QUALITY ASSURANCE PROJECT PLAN

Revision 6.0
For the
Red and Canadian River Basins

FY 2002 ~ FY 2003

Prepared in Cooperation with the
Texas Natural Resource Conservation Commission
Under the
Texas Clean Rivers Act

RED AND CANADIAN RIVER BASINS

QUALITY ASSURANCE PROJECT PLAN

Revision 6.0

RED RIVER AUTHORITY OF TEXAS
HAMILTON BUILDING, SUITE 520
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CLEAN RIVERS PROGRAM
TECHNICAL ANALYSIS DIVISION
TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
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December 1, 2001 through August 31, 2003

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

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A1 APPROVAL PAGE

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David L. Holub Quality Assurance Officer	11/14/01		

Note: Red River Authority of Texas 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 revisions of this plan. Red River Authority of Texas will maintain this documentation as part of the project's quality assurance records, and will ensure that the document is available for review.

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LIST OF ACRONYMS

AWRL	Ambient Water Reporting Limits
BAC	Basin Advisory Committee
BMP	Best Management Practices
BMP	Basin Monitoring Plan
CFU	Colony Forming Unit
COC	Chain-of-Custody
COD	Chemical Oxygen Demand
CRMWA	Canadian River Municipal Water Authority
CRP	Clean Rivers Program
DBMS	Database Management System
DMP	Data Management Plan
DO	Dissolved Oxygen
DQO	Data Quality Objective
EDP	Electronic Data Processing
EPA	U.S. Environmental Protection Agency
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
HUA	Hydrologic Unit Area
HUC	Hydrologic Unit Code
LAN	Local Area Network
LCRA	Lower Colorado River Authority
LCS	Laboratory Control Standard
MDMA	Monitoring Data Management & Analysis
mg	Milligrams
mL	Milliliter
NIST	National Institute Standards and Testing
NTCC	North Texas Chemical Consultants Lab
NTU	Nephalometric Turbidity Units
NWQL	National Water Quality Laboratory
QA	Quality Assurance
QAM	Quality Assurance 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
RPD	Relative Percent Difference
RRA	Red River Authority of Texas (Authority)
RWA	Receiving Water Assessment
SOP	Standard Operating Procedure
SRA	Sabine River Authority
SWQM	Surface Water Quality Monitoring
TBD	To Be Determined
TDH	Texas Department of Health
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon
TRACS	TNRCC Regulatory Activities/Compliance System
TSS	Total Suspended Solids
TSWQS	Texas Surface Water Quality Standards
µg	Micrograms
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
VOA	Volatile Organic Analytes
VSS	Volatile Suspended Solids
WLE	Waste Load Evaluation
WMT	Watershed Management Team

A3 DISTRIBUTION LIST

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The Red River Authority of Texas will provide copies of this project plan and any amendments or revisions of this plan to each sub-tier project participant, e.g., subcontractors, other units of government, laboratories. The Red River Authority of Texas will document distribution of the plan by sub-tier participants and maintain this documentation as part of the project's quality assurance records, and will ensure that the document will be available for review.

A4 PROJECT/TASK ORGANIZATION

Description of Responsibilities

TNRCC

Linda Brookins
CRP Program Manager

Responsible for TNRCC activities supporting the development and implementation of the Texas Clean Rivers Program. Responsible for verifying that the QMP is followed by CRP staff. Supervises TNRCC CRP staff. 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.

Bernard Ray
CRP Lead Quality Assurance Specialist

Responsible for CRP QA management. Assists CRP Project Managers in QA-related issues. Assists in CRP guidance development. Develops and updates the CRP QMP. Coordinates the review and approval of CRP QA documents. Conducts monitoring systems audits of Planning Agencies. Monitors implementation of corrective actions. Conveys QA problems to appropriate management. Advises CRP Project managers regarding the development of QAPPs. Facilitates and monitors corrective action process.

Laurie Curra
CRP Project Manager

Responsible for the development, implementation, and maintenance of CRP contracts. Tracks deliverables. Participates in guidance development. Reviews and approves QAPPs, QAPP amendments and appendices. Assists CRP Lead QA Specialist in conducting Red River Authority of Texas audits; verifies that QAPPs are being followed by contractors and that projects are producing data of known quality. Reviews data and reports produced by contractors. Notifies QA Specialist of circumstances which may adversely affect the quality of data derived from the collection and analysis of samples. For corrective actions, determines and documents the root cause(s), programmatic impact, required corrective action(s), actions needed to prevent recurrence, method(s) of verification, timetable(s) for completion, and responsible staff for correcting and monitoring the corrective action.

Eric Reese
CRP Data Manager

Responsible for tracking and verifying CRP data. Provides quality assured data sets to TNRCC Information Resources in compatible formats for uploading to the statewide database. Coordinates correction of data errors with CRP Project Managers, Planning Agency Data Managers, and TNRCC Information Resources Staff. 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. Performs technical reviews of project-specific Data Management Plans. Develops and maintains Standard Operating Procedures for CRP data management.

Red River Authority of Texas

Ronald J. Glenn
RRA Clean Rivers Program Project Director

Responsible for ensuring that all the Authority's positions defined in the project organization are assigned to a specific person or team. The Project Director is also responsible for ensuring that all tasks assigned to the Authority's position are completed in accordance with the terms and conditions of the executed contract.

Curtis W. Campbell
RRA Clean Rivers Program Project Manager

Responsible for implementing CRP requirements in contracts, QAPPs, and QAPP amendments and appendices. Coordinates basin planning activities and work of basin partners. Ensures monitoring systems audits are conducted to ensure QAPPs are followed by Red River Authority of Texas participants and that projects are producing data of known quality. Ensures that subcontractors are qualified to perform contracted work. Ensures CRP Project Managers and/or QA Specialists are notified of circumstances which may adversely affect quality of data derived from collection and analysis of samples. Responsible for validating that all data collected meet the data quality objectives of the project and are suitable for reporting to the TNRCC.

A4 PROJECT/TASK ORGANIZATION (continued)

David L. Holub
RRA Clean Rivers Program Quality Assurance Officer

Responsible for ensuring that all provisions of the QAPP, amendments and appendices are performed in accordance with the protocols defined in this document. Ensures that all sampling and data handling activities comply with the CRP Program Guidance FY 2002-2003, the SWQM Procedures Manual, and that the data is suitable for delivery to the Data Manager. The QA Officer ensures that internal and contracted laboratories conform with the requirements of this QAPP and reviews and decides upon the acceptability of all data submitted by the laboratories. The QA officer is responsible to perform, or arrange for another qualified person to perform, a technical systems audit of the laboratories employed by the Authority as part of the CRP.

Danna K. Hamilton
RRA Clean Rivers Program Data Manager

Responsible for ensuring that field data are properly reviewed, verified and quality assured prior to input to the project database. Conducts preliminary screening analysis and reporting. Provides quality assured data to the TNRCC in a compatible electronic format and completion of a data checklist. Maintains quality-assured datasets and databases linked to the Red River Authority of Texas internet site. Responsible for the Authority's Data Management Plan and subsequent updates.

James E. Wright
Red River Authority of Texas Laboratory Supervisor

Responsible for ensuring that all samples received in the Environmental Services Division Laboratory are within the allotted time, and that the chain-of-custody has been observed. Ensures that the samples are analyzed in accordance with standard accepted methods as described in the SOP manual. The Laboratory Supervisor further ensures that all analysis results are correctly performed and properly recorded on the lab data sheets and in the appropriate analytical log books prior to transmittal to the Quality Assurance Officer.

W. Scott Burns
RRA Clean Rivers Program Field Supervisor

Responsible for overseeing the field personnel that conduct sampling events. Ensures that all field personnel are properly trained and equipped to conduct the necessary monitoring. Ensures that personnel and equipment are available at appropriate times. The Field Supervisor ensures that all field data are collected as outlined by the QAPP and the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999).*

A4 PROJECT/TASK ORGANIZATION (continued)

Other Entities

Canadian River Municipal Water Authority (CRMWA)

Collects and analyzes specific water quality samples required for their specific operations. Data which are submitted to the Authority, as identified in Table A7.1 for use in the CRP, will be collected and analyzed under the guidelines set forth by the QAPP.

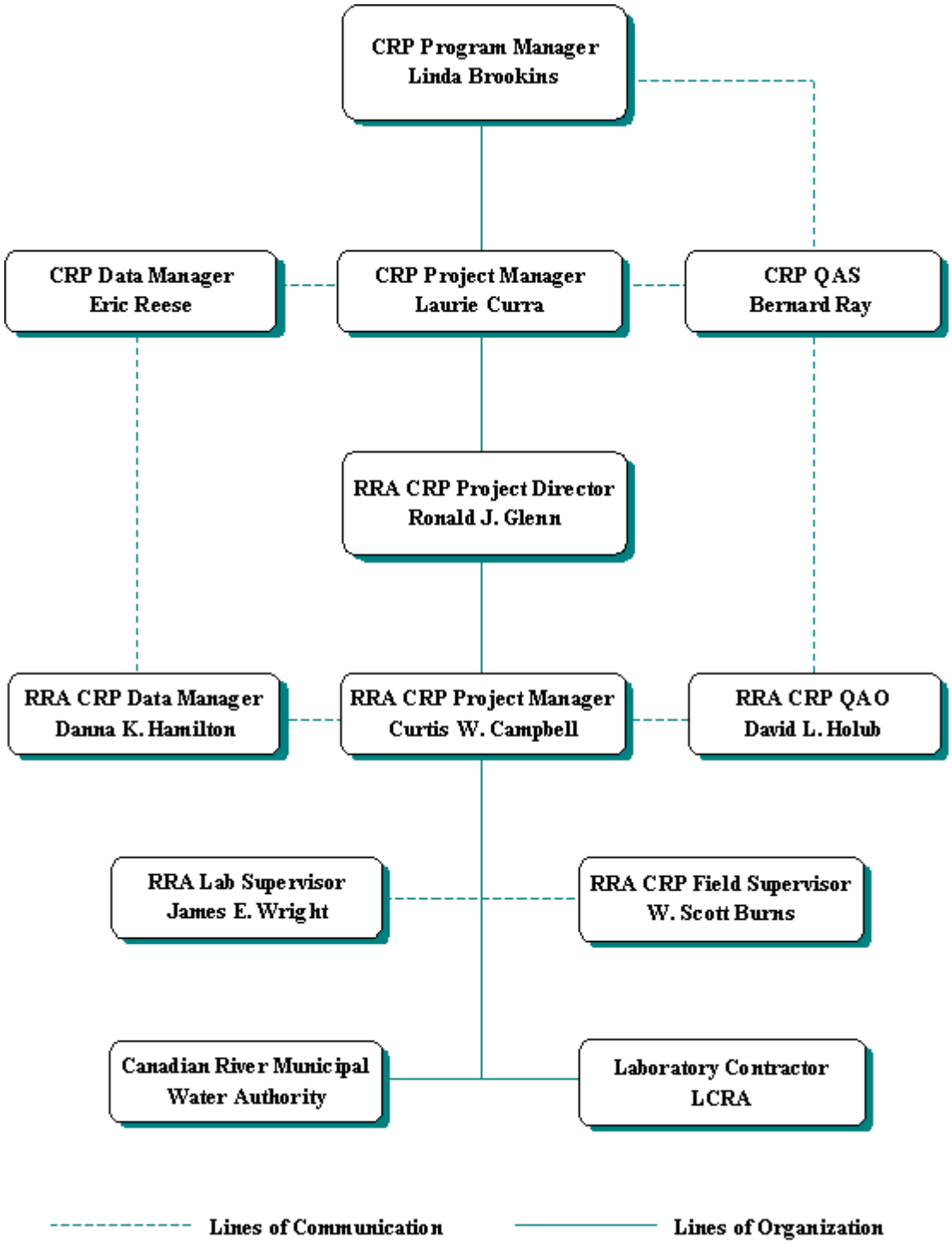
Contract Laboratories

Lower Colorado River Authority Laboratory

The Lower Colorado River Authority Laboratory (LCRA) is a river authority laboratory that is able to perform sophisticated chemical tests as required by the CRP and has contracted with the Authority to perform specific specialized analyses. The Authority will utilize LCRA as a source for specific tests, as identified in Table A7.1, that the Authority's laboratory cannot perform in-house.

PROJECT ORGANIZATION CHART

CHART 1



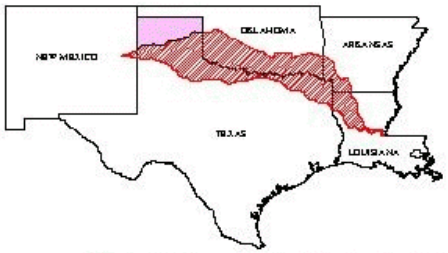
A5 PROBLEM DEFINITION/BACKGROUND

In 1991, the Texas Legislature passed the Texas Clean Rivers 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 within the watershed. The CRP Legislation mandates that "each river authority (or local governing entity) will submit quality-assured data collected in the river basin to the commission". "Quality-assured (QA) data" in the context of the legislation means "data that complies with commission rules for 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". This QAPP addresses the program developed between the Red River Authority of Texas and the TNRCC to carry out the activities mandated by the legislation for the Red and Canadian River Basins. The QAPP was developed and will be implemented in accordance with provisions of the *Quality Management Plan for the Clean Rivers Program* (most recent version). Refer to the Vicinity Map – Figure 1, for geographical coverage of the area.

The purpose of this QAPP is to clearly delineate Red River Authority of Texas QA policy, management structure, and policies which will be used to implement the QA requirements necessary to document the reliability and validity of environmental data. The QAPP is reviewed by the TNRCC to 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 state-wide 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 TNRCC. 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 2002 - 2003.*

The FY 2002 monitoring schedule and QAPP are based on results from previous Water Quality Assessment Reports conducted under the CRP, specific constituents listed on the §303(d), and specific requests from TNRCC and the Red and Canadian River Basins Advisory Committees. The primary concerns in the basins are naturally occurring chlorides, low dissolved oxygen levels, coliform bacteria, and the lack of water quality data. Therefore, the monitoring plan developed by the Authority is designed to accomplish the following: adequate baseline water quality data throughout each basin, collect the data necessary to prove or dispute the §303(d) listings, and collect the data needed to meet the needs of TNRCC and/or the stakeholders as requested by the Basin Advisory Committee.

CANADIAN AND RED RIVER BASINS VICINITY MAP



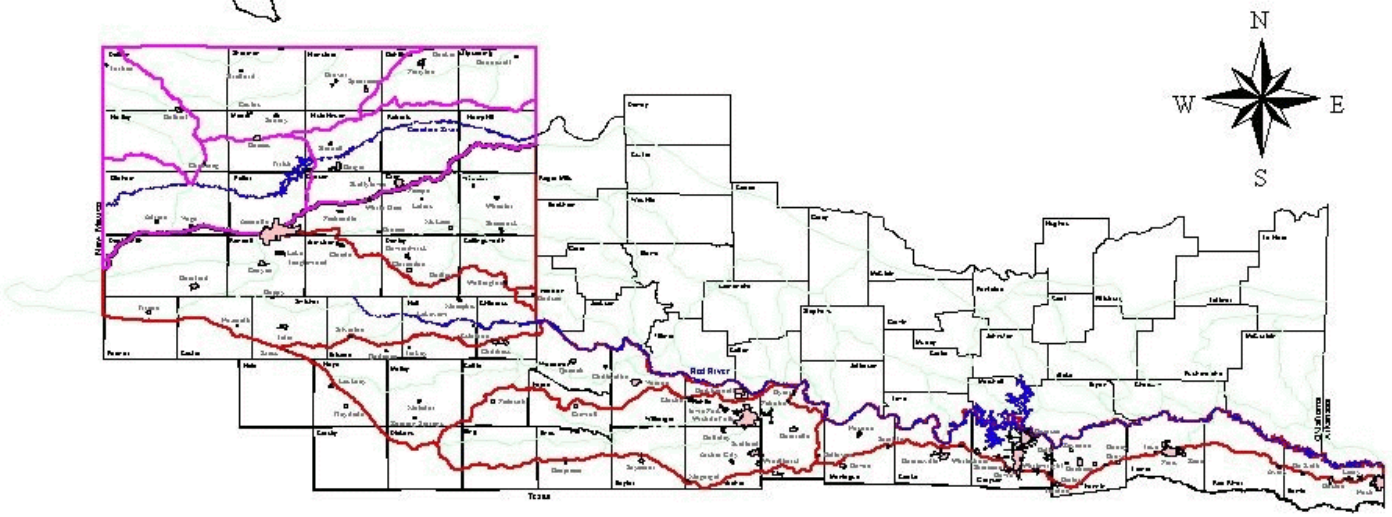


Figure 1

A6 PROJECT/TASK DESCRIPTION AND SCHEDULE

The TNRCC has identified four types of monitoring: fixed station monitoring, systematic watershed evaluation, targeted monitoring and special studies. For this QAPP, the Authority will focus on fixed station and systematic monitoring only. Unless funding becomes available, there will be no special studies performed this fiscal year. However, should funding become available for a special study to be performed, this QAPP will be amended with an Addendum. The following paragraphs provide a general description of what these monitoring programs are expected to accomplish:

> *The fixed station monitoring program* provides an early detection of potential problems. Fixed stations can provide long-term historical information concerning the attainment or non-attainment of water quality objectives within the basin and assist the TNRCC in the assessment of Texas Surface Water Quality Standards (TSWQS) attainment. The fixed stations will allow the water quality to be compared between each of the stream segments, as well as determine any impacts from point discharges. The water quality data generated from these stations assist the TNRCC in conducting the Biennial Water Quality Assessment 305(b) required by the U.S. Environmental Protection Agency (EPA).
>
> *The systematic watershed assessment program* allows for the screening of major and sub-watersheds utilizing both ambient water quality and bacteriological indicators on a more intensive scale and on a rotating schedule. The objectives are to evaluate known areas of concern and identify previously undetected problem areas within a watershed.
>
> *The Special Studies program* focuses on basin priorities not directly related to permitting and will address through intensive data collection efforts to evaluate stream standard exceedances, non-attainment of designated uses, the loading contribution of nonpoint sources in a watershed, problems identified through data screening analysis and expressed concerns from the BAC.

The Authority's staff will be responsible for coordinating and conducting the collection of water samples and performing field measurements. The water samples will be relinquished to LCRA or the Authority's Environmental Services Laboratory for analysis. The CRMWA will collect and analyze water samples to be submitted to the Authority under the QAPP. The parameters to be analyzed by each laboratory are shown in Table A7.1.

A6 PROJECT/TASK DESCRIPTION AND SCHEDULE (continued)

A6.1 CANADIAN RIVER BASIN

The Canadian River Basin has a total drainage area of 22,866 square miles, the headwaters beginning in northeastern New Mexico. The Canadian River is a tributary to the Arkansas River, which eventually flows into the Mississippi River. The basin was divided into five reaches in an attempt to design the most efficient sampling plan within the limited budget available (See Figures 1-1 through 1-5). There are a total of 13 Hydrologic Unit Areas (HUAs) in the five reaches of the Canadian River Basin. The reaches were ranked so that monitoring could be scheduled corresponding to CRP priorities. The ranking of each reach was based on the combined ranking of the segments in each reach (segments were ranked in accordance with the TNRCC procedure), the total number of domestic and industrial dischargers in the reach, and the total volume of effluent discharged in the reach. The resultant ranking and corresponding schedule for focused monitoring are as follows:

FY 2002 – Reach III
FY 2003 – Reach IV

The main water quality problem within the Canadian River Basin is high concentrations of total dissolved solids (TDS). The TDS within the basin primarily originates from natural salt water intrusions below Ute Lake, New Mexico. The monitoring plan for the reaches in the Canadian River Basin will attempt to determine mineral loading for the major tributaries (including the main stem of the Canadian River), in order to determine inputs into Lake Meredith, which serves as the primary drinking water supply in the Panhandle of Texas.

Other problems in the basin include elevated nutrient levels. This will be addressed through detailed nutrient analyses and as resources become available, diurnal dissolved oxygen studies will be performed. This will determine whether the elevated nutrients are causing a problem via depleted oxygen and/or eutrophication.

Screening of fecal coliform concentrations showed many segments having concerns and possible concerns. A consistent sampling regime will be performed throughout the basin targeting those areas (segments) showing a concern or possible concern. This procedure will aid in determining whether there is truly a problem and if so, what are the sources and relationship to the other parameters (i.e. flow). *E. coli* concentrations will also be analyzed, since the TNRCC has changed from using fecal coliform concentrations to *E. coli* concentrations in assessing bacteriological communities with respect to water quality. The change to *E. coli* is due to the uncertainty of fecal coliform concentrations in determining health risks.

See Appendix A for the project related Work Plan tasks and Schedule of Deliverables for a description of work defined in this QAPP.

