Global Positioning System (GPS) equipment. GPS equipment may be used as a component of the information required by the Station Location (SLOC) request process, but TCEQ staff is responsible for creating the certified locational data that will ultimately be entered into the TCEQ's Surface Water Quality Monitoring database. Any information developed by Clean Rivers Program grantees using a Geographic Information System (GIS) will be used solely to meet deliverable requirements and will not be submitted to the TCEQ as a certified data set. Because the Clean Rivers Program grantees do not create certified locational data, TCEQ's OPP 8.11 and 8.12 do not apply.

C1 ASSESSMENTS AND RESPONSE ACTIONS

Table C1.1 presents the types of assessments and response actions for data collection activities applicable to the QAPP.

Table C1.1 Assessments and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	Cypress Creek Basin Planning Agency	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TCEQ in Quarterly Report
Monitoring Systems Audit of Planning Agency	Dates to be determined by TCEQ CRP	TCEQ	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to the TCEQ to address corrective actions
Monitoring Systems Audit of Program Sub participants	Once/contract by the Cypress Creek Basin Planning Agency on the Caddo Lake Institute	Cypress Creek Basin Planning Agency	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to the Basin Planning Agency. PA will report problems to TCEQ in Progress Report.
Laboratory Inspection	Dates to be determined by TCEQ	TCEQ Laboratory Inspector	Requirements appearing in lab SOPs and QAPP, ISO/IEC Standard 17025, applicable EPA methods and Standard Methods, 40 CFR 136, and other documents applicable to CRP programs including portions of the Texas Administrative Code and the Code of Federal Regulations.	30 days to respond in writing to the TCEQ to address corrective actions

Corrective Action

The Cypress Creek Basin QAO is responsible for implementing and tracking corrective action resulting from audit findings outlined in the audit report. Records of audit findings and corrective actions are maintained by both the CRP and the Cypress Creek Basin QAO. Audit reports and corrective action documentation will be submitted to the TCEQ with the Progress Report.

If audit findings and corrective actions cannot be resolved, then the authority and responsibility for terminating work are specified in the CRP QMP and in agreements in contracts between participating organizations.

C2 REPORTS TO MANAGEMENT

Reports to Cypress Creek Basin Planning Agency Project Management

Each subcontractor will submit a brief quarterly report including a summary of their work efforts, analytical results, and any problems and corrective actions taken during the quarter's work. These reports will be submitted to the QAO and will be reviewed and transmitted to the TCEQ for their review. The contract laboratory will submit data and QA/QC reports within a one-month time period from the receipt of samples for analysis.

Reports to TCEQ Project Management

All reports detailed in this section are contract deliverables and are transferred to the TCEQ in accordance with contract requirements.

Progress Report - Summarizes the Cypress Creek Basin's activities for each task; reports monitoring status, problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response - Following any audit performed by the Cypress Creek Basin Planning Agency, a report of findings, recommendations and response is sent to the TCEQ in the quarterly progress report.

Reports by TCEQ Project Management

Contractor Evaluation - The Cypress Creek Basin Planning Agency participates in a Contractor Evaluation by the TCEQ annually for compliance with administrative and programmatic standards. Results of the evaluation are submitted to the TCEQ Financial Administration Division, Procurement and Contracts Section.

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

All field and laboratory will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements, and then validated against the project objectives and measurement performance specifications which are listed in Section A7. Only those data which are supported by appropriate quality control data and meet the measurement performance specifications defined for this project will be considered acceptable, and will be reported for entry into the SWQM portion of TRACS.

D2 VERIFICATION AND VALIDATION METHODS

All field and laboratory data will be reviewed, verified and validated to ensure they conform to project specifications and meet the conditions of end use as described in Section A7 of this document.

Data review, verification, and validation will be performed using self-assessments and peer and management review as appropriate to the project task. The data review tasks to be performed by field and laboratory staff are listed in the first two sections of Table D.2, respectively. Potential errors are identified by examination of documentation and by manual (or computer-assisted) examination of corollary or unreasonable data. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with higher level project management to establish the appropriate course of action, or the data associated with the issue are rejected. Field and laboratory reviews, verifications, and validations are documented.

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. This review step as specified in Table D.2 is performed by the Cypress Creek Basin Planning Agency Data Manager and QAO. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of lab and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

Another element of the data validation process is consideration of any findings identified during the monitoring systems audit conducted by the TCEQ CRP Lead Quality Assurance Specialist. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data will be assessed. After the data are reviewed and documented, the Cypress Creek Basin Planning Agency Project Manager validates that the data meet the data quality objectives of the project and are suitable for reporting to TCEQ.

If any requirements or specifications of the CRP are not met, based on any part of the data review, the responsible party should document the nonconforming activities and submit the information to the Cypress Creek Basin Planning Agency Data Manager with the data. This information is communicated to the TCEQ by the Cypress Creek Basin Planning Agency in the Data Summary.

Table D2.1: Data Review Tasks

Field Data Review	**Responsibility**
Field data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements	TC and QAO
Post-calibrations checked to ensure compliance with error limits	SC
Field data calculated, reduced, and transcribed correctly	TC and SC
Laboratory Data Review	
Laboratory data reviewed for conformance with data collection, sample handling and chain of custody, analytical and QC requirements to include documentation, holding times, sample receipt, sample preparation, sample analysis, project and program QC results, and reporting	QAO and DM
Laboratory data calculated, reduced, and transcribed correctly	QAO
Reporting limits consistent with requirements for Ambient Water Reporting Limits.	QAO
Analytical data documentation evaluated for consistency, reasonableness and/or improper practices	QAO and DM
Analytical QC information evaluated to determine impact on individual analyses	QAO
All laboratory samples analyzed for all parameters	QAO
Data Set Review	
The test report has all required information as described in Section A9 of the QAPP	QAO
Confirmation that field and lab data have been reviewed	QAO
Data set (to include field and laboratory data) evaluated for reasonableness and if corollary data agree	QAO
Outliers confirmed and documented	QAO
Field QC acceptable (e.g., field splits and trip, field and equipment blanks)	QAO
Sampling and analytical data gaps checked and documented	QAO
Verification and validation confirmed. Data meets conditions of end use and are reportable	QAO, DM, TC and PM

D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced in this project, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data meeting project requirements will be used by the TCEQ for the *Texas Water Quality Inventory and 303(d) List* in accordance with TCEQ's *Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data*, and for TMDL development, stream standards modifications, and permit decisions as appropriate. Data that do not meet requirements will not be submitted to the SWQM portion of TRACS nor will be considered appropriate for any of the uses noted above.