Sabine River Authority
Quality Assurance Project Plan

Sabine River Authority
1895 O-I Road
Orange, TX. 77632

Clean Rivers Program
Technical Analysis Division
Texas Natural Resource Conservation Commission
P.O. Box 13087, MC - 147
Austin, Texas 78711-3087

Effective Period: December 2001 through August 2003

Questions concerning this quality assurance project plan should be directed to:

Leigh-ann Arena
Quality Assurance Officer
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A1 APPROVAL PAGE

Texas Natural Resource Conservation Commission

Technical Analysis Division

Jim Thomas, Director Date
Technical Analysis Division

Charles Dvorsky, Manager Date
Water Quality Planning & Assessment Section

Linda Brookins Date
Program Manager, Clean Rivers Program

Eric Reese Date
Project Manager, Clean Rivers Program

Compliance Support Division

Carol Batterton, Director Date
Compliance Support Division

Stephen Stubbs Date
TNRCC Quality Assurance Manager

Bernard Ray Date
CRP Quality Assurance Specialist
Quality Assurance Section

Sabine River Authority

Gerard Sala Date
Sabine River Authority Project Manager

Leigh-ann Arena Date
Sabine River Authority Quality Assurance Officer

The SRA 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. The SRA will maintain this documentation as part of the project's quality assurance records, and will ensure that the document is available for review.

A2 TABLE OF CONTENTS

LIST OF ACRONYMS

AWRL	**Ambient Water Reporting Limits**
BMP	**Best Management Practices**
COC	**Chain-of Custody**
CRP	**Clean Rivers Program**
DMP	**Data Management Plan**
DQO	**Data Quality Objective**
FY	**Fiscal Year**
MDMA	**Monitoring Data Management & Analysis**
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**
RWA	**Receiving Water Assessment**
SOP	**Standard Operating Procedure**
SRA	**Sabine River Authority**
SWQM	**Surface Water Quality Monitoring**
TMDL	**Total Maximum Daily Load**
TNRCC	**Texas Natural Resource Conservation Commission**
TRACS	**Texas Regulatory and Compliance System**
TSWQS	**Texas Surface Water Quality Standards**
VOA	**Volatile Organic Analytes**
WMT	**Watershed Management Team**
NA	**Not Applicable**

A3 DISTRIBUTION LIST

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Leigh-ann Arena, Quality Assurance Officer
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The SRA 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 SRA 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.

Eric Reese
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 Planning agency 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 Specialists 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 QAPP's. Performs technical reviews of project-specific Data Management Plans. Develops and maintains Standard Operating Procedures for CRP data management.

Laurie Curra
CRP Project Quality Assurance Specialist

Assists Lead QAS with CRP QA management. Serves as liaison between CRP management and agency QA management. Responsible for CRP guidance development related to program quality assurance. Responsible for the review and approval of amendments and appendices to QAPPs. Serves on planning team for CRP special projects. Monitors implementation of corrective actions.

Sabine River Authority

Gerard Sala
Sabine River Authority 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 planning agency 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.

Leigh-ann Arena
Sabine River Authority Quality Assurance Officer

Responsible for writing and maintaining basin QAPPs, amendments and appendices. Responsible for determining if all data collected meet the data quality objectives of the project and are suitable for reporting to the TNRCC. Assists with conduct of monitoring systems audits for planning agency projects.

Mary Vann
SRA Data Manager
Responsible for ensuring that field data are properly reviewed and verified. Responsible for the transfer of basin quality-assured water quality data to the TNRCC in a compatible format. Maintains quality-assured data on planning agency internet sites. Responsible for the basin Data Management Plan.

Miles A. Hall
Assistant Environmental Services Division Manager

Responsible for coordinating activities between the Laboratory Supervisor, Biomonitoring Coordinator, and Field Office Coordinators. This includes the collection testing and reporting of CRP data. The development and implementation of the Water Quality Monitoring Program (WQMP) and any other special studies. The coordination of data transfer from the lab to the Data Resources Manager.