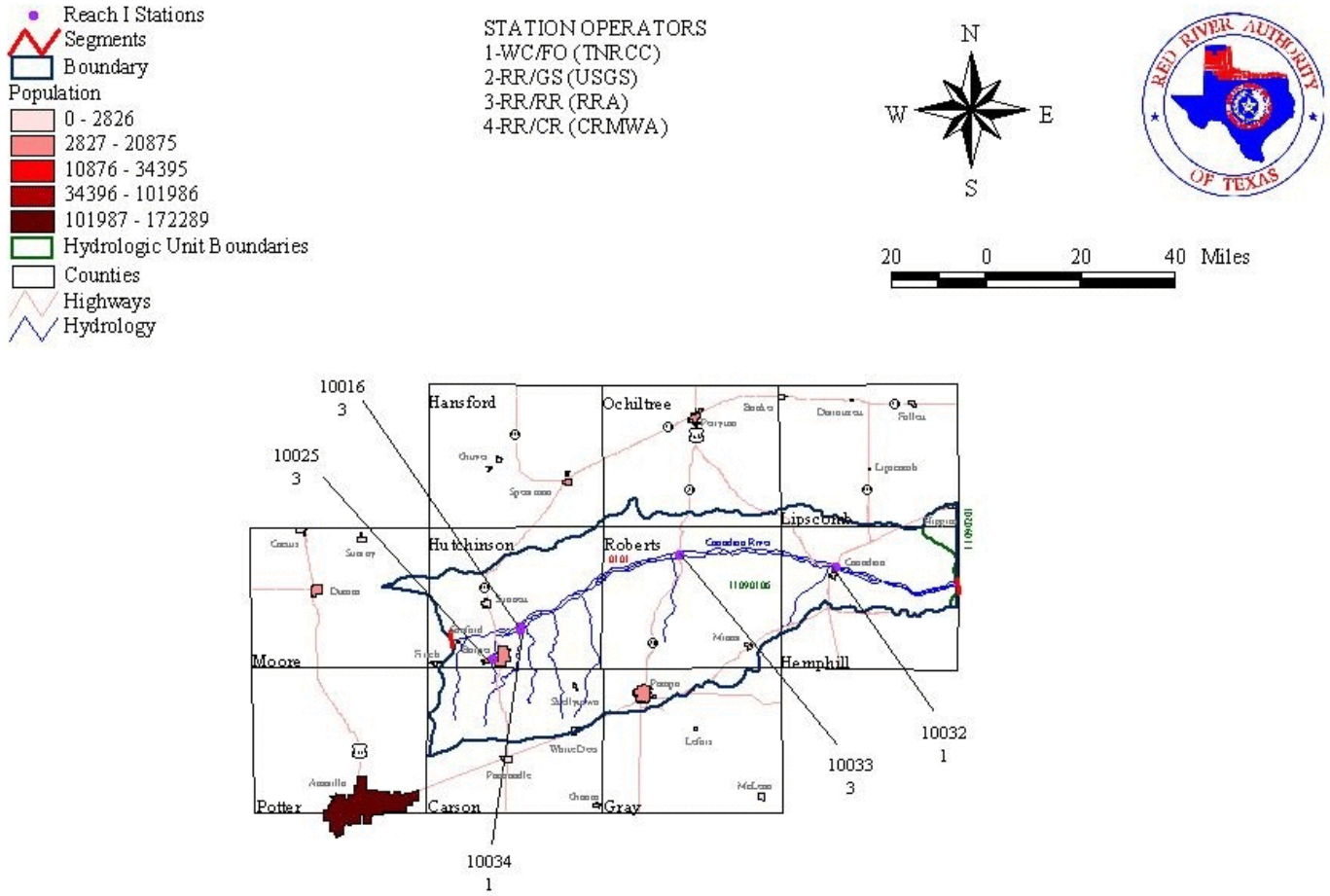


FIGURE 1-1
CANADIAN RIVER WATERSHED REACH I
2002 STATION LOCATIONS

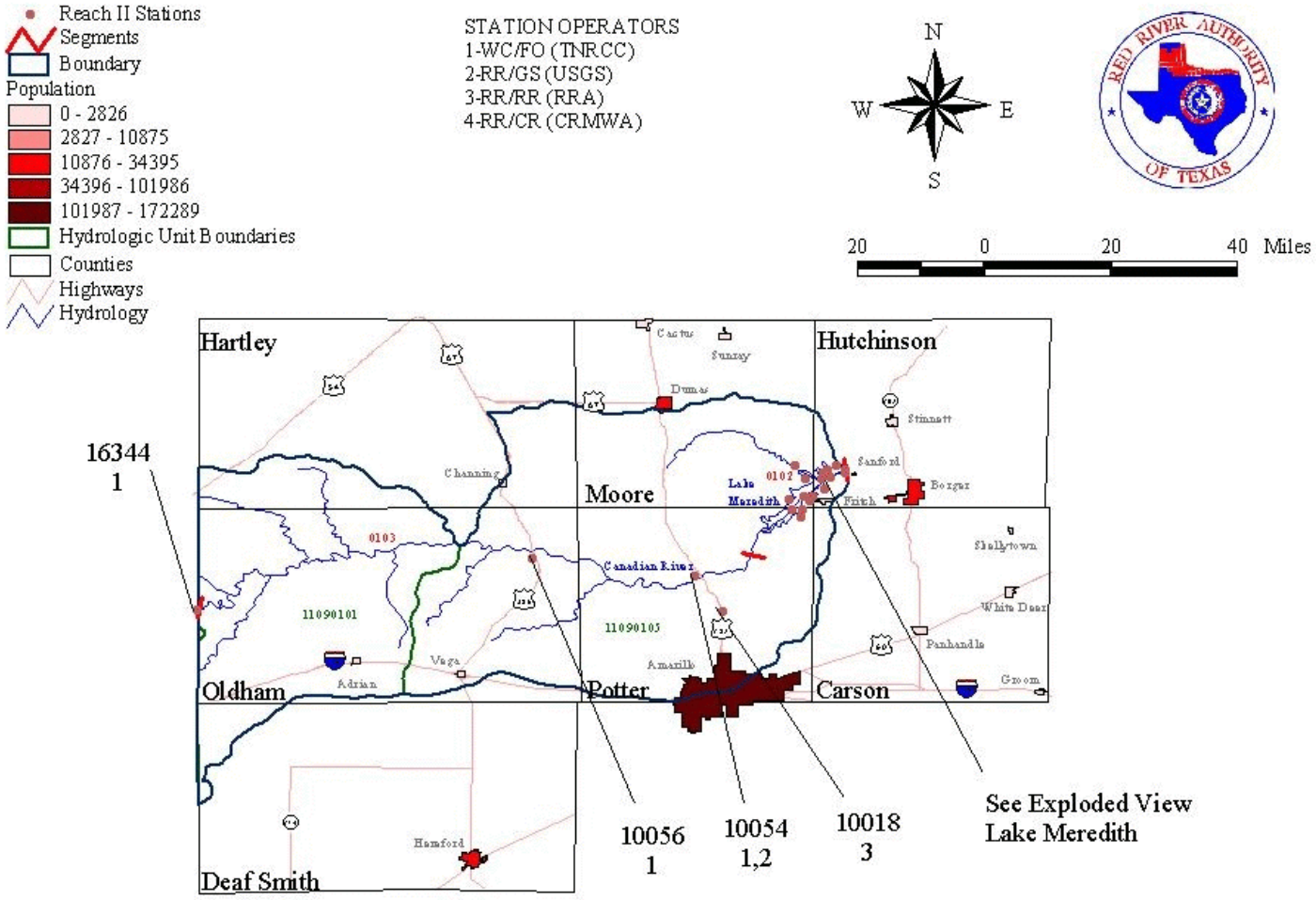


FIGURE 1-2
CANADIAN RIVER WATERSHED REACH II
2002 STATION LOCATIONS

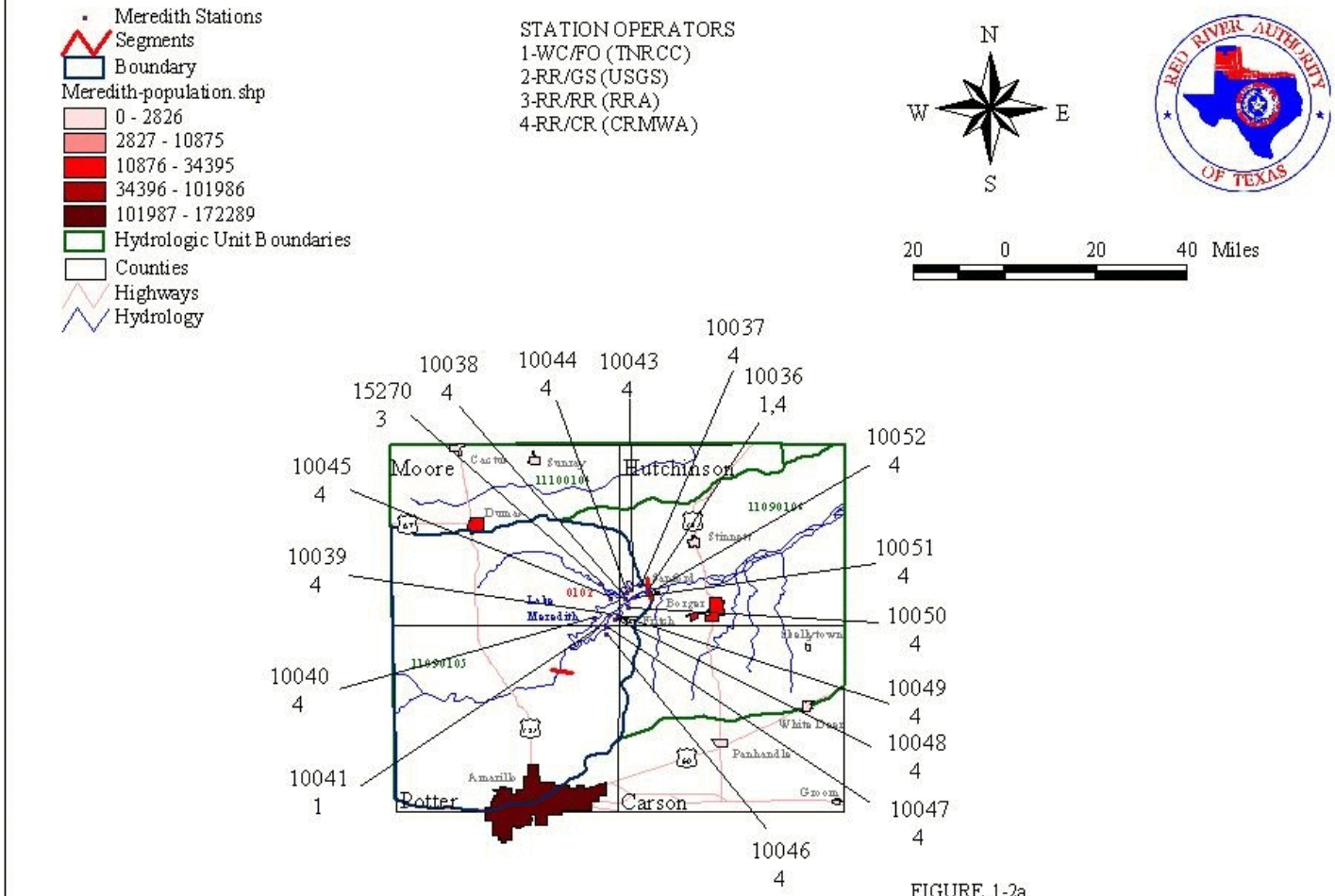


FIGURE 1-2a
CANADIAN RIVER WATERSHED REACH II
LAKE MEREDITH
2002 STATION LOCATIONS

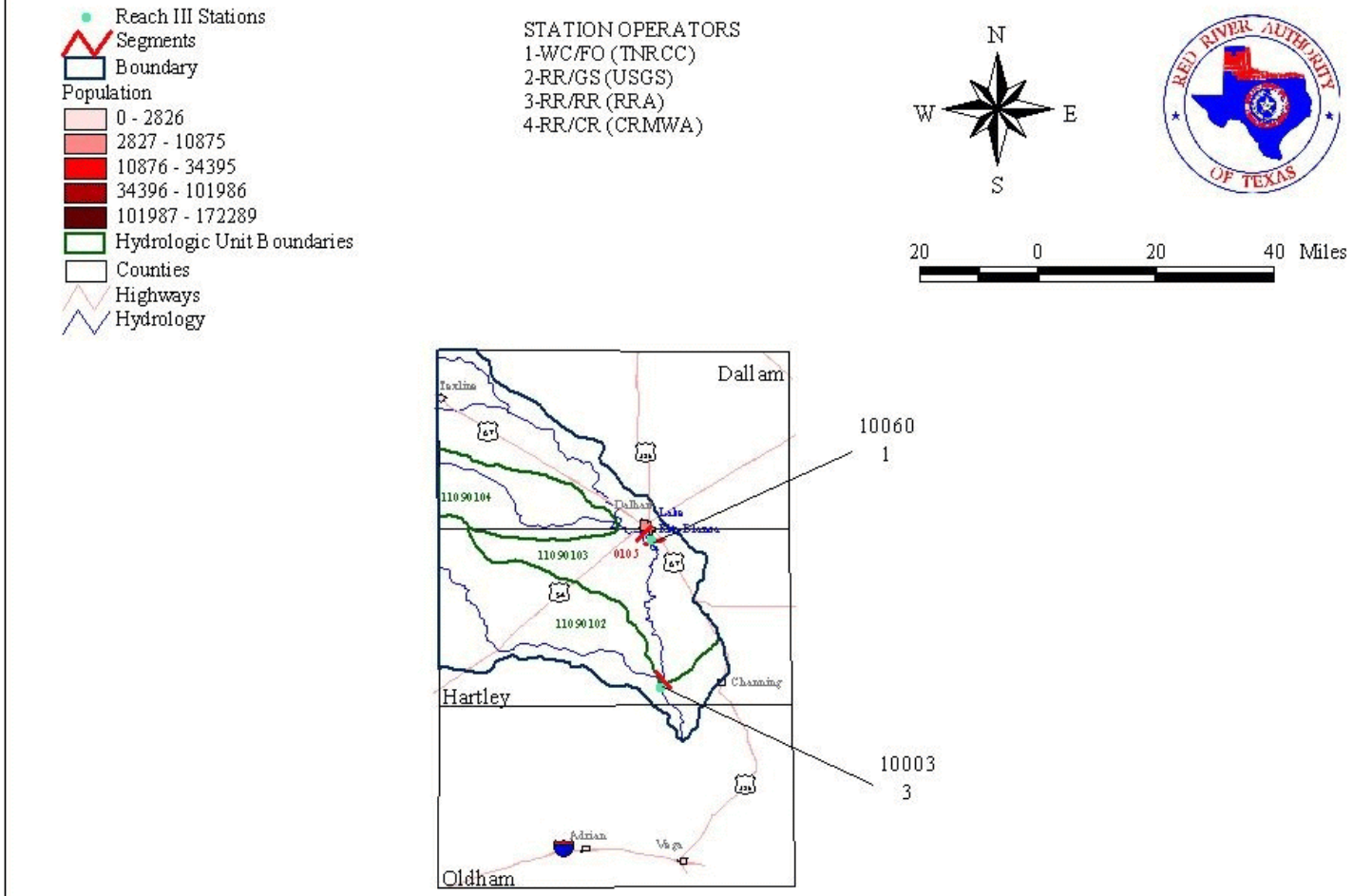


FIGURE 1-3
CANADIAN RIVER WATERSHED REACH III
2002 STATION LOCATIONS

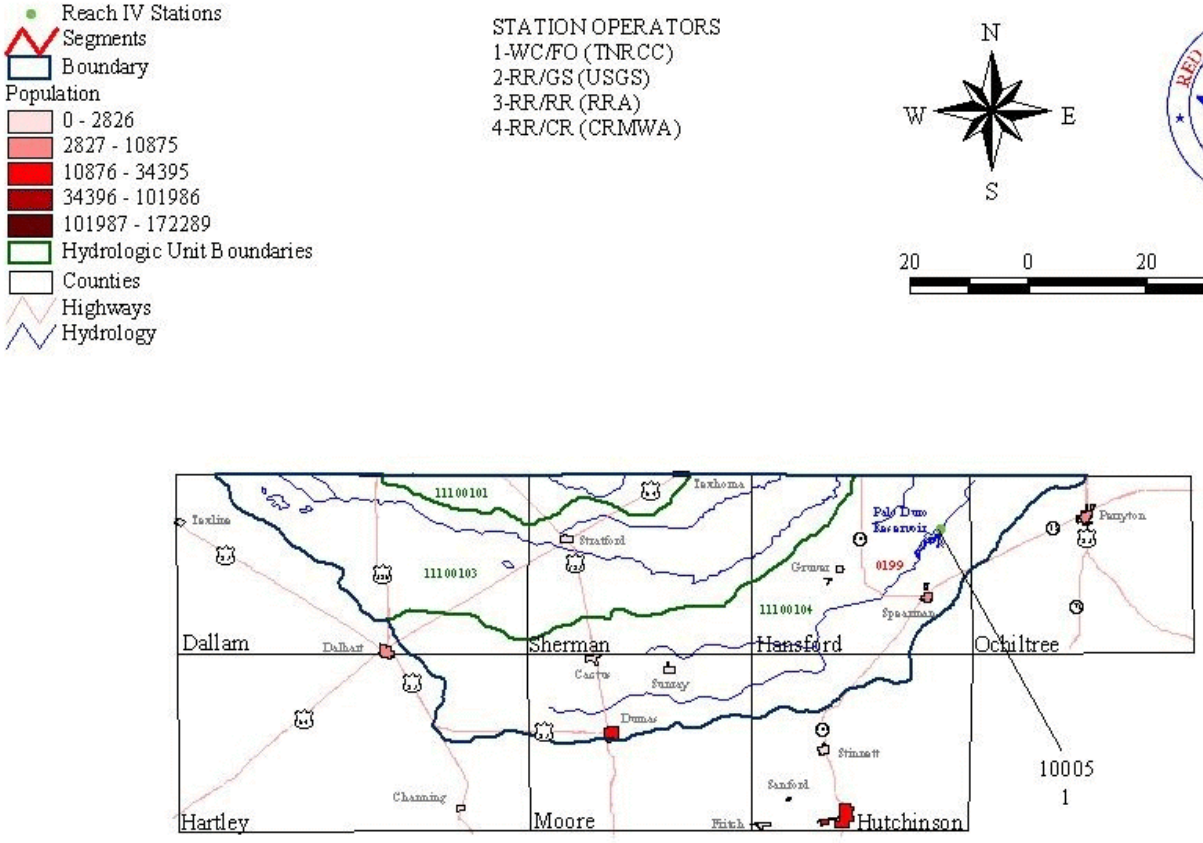


FIGURE 1-4
CANADIAN RIVER WATERSHED REACH IV
2002 STATION LOCATIONS

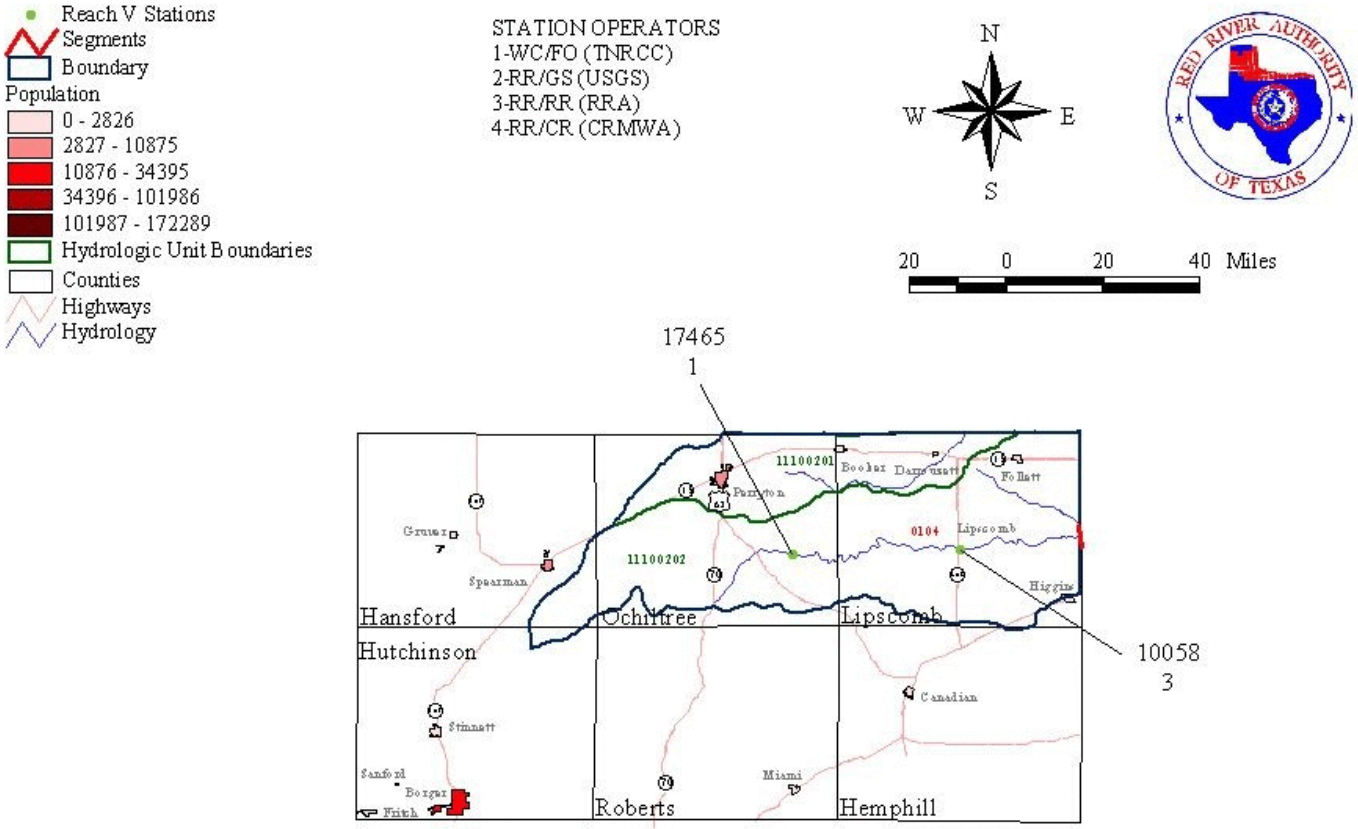


FIGURE 1-5
CANADIAN RIVER WATERSHED REACH V
2002 STATION LOCATIONS

A6 PROJECT/TASK DESCRIPTION AND SCHEDULE (continued)

A6.2 RED RIVER BASIN

The Red River Basin covers a total drainage area of 94,450 square miles; 24,463 square miles lie within Texas. The basin was divided into five reaches, in an attempt to design the most efficient sampling plan within the limited budget available (see Figures 2-1 through 2-5). Reach 1 contains four HUAs. The remaining reaches each contain five HUAs. The reaches were ranked so that monitoring could be scheduled according to CRP priorities. The ranking of each was based on the combined ranking of the segments in each reach (segments were ranked in accordance with the TNRCC procedure), the total number of domestic and industrial dischargers in the reach, and the total volume of effluent discharged in the reach. The resultant ranking and corresponding schedule for focused monitoring are as follows:

FY 2002 – Reach II
FY 2003 – Reach III

See Appendix B for monitoring to be conducted under this QAPP.

The main water quality concern within the Red River Basin is high concentrations of total dissolved solids (TDS). The TDS within the basin primarily originates from natural salt springs. Other sources include oilfield brine and urban activities. The monitoring plans for the reaches in the Red and Canadian River Basins will attempt to determine mineral loading for the major tributaries, in order to clarify sources and to what extent these sources contribute to the elevated TDS concentrations.

Although nutrients were not considered a concern during screening, several nutrient parameters showed abnormal fluctuations. This will be addressed through detailed nutrient analyses and as resources become available, diurnal dissolved oxygen studies will be performed. This will determine whether the elevated nutrients are causing a problem via depleted oxygen and/or eutrophication.

Screening of fecal coliform concentrations showed many segments having concerns and possible concerns. A consistent sampling regime will be performed throughout the basin targeting those areas (segments) showing a concern or possible concern. This procedure will aid in determining whether there is truly a problem, and if so, what are the sources and relationship to the other parameters. *E. coli* concentrations will also be analyzed, since the TNRCC has changed from using fecal coliform concentrations to *E. coli* concentrations in assessing bacteriological communities with respect to water quality. The change to *E. coli* is due to the uncertainty of fecal coliform concentrations in determining health risks.

Tables A6.1 and A6.2 summarize the results of the *Red and Canadian River Basin Highlights Reports*, including specific parameters determined to be of concern and recommendations for monitoring.

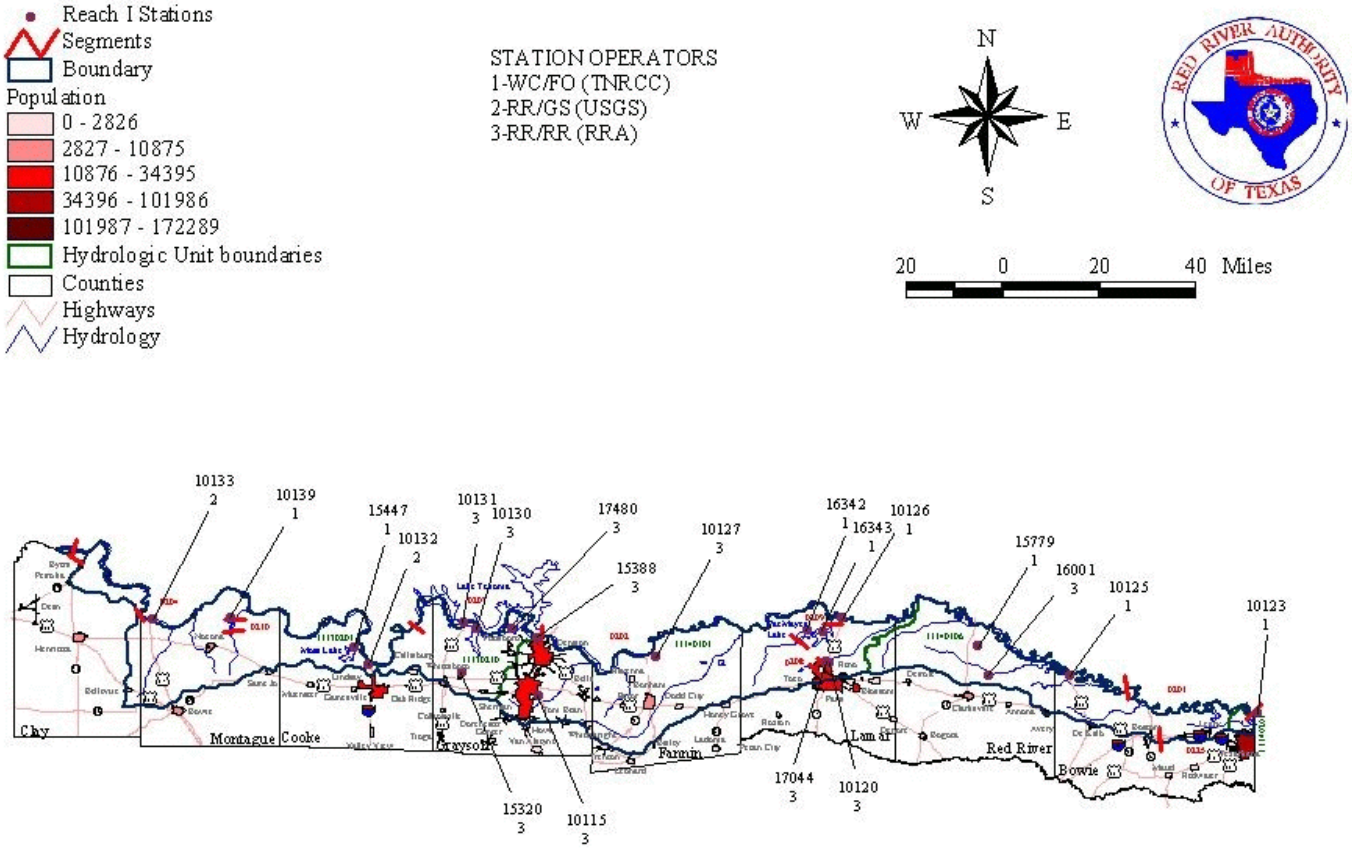


FIGURE 2-1
RED RIVER WATERSHED REACH I
2002 STATION LOCATIONS

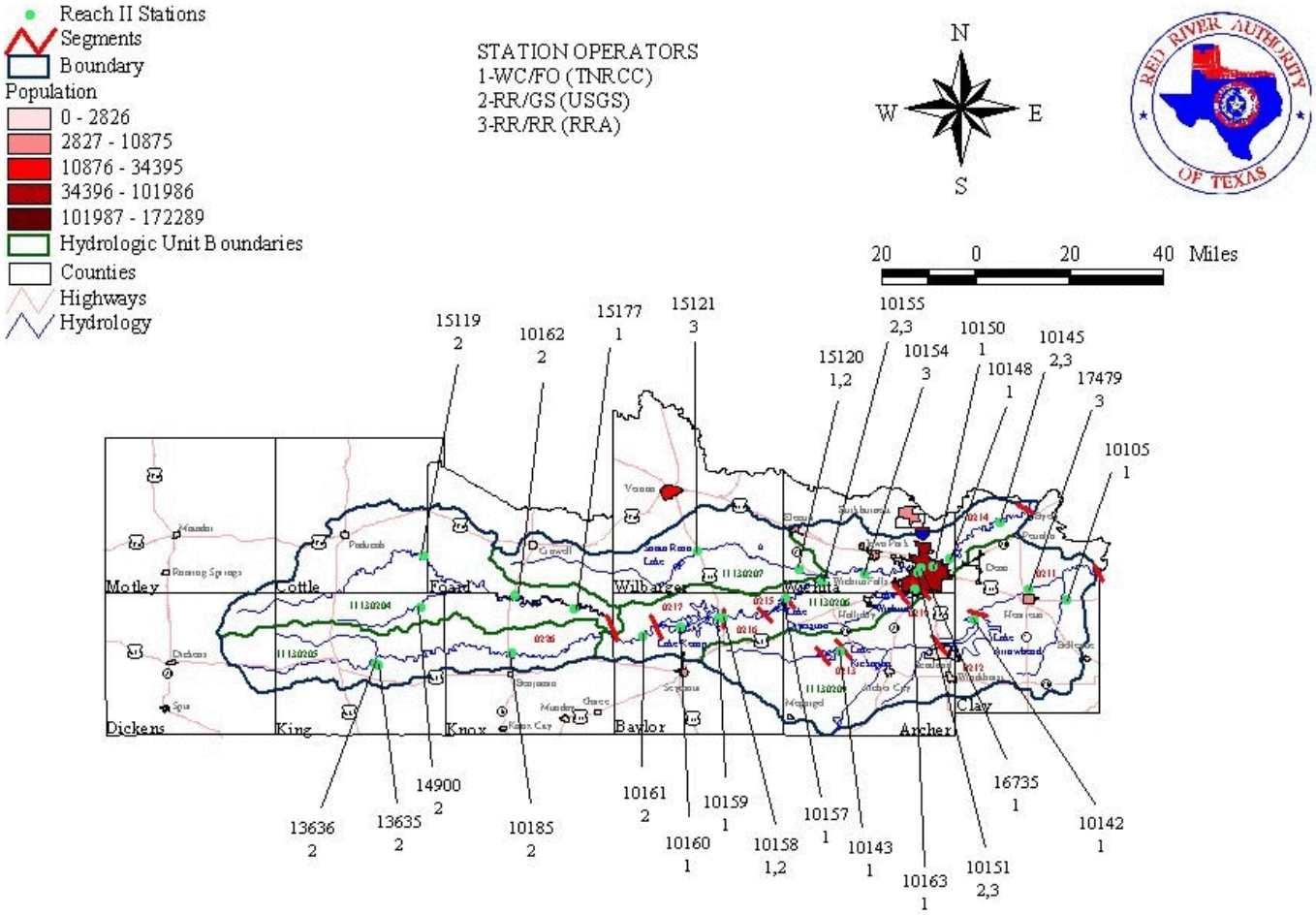


FIGURE 2-2
RED RIVER WATERSHED REACH II
2002 STATION LOCATIONS

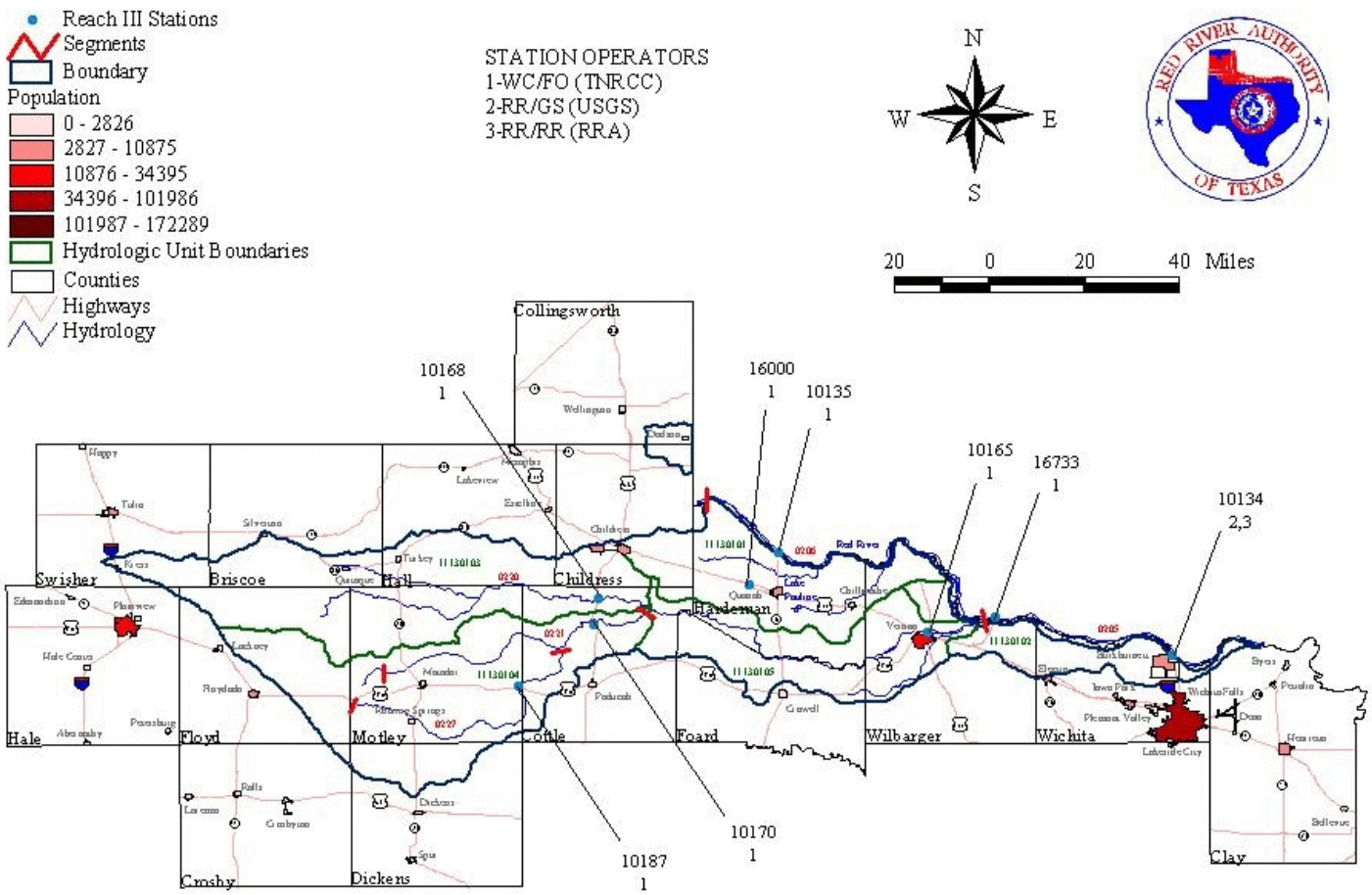


FIGURE 2-3
RED RIVER WATERSHED REACH III
2002 STATION LOCATIONS

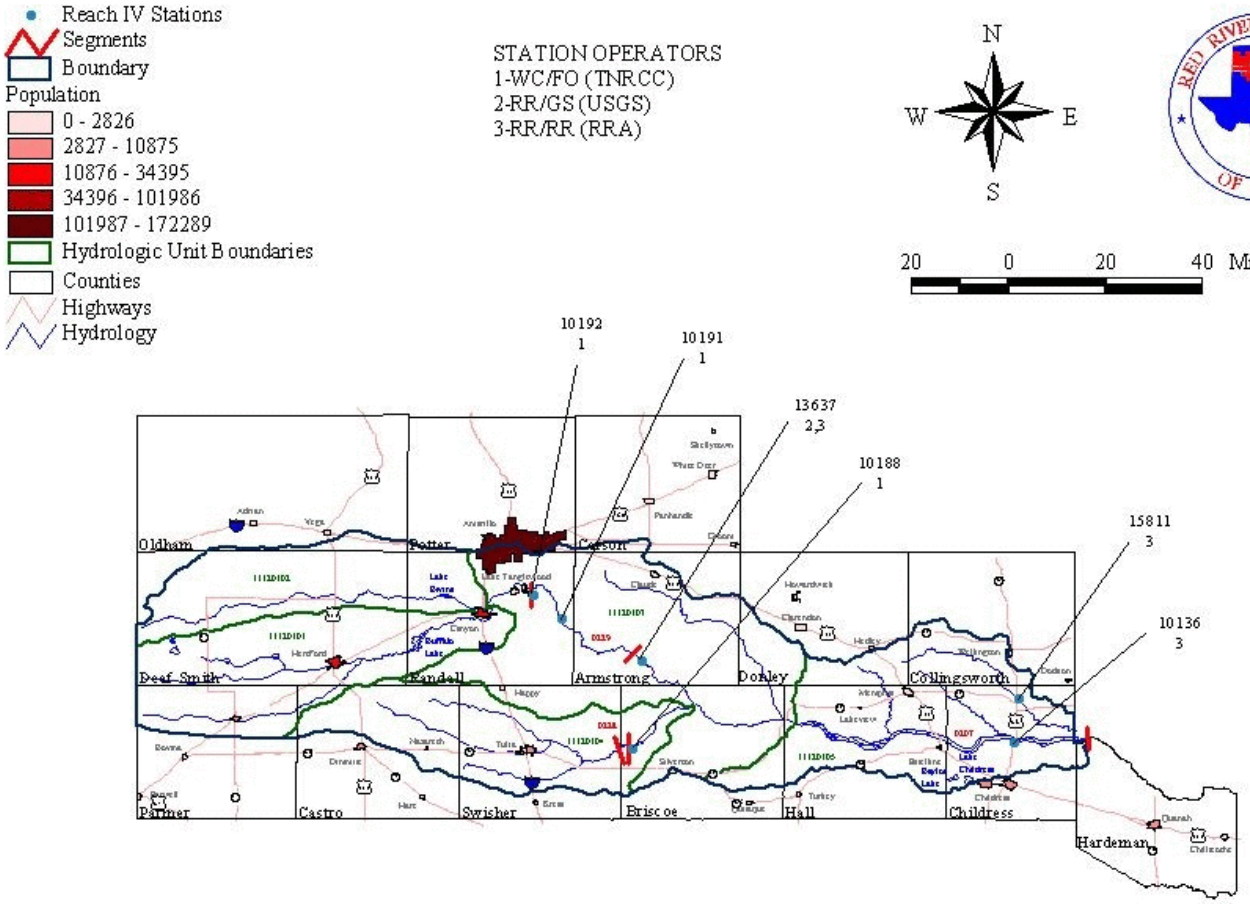


FIGURE 2-4
RED RIVER WATERSHED REACH IV
2002 STATION LOCATIONS

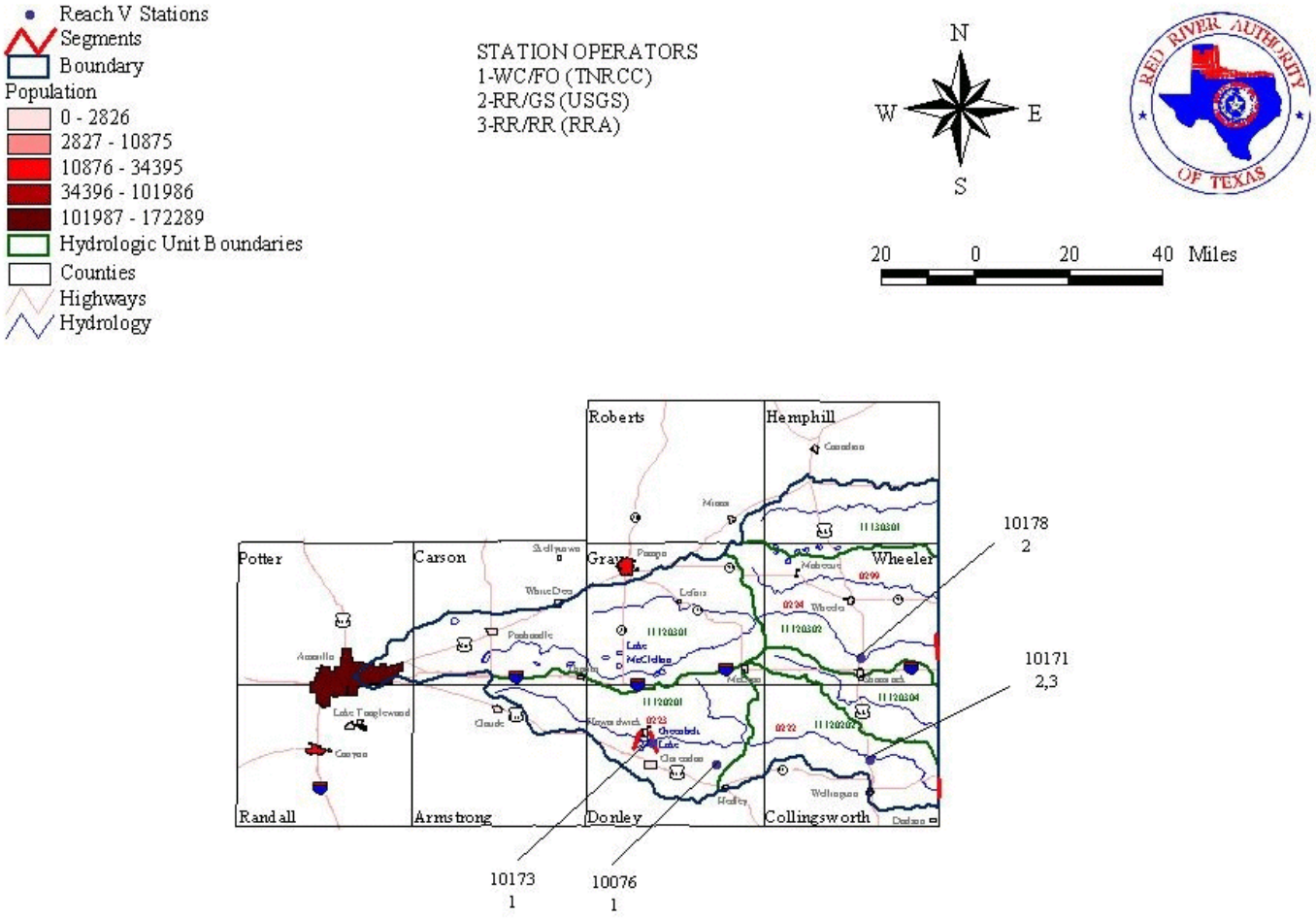


FIGURE 2-5
RED RIVER WATERSHED REACH V
2002 STATION LOCATIONS

A6 PROJECT/TASK DESCRIPTION AND SCHEDULE (continued)

A6.3 AMENDMENTS TO THE QAPP

Revisions to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives and methods to improve operational efficiency and to accommodate unique or unanticipated circumstances. Requests for amendments are directed from the Red River Authority of Texas Project Manager to the CRP Project Manager in writing. They are effective immediately upon approval by the Authority's CRP Project Manager, the Authority's QAO, the CRP Project Manager, and the CRP Lead QA Specialist. They will be distributed by the Authority's Project Manager and incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list. Amendments to the QAPP are accomplished without a new signature page.