Bo Blankfield
Laboratory Supervisor

Responsibilities include, but not limited to the supervising of: the receiving of samples into the laboratory, the analyzing of the samples within proper holding time, and the entry of the results into the laboratory information system (LIMS).

Debra Ebarb
Biomonitoring Coordinator

Responsible for the coordination of all Biomonitoring activities which include, but not limited to Ambient Toxicity testing for the WQMP in conjunction with the CRP.

Cynthia Darbonne/John Payne
Lower and Upper Basin Field Office Coordinators

Responsible for designing and implementing the WQMP and any other special studies. Responsible for all field equipment calibration and maintenance, data collection and, bench sheets. Responsible for all special investigations. Responsible for the collection of Global Positioning Systems (GPS) data. Responsible for entering all field data into the SRA database.

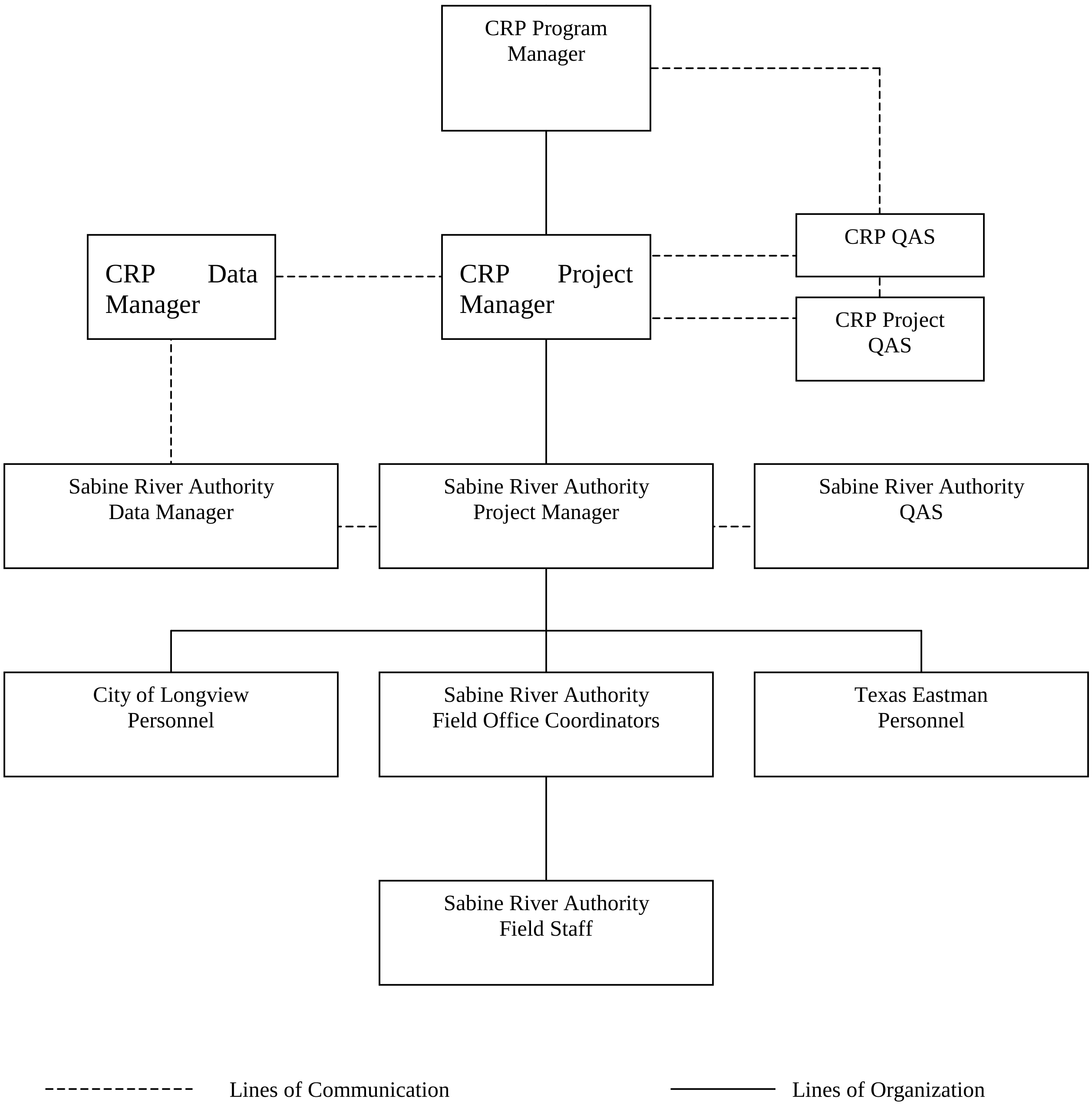
Eastman Chemical Company

Personnel from Eastman Chemical Company will collect water samples and send them to the SRA laboratory for metals analysis. The samples will be analyzed for both dissolved and total lead and cadmium. The samples will be collected and handled as specified in this document.

City of Longview

Personnel from the City of Longview will collect field data and water samples to be sent to the SRA laboratory for analysis. The samples will be collected and handled as specified in this document.

FIGURE A4.1 PROJECT ORGANIZATION CHART



A5 PROBLEM DEFINITION/BACKGROUND

In 1991, the Texas Legislature passed the Texas Clean River Act (Senate Bill 818) in response to growing concerns that water resource issues were not being pursued in an integrated, systematic manner. The act requires that ongoing water quality assessments be conducted for each river basin in Texas, an approach that integrates water quality issues within the watershed. The CRP Legislation mandates that "each river authority (or local governing entity) shall submit quality-assured data collected in the river basin to the commission." "Quality-assured data" in the context of the legislation means "data that 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 SRA and the TNRCC to carry out the activities mandated by the legislation. 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).