A6.4 APPENDICES TO THE QAPP

Appendices as referenced under the Project Description above will be submitted as work is planned. Projects requiring QAPP appendices will be planned in consultation with the Red River Authority of Texas and the TNRCC Project Manager and TNRCC technical staff. Appendices will be written in an abbreviated format and will reference the Red and Canadian Basin QAPP where appropriate. Appendices will be approved by the Authority's Project Manager, the Authority's QAO, the CRP Project Manager, the CRP Lead QA Specialist and other TNRCC personnel as appropriate. Copies of approved QAPPs appendices will be distributed by the Authority to project participants before monitoring activities are commenced.

TABLE A6.1
PARAMETERS OF CONCERN OR WHICH WARRANT FURTHER STUDY
CANADIAN RIVER BASIN

REACH NUMBER	HUA NUMBER	TNRCC SEGMENT NUMBER	LOCATION	PARAMETER
I	11090106	0101	Canadian River below Lake Meredith	Chloride, Nutrients, Cadmium
II	11090105	0102	Lake Meredith	Salts, Chromium in Sediment, Nickel in Sediment
II	11090105	0103	Canadian River above Lake Meredith	Salts, Fecal Coliform
III	11090103	0105	Rita Blanca Lake	Salts, Nutrients, Dissolved Oxygen, pH

TABLE A6.2
PARAMETERS OF CONCERN OR WHICH WARRANT FURTHER STUDY
RED RIVER BASIN

REACH NUMBER	HUA NUMBER	TNRCC SEGMENT NUMBER	LOCATION	PARAMETER
I	11140106	0201	Mud Creek	Dissolved Oxygen, pH
I	11130210	0203	Lake Texoma	Chromium, Nickel, and Manganese in Sediments
II	11130209	0211	Little Wichita River	Chlorophyll-*a*, Dissolved Oxygen
II	11130206	0214	Wichita River below Lake Diversion	Chlorophyll-*a*, Chloride, Barium, Nickel and Manganese in Sediments
II	11130207	0214	Beaver Creek	Chloride, Dissolved Oxygen
II	11130204	0218	North Fork of Wichita River	Selenium
III	11130102	0205	Red River below Pease River	Fecal Coliform, Cadmium
III	11130104	0221	Middle Fork of Pease River	Temperature, Chloride, Sulfate, Total Dissolved Solids
IV	11120103	0207	Lower Prairie Dog Town Fork	Fecal Coliform
IV	11120104	0228	Lake Mackenzie	Chloride, Sulfate, Total Dissolved Solids, Manganese in Sediments
IV	11120103	0229	Upper Prairie Dog Town Fork	Chloride, Sulfate, Total Dissolved Solids, Barium in Sediments, Dissolved Oxygen
V	11120202	0222	Salt Fork of Red River	Sulfate
V	11120201	0223	Greenbelt Lake	Barium and Manganese in Sediments
V	11120302	0224	North Fork of Red River	Temperature

A7 QUALITY OBJECTIVES AND MEASUREMENT DATA CRITERIA

The purpose of fixed/routine water quality monitoring is to collect surface water quality data needed for conducting water quality assessments in accordance with TNRCC'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, TNRCC, etc.), will be subsequently reconciled for use and assessed by the TNRCC. No decisions will be made by the project team based on the data collected.

The purpose of systematic monitoring is to allow for a more intensive investigation of known concerns in a watershed and to detect areas of possible concerns not identified by routine water quality monitoring. The additional use of biological data collected under the systematic monitoring will also allow for a better understanding on the long term effects of water quality within the watershed.

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

The Authority and its subcontractors are committed to obtaining and providing environmental data of a known and verifiable quality that can be utilized to meet the objectives of the CRP. These objectives include the collection, dissemination and analysis of water quality conditions in the Red and Canadian River Basins. This will allow analysis of trends and provide baseline data for future comparisons, as well as identifying problems and sources of problems concerning water quality in these basins. These outcomes will be used in the writing of Basin Highlight Reports, Basin Summary Reports, and the §305(b) Reports. Additionally, the data will be used in important decision making processes, such as permitting decisions, causes and degree of impairment of sites on the §303(d) list, and the modification or initiation of stream segment standards.

The measurement performance criteria to support the project objectives are specified in Table A7.1.

TABLE A7.1 – DATA QUALITY OBJECTIVES FOR FIELD AND LABORATORY MEASUREMENTS

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION OF LABORATORY DUPLICATES (RPD)	ACCURACY AT AWRLS (% REC.)	ACCURACY OF LAB MATRIX SPIKES (% REC.)	LABORATORY PERFORMING ANALYSIS
FIELD PARAMETERS									
Conductivity	umhos/cm	Water	EPA 120.1 and TNRCC SOP	00094	N/A*	N/A	N/A	N/A	Field
Days Since Last Significant Rainfall	Days	NA	TNRCC SOP	72053	N/A*	N/A	N/A	N/A	Field
Dissolved Oxygen	mg/L	Water	EPA 360.1 and TNRCC SOP	00300	N/A*	N/A	N/A	N/A	Field
Flow	cfs	Water	TNRCC SOP	00061	N/A*	N/A	N/A	N/A	Field
Flow Severity	1 - No Flow 2 - Low 3 - Normal 4 - Flood 5 - High 6 - Dry	Water	TNRCC SOP	01351	N/A*	N/A	N/A	N/A	Field
Flow Measurement Method	1 - Gage 2 - Electric 3 - Mechanical 4 - Weir/Flume	Water	TNRCC SOP	89835	N/A*	N/A	N/A	N/A	Field
pH	Standard Units	Water	EPA 150.1 and TNRCC SOP	00400	N/A*	N/A	N/A	N/A	Field

TABLE A7.1 – DATA QUALITY OBJECTIVES FOR FIELD AND LABORATORY MEASUREMENTS

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION OF LABORATORY DUPLICATES (RPD)	ACCURACY AT AWRLS (%REC.)	ACCURACY OF LAB MATRIX SPIKES (%REC.)	LABORATORY PERFORMING ANALYSIS
FIELD PARAMETERS (CONTINUED)									
Present Weather	1 - Clear 2 - Partly Cldy 3 - Cloudy 4 - Rain 5 - Other	Air	TNRCC SOP	89968	N/A*	N/A	N/A	N/A	Field
Temperature	Degrees Centigrade	Water	EPA 170.1 and TNRCC SOP	00010	N/A*	N/A	N/A	N/A	Field
Water Clarity	1 - Excellent 2 - Good 3 - Fair 4 - Poor 5 - Other	Water	TNRCC SOP	SA300	N/A*	N/A	N/A	N/A	Field
Water Color	1 - Brownish 2 - Reddish 3 - Greenish 4 - Blackish 5 - Clear 6 - Other	Water	TNRCC SOP	89969	N/A*	N/A	N/A	N/A	Field
Water Odor	1 - Sewage 2 - Chemical 3 - Rotten Egg 4 - Musky 5 - Fishy 6 - None 7 - Other	Water	TNRCC SOP	89971	N/A*	N/A	N/A	N/A	Field

TABLE A7.1 – DATA QUALITY OBJECTIVES FOR FIELD AND LABORATORY MEASUREMENTS

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION OF LABORATORY DUPLICATES (RPD)	ACCURACY AT AWRLS (% REC.)	ACCURACY OF LAB MATRIX SPIKES (% REC.)	LABORATORY PERFORMING ANALYSIS
CONVENTIONAL AND BACTERIOLOGICAL PARAMETERS									
Alkalinity	mg/L	Water	SM 2320-B	00410	10	15	N/A	80-120	CRMWA
Alkalinity	mg/L	Water	EPA 310.1	00410	10	15	N/A	80-120	RRA
Ammonia-N	mg/L	Water	EPA 350.1	00610	0.02	15	75-125	80-120	RRA
Bicarbonate	mg/L	Water	SM 2320-B	00440	3.0 as $CaCO_3$	20	N/A	80-120	CRMWA
Calcium, Dissolved	mg/L	Water	EPA 215.2	00915	0.5	10	75-125	80-120	RRA
Carbonate	mg/L	Water	SM 2320-B	00445	5.0 as $CaCO_3$	20	N/A	80-120	CRMWA
Chloride	mg/L	Water	EPA 300.0	00940	10	15	75-125	80-120	CRMWA
Chloride	mg/L	Water	EPA 300.0	00940	10	10	75-125	80-120	RRA
Chlorophyll-*a*	ug/L	Water	SM 10200-H	32211	10	0-10 mg/L: 30*** 10-100 mg/L: 20 >100 mg/L: 10	75-125	N/A	LCRA
Conductivity	umhos/cm	Water	SM 2510-B	00095	1	N/A	N/A	N/A	CRMWA
COD	mg/L	Water	EPA 410.4	00335	10	10	75-125	80-120	RRA
Total Dissolved Solids	mg/L	Water	SM 1032-F	70301	10.0	0-10 mg/L: 30*** 10-100 mg/L: 20 >100 mg/L: 10	N/A	80-120	CRMWA

TABLE A7.1 – DATA QUALITY OBJECTIVES FOR FIELD AND LABORATORY MEASUREMENTS

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION OF LABORATORY DUPLICATES (RPD)	ACCURACY AT AWRLS (%REC.)	ACCURACY OF LAB MATRIX SPIKES (%REC.)	LABORATORY PERFORMING ANALYSIS
CONVENTIONAL AND BACTERIOLOGICAL PARAMETERS (CONTINUED)									
E. *coli*, IDEXX Colilert	MPN/100 mL	Water	SM 9223-B	31699	1	1 **	N/A	N/A	RRA
Fecal Coliform	cfu/100 mL	Water	SM 9222-D	31616	1	1 **	N/A	N/A	RRA
Total Hardness as $CaCO_3$	mg/L	Water	EPA 130.2	00900	0.5	20	75-125	80-120	CRMWA
Nitrate-Nitrogen, Total	mg/L	Water	EPA 354.1	00620	0.02	20	75-125	80-120	CRMWA
Nitrite plus Nitrate, Total	mg/L	Water	EPA 353.3	00630	0.02	20	75-125	80-120	CRMWA
O-phosphate-P, dissolved	mg/L	Water	EPA 365.2	00671	0.04	15	75-125	80-120	RRA
P. Alkalinity	mg/L	Water	SM 2320-B	00415	3.0 as $CaCO_3$	20	N/A	80-120	CRMWA
pH	Standard Units	Water	EPA 150.1	00403	N/A*	N/A	N/A	N/A	CRMWA
Pheophytin	ug/L	Water	SM 10200-H	32218	5	0-10 mg/L: 30*** 10-100 mg/L: 20 >100 mg/L: 10	75-125	N/A	LCRA
Total phosphate-P	mg/L	Water	EPA 365.2	00665	0.06	10	75-125	80-120	RRA
Sulfate	mg/L	Water	EPA 300.0	00945	10	25	75-125	80-120	RRA
Sulfate	mg/L	Water	EPA 300.0	00945	10	25	75-125	80-120	CRMWA

TABLE A7.1 – DATA QUALITY OBJECTIVES FOR FIELD AND LABORATORY MEASUREMENTS

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION OF LABORATORY DUPLICATES (RPD)	ACCURACY AT AWRLS (% REC.)	ACCURACY OF LAB MATRIX SPIKES (% REC.)	LABORATORY PERFORMING ANALYSIS
CONVENTIONAL AND BACTERIOLOGICAL PARAMETERS (CONTINUED)									
Sodium	mg/L	Water	SM 3500-NA-D	00930	0.01	20	75-125	80-120	CRMWA
Total Suspended Solids	mg/L	Water	EPA 160.2	00530	4	0-10 mg/L: 30*** 10-100 mg/L: 20 >100 mg/L: 10	N/A	N/A	RRA
Total Dissolved Solids	mg/L	Water	EPA 160.1	70300	10	0-10 mg/L: 30*** 10-100 mg/L: 20 >100 mg/L: 10	N/A	N/A	RRA
Total Organic Compound	mg/L	Water	EPA 415.1	00680	2.0	20	75-125	80-120	LCRA
Turbidity	NTU	Water	SM 2130-B and EPA 180.1	82079	0.5	N/A	N/A	N/A	RRA
Volatile Suspended Solids	mg/L	Water	EPA 160.4	00535	4	0-10 mg/L: 30*** 10-100 mg/L: 20 >100 mg/L: 10	N/A	80-120	RRA
TSWQS METALS									
Selenium, Total	ug/L	Water	EPA 200.8	01147	2	20	75-125	80-120	LCRA
Calcium	mg/L	Water	SM 3500-Ca-D	00915	0.5	15	75-125	80-120	CRMWA
Magnesium, Dissolved	mg/L	Water	SM 3500-Mg-B	00925	0.5	20	75-125	80-120	CRMWA
Fluoride, Dissolved	mg/L	Water	EPA 300.0	00950	0.5	20	75-125	80-120	CRMWA

* Reporting to be consistent with SWQM guidance and based on measurement capability.

** Based on range statistics as described in *Standard Methods, 20th Edition*, Section *9020-B*, "Quality Assurance/Quality Control - Intra laboratory Quality Control Guidelines."

*** Measurement performance criteria will vary according to range of results.

References: United States Environmental Protection Agency (US EPA) *"Methods for Chemical Analysis of Water and Wastes"*, *Manual #EPA-600/4-79-020, 20th Edition Standard Methods for the Examination of Water and Wastewater 1998,*
TNRCC SOP – *TNRCC Surface Water Quality Monitoring Procedures Manual, June 1999* or subsequent editions.

A7 QUALITY OBJECTIVES AND MEASUREMENT DATA CRITERIA
(continued)

A7.1 AMBIENT WATER REPORTING LIMITS

Ambient water reporting limits, or AWRL's, are the specifications at or below which data will be reported to the TNRCC. Ongoing ability to recover an analyte at the AWRL is demonstrated through analysis of a calibration or check standard at the AWRL. The AWRLs for target analytes and performance limits at AWRLs for this project are set forth in Table A7.1. Quality control requirements are defined in Section B5.

A7.2 PRECISION

The precision of data is a measure of the reproducibility of a measurement when a collection or an analysis is repeated. It is strictly defined as the degree of mutual agreement among independent measurements as a result of repeated application of the same process under similar conditions. Performance limits for laboratory duplicates are defined in the table above. Performance limits for field duplicates are defined in Section B5.

A7.3 ACCURACY

Accuracy is a statistical measurement of correctness and includes components of systemic error. A measurement is considered accurate when the value reported does not differ from the true value. Accuracy is verified through the analysis of laboratory spikes and calibration control standards. Performance limits for laboratory spikes and calibration control standards for AWRLs are specified in the table above.

A7.4 REPRESENTATIVENESS

Site selection, the appropriate sampling regime, the sampling of all pertinent media according to TNRCC SOPs, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Fixed/routine data collected under the Clean Rivers Program for water quality assessments are considered to be spatially and temporally representative of fixed/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 through 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.

A7.5 COMPARABILITY

Confidence in the comparability of fixed/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 TNRCC 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 the Data Management Plan (Appendix E).

A7.6 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 REQUIREMENTS/CERTIFICATION

No special training or certifications are required for this project. Training on field techniques, quality assurance, data management, etc., is provided by the TNRCC for the Authority as part of the Clean Rivers Program.

A9 DOCUMENTATION AND RECORDS

The documents that describe, specify, report, or certify activities are listed below.

TABLE A9.1 – PROJECT DOCUMENTS AND RECORDS

Document/Record	Location	Retention (yrs)	Format
QAPPs, Amendments and Appendices	TNRCC/RRA	7	Paper
QAPP Distribution Documentation	RRA	7	Paper
Field Notebooks or Field Data Sheets	RRA[3]	7	Paper
Field Equipment Calibration/Maintenance Logs	RRA[3]	7	Paper
Chain of Custody Records	RRA[3]	7	Paper
Field SOPs	RRA[3]	7	Paper
Laboratory QA Manuals	RRA[1, 2, 3]	7	Paper
Laboratory SOPs	RRA[1, 2, 3]	7	Paper
Laboratory Data Reports/Results	RRA[1, 2, 3]	7	Paper
Instrument Printouts	RRA[1, 2, 3]	7	Paper
Laboratory Equipment Maintenance Logs	RRA[3]	7	Paper
Laboratory Calibration Records	RRA[3]	7	Paper
Corrective Action Documentation	RRA[3]	7	Paper

1. Red River Authority of Texas
   Environmental Laboratory
   900 8th Street, Hamilton Bldg., Suite 426
   Wichita Falls, Texas 76301-6894

2. LCRA Environmental Laboratory Services
   P. O. Box 200
   Austin, Texas 78767
   (or 3505 Montopolis, 78744-1417)
   (physical address)

3. Canadian River Municipal Water Authority
   P.O. Box 99
   Sanford, Texas 79078

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

B2.1 FIELD SAMPLING PROCEDURES

The field sampling procedures are documented in the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)*. Additional aspects outlined in Section B below reflect specific requirements for sampling under the Clean Rivers Program and/or provide additional clarification.

TABLE B2.1 – SAMPLE STORAGE, PRESERVATION AND HANDLING REQUIREMENTS

Parameter (Matrix/Test)	Container[1]	Preservation[2]	Sample Volume[3]	Holding Time[4]
Bacteriological (Water)				
Escherichia coli and Fecal Coliforms	P, G	Sodium Thiosulfate, Cool 4°C	250 mL	6 hours
Conventionals and Minerals (Water)				
Total Hardness	P, G	Cool, 4°C	1.2 L	48 Hours
Alkalinity, Carbonate, Bicarbonate, P. Alkalinity	P, G	Cool, 4°C	1.2 L	14 Days
Calcium, Dissolved	P, G	HNO_3 to pH<2	250 mL	6 Months
Solids TSS, TDS, VSS	P, G	Cool, 4°C	1.2 L	7 Days
Chloride	P, G	None Required	1.2 L	28 Days
Sulfate	P, G	Cool, 4°C	1.2 L	28 Days
Turbidity	P, G	Cool, 4°C	250 mL	48 Hours
Nutrients (Water)				
Ammonia , Nitrate + Nitrite, Total Phosphorus, TOC & COD	P, G	Cool, 4°C, H_2SO_4 to pH<2	500 mL	28 Days
O-Phosphorus	P, G	Filtered, Cool, 4 °C	250 mL	48 Hours
Chlorophyll *a* and Pheopytin	P, G Opaque	Filter ≤ 48 Hours, Frozen Dark	200 mL	21 Days
Metals (Water)				
Total Selenium, and Dissolved Calcium and Magnesium	P, G	HNO_3 to pH<2	250 mL	6 Months
Fluoride	P, G	HNO_3 to pH<2	250 mL	28 Days

[1] Polyethylene (P) or Glass (G).
[2] Sample preservation should be performed immediately upon sample collection.
[3] Samples volumes may be combined by preservative to minimize volumes and reduce container size and space.
[4] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before sample preparation or analysis and still be considered valid.

B2.2 HOLDING TIME AND TEMPERATURE

Holding times and temperatures vary by parameter and preservative. The Authority and CRMWA field staff responsible for collecting and analyzing samples will follow the established guidelines as presented in the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)* so that samples are preserved properly, that holding times are met, and that the laboratory processing the samples has adequate time to conduct the tests.

B2.3 SAMPLE CONTAINERS

Sample containers chosen and are used according to the Authority's sample needs. Some containers are purchased either new and pre-cleaned, while others are reusable and washable. Samples for specific field and conventional parameters will be collected in individual or aggregate containers depending on sample preservatives. The sample containers for metals are new, certified glass or plastic containers. Sterilized leakproof polypropylene containers are used for bacteriological samples an may have 1% sodium thiosulfate added. Reusable containers are cleaned in accordance with the bottle washing schedule maintained on each set of containers and follows a written SOP which contains the following procedures:

1. All containers must be rinsed thoroughly as soon as possible after use. All labels must be removed from containers prior to placing in dishwasher.
2. Items that are too large to fit in the dishwasher must be washed thoroughly be hand in hot water using the Liquinox(R) glassware cleaner and a bottle brush.
3. Once all items are properly placed in the dishwasher, it is set to run. It takes approximately one (1) hour to run a complete cycle. The heating element of the dishwasher is not used in order to prevent damage to any plastic items in the dishwasher and to reduce the chance of any soap residue drying on the containers.
4. Once the dishwasher completes its cycle, the sample containers are removed and rinsed twice in deionized water and placed on the drying rack to air dry.
5. Each batch of cleaned containers is checked for cleaning solution residue by performing a pH check utilizing Bromothymol Blue. Any color change to the Bromthymol Blue results in the entire batch being rinsed in deionized water, and checked again. The results of the pH check are recorded in the Labware QC logbook.

B2 SAMPLING METHODS (continued)

B2.4 PROCESSES TO PREVENT CROSS CONTAMINATION

Procedures in the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)* outlines the necessary steps to prevent cross-contamination of samples. These include such things as direct collection into sample containers, when possible; clean sampling techniques for metals; and certified containers for organics. Field QC samples as discussed in Section B5 are collected to verify that cross-contamination has not occurred. All Authority and CRMWA personnel will follow these procedures.

B2.5 DOCUMENTATION OF FIELD SAMPLING ACTIVITIES

Field sampling activities are documented on field data sheets as presented in Appendix C Flow Data Sheets, RBP Data Sheets, and Records of Indicator Bacteria are part of the Field Data Record. All Authority and CRMWA personnel will utilize the Authority's Field Data Sheets.

The following will be recorded for all visits:

1. Station ID
2. Location
3. Sampling time
4. Sampling date
5. Sampling depth
6. Sample collector's name/signature
7. Values for all measured field parameters
8. Detailed observational data, including:
    - Water appearance
    - Weather
    - Days since last significant rainfall
    - Flow severity
9. Other observational data , including:
    - Biological activity
    - Pertinent observations related to water quality or stream uses (e.g, exceptionally poor water quality conditions/standards not met; stream uses such as swimming, boating, fishing, irrigation pumps, etc.)
    - Watershed or instream activities (events impacting water quality, e.g, bridge construction, livestock watering upstream, etc.)
    - Unusual odors
    - Missing parameters (i.e.,when a scheduled parameter or group of parameters are not collected)

B2 SAMPLING METHODS (continued)

B2.6 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 with no modifications, write-overs or cross-outs;
2. Correction of errors with a single line followed by an initial and date, if correction date is not the same as the sample date; and
3. Close-outs on incomplete pages with an initialed and dated diagonal line.

B2.7 FAILURES IN SAMPLING METHODS REQUIREMENTS AND/OR DEVIATIONS FROM SAMPLE DESIGN AND CORRECTIVE ACTION

Examples of failures in sampling methods and/or deviations from sample design requirements include, but are not limited to, such things as sample container problems, sample site considerations, etc. Failures or deviations from the QAPP are documented on the field data sheet and reported to the Authority's Project Manager. The Authority's Project Manager will determine if the deviation from the QAPP compromises the validity of the resulting data. The Authority's Project Manager, in consultation with the Authority's Quality Assurance Officer, will decide to accept or reject data associated with the sampling event, based on best professional judgement. The resolution of the situation will be reported to the TNRCC in the quarterly report. Subsequent corrective action reports will be maintained by the Authority. All Authority and CRMWA personnel will follow these procedures.

B3 SAMPLE HANDLING AND CUSTODY PROCEDURES

B3.1 CHAIN-OF-CUSTODY

The Chain-of-Custody (COC) system described in this QAPP replaces the *tag* system as described in the SWQM Manual. All Authority and CRMWA personnel will utilize the Authority's COC form.

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 contractors. The following information concerning the sample is recorded on the COC form (See Appendix D):

1. Date and time of collection
2. Sample identification
3. Sample matrix
4. Number of containers
5. Preservative used or if the sample was filtered
6. Analyses required
7. Sampling by name of collector(s)
8. Custody transfer signatures and dates and times of transfer
9. Remarks (this box is utilized to indicate which laboratory the samples were shipped to for analysis)
10. Bill of lading, when analytes are shipped to contractors (attached to COC originals)..

B3.2 SAMPLE LABELING

Samples are labeled on the container (or on a label) with an indelible marker. Label information includes the site identification, date and time of sampling, the lab ID number and the preservative added, if applicable.

B3.3 SAMPLE HANDLING

Written SOPs have been developed for sample handling, sample receiving, and sample shipping. The SOPs utilized for all Clean Rivers Program sampling include the following procedures:

1. During preparations for a sampling event, samples scheduled to be collected are assigned an ID number which is recorded in the lab accessions logbook. Preliminary sample and event information is recorded on a COC form, leaving only the date, time and sample information to be recorded when the sample is collected.
2. Sample kits are prepared and assembled including sample container type, size and preservative required, which are determined by the type of sample to be collected. The sample kits are loaded in the vehicle in the order of the proposed site visits.
3. Samples are collected under protocols documented in the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)*. The samples are then packed in loose ice and preserved in accordance with the preservation criteria listed in Table B2.1 of this document. Once each quarter a check is made to assure sample temperature reaches four degrees Celsius (4°C) in 45 minutes.
4. The date, time and collector information is completed on the sample container labels and the COC.
5. The ice chests with the samples are secured in the vehicle until delivered to the Authority's ESD Laboratory.

6. The samples are received in the lab in a designated area where the Authority's sample custodian inspects the containers and signs the COC on the receiving line.
7. The lab accessions logbook is filled in for each sample corresponding to the ID number issued during the sample event preparations. Data added to the accessions logbook include:

- Current Date
- Client
- Assigned ID Number
- Sample ID
- Sample Source
- Collector
- Collection Date
- Parameters
- Preservative
- Time Sample Received
- Chain of Custody Number

8. The unique ID number is written on the containers with a permanent marker.
9. Samples are the transported to the laboratory storage facility by the Authority's sample custodian. Access to the storage facility is limited to Environmental Services personnel only.
10. Samples to be shipped to contract laboratories are added to a separate COC form with the original COC number written in the comment section. The contract lab name will be written in the comment section of the original COC form which will remain with the Authority's laboratory.
11. The samples along with the COC are then packed in an ice chest with ice or in a box container depending on the preservation requirements. A sample of DI water chilled to 4°C and marked as "Temperature Blank" is included with the samples. The shipping container is then sealed, marked with (↑) on all four sides and labeled with the contract laboratory's name and address. The shipping containers may be held in the sample cooler overnight if needed.
12. The sealed sample containers are then shipped to the contract laboratory by bus. The contract lab is contacted by phone and/or e-mail informing them that they should receive a shipment the same day.

B3.4 FAILURES IN CHAIN-OF-CUSTODY AND CORRECTIVE ACTION

All failures associated with COC procedures for samples collected by the Authority and CRMWA personnel are immediately reported to the Authority's Project Manager. These include such items as delays in transfer, resulting in holding time violations, violations of sample preservation requirements, incomplete documentation, including signatures; possible tampering of samples, broken or spilled samples, etc.

The Authority's Project Manager, in consultation with the Authority's QAO will determine if the procedural violation may have compromised the validity of the resulting data.

B3 SAMPLE HANDLING AND CUSTODY PROCEDURES (continued)

The Authority's Project Manager, in consultation with the Authority's QAO, will decide how the issue will be resolved based on best professional judgement, and inform the staff. Possible courses of action include: document and proceed, repeat the entire sampling event, or selectively analyze the samples. The resolution of the situation will be reported to the TNRCC in the quarterly progress report. Corrective action reports will be maintained by the Authority.

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 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 the *Standard Methods for the Examination of Water and Wastewater*, the latest version of the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)*, 40 CFR 136, or other reliable procedures acceptable to the Agency."

Laboratories collecting data under this QAPP are compliant with ISO/IEC Guide 25. Copies of laboratory SOPs are retained by the Authority and are available for review by the TNRCC. Laboratory SOPs are consistent with EPA requirements as specified in the method.

B4.1 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.

B4.2 ANALYTICAL METHOD MODIFICATION

Only data generated using TNRCC-approved analytical methodologies as specified in this QAPP will be submitted to the TNRCC. Requests for method modifications will be documented on form TNRCC-10364, the TNRCC Application for Analytical Method Modification, and submitted for approval to the TNRCC Quality Assurance Section. Approval by the TNRCC will be granted or denied based on review of the application, specifically the section documenting an initial demonstration of method equivalency conducted by the laboratory. Work will only begin after the modified procedures have been approved.

B4 ANALYTICAL METHODS (continued)

B4.3 FAILURES OR DEVIATIONS IN ANALYTICAL METHOD REQUIREMENTS AND CORRECTIVE ACTIONS

Failures in field and laboratory measurement systems involve, but are not limited to, instrument malfunctions, failures in calibration, blank contamination, QC sample problems (i.e., poor spike recoveries), etc. In many cases, the field technician or lab analyst will be able to correct the problem (i.e., via re-calibration or re-analysis).

If the problem is resolvable by the field technician or lab analyst, then they will document the problem on the field data sheet or laboratory record and complete the analysis. If the problem is not resolvable, then it is conveyed to the respective supervisor, who will make the determination. If the analytical system failure compromises the sample results, the data will not be reported to the TNRCC as part of this study. The nature and disposition of the problem is reported on the data report, which is sent to the Authority's Project Manager. The Authority's Project Manager will include this information on the Quarterly Report, which is sent to the TNRCC.

The TNRCC has determined that analyses associated with remark codes including, but not limited to: *exceeded holding time, did not pass all QC criteria, instrument failure, etc*; has measurement uncertainty associated with them. This type of entry will immediately disqualify analyses from submittal to TNRCC Regulatory Activities and Compliance System (TRACS). Therefore, data with these types of problems should not be reported to the TNRCC. Refer to the Program Guidance, Appendix 3, for a complete list of remarked data. Corrective action reports will be maintained by the Authority.

B5 QUALITY CONTROL

B5.1 SAMPLING QUALITY CONTROL REQUIREMENTS AND ACCEPTABILITY CRITERIA

The minimum field QC requirements are outlined in the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)*. Specific requirements are outlined below. Field QC sample results are reported with the data report (See Section C2).

Field Equipment Blanks – 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. In addition to regularly collected equipment blanks, 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 equipment is sent to the field.

The analysis of equipment blanks should yield values lower than the AWRL, 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. All Authority and CRMWA personnel will follow these procedures.

Field Duplicates – A field duplicate is defined as a second sample, or measurement, from the same location, collected in immediate succession, using identical techniques. Except for bacteriological sample collection. This applies to all cases of routine surface water collection procedures, including in-stream grab samples, bucket grab samples (e.g., from bridges), pumps, and other water sampling devices. Duplicate samples are sealed, handled, stored, shipped, and analyzed in the sample manner as the primary sample. Precision of duplicate results is calculated by the relative percent difference (RPD) 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 equation below:

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

Field duplicate samples will be collected randomly for every ten (10) samples collected. If less than ten (10) samples are taken, there will be one random duplicate per trip. The range statistic is determined 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 field duplicate analyses.

Field Blank – A field blank consists of deionized water that is taken to the field and poured into the sample container. Field blanks are not routinely required but are used to assess the contamination from field sources such as airborne materials, containers, and preservatives. The analysis of field blanks should yield values lower than the AWRL. When target analyte concentrations are high, blank values should be lower than 5% of the lowest value of the batch.

B5.2 LABORATORY MEASUREMENT QUALITY CONTROL REQUIREMENTS AND ACCEPTABILITY CRITERIA

Detailed laboratory QC requirements are contained within the individual Laboratory Quality Assurance Manuals (QAMs). The minimum requirement that all participants abide by are stated below. Lab QC sample results are submitted with the data report (see Section C2).

Laboratory Equipment Blank – Laboratory equipment blanks are prepared at the laboratory where collection materials for 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 sampling equipment is sent to the field. The analysis of laboratory equipment blanks should yield values less than the AWRL, otherwise the equipment should not be used.

B5 QUALITY CONTROL (continued)

Laboratory Duplicate – Laboratory duplicates are used to assess precision. A laboratory duplicate is prepared by splitting aliquots of a single sample (or a matrix spike or laboratory control standard) in the laboratory. Both samples are carried through the entire preparation and analytical process. Laboratory duplicates are performed on 10% of samples analyzed. Acceptability criteria are outlined in Table A7.1.

Precision is calculated by the relative percent difference (RPD) of 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:

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

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. Precision limits for bacteriological analyses are defined in section A7 – Quality Objectives and Criteria.

Performance limits and control charts are used to determine the acceptability of duplicate analyses.

Laboratory Control Standard (LCS) – A laboratory control sample consists of analyte-free water spiked with the analyte of interest prepared from standardized reference material. The laboratory control standard is generally spiked into laboratory pure water at a level less than or equal to the mid-point of the calibration curve for each analyte. The LCS is carried through the complete preparation and analytical process. The LCS is used to document the accuracy of the method due to the analytical process. LCSs are generally run at a rate of one per batch. Acceptability criteria are laboratory-specific and are usually based on results of past laboratory data. LCSs are routinely incorporated into the analysis program. The analysis of LCSs is a measure of accuracy and is calculated by Percent Recovery (%R), which is defined as 100 times the observed concentration, divided by the true concentration of the spike.

The following formula is used to calculate percent recovery, where %R is percent recovery; SR is the sample result; SA is the spike added:

$$\mathbf{\%R = SR/SA * 100}$$

B5 QUALITY CONTROL (continued)

AWRL Calibration Standard or Check Standard – To demonstrate ongoing ability to recover at the AWRL, the laboratory will analyze a calibration standard (if applicable) at or below the AWRL on each day Clean Rivers Program samples are analyzed. Two acceptance criteria will be met. First, calibrations including the standard at the AWRL will meet the calibration requirements of the analytical method. Second, the instrument response (e.g., absorbance, peak area, etc.) for the standard at the AWRL 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 AWRL 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 AWRL 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:

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

Matrix Spikes (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. The MS is spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. The MS is used to document the accuracy of a method due to sample matrix and not to control the analytical process. Acceptability criteria are outlined in Table A7.1 and are calculated by percent recovery. 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:

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

B5 QUALITY CONTROL (continued)

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 AWRL. For very high level analyses, the blank value should be less than 5% of the lowest value of the batch, or corrective actions will be implemented.

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

B5.3 Failures in Field and Laboratory Quality Control and Corrective Action

Sampling QC excursions are evaluated by the Authority's Project Manager, in consultation with the Authority's QAO. In that differences in field duplicate sample results are used to assess the entire sampling process, including environmental variability, the automatic rejection of results based on control chart limits is not practical.

Therefore, some professional judgement will be relied upon in evaluating results. Rejecting sample results based on wide variability is a possibility. Blank data are scrutinized very closely. Blank values exceeding the acceptability criteria may automatically invalidate the sample, especially in cases where high blank values may be indicative of contamination which may be causal in putting a value above the standard. Field duplicate excursions and blank contamination are noted in the CRP quarterly report.

Laboratory measurement quality control failures are evaluated by the laboratory staff. The disposition of such failures and conveyance to the TNRCC are discussed in Section B4 under "Failures or Deviations in Analytical Methods and Corrective Actions." Corrective action documentation is maintained by the Authority.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

All sampling equipment testing and maintenance requirements are detailed in the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)*. 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.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE (continued)

All laboratory tools, gauges, instruments, and equipment testing and maintenance requirements are contained within the Laboratory Quality Assurance Manual (QAM). Testing and maintenance records are maintained and are available for inspection by the TNRCC. 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 TNRCC.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

Field equipment calibration requirements are contained in the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999)*. 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 TNRCC.

Detailed laboratory calibrations are contained within the QAM(s). The laboratory QAM 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 TNRCC. Equipment requiring periodic calibrations include, but are not limited to, thermometers, pH meters, balances, incubators, turbidity meters, and analytical instruments. Calibration records are available to the TNRCC for review.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

A vendor of testing or analytical supplies and materials is regarded as a resource to and as an extension of the laboratory. The standards of quality imposed on vendors are the same as those imposed on the laboratory.

The vendor is responsible for marking packing slips and containers of reagents, chemicals, and testing supplies with the name of the material, vendor's name and address, vendor's item number, quantity, material specification number, and date. This assures that the material is properly identified. Receiving documents and accompanying certifications are used as part of the receiving control procedures and show information necessary to identify the material being received. Incoming supplies are unpacked by laboratory personnel and checked against the packing slip and the purchase order. If any items are missing or damaged, the vendor is contacted immediately.

Standards, reagents, and chemicals are marked with the date received, the expiration date, if applicable, and placed in storage. All standards, chemicals, and reagents are logged into the Chemical Log with the lot number, date received, and technician's initials. Supplies are used on a "first in, first out" basis. Supplies are ordered on an "as needed" basis to avoid excessive inventories of reagents and chemicals.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES (continued)

Packing slips, certifications, and other receiving documents are maintained in a file as a reference of procurement. Chemical logs are maintained as a trace reference for chemicals, standards, and reagents.

B9 NON-DIRECT MEASUREMENTS

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

B10 DATA MANAGEMENT

Data Management Protocols are addressed in the Data Management Plan, which is located in Appendix E of this document.

C1 ASSESSMENTS AND RESPONSE ACTIONS

C1.1 The following table represents the types of assessments and response actions for data collected activities applicable to the QAPP.

TABLE C1.1 – TYPES OF ASSESSMENTS AND RESPONSE ACTION FOR DATA COLLECTION

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Monitoring Systems Audit	Dates TBD by TNRCC CRP	TNRCC	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to the TNRCC to address corrective actions.
Laboratory Inspection	Dates TBD by RRA	Individual Labs (RRA will only audit contract labs in cases of suspected problems)	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to the Authority. The Authority will report problems to TNRCC in Progress Report.
Laboratory Inspection	Dates TBD by TNRCC	TNRCC Laboratory Inspector	Requirements appearing in lab SOPs and QAPs, ISO/IEC Guide 25, 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 TNRCC to address corrective actions.
Performance Evaluation Samples	Annually	Laboratories and Commercial Suppliers	Evaluation of laboratory competency in performing analyses	Report problems to the TNRCC in Progress Report.
Monitoring Systems Audit	Dates TBD by RRA	CRMWA	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to RRA to address corrective actions.

C1.2 CORRECTIVE ACTION

The Authority's Project Manager is responsible for implementing and tracking corrective action procedures as a result of audit findings. Records of audit findings and corrective actions are maintained by both the CRP and Authority's Project Manager. Corrective action documentation will be submitted to the TNRCC with the Progress Report.

If audit findings and corrective actions cannot be resolved, the Authority will have the responsibility for terminating work as specified in the CRP QMP and agreements between participating organizations.

C1 ASSESSMENTS AND RESPONSE ACTIONS (continued)

Blank failures, calibration failures, QC sample failures, and general instrument trouble are some of the events that cause process failures in laboratory and field work. In most cases, the problem will be corrected by the laboratory or field technician. When the problem can be corrected by the technician, the problem is documented on an appropriate record sheet and the procedure will be completed. If the problem cannot be corrected by the technician, the technician reports the problem to the immediate supervisor and the Authority's QAO. The immediate supervisor and QAO make the determination whether or not the data should be included in a report. If the immediate supervisor and QAO have to make a determination on the possible exclusion of CRP data, a data report is filed with the Authority's Project Manager. The Authority retains copies of all corrective actions on file. A quarterly report that contains the information given on the data report forms will be prepared and filed with the TNRCC.