The purpose of this QAPP is to clearly delineate SRA QA policy, management structure, and procedures, 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 help ensure that data generated for the purposes described above are scientifically valid and legally defensible. This process will ensure that data collected under this QAPP and submitted to the 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 SRA Environmental Services Division (ESD) collects surface water quality data as part of its commitment to water quality protection in the Sabine Basin. This Water Quality Monitoring Program (WQMP) includes fixed station monitoring and analyses of physical, chemical, bacteriological, and biological parameters. SRA also conducts special investigations concerning pollution complaints.

Additional monitoring requirements have been brought about through the implementation of the TCRP. This additional systematic monitoring program complements the existing fixed station monitoring by providing information on the many subwatersheds not covered by the fixed station monitoring. The systematic monitoring utilizes biological screening studies in combination with routine physical and chemical parameters to provide data on the health of aquatic life and long-range water quality protection. The systematic monitoring also includes field investigations to provide data on subwatersheds, which have never been sampled.

The basin topography has been used to divide the Basin into 110 subwatersheds (24 of these are located in Louisiana), which are organized into 7 reaches. A 'reach' of the main-stem of the River roughly corresponds to the old segment system but the reaches are based on hydrography and similarity of land features. This system allows a manager to determine which areas have adequate water quality information and which areas do not. The subwatershed approach also incorporates risk factors such as municipal and industrial outfalls, solid waste sites, urban and rural land use, etc., into the decision making process.

Water quality data is analyzed using the data analysis program developed by SRA following guidance from the TNRCC. The fixed station and systematic programs are reviewed each year to consider revisions in every aspect of the programs.

The 1999 TCRP Sabine Basin Summary Report identified subwatersheds with water quality concerns in the Sabine Basin. The areas were prioritized using input from the Sabine Basin Steering Committee and the SRA staff. Monitoring plans were developed by the SRA and other monitoring partners in cooperation with TNRCC staff at the annual coordinated monitoring meetings to address these priority Subwatersheds.