C2 REPORTS TO MANAGEMENT

C2.1 LABORATORY DATA REPORTS

Laboratory data reports contain QC information so that this information can be reviewed by the Authority's Project Manager.

C2.2 REPORTS TO RED RIVER AUTHORITY PROJECT MANAGEMENT

The Authority's Project Manager will be kept apprized of all project status, results of assessments and any significant QA issues as they occur. Additionally, written reports and daily time sheets will contain information regarding daily activities.

C2.3 REPORTS TO TNRCC PROJECT MANAGEMENT

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

Progress Report – Summarizes the Authority's activities for each task; reports problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response – Following the annual audit performed by the Authority, the monitoring systems audit checklist along with recommendations and corrective actions are sent to the TNRCC.

Following any audit performed by the Authority, a report of findings, recommendations and response is sent to the TNRCC in the quarterly progress report.

C2 REPORTS TO MANAGEMENT (continued)

C2.4 REPORTS BY TNRCC PROJECT MANAGEMENT

Contractor Evaluation – The Authority participates in a Contractor Evaluation by the TNRCC annually for compliance with administrative and programmatic standards. Results of the evaluation are submitted to the TNRCC Financial Administration Division, Procurements and Contracts Section.

D1 DATA REVIEW, VERIFICATION AND VALIDATION

All data obtained from field and laboratory measurements will be reviewed and verified for integrity and continuity; reasonableness, and conformance to project requirements, and then validated against the data quality objectives which are listed in Section A7. Only those data which are supported by appropriate quality control data and meet the data quality objectives defined for this project will be considered acceptable, and will be reported for entry into TNRCC's state-wide database.

The procedures for verification and validation of data are described in Section D2 below. The Authority's QAO is responsible for ensuring that field data are properly collected and recorded in accordance with this QAPP, the *CRP Program Guidance and Reference Guide for FY 2002-2003*, and the *TNRCC Surface Water Quality Monitoring Procedures Manual, (1999).* Likewise, the Authority's Lab Supervisor, CRMWA Lab Manager, and the LCRA Lab Manager are responsible for ensuring that the data are reviewed, verified, and submitted in the required format. The QAO is responsible for validating that all data collected meets the data quality objectives of the project.

D2 VERIFICATION AND VALIDATION METHODS

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the data and associated quality control data conforms to project specifications. The staff and management of the respective field, laboratory, and data management tasks are responsible for verifying the data each task generates or handles. The field and laboratory tasks ensure the verification of raw data, electronically generated data, and data on COC forms and hard copy output from instruments. The data management task deals with both raw and electronic data.

Verification of data will be performed using self-assessments and peer review, as appropriate to the project task, followed by technical review by the manager of the task. The data to be verified (listed by task in Table D2.1) are evaluated against project specifications and are checked for errors, especially errors in transcription, calculations, and data input. Potential outliers are identified by examination for unreasonable data, or identified using computer-based statistical software. If a question arises or an error or potential outlier 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 electronically or by initialing and dating the associated paperwork. 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. The performance of the data management task is documented by completion of a data review checklist.

D2 VERIFICATION AND VALIDATION METHODS (continued)

The Authority's Data Manager, Quality Assurance Officer and Project Manager are responsible for validating that the verified data are usable and reportable to TNRCC. One element of the validation process involves evaluating the data additionally for anomalies. Any suspected errors or aberrant data must be addressed by the manager of the task associated with the data, before data validation can be completed. Any issues of suspected anomalous data or errors are researched by the Authority's Data Manager and reported to the Authority's Project Manager. Once corrective action is addressed by the appropriate manager of the task associated with the data, the data are then assessed whether it is suitable for populating the Authority's project database and reporting to TNRCC. A second element of the validation process is consideration of any findings identified during the annual monitoring systems audit conducted by the TNRCC Quality Assurance Specialist assigned to the project. Any issues requiring corrective action must be addressed, and the potential impact of these issues on previously collected data meet the data quality objectives of the project and are suitable for reporting to TNRCC.

TABLE D2.1 – DATA VERIFICATION TASKS

Data to be Verified	QAO Task	Field Task	Lab Task	Database Task
Sample documentation complete	✔	✔	✔	
Standards and reagents traceable	✔	✔	✔	
Holding times not exceeded	✔	✔	✔	
Collection, preparation, and analysis consistent with SOPs and QAPP	✔	✔	✔	✔
Analytical sensitivity (AWRLs) consistent with QAPP	✔	✔	✔	✔
QC analyzed at required frequency	✔	✔	✔	
QC results meet performance and program specifications	✔	✔	✔	✔
Results, calculations, transcriptions checked	✔	✔	✔	
Laboratory bench-level review performed			✔	
All laboratory samples analyzed for all parameters	✔		✔	
Corollary data agree	✔	✔	✔	✔
Nonconforming activities documented	✔	✔	✔	✔
TAG IDs correct				✔
TNRCC ID number assigned	✔			✔
Dates formatted correctly				✔
Depth reported correctly	✔			✔
Source codes 1, 2, and program code used correctly				✔
STORET codes valid and in QAPP	✔			✔
Time based on 24-hour clock	✔	✔	✔	✔
Outliers confirmed and documented				✔
Verified data log submitted				✔
10% of data manually reviewed	✔			✔
Sampling and analytical data gaps checked (e.g., all sites for which data are reported are on the coordinated monitoring schedule)	✔	✔	✔	✔

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

Data produced in this project will not be used by the project team. These data, and data collected by other organizations will be subsequently analyzed and used by TNRCC for TMDL development, stream standards modifications, permit decisions, and water quality assessments in accordance with TNRCC's *Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data*.

QUALITY CONTROL REVIEW PROCEDURES

I. Identify data limitations
   - A. Missing values
   - B. Varying sampling frequencies
   - C. Multiple measurements
   - D. Analytical uncertainty
   - E. Censored data
   - F. Unavailable or classified data
   - G. Small sample size
   - H. Outliers

II. Define how a raw data file is to be modified to address the above limitations so that a data analysis file can be created for graphical and statistical analysis
   - A. Missing values: Statistical tests which require the use of regularly measured sequences are not applicable. All time periods are not equally weighted as to importance or representation.
   - B. Varying sample frequencies: Statistical tests requiring temporally equal spacing are not applicable. Statistical summaries over will be weighted more to period when sampling frequency is highest.
   - C. Multiple observations in the same sampling period can result from mixing original measurements with quality control measurements.
   - D. Analytical uncertainty: Random analytical error is sometimes ignored. For this reason the analytical protocol must incorporate a separate QA/QC program.
   - E. Censored data: Censoring data may occur when values exceed the designated upper and lower tolerance limits. Detection capabilities change over time as new technology becomes available. Sampled constituents may have differing detection limits on data sets with long periods of record.
   - F. Unavailable or classified data: Unclassified segments within military or Department of Energy installations, may be difficult to access or not provide adequate information for meaningful analyses. In depth research could be necessary in the basins for data acquisition methodologies concerning these areas.
   - G. Small sample size: There are sample size limits below which meaningful statistical analysis is impossible. Familiarity with dataset size and content is integral to QA/QC completeness.

D3 RECONCILIATION WITH DATA QUALITY OBJECTIVES (continued)

H. Outliers: Outlying data points can seriously skew statistical analysis usually resulting from extreme events or erroneous measurements. Documentation of outlier deletions or inclusions must be based on scientific evidence or sound professional judgement.

III. Procedures for quality control and assurance of data integrity should include representative sampling techniques, quality control of analytical tests, and documentation of methodologies. COC records must be accurate and complete to ensure proper handling and identification of samples and/or measurements.

A. Data Input

1. If from raw data, cross check and screen data;

2. If from monitoring stations via digital media, develop statistical routines to report on apparent data discrepancies to be reviewed; and

3. Log various errors and omissions detected for further validation or field investigation.

B. Data should be reported in the measurement units corresponding to the detection limits established in the analytical protocol.

C. Numerical rounding conventions will be established and rounding procedures followed.

D. Deletion or inclusion of outliers will be noted and explained.

E. Generate a QA/QC report detailing COC, description of weakness, adjustment, data manipulations, and proposed disposition of data.

APPENDIX A

WORK PLAN ~ TASK 3

TASK 3: WATER QUALITY MONITORING

OBJECTIVES: Continue water quality monitoring activities in accordance with the approved Coordinated Monitoring Plan (CMP) and Quality Assurance Project Plan (QAPP) together with a detailed monitoring schedule describing the subwatersheds and/or stream segments, parameters, sampling frequency and locations. The plan will include coordination with other existing monitoring programs participating under the approved QAPP. The intent of the approved plan is to minimize duplicate monitoring efforts within the basins and focus on watershed coverage that provides water quality data in support of the following:

- Temporal and spatial analysis of water quality
- Knowledge of water quality and flow for unclassified streams
- Evaluation and development of state-wide, regional, and site-specific water quality standards
- Permit criteria related to the perennial or intermittent nature of receiving streams receiving water assessments
- §305(b) assessment and §303(d) priority monitoring
- Use attainability assessments
- Waste load evaluations (WLE) or total maximum daily load (TMDL) development special studies

TASK DESCRIPTION: **Coordinated Monitoring Plan (CMP)**: The CMP schedule will be revised and submitted for approval to reflect the informational needs of both the Red and Canadian River Basins with intensive focus on priority issues identified in previous assessments and direction from the Basin Advisory Committees. The QAPP currently details the methodologies for conducting monitoring and for compliance with TNRCC guidance on a priority watershed basis. The Authority proposes to collect approximately 200 samples from 7 stations in the Canadian River Basin and 976 samples from 21 stations in the Red River Basin during the ensuing contract period. It should be noted, however, that the number of samples per category are subject to change relative to local priorities, changes in TNRCC needs and site specific impairments requiring immediate attention. Specific components describing the temporal and spatial considerations, geographical coverages, types of monitoring, parametric coverages, and frequency of collection are contained in the CMP document together with a proposed sampling schedule and QAPP. Refer to Schedule 8 of the *CRP FY 2002 - 2003 Work Plan* for details of site locations, parameters and frequency of sampling within each basin.

Description of Study Area: The primary area of study will consist of 35,876 square miles of watershed contributing to the Red and Canadian River Basins in Texas, including the influence of major tributaries out of Oklahoma and New Mexico. The watersheds were hydrologically divided into five basin reaches containing approximately 7,000 square miles each. The basin reaches were further divided into subwatersheds from five to six hydrologic unit areas, each containing approximately 1,400 square miles. Based on previous basin assessments and evaluations of past screenings, the hydrologic subdivisions of each basin have been prioritized according to the level of concern and need for additional information in an effort to expend resources as prudently as possible. This approach enables comprehensive monitoring to occur on a rotational reach basis and completely encompasses the basins within the five-year basin management cycle. The subwatershed areas will now be hydrologically divided into intensive study areas for use in point and nonpoint source identification, biological assessments, intensive monitoring surveys, receiving water assessments, stream segment classification and in determining accurate cause and effect relationships of pollution to the subwatershed areas.

TASK 3: WATER QUALITY MONITORING (Continued)

Types of Monitoring: Four types of water quality monitoring were determined to be useful components for inclusion in the CRP CMP to accomplish the state's monitoring objectives. The four types of monitoring components are fixed station monitoring, systematic watershed monitoring, targeted monitoring and priority watershed special studies. The number of samples to be collected per type or category is not predictable and subject to change relative to local priorities, changes in TNRCC needs and newly identified concerns requiring further study or immediate attention. Each type is more fully described in the CMP and briefly summarized here as intended for use during this contract period.

Fixed/Routine Station Monitoring (3.1): Fixed station monitoring will be utilized to delineate overall water quality from the subwatershed level to the basin as a whole. This more traditional type of monitoring is conducted at key sites over a five-year period to adequately characterize water quality trends and progress in protecting or restoring overall water quality throughout the basin. Sites are selected based on the need for continuous or up-to-date water quality information to establish temporal and spatial trends. Monitoring will commonly include at least four seasonal field measurements with flow, *E. coli* and/or fecal coliform bacteria monitoring and conventional chemical parameters over a range of flow conditions, for a minimum ten samples over a five year period. These parameters will also be used to delineate and describe overall water quality throughout the basin. These data will be utilized in determining compliance with water quality standards and to support revision to the Texas Water Quality Inventory Report, CWA §305(b), CRP Summary Reports, the CWA §303(d) List and to identify sources of water quality concerns.

Routine monitoring at key sites will also be performed regardless of the reach rotation in order to maintain adequate baseline data for long-term reference, trend relationships and determine if present water quality conditions deem further attention.

Systematic Watershed Monitoring (3.2): This type monitoring will be utilized to screen subwatershed areas on a rotational basis within the confines of the five-year basin management cycle. This monitoring is necessary to collect data on undesignated water bodies and provide trend analysis of classified stream segments or subwatersheds. Monitoring will focus on known areas of concern and potential concern for the basin as a whole and for priority subwatersheds. Sites will be rotated over the five-year basin cycle by selecting two subwatersheds of a designated segment each year for comparability when determining overall water quality conditions of the basin reach. Monitoring will include at least four seasonal samples for field measurements with flow and conventional chemical parameters in each year of monitoring, for a minimum ten samples over a five year period. *E. coli* and/or fecal coliform densities will be collected with the chemical samples where contact recreation has not been determined to be impaired. No 24-hour diurnal monitoring is scheduled during this contract period.

Targeted Monitoring Program (3.3): No targeted monitoring will be conducted during this contract cycle.

TASK 3: WATER QUALITY MONITORING (Continued)

Special Studies (3.4): This type monitoring activity will focus on basin priorities not directly related to permitting and will address through intensive data collection efforts to evaluate stream standard exceedance, non-attainment of designated uses, the loading contribution of nonpoint sources in a watershed, problems identified through data screening analyses and expressed concerns from the BAC. Monitoring will be conducted at sites where historical data is available and representative of an impaired water body for intensive sampling over the two year data collection phase.

A proposed project plan will be submitted for each special study delineating the need for additional data collection and analysis, estimated cost and the results expected to accomplish for the benefit of the CRP assessment process. The Authority proposes two (2) special studies during this project period contingent upon funds and/or cooperative in kind services being provided by participating entities and are described as follows:

- The first proposed special study will be on Smith Creek, which is a tributary of Pine Creek in Lamar County. Pine Creek was listed on the §303(d) list for elevated fecal and *E. coli* bacteria. However, recent monitoring activities indicate that the coliforms are originating from Smith Creek. The Authority has had preliminary discussions with Campbell Soup Company and the City of Paris. Both have indicated a willingness to participate in the study by providing services and/or funding.

  The Authority has included one site on Pine Creek downstream of the City of Paris Wastewater Treatment Plant outfall and one site on Smith Creek downstream of Campbell Soup Company's plant for base points. The Authority's plan would be to monitor the creek entering the Campbell Soup Company plant area and immediately downstream of the outfall. Fecal and *E. coli* bacteria will be sampled on a monthly basis at all sites. In addition, Campbell Soup Company has asked the Authority to consider utilizing DNA testing of the *E. coli* to determine where it may be originating. Campbell Soup Company has expressed a desire to fund this portion of the project.

  The City of Paris has expressed an interest in collecting samples at all storm water points entering the Campbell Soup grounds to ensure that the fecal are not originating off site. All data collected will be under the Authority's approved QAPP to meet the project goals which include: to definitely determine the source of the elevated bacteria levels, develop and implement a plan to correct the problem, and possibly remove Pine Creek from the §303(d) list.

- The second proposed special study will be on the Wichita River below Lake Diversion. Previous studies have indicated that the TDS and chlorides are increasing below Lake Diversion while they are decreasing above Lake Kemp. The source(s) of the chlorides and TDS need to be determined and corrected to enhance the Chloride Control Project currently in operation upstream of Lake Kemp.

TASK 3: WATER QUALITY MONITORING (Continued)

The Authority is currently visiting with prospective participants, such as the Texas Railroad Commission, the City of Wichita Falls, the Wichita County Water Improvement District Number 2, and the U.S. Geological Survey for funding and/or cooperative services for the project.

Should funding and TNRCC approval for either or both special projects be obtained, work will begin as soon as the QAPP has been amended to reflect the studies. It is anticipated that at least 18 months of data will need to be collected prior to developing any conclusions to the studies. However, status reports on the studies will be included as a stand alone report with each quarterly progress report. The final report for each study will be submitted as a Special Study Report to each participant and the TNRCC. All data collected in the studies will be added to the Authority's Water Quality Database for use in future screening events.

RESOURCES: The Authority proposes to utilize its personnel for all routine field sample collection and analysis in accordance with the approved CMP and QAPP, as amended. Chemical and biological samples will be collected and analyzed according to the sampling design and analysis protocols described in the plan. Data management and quality assurance will be performed by Authority personnel with approved hardware and software currently available. Refer to **Schedule 8** for details of monitoring site locations, parameters and frequency of sample collections.

Selected monitoring sites, parameters and sample frequency will be collected and analyzed by the U.S. Geological Survey (USGS) under separate contract to supplement the overall basin-wide monitoring efforts. The USGS will collect samples and analyze water quality parameters under their own existing protocols and methodologies and will submit the results to the TNRCC and/or the Authority as acquired data under the *TNRCC Surface Water Quality Monitoring QAPP*. The Canadian River Municipal Water Authority (CRMWA), who will conduct monitoring around Lake Meredith, will collect and analyze water samples under the Authority's QAPP submitting the results to the Authority. The Authority's regional laboratory will be the primary analytical service provider for the CMP, however, outside contract laboratories may be utilized as needed to accomplish the full intent of the CMP.

Other resources to be utilized in support of this task include:

- TNRCC approved CMP and QAPP
- Coordination with TNRCC field operations staff
- Coordination with TNRCC SWQM and CRP staff
- Coordination with other approved monitoring entities
- TNRCC's §305(b) Water Quality Inventory Report
- TNRCC's §303(d) List and previous assessments

TASK 3: WATER QUALITY MONITORING (Continued)

DELIVERABLES & DUES DATES:

SEPTEMBER 1, 2001 THROUGH AUGUST 31, 2002

Task 3.1 – Routine Monitoring and 3.2 – Systematic Monitoring

A. Conduct water quality monitoring and provide details of the monitoring activities in Progress Reports – December 15, 2001, March 15, 2002 and June 15, 2002

Task 3.3 – Targeted Monitoring

A. No targeted monitoring will be conducted during this contract cycle
B. No RWAs will be done in this contract period
C. No flow monitoring studies will be conducted during this contract period

Task 3.4 – Special Studies

A. Conduct water quality monitoring – provide details of the monitoring activities in Progress Reports – December 15, 2001, March 15, 2002 and June 15, 2002
B. Special Studies – Pine Creek and Wichita Basin Status Reports – with Progress Reports

SEPTEMBER 1, 2002 THROUGH AUGUST 31, 2003

Task 3.1 – Routine Monitoring and 3.2 – Systematic Monitoring

A. Conduct water quality monitoring – provide details of the monitoring activities in Progress Reports – September 15, 2002, December 15, 2002, March 15, 2003, June 15, 2003 and August 31, 2003

Task 3.3 – Targeted Monitoring

A. No targeted monitoring will be conducted during this contract cycle
B. No RWAs will be done in this contract period
C. No flow monitoring studies will be conducted during this contract period

Task 3.4 – Special Studies

A. Conduct water quality monitoring – provide details of the monitoring activities in Progress Reports – September 15, 2002, December 15, 2002, March 15, 2003, June 15, 2003 and August 31, 2003
B. Special Studies – Pine Creek and Wichita Basin Status Reports – with Progress Reports
C. Special Studies – Pine Creek and Wichita Basin Draft Reports – June 30, 2003
D. Special Studies – Pine Creek and Wichita Basin Final Reports – August 15, 2003
   - Post key elements of monitoring Special Study Reports or Summaries (e.g., executive summary, maps, data analysis) to the web site in a timely manner

APPENDIX B

SAMPLING PROCESS DESIGN AND MONITORING SCHEDULE

SAMPLE DESIGN RATIONALE

The sample design is based on the legislative intent of the Clean Rivers Program. Under the legislation, the Authority has been tasked with providing data to identify significant long-term water quality trends, to characterize water quality conditions in support of the §305(b) assessment, to support the permitting and TMDL process, and to classify unclassified waters. Based on Steering Committee input, achievable water quality objectives and priorities and the identification of water quality issues are used to develop work plans, which are in accordances with available resources. As part of the Steering Committee process, the Authority coordinates closely with the TNRCC and other participants to ensure a comprehensive water monitoring strategy within the watershed. Refer to the Water Quality Monitoring Protocol and Sampling Protocol charts contained in Appendix D.

Based on previous basin assessments and evaluations of past screenings, the hydrologic subdivisions of each basin have been prioritized according to the level of concern and need for additional information in an effort to expend resources as prudently as possible. A priority list is prepared for discussion with the other monitoring entities and the TNRCC at a Coordinated Monitoring Meeting. The results of the priority ranking are presented for approval at a meeting of the Basin Advisory Committee. This approach enables comprehensive monitoring to occur on a rotational reach basis and completely encompasses the basins within the five-year basin management cycle, limited only by the availability of funds.

SITE SELECTION CRITERIA

This data collection effort involves monitoring fixed/routine water quality, using procedures that are consistent with the TNRCC SWQM program, for the purpose of data entry into the statewide database maintained by the TNRCC. To this end, some general guidelines are followed when selecting sampling sites, as identified below. Overall consideration is given to accessibility and safety. All monitoring activities have been developed with coordination of the CRP Steering Committee and the TNRCC.

1. Fixed station and systematic monitoring sites are representative of in-stream data and are free from back-water effects.

2. Fixed/routine monitoring sites are selected to maximize stream coverage or basin coverage. For very long stretches of river length, a station is considered representative of a water body for not more than 25 miles in freshwater and tidal streams. A single monitoring site is considered representative of 25 percent of the total reservoir acres and estuary or ocean square miles, but not more than 5,120 acres or 8 square miles.

3. Fixed/routine monitoring sites are located preferentially where there are “localized” water quality effects based on past water quality data.

SITE SELECTION CRITERIA (continued)

4. Fixed/routine monitoring sites are located where historical data exists. No degradation of water quality may be indicated. However, the continuation of water quality monitoring at this site has been deemed important.

5. At least one site for each classified segment will be selected for fixed/routine monitoring unless the segment is already covered by TNRCC or other qualified monitoring entities reporting fixed/routine data to TNRCC.

6. Targeted monitoring sites are based on input from the TNRCC, permit renewal schedules and data needs.

7. Fixed/routine monitoring sites are chosen based on accessibility. When possible, sites are selected where it is possible to collect flow measurements during routine visits or where a stream flow gage is located.

8. Fixed/routine monitoring sites may be selected to bracket sources of pollution, influence of tributaries, changes in land uses, and hydrological modifications.

MONITORING SITES

Following is the monitoring schedule for FY 2002. The goal is to have a two year QAPP which is consistent with the terms of the contract. Therefore, the following Monitoring Schedule as presented on in Appendix B can be modified annually. The Monitoring Schedule for FY 2003 will be submitted in the ensuing year.

RED RIVER AUTHORITY OF TEXAS

Surface Water Quality Monitoring Schedule
Fiscal Year 2002
Red and Canadian River Basins

THE TEXAS CLEAN RIVERS PROGRAM

Reach	Comments	Basin ID	Region	Segment	Station ID	Start Date	End Date	Mon Resp	Mon Type	Station Description	Latitude	Longitude	E. Coli Bacteria	24 Hr DO	Aq Hab	Routine Benthics	Routine Nekton	TSWQS Metals Water	Organics Water	Metals Sed	Organics Sed	Conv	Amb Tox Water	Amb Tox Sed	Fecal Coliform Bacteria	Inst Flow	Fish Tissue	Field	Total Samples
I		1	1	101	10016	09/01/01	08/31/02	RR/RR	RT	Dixon Creek near Canadian River Confluence, Northeast of Borger	35.742	101.342	4					2 *				4			4	4		4	20
I		1	1	101	10025	09/01/01	08/31/02	RR/RR	RT	Rock Creek at Hwy 136 Downstream of Lake Weatherly, West of Borger	35.655	101.423	4									4			4	4		4	20
I		1	1	101	10033	09/01/01	08/31/02	RR/RR	RT	Canadian River Bridge on SH 70, North of Pampa	35.970	100.858	4									4			4	4		4	20
II		1	1	103	10018	09/01/01	08/31/02	RR/RR	RT	East Amarillo Creek at US 287, North of Amarillo	35.396	101.834	4									4			4	4		4	20
II		1	1	102	10036	09/01/01	08/31/02	RR/CR	IS	Lake Meredith near Intake Tower at Dam, Northwest of Sanford	35.717	101.557													12				12
II		1	1	102	10037	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, North Canyon Arm	35.721	101.575													12				12
II		1	1	102	10038	09/01/01	08/31/02	RR/CR	RT	Lake Meredith Mid-Lake, between Blue East & Fritch Fortress	35.690	101.603													12				12
II		1	1	102	10039	09/01/01	08/31/02	RR/CR	RT	Lake Meredith Mid-Lake, Southeast of Martin's Canyon	35.650	101.645													12				12
II		1	1	102	10040	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Evans Canyon	35.642	101.681													12				12
II		1	1	102	10043	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Bugboe Canyon at Buoy Line	35.713	101.596													12				12
II		1	1	102	10044	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, North Turkey Creek Canyon Arm	35.708	101.608													12				12
II		1	1	102	10045	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Big Blue Canyon between Chimney Hollow & Timber Hollow	35.697	101.640													12				12
II		1	1	102	10046	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Turkey Creek Canyon Arm	35.608	101.653													12				12
II		1	1	102	10047	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Short Creek Canyon Arm	35.626	101.650													12				12
II		1	1	102	10048	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Harbor Bay	35.648	101.632													12				12
II		1	1	102	10049	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Fritch Canyon Arm	35.653	101.622													12				12
II		1	1	102	10050	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Meredith Harbor	35.675	101.602													12				12
II		1	1	102	10051	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, Cedar Canyon Arm	35.697	101.580													12				12
II		1	1	102	10052	09/01/01	08/31/02	RR/CR	RT	Lake Meredith, South Canyon Arm	35.705	101.553										12			12				24
II		1	1	102	15270	09/01/01	08/31/02	RR/RR	RT	Big Blue Creek, Approx 250 yards Upstream of 1913, 21 Mi SE of Dumas	35.721	101.664	4									4			4	4		4	20
III		1	1	101	10003	09/01/01	08/31/02	RR/RR	IS	Punta De Agua Creek at FM 767, West of Channing	35.668	102.481	4									4			4	4		4	20
V		1	1	104	10058	09/01/01	08/31/02	RR/RR	RT	Wolf Creek Bridge at SH 305, North of Lipscomb	36.239	100.275	4									4			4	4		4	20
I		2	4	202	10115	09/01/01	08/31/02	RR/RR	RT	Post Oak Creek at FM 1417, Southeast of Sherman	33.603	96.576	4									4			4	4		4	20
I		2	5	202	10120	09/01/01	08/31/02	RR/RR	RT	Pine Creek at US 271, near the City of Paris	33.732	95.548	4									4			4	4		4	20
I		2	4	202	10127	09/01/01	08/31/02	RR/RR	RT	Red River at SH 78, North of Bonham	33.754	96.196	4									4			4			4	16
I		2	4	203	10130	09/01/01	08/31/02	RR/RR	RT	Lake Texoma, Big Mineral Arm	33.850	96.788	4									4			4			4	16
I		2	4	203	10131	09/01/01	08/31/02	RR/RR	RT	Lake Texoma at US 377, North of Gordonville	33.867	96.833	4									4			4			4	16
I		2	4	203	15320	09/01/01	08/31/02	RR/RR	RT	Big Mineral Creek at FM 901, North of Sadler	33.702	96.848	4									4			4	4		4	20
I		2	4	203	15440	09/01/01	08/31/02	RR/RR	RT	Lake Texoma at South End of Denison Dam, West of SH 75A, North of Denison	33.818	96.572	4									4			4			4	16
I		2	5	202	16001	09/01/01	08/31/02	RR/RR	RT	Pecan Bayou at 1159, 6 Miles Northeast of Clarksville	33.685	94.994	4									4			4	4		4	20
I		2	5	202	17044	09/01/01	08/31/02	RR/RR	RT	Smith Creek at US 271, 300 Meters Upstream of the Confluence with Pine Creek, North of Paris	33.730	95.548	4									4			4	4		4	20
I		2	4	203	RR102	09/01/01	08/31/02	RR/RR	RT	Lake Texoma Little Mineral Arm, South and East of Preston Shores, near Intake Structure	33.851	96.679	4									4			4			4	16
II		2	3	214	10145	09/01/01	08/31/02	RR/RR	IS	Wichita River at FM 810, West of Byers	34.053	98.296	4									4			4	4		4	20
II		2	3	214	10151	09/01/01	08/31/02	RR/RR	IS	Wichita River at SH 11 in Wichita Falls	33.909	98.533	4									4			4	4		4	20
II		2	3	214	10154	09/01/01	08/31/02	RR/RR	IS	Wichita River at FM 368	33.897	98.707	4									4			4	4		4	20
II		2	3	214	10155	09/01/01	08/31/02	RR/RR	IS	Wichita River at SH 25	33.869	98.839	4									4			4	4		4	20
II		2	3	214	15121	09/01/01	08/31/02	RR/RR	RT	Beaver Creek at US 283/183, Approximately 18.2 km South of Vernon	33.962	99.212	4									4			4	4		12	28
II		2	3	211	RR101	09/01/01	08/31/02	RR/RR	IS	Little Wichita River at FM 1197, Northwest of Henrietta	33.829	98.208	4									4			4	4		12	28
III		2	3	205	10134	09/01/01	08/31/02	RR/RR	RT	Red River Bridge on US 277-281, Northeast of Burkburnett	34.108	98.533	4									4			4	4		4	20
IV		2	1	207	13637	09/01/01	08/31/02	RR/RR	RT	Lower Prairie Dog Town Fork Red River at SH 207, 26 Miles South of Claude	34.838	101.414	4									4			4	4		4	20
IV		2	1	207	15811	09/01/01	08/31/02	RR/RR	RT	Buck Creek at US 83, 19 Miles North of Childress	34.702	100.188	4									4			4	4		4	20
IV		2	1	207	10136	09/01/01	08/31/02	RR/RR	RT	Prairie Dog Town Fork Red River Bridge at US 62-83, North of Childress	34.569	100.194	4									4			4	4		4	20
V		2	1	222	10171	09/01/01	08/31/02	RR/RR	RT	Salt Fork Red River Bridge at US 83, North of Wellington	34.958	100.221	4									4			4	4		4	20

Basin: (1) Canadian (2) Red
Reach: Hydrologic Subdivision of Basin
Region: TNRCC Region where Station is Located
Station ID: TNRCC Station ID Numbers
Site Description: Long Description of Sampling Site
Start Date: Beginning Date of Sampling Period
End Date: Ending Date of Sampling Period
Monitoring Type:
(IS) Intensive/Systematic - Subwatershed Monitoring on a Cyclical Basis;
(RT) Routine Water Sampling/Baseline - Long Term Monitoring

SC1: Monitoring Responsibility
(RR) Red River Authority of Texas;

SC2: Entity Conducting Sampling:
(CR) Canadian River Municipal Water Authority

***E. coli* Bacteria:** Indicator Bacteria
TSWQS Metals Water: Total and Dissolved Metals in Water
* = Selenium only
Fecal Coliform Bacteria: Indicator Bacteria
Conv: Samples of Nutrients and Minerals Collected and Analyzed by a Laboratory
Inst Flow: Instantaneous Flow Measurement at Time of Sampling
Field: Parameters Measured in the Field; ie: Temperature, pH, DO, Conductivity, Flow Severity, etc.

APPENDIX C

FIELD DATA SHEETS

RED RIVER AUTHORITY OF TEXAS
FIELD DATA REPORTING FORM

Date:	Station Location:	TNRCC Site ID:
Time:	Bas/Rch/Seg: / / HUA No:	RRA Tag No:
County:	(82903) Monitoring Type: QAO:	DM Tech:

Red River ID # _____

Chain of Custody # _____

Comments: _____

Tech(s): **Stream Width:** **(ft)**

Time Start: **Time End:**

					Section Width A	Midpoint of Section B	Section Depth C	Velocity D	Discharge AxCxD
		Sample Collection Depth	1						
00010		**Water Temp (°C)**	2						
00094		**Conductivity (uS/cm)**	3						
00400		**pH (Standard Units)**	4						
82078		**Field Turbidity (NTU)**	5						
82079		**Lab Turbidity (NTU)**	6						
00300		**Dissolved Oxygen (mg/L)**	7						
00061		**Flow (CFS)**	8						
89835		**Flow Measurement Method**	9						
		1-USGS 2-Marsh-McBirney 3-Mont-Whit 4-Pygmy	10						
01351		**Flow Severity**	11						
		1-no flow 2-low flow 3-normal 4-flood 5-high 6-dry	12						
31700		***E. Coli* (MPN / 100 ml)**	13						
31616		**Fecal Coliform (# / 100 ml)**	14						
89969		**Water Color**	15						
		1-brown 2-reddish 3-green 4-black 5-clear 6-other*	16						
89971		**Water Odor** 1-sewage 2-oily/chem	17						
		3-rotten eggs 4-musky 5-fishy 6-none 7-other*	18						
89966		**Weather**	19						
		1-clear 2-partly cloudy 3-cloudy 4-rain 5-other*	20						
72053		**Days Since Last Significant Precipitation (< or >)**						**Total Flow in CFS**	
SA300		**Water Clarity**							
		1-excellent 2-good 3-fair 4-poor 5-other*							

Other* – Indicate

MEASUREMENT COMMENTS AND FIELD OBSERVATIONS

Air Temperature:

Wind Conditions:

Climatic Conditions:

Vegetation:

Animals:

Insects:

Left Bank:

Right Bank:

Watershed Activities:

Biologic Activities:

Water Quality:

Stream Use:

Specific Sample Info:

Missing Parameters:

Comments:

RED RIVER AUTHORITY OF TEXAS
BACTERIA LOG

Exp. Date of Media:				Technician(s):			
Date on: Time on:				Start Temp: °C		Start Temp: °C	
	Sample Location	Sample ID No.	ml Used	*E. coli* – Colonies	*E. coli* # /100 ml	Fecal – Colonies	Fecal # /100 ml
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
Date off: Time off:				End Temp: °C		End Temp: °C	
Methods Used to Count Colonies:						Technician(s):	

COMMENTS:

✔ Filter Manifold: ( ) Autoclaved or ( ) Flamed with reagent alcohol prior to use. QAO

RED RIVER AUTHORITY OF TEXAS
TURBIDITY LOG

Date On:		Time On:
Instrument:	Last Calibration:	Technician:

	Sample Location	Sample ID #	Reading (NTU)	RPD or % R
1	Check Standard: ( )			
2	Check Standard: ( )			
3	DI Standard			
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20	QC Check: ( )			

Notes:

RPD = $(X_1 - X_2)/\{(X_1+X_2)/2\} * 100$ (where X_1 is the sample and X_2 Field Duplicate)

%R = SR/SA * 100 (where SR = Sample Result and SA = Check Standard or Lab Duplicate)

QAO

Red River Authority of Texas
Hydrolab Calibration Log
Instrument (I or II)

CALIBRATION

Date: Initials:

Time: Battery Voltage:

Function	Temp of Standard	Initial Reading	Value of Standard	Calibrated To	Comments	Expiration Date of Standards
D.O.						
Conductivity (high)						
Conductivity (low)						
pH calibrate (~7)						
pH slope (~10)						

Table _____ Alt (ft) _____ ALTCORR _____ Bar. Pres. (in) _____ BAROCORR _____

Dissolved Oxygen Standard = Table D.O. Value x ALTCORR x BAROCORR

POST CALIBRATION

Date: Initials:

Time: Battery Voltage:

Function	Temp of Standard	Initial Reading	Value of Standard	Calibrated To	Comments	Expiration Date of Standards
D.O.						
Conductivity (high)						
Conductivity (low)						
pH calibrate (~7)						
pH slope (~10)						

Table _____ Alt (ft) _____ ALTCORR _____ Bar. Pres. (in) _____ BAROCORR _____

Dissolved Oxygen Standard = Table D.O. Value x ALTCORR x BAROCORR

Check previous maintenance and use – do the following before calibration:

	Name	Date
Polish conductivity probe – Must be polished within the last 2 months or once every 15 field trips		
Change pH reference probe solution – Must be renewed within the last 2 months or once every 15 field trips		
Inspect D.O. membrane for nicks or bubbles – Must be changed within last 6 months or once every 15 field trips		
Change D.O. battery in 4141 sonde – Change once a year		
Verify temperature function – Check the temperature function against a thermometer once a year		

BAROCORR = (NOAA pressure in inches/29.921) **ALTCORR = {760 - altitude in feet x 0.0261)}/760** **Note: 1 inch = 25.4 mm**

Red River Authority of Texas

YSI Instrument III or IV Calibration Log

Date:	Time:
Site: (where calibrated): Technician(s):	Barometric Pressure Uncorrected:
	Barometer Reading:

Calibration Values	Actual (read before final calibration) Temp	Actual Value	Sonde (read after calibration) Temp	Sonde Value	Post Cal. Values Date: Time: Temp	Post Cal. Values Value	Calibration Constants and Ranges	Record Constants or Values
Conductivity _____							Conductivity Cell (4.5 to 5.5)	
Turbidity 0 NTU								
Turbidity _____NTU								
pH 7 (Exp.)							pH 7 – (0 to ± 40 MV)	
pH 10 (Exp.)							pH 10 – (-180 ± 40 MV)	
DO (actual)							DO Charge (25 to 75)	
DO (%)							DO Gain (0.7 to 1.7)	
Battery Voltage								
Wiper Parks 180° from Optics?	Yes	No			Yes	No	Note: Span between pH 7 and 10 should be ≈ 170 to 180 MV	
							DO Membrane Changed?	Yes No
							(If yes, wait 8 hours before final calibration)	

Notes and Comments:

Equipment Maintenance:

ESD-05 (07-01)

RED RIVER AUTHORITY OF TEXAS
CRP SAMPLING CHECKLIST

Equipment

HydroLab – Units I or II (charged) ❑
YSI – Units III or IV (charged) ❑
Incubator – Unit A or B
(W/power strip, cables and battery charger) ❑
Incubator Battery (charged) ❑
IDEXX Bacteria Equipment ❑
Flow Meter (w/extra batteries) ❑
Top Set Wading Pole ❑
Tape Measure (w/stakes) ❑
Torpedo ❑
Drill (charged) ❑
Ice Chest(s) – Samples ❑
Small Ice Chest – Media ❑
Bucket(s) – Sampling and Equipment ❑
Camera ❑
Racal GPS ❑
Laptop Computer ❑
Other_____ ❑
Other_____ ❑

Standards / Reagents / Solutions

E. coli Media ❑
Fecal Coliform Media ❑
pH Standards 7 and 10 ❑
Conductivity Standards ❑
Sterile De-ionized Water ❑
Bulk De-ionized Water ❑
Tap Water ❑
Other_____ ❑
Other_____ ❑

Supplies

Pipettes ❑
Bacteria Filters ❑
Stainless Steel Filter Manifold ❑
Peristaltic Pump (w/tubing) ❑
Lighter, Candle, Forceps and Alcohol ❑
Rubber Gloves (powder free) ❑
Paper Towels ❑
Ice or Ice Packs ❑
Field Data Sheets ❑
"Field" Sampling Kits ❑
"Conventional" Sampling Kits ❑
Other_____ ❑
Other_____ ❑

Miscellaneous

Sharpies ❑
Insect Repellent ❑
Sun Screen ❑
Waders – Hip and Chest ❑
Shovel ❑
Rope ❑
Come - A - Long ❑
Copy of QAPP Guidance ❑
Copy of SWQM Procedures Manual ❑
Bacteria / Turbidity Logbooks ❑
Other_____ ❑
Other_____ ❑

Preparer(s): _____ Date: _____

QA Check: _____ Project: _____ Anticipated Return: _____

Comments: _____

VEHICLE CHECKLIST

Vehicle Unit Number: _____

Equipment

Gas ❑
Oil ❑
Headlamps and Lights ❑
Air Conditioner ❑
Mirrors (Side and Rear View) ❑

Comments

_____
_____
_____
_____
_____

Battery	❑	
Tires and Spare	❑	
Antennas	❑	
Two-Way Radio	❑	
Telephone	❑	
Fire Extinguisher	❑	
Field Procedures	❑	
Equipment Manual	❑	
Slide Table and Brace	❑	
Tool Kit	❑	
Spare Belt	❑	

Preparers: _____ Date: _____

QA Check: _____ Project: _____ Anticipated Return: _____

Special Equipment: _____

APPENDIX D

CHAIN OF CUSTODY FORM

CUSTODY RECORD and ANALYSIS REQUEST

Red River Authority of Texas
900 8th St., Suite 520
Wichita Falls, Texas 76301-6894

Results To: ASAP ☐

Address:

Phone: ASAP ☐ | Fax: ASAP ☐ | Project Name: | Project No:

Sampling By: ⑦

Analysis Request ⑥

Sample Identification ②	Lab Only	④ No. Containers	Matrix ③				Preserved ⑤						Sampling ①	
			Water	Soil	Sludge	Other	HNO 3(N)	H2SO4 (S)	HCL (C)	Ice / Ref. (I)	None (N)	Other (O)	Date	Time

Relinquished By: ⑧	Date	Time	Received By:	Date	Time

Remarks: ⑨

APPENDIX E

DATA MANAGEMENT PLAN

DATA MANAGEMENT PLAN

PERSONNEL

1. Management

Pursuant to the Authority's General Administrative Policy, § 1, 2, 4 and 7; personnel assigned to General Administration are responsible for applying professional management practices and established internal controls to ensure the integrity and safeguard(ing) of all data associated with various Authority business activities. Leadership is provided by key administrative personnel under guidance of the Board Adopted Administrative Policy relevant to each division, department, function or level of interactivity.