A6 PROJECT/TASK DESCRIPTION

SRA will conduct monitoring at fixed monitoring sites to adequately characterize water quality trends and monitor progress in protecting or restoring water in the Sabine Basin. All monitoring plans are coordinated with the TNRCC regional offices to avoid duplication of effort. The fixed monitoring sites include 30 - 40 sampling sites that are monitored monthly for routine physical and chemical parameters. Selected sites are also monitored annually for metals in water and metals in sediment. Details of the monitoring schedule, parameters, and sampling locations are included in Appendix B.

SRA will conduct systematic monitoring utilizing biological screening studies in combination with routine physical and chemical parameters. Approximately seven sites will be monitored in FY 2002 and four to six sites will be monitored in FY 2003. Details of the monitoring schedule, parameters, and sampling locations will be included in Appendix B. The water quality data includes monitoring and analyses of physical, chemical, bacteriological, and biological parameters. Instantaneous flows will be collected at selected sites. These programs provide data on the health of aquatic life and long-range water quality protection.

Special studies will be conducted in the Caney Creek Subwatershed to determine impacts due to changes in effluent loading. A non-point study will continue in the Grace Creek Subwatershed to delineate concerns identified in the 1999 assessment. The Rabbit Creek and Hawkins Creek Subwatersheds are scheduled for special studies to determine non-point impairments.

See Appendix A for the project-related work plan tasks and schedule of deliverables for a description of work defined in this QAPP.

See Appendix B for details on monitoring to be conducted under this QAPP. The TNRCC monitoring sites are included only for the purposes of showing coordinated basin monitoring and are addressed by the TNRCC Surface Water Quality Monitoring (SWQM) QAPP.

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 SRA Project Manager to the CRP Project Manager in writing. They are effective immediately upon approval by the SRA Project Manager, the Planning Agency QAO, the CRP Project Manager, the CRP Lead QA Specialist, and the CRP Project QA Specialist. They will be distributed by the SRA Project Manager and incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list.

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 SRA and the TNRCC Project Manager and TNRCC technical staff. Appendices will be written in an abbreviated format and will reference the Basin QAPP where appropriate. Appendices will be approved by the SRA Project Manager, the SRA QAO, the CRP Project Manager, the CRP Project QA Specialist, the CRP Lead QA Specialist and other TNRCC personnel as appropriate. Copies of approved QAPPs appendices will be distributed by the SRA to project participants before monitoring activities are commenced.