2. Program Organizational Chart

An Organizational Chart depicts the level of administration and responsibility for the operative management of data. Concise guidance and specific component accountability is achieved under the referenced organizational diagram. Revisions of the program are selectively implemented as necessary. Classification of personnel is based on a skill and/or expertise level required to perform the assigned tasks. Refer to Chart 1, for details of the program organizational chart.

3. Training

Continual training and instruction is provided, enabling management and staff to expand capacity and enhance skills in an effort to maintain the highest degree of accuracy and performance feasible. Performance is measured both individually and as a group, providing guidance for necessary continuing education programs and the basis for personnel career advancement, which ultimately improves unit efficiency and effectiveness.

The Authority employs an interactive data management team, which is multi-functionally cross-trained to perform under the guidance of the *Red River Authority's Administrative Policy and Procedures Manual*. All data management personnel are provided continuing education, both formal and informal, to maintain proficiency with dynamic hardware, software and application protocols.

HARDWARE CONSIDERATIONS

Data Management occurs within the framework of a Local Area Network (LAN) running under Windows NT 4.0 and Novell NetWare 5.0 on a Pentium II 350 with 192 MB Ram and 45 GB hard drive storage. Work stations utilize Pentium II class processor operating at 300 MHz or higher running under Microsoft Windows 98 with at least 126 MB of Ram and 4.5 GB hard drive storage. The LAN and work stations are supervised and maintained by the Systems Analyst under the direction of the General Manager.

SOFTWARE CONSIDERATIONS

The Authority employs a complement of proprietary software applications and support utilities in the accomplishment of data management objectives. Software acquisitions and upgrades follow a defined procedure in that all critical software meets the data management objectives for the intended use, is compatible with other statistical and geographic software applications, and is certified as being Year 2000 Compliant and capable.

The Authority utilizes Microsoft Access 97 as its primary database management software application to screen and manage all data entering the data management system. Paradox 7.0 is utilized as an alternate database management system to maintain compatibility with other entities.

Other applications considered essential to the data management system are Corel WordPerfect Office 2000 and Microsoft Office 2000 for general word processing, presentations graphics and subsidiary data management and analysis. AutoCAD 2000 and ArcView 3.2 are used for high end graphics and the Geographical Information System (GIS). StatSoft Statistica 5.0 for Windows is the primary statistical analysis software applied to processed data. Microsoft Excel 2000 is utilized as subsidiary analysis software and to maintain compatibility with other entities.

DATA DICTIONARY

Terminology and field descriptions are included in the *SWQM Data Management Reference Guide (1999)*, provided in Appendix 2 of the *FY 2002-2003 CRP Program Guidance*.

For the purposes of verifying which source codes are included in this QAPP, a table outlining the codes that will be used when submitting data under this QAPP is included below. Source Code 1 specifies the entity responsible for the sampling (Red River Authority of Texas), while Source Code 2 indicates the actual entity collecting the samples in the field. This table will be resubmitted with amendments to the QAPP that involve the addition of other monitoring entities under the QAPP.

Name of Monitoring Entity	Source Code 1	Source Code 2
Red River Authority of Texas	RR	RR
Canadian River Municipal Water Authority	RR	CR

DATA MANAGEMENT PLAN IMPLEMENTATION

The Authority's Data Manager is responsible for implementation of the plan when any new data is received for storage and analysis or when existing data inventories are retrieved for a specific task. The Data Manager provides supervision of all tasks relating to management of data contained in the system, either in hard copy or electronic format. On-line data inventories are maintained on a dedicated volume of the LAN for access by other staff members and technicians performing specialized tasks. Final quality controlled field data sheets or data sets are assembled with the lab reports and COC reports for inclusion into a three-ring binder. Custody of the original records and off-line digital copies are maintained in the Data Manager's office.

There are a minimum of five stages of quality assurance and quality control (QA/QC) that the data is subjected to from the point of entry into the data management processing system through publication and storage. During each stage of QA/QC, the data are visually checked and/or electronically screened in accordance with a detailed QA/QC protocol to ensure that the highest data integrity is maintained. The QA/QC process returns either a pass or fail result in which case the data are returned for corrective actions or passes on to the next processing steps. A QA/QC log and/or report is generated to verify the completed processes applied to the data and show responsibility for the person or persons managing the data in support of each assigned task. The Authority's QAO is responsible for performing all control processes and initializing the completed process. The Data Manager validates the QA/QC process prior to data entry or importation of data in the primary database structure.
Refer to the Quality Assurance Protocols in Section D1, D2 and D3 of this QAPP and the attached Data Management Schematic for details of the QA/QC stages applied during the processing path of data throughout the Data Management System.

QUALITY ASSURANCE QUALITY CONTROL

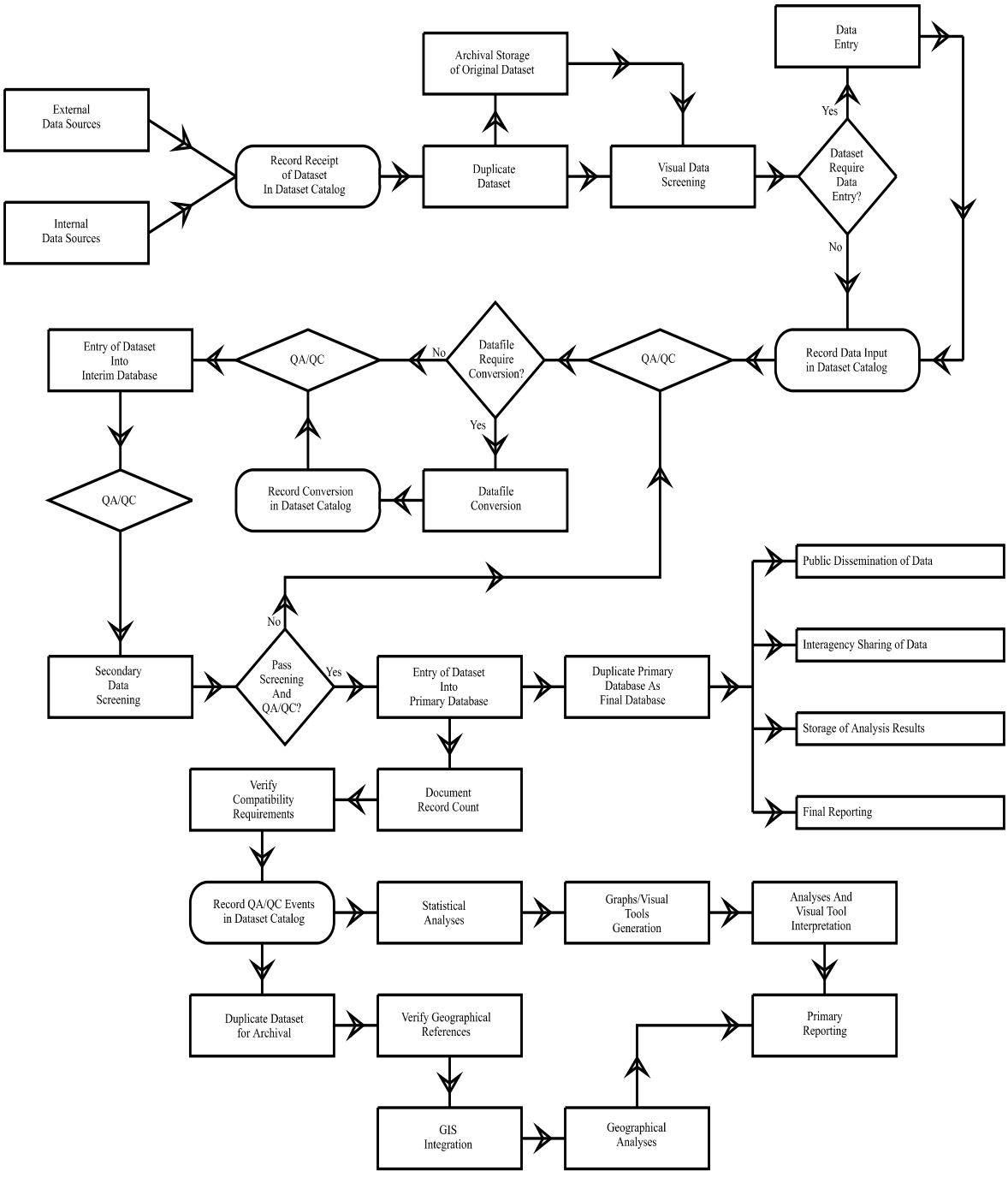
Refer to Section D1, D2 and D3 of this QAPP.

MIGRATION/TRANSFER/CONVERSION

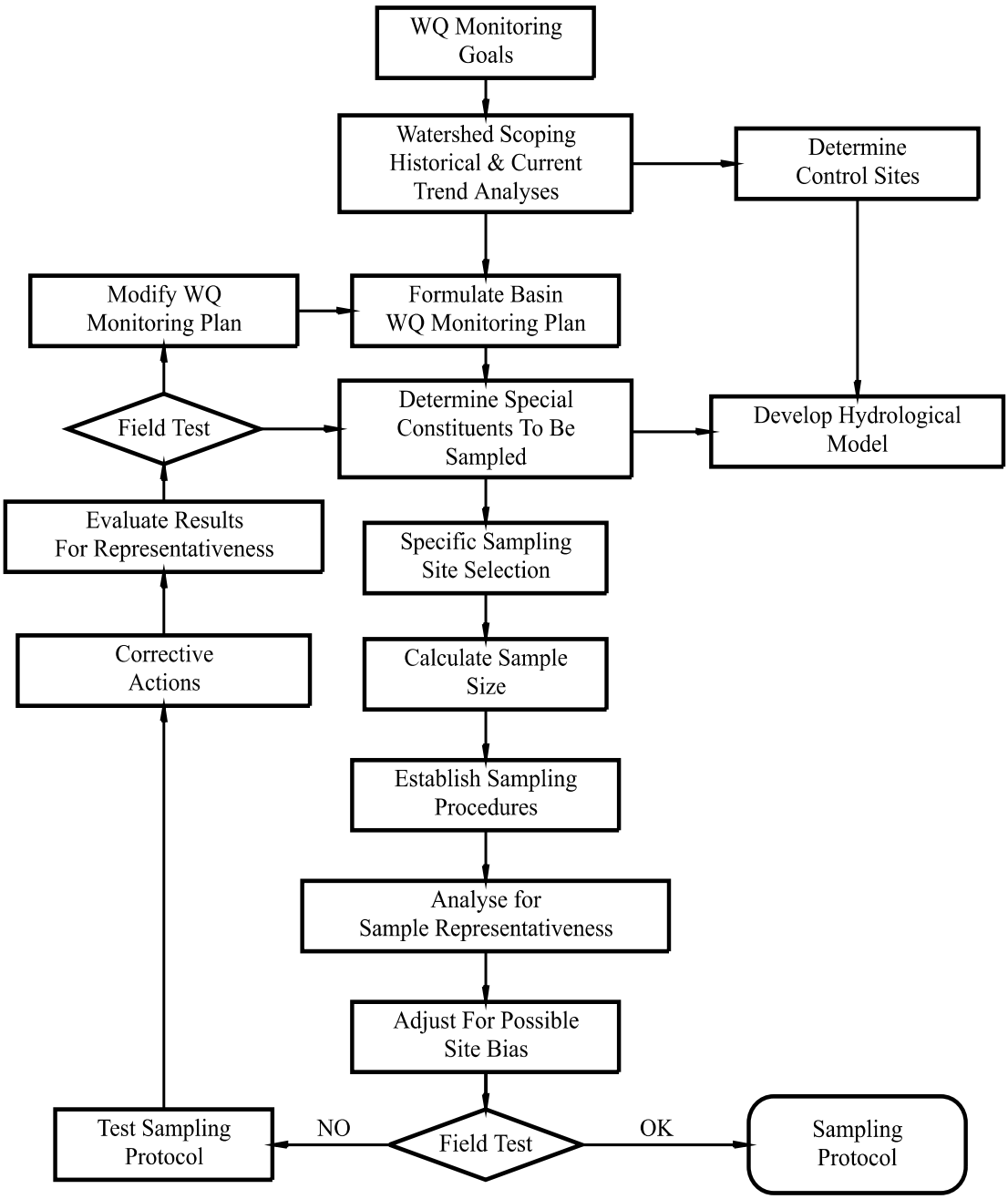
Data to be imported into a database, either from hard copy for manual data entry or in digital format for electronic entry, follows the conversion protocol best suited for the application and to comply with the structure of the host database design. In most cases, ASCII delimited text is the common migration format of choice.

Any new data for entry in the database management system (DBMS) not already in an acceptable format is converted to ASCII delimited text for importation. ASCII is the common medium for data archival and security and is utilized to maintain compatibility with all other format types, especially as new databases are introduced. An ASCII text editor is utilized to read the datafile and determine its basic format, remove dead space, and arrange the fields in the most desirable edit order. These steps are accomplished in the data screening and preparatory processing stages where individual specifications are prepared for each different data set to be included in the DBMS.

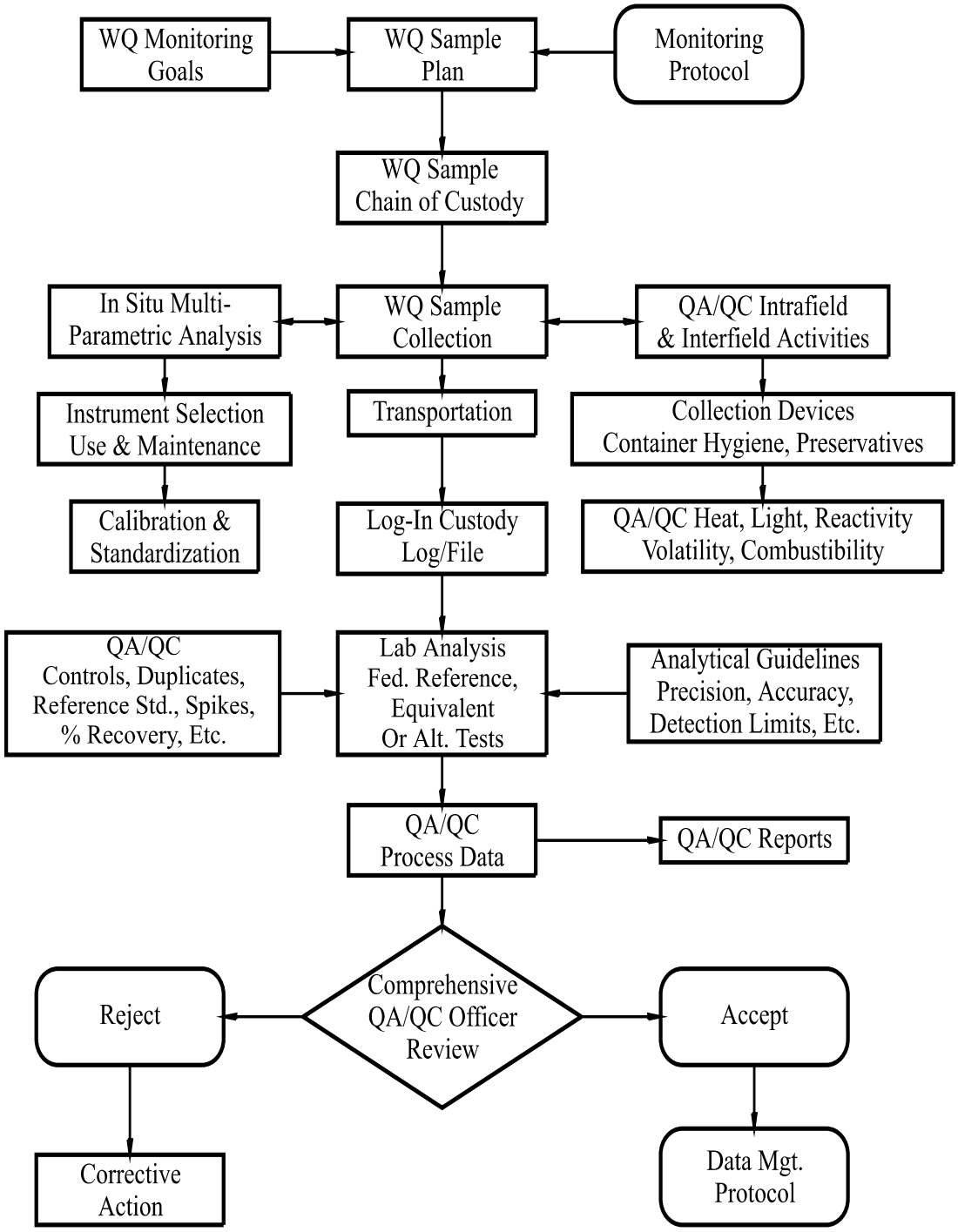
Data Management Schematic
Data Path Profile
Chart 2



WATER QUALITY MONITORING
Monitoring Protocol
Chart 3



WATER QUALITY MONITORING
Sampling Protocol
Chart 4



MIGRATION/TRANSFER/CONVERSION (continued)

Working with a copy of the datafile, the conversion processing stage consists of the following defined procedures:

1. Separate datafile into subsidiary blocks by predefined table specifications;
2. Normalize the table(s) by key field group relationships;
3. Set form and table assignments;
4. Arrange field order per table;
5. Add field and record delimiters as needed; and
6. Apply QA/QC review and log.

Table blocks may then be arranged to comply with the host database structure configuration to facilitate importation without error. Preferred field/record delimiters are installed and a test import to the host database structure is performed with a sampling of actual data for QA/QC review purposes.

BACKUP/DISASTER RECOVERY

1. Archives/Datafile Backups

Copies of data files are retained on-line for comparison and edification with two duplicates of each datafile stored off-site on 4mm data tape. The copies are logged with one remanded to a fireproof vault and the other is remanded to senior staff members for off-site storage until they are one month old. They are then stored in a fireproof safe located on-site until they are rotated through recycling of the backup data tape. Alternating tape backups are made weekly and stored off-site for safety against hazards that may affect the Authority's offices.

2. Disaster Recovery

Restoration of individual data files and source programs may be obtained from duplicates contained on tape and stored off-line. A control duplicate of the CRP data volume contained on the LAN file server is stored on CD(s) that may be restored to any workstation or server upon recovery of the system.

3. Archives/Data Retention

Complete original data sets are archived on permanent media; tape backup, CD-ROM, and retained indefinitely on-site by the Authority and off-site for a retention period specified in the original QAPP document.

The Authority applies the rules of Generally Accepted Accounting Principles for internal controls and custody of funds in maintaining its data security and storage. That is, all software applications, source programs and archived data are retained in original form together with a backup copy and kept off-line, off premises, and in a secure environment. All data files are retained in their original media and format without modification. Copies are utilized for initial conversion, formatting and importation to the interim database structure for continued processing.

INFORMATION DISSEMINATION

1. Public Access

Multimedia editorials and educational programs to be distributed throughout the watersheds will be made available through the information resources library and the Authority's Internet site as funds permit. Final quality assured data contained in the primary database structure is linked to the website for ready access of the most current data available.

The Data Management Program is flexible enough to provide a vast amount of relevant information through other public information programs produced by the Authority for use in public schools and the general public through public forums and meetings.

2. Internet

An Internet World Wide Web site is hosted by the Authority and dedicated to the CRP to provide the public with timely updates of Authority projects and programs. Select datasets and other products are also made available. This site is in a continuous state of modification to provide the most current information available. The CRP home page provides current information on the assessment process and over five years of water quality monitoring data. This information may be retrieved by county, basin reach, hydrologic unit area, segment, or by station number. An information repository is being expanded to include technical summaries, intensive survey reports, priority watershed studies and other publications relevant to the CRP that may also be of interest to the general public. Data links are maintained to other similar sites of interest.

3. Reporting

The Authority produces externally available reports, such as the Biennial Regional Assessment of Water Quality, Annual Financial Report, Project Summary Reports, newsletters, and Program Reports relevant to all major programs or projects to which the Authority is engaged. Summaries of published CRP reports are made available on the Authority's website in the Public Information Repository section.

INTER-AGENCY DATA SHARING

Software packages today provide features and conversion utilities that allow nearly universal translation of digital data files. The Authority keeps on hand a number of software products with extensive data translation functions to ensure that any user request for data in nearly any format can be met.