A7 QUALITY OBJECTIVES AND 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 measurement performance criteria to support the project objectives for a minimum data set are specified in Table A7.1. The SRA Laboratory will perform all of the analyses listed 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									
pH	pH/ units	water	150.1(1) & TNRCC SOP	00400	NA*	NA	NA	NA	Field
DO	mg/L	water	360.1(1) & TNRCC SOP	00300	NA*	***NA***	NA	NA	Field
Percent Saturation of DO	%	water	360.1(1) & TNRCC SOP	00301	NA*	NA	NA	NA	Field
Conductivity	uS/cm	water	120.1(1) & TNRCC SOP	00094	NA*	NA	NA	NA	Field
Salinity	ppt, marine only	water	SM 2520B & TNRCC SOP	00480	NA*	NA	NA	NA	Field
TDS	mg/L	water	calculated	70294	NA	NA	NA	NA	Field
Temperature	°centigrade	water	170.1(1) & TNRCC SOP	00010	NA*	NA	NA	NA	Field
Secchi Depth	meters	water	TNRCC SOP(2)	00078	NA*	NA	NA	NA	Field
Days since last significant rainfall	days	NA	TNRCC SOP(2)	72053	NA*	NA	NA	NA	Field
Water Color	1-brown 2-reddish 3-green 4-black 5-clear 6-other	water	Field Observation	89969	NA*	NA	NA	NA	NA
Water Odor	1-sewage 2-oily/chemical 3-rottenegg 4-musky 5-fishy 6-none 7-other	water	Field Observation	89971	NA*	NA	NA	NA	NA
Weather	1-clear 2-ptcloudy 3-cloudy 4- rain	NA	Field Observation	89966	NA*	NA	NA	NA	NA
Wind Intensity	1-calm 2-slight 3-moderate 4-strong	Air	Field Observation	89965	NA*	NA	NA	NA	NA
Wind Direction	1-North 2-South 3-East 4-West 5-Northeast 6-Southeast 7-Northwest 8-Southwest	Air	Field Observation	89010	NA	NA	NA	NA	NA
Total water depth	meters	water	TNRCC RWA SOP	82903	NA*	NA	NA	NA	NA
Flow	cfs	water	TNRCC SOP(2)	00061	NA*	NA	NA	NA	Field
Flow severity	1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry	water	TNRCC SOP(2)	01351	NA*	NA	NA	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION of laboratory duplicates (RPD)	ACCURACY of calibration control stds. AWRLS (%Rec.)	ACCURACY of lab matrix spikes (%Rec.)	LABORATORY PERFORMING ANALYSIS
Field Parameters continued									
Flow Estimate	Ft^3/sec	water	TNRCC SOP	74069	NA*	NA	NA	NA	Field
Flow measurement method	1-Gage 2-Electrical 3-mechanical 4-weir/flume	water	TNRCC SOP	89835	NA*	NA	NA	NA	Field
24hrDO ave.	mg/L	water	EPA 360.1	89855	NA	NA	NA	NA	Field
24hr DO min.	mg/L	water	EPA 360.1	89856	NA	NA	NA	NA	Field
24hrDO max.	mg/L	water	EPA 360.1	89857	NA	NA	NA	NA	Field
24hrDO num. meas.	--	water	TNRCC SOP/ Calculation	89858	NA	NA	NA	NA	Field
24-hr ave. water temperature	C	water	TNRCC SOP/ Calculation	00209	NA	NA	NA	NA	Field
max daily water temperature	C	water	TNRCC SOP/ Calculation	00210	NA	NA	NA	NA	Field
min daily water temperature	C	water	TNRCC SOP/ Calculation	00211	NA	NA	NA	NA	Field
24hr temperature number measurements	--	water	TNRCC SOP/ Calculation	00221	NA	NA	NA	NA	Field
24-hr ave. conductivity	uS/cm	water	TNRCC SOP/ Calculation	00212	NA	NA	NA	NA	Field
max daily conductivity	uS/cm	water	TNRCC SOP/ Calculation	00213	NA	NA	NA	NA	Field
min daily conductivity	uS/cm	water	TNRCC SOP/ Calculation	00214	NA	NA	NA	NA	Field
24hr conductivity number measurements	--	water	TNRCC SOP/ Calculation	00222	NA	NA	NA	NA	Field
max daily pH	s.u.	water	TNRCC SOP/ Calculation	00215	NA	NA	NA	NA	Field
min daily pH	s.u.	water	TNRCC SOP/ Calculation	00216	NA	NA	NA	NA	Field
24hr pH number measurements	--	water	TNRCC SOP/ Calculation	00223	NA	NA	NA	NA	Field

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION of laboratory duplicates (RPD)	ACCURACY of calibration control stds. AWRLS (%Rec.)	ACCURACY of lab matrix spikes (%Rec.)	LABORATORY PERFORMING ANALYSIS
Conventional and Bacteriological Parameters									
TSS	mg/L	water	EPA 160.2	00530	4	0-10 mg/L: 30**** 10-100 mg/L: 20 >100 mg/L: 10	NA	NA	SRA
TOC	mg/L	water	EPA 415.1	00680	2.0	10	75-125	80-120	SRA
Turbidity	NTU	water	EPA 180.1	82079	0.5	0-10 NTU 30 10-100 NTU 20 >100 NTU 1010	75-125	NA	SRA
BOD, 5-day	mg/L	water	EPA 405.1	00310	2	10	NA	NA	SRA
O-phosphate-P	mg/L	water	EPA 300.1	00671	0.04	10	75-125	80-120	SRA
Nitrate/nitrite-N	mg/L	water	EPA 300.1	00630	0.04	10	75-125	80-120	SRA
Sulfate	mg/L	water	EPA 300.1	00945	10	10	75-125	80-120	SRA
Bromide	mg/L	water	EPA 300.1	71870	0.5	10	75-125	80-120	SRA
Fluoride	mg/L	water	EPA 300.1	00951	0.5	10	75-125	80-120	SRA
Chloride	mg/L	water	EPA 300.1	00940	10	10	75-125	80-120	SRA
Alkalinity, total	mg/L	water	EPA 310.1	00410	10	10	NA	80-120	SRA
Hardness, total (as CaC03)	mg/L	water	EPA 130.2	00900	5	10	NA	80-120	SRA
Chlorophyll-a	ug/L	water	Std. Methods 19 10200-H	32211	10	0-10 mg/L: 30**** 10-100 mg/L: 20 >100 mg/L: 10	75-125	NA	SRA
Pheophytin	ug/L	water	Std. Methods 19 10200-H	32218	5	0-10 mg/L: 30**** 10-100 mg/L: 20 >100 mg/L: 10	75-125	NA	SRA
E. coli, IDEXX Colilert	MPN/100mL	water	SM 9223-B	31699	1	1 *****	NA	NA	SRA
Enterococcus, Enterolert	MPN/100mL	water	ASTM D6503-99	31701	1	1*****	NA	NA	SRA
Fecal coliform	org/100mL	water	Std. Methods 19 9222-D	31616	1	1 *****	NA	NA	SRA
Fecal Streptococcus	CFU/100mL	Water	Std. Methods 19 9230C	31673	1	1	NA	NA	SRA
Metals									
Arsenic, dissolved	ug/L	water	EPA 206.2 GFAA/ EPA 200.8 ICP-MS	01000	5	10	75-125	75-125	SRA
Barium, dissolved	ug/L	water	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01005	1000	10	75-125	75-125	SRA
Cadmium, dissolved	ug/L	water	EPA 213.2 GFAA/ EPA 200.8 ICP-MS	01025	0.1 for waters <50 mg/L hardness 0.3 for waters ≥50 mg/L hardness	10	75-125	75-125	SRA

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION of laboratory duplicates (RPD)	ACCURACY of calibration control stds. AWRLS (%Rec.)	ACCURACY of lab matrix spikes (%Rec.)	LABORATORY PERFORMING ANALYSIS
Metals Continued									
Chromium, dissolved	ug/L	water	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01030	10	10	75-125	75-125	SRA
Copper, dissolved	ug/L	water	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01040	1 for waters <50 mg/L hardness 3 for waters ≥50 mg/L hardness	10	75-125	75-125	SRA
Lead, dissolved	ug/L	water	EPA 239.2 GFAA/ EPA 200.8 ICP-MS	01049	0.1 for waters < 85 mg/L hardness 1 for waters ≥85mg/L hardness	10	75-125	75-125	SRA
Nickel, dissolved	ug/L	water	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01065	10	10	75-125	75-125	SRA
Selenium, total	ug/L	water	EPA 270.2 GFAA/ EPA 200.8 ICP-MS	01147	2	10	75-125	75-125	SRA
Silver, dissolved	ug/L	water	EPA 272.2 GFAA/ EPA 200.8 ICP-MS	01075	0.5	10	75-125	75-125	SRA
Zinc, dissolved	ug/L	water	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01090	5	10	75-125	75-125	SRA
Metals in Sediment									
Arsenic in sediment	mg/kg	sediment	EPA 7061/ EPA 200.8 ICP-MS	01003	7	10	75-125	75-125	SRA
Barium in sediment	mg/kg	sediment	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01008	200	10	75-125	75-125	SRA
Cadmium in sediment	mg/kg	sediment	EPA 7131/ EPA 200.8 ICP-MS	01028	0.6	10	75-125	75-125	SRA
Chromium in sediment	mg/kg	sediment	EPA 200.7 ICp/ EPA 200.8 ICP-MS	01029	21	10	75-125	75-125	SRA

PARAMETER	UNITS	MATRIX	METHOD	STORET	AWRL	PRECISION of laboratory duplicates (RPD)	ACCURACY of calibration control stds. AWRLS (%Rec.)	ACCURACY of lab matrix spikes (%Rec.)	LABORATORY PERFORMING ANALYSIS
Metals in Sediment Continued									
Copper in sediment	mg/kg	sediment	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01043	14	10	75-125	75-125	SRA
Lead in sediment	mg/kg	sediment	EPA 7420/ EPA 200.8 ICP-MS	01052	20	10	75-125	75-125	SRA
Mercury in sediment	mg/kg	sediment	EPA 7471/ EPA 200.8 ICP-MS	71921	0.1	10	75-125	75-125	SRA
Nickel in sediment	mg/kg	sediment	EPA 200.7ICP/ EPA 200.8 ICP-MS	01068	15	10	75-125	75-125	SRA
Selenium in sediment	mg/kg	sediment	EPA 7740/ EPA 200.8 ICP-MS	01148	1	10	75-125	75-125	SRA
Silver in sediment	mg/kg	sediment	EPA 7760/ EPA 200.8 ICP-MS	01078	0.5	10	75-125	75-125	SRA
Zinc in sediment	mg/kg	sediment	EPA 200.7 ICP/ EPA 200.8 ICP-MS	01093	64	10	75-125	75-125	SRA
Ambient Toxicity			Toxnet						
Ceriodaphnia dubia-Acute	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-90/027F	89808	NA	NA	NA	NA	SRA
Daphnia pulex-Acute	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-90/027F	89807	NA	NA	NA	NA	SRA
Pimephales promelas-Acute	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-90/027F	89809	NA	NA	NA	NA	SRA
Menidia beryllina-Acute	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-90/027F	89812	NA	NA	NA	NA	SRA
Mysidopsis bahia-Acute	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-90/027F	89811	NA	NA	NA	NA	SRA
Ceriodaphnia dubia-Chronic	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-91/002	89802	NA	NA	NA	NA	SRA
Daphnia pulex-Chronic	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-91/002	89801	NA	NA	NA	NA	SRA
Pimephales promelas-Chronic	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-91/002	89803	NA	NA	NA	NA	SRA
Menidia beryllina-Chronic	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-91/003	89806	NA	NA	NA	NA	SRA
Mysidopsis bahia-Chronic	1-toxic 2-sublethal 3-No toxicity	Water	EPA/600/4-91/003	89805	NA	NA	NA	NA	SRA
Rapid Bioassessment	None	NA	EPA/444/4-89-001	NA	NA	NA	NA	NA	SRA

Benthics- Freshwater - Quantitative					
PARAMETER	**UNITS**	**MATRIX**	**METHOD**	**STORET**	**LABORATORY PERFORMING ANALYSIS*** **
Biological Data Reporting Units	1= number of individuals from sub-sample; 2 = number of individuals/ft^2; 3 = number of individuals/m^2; 4 = total number in kicknet	Water	TNRCC RWA SOP	89899	NA
Surber Sampler Effort, area sampled	m^2	Water	TNRCC RWA SOP	89901	NA
Ekman Sampler Effort, area sampled	m^2	Water	TNRCC RWA SOP	89935	NA
Petersen Sampler Effort, area sampled	m^2	Water	TNRCC RWA SOP	89934	NA
Hester-Dendy Duration	days	Water	TNRCC RWA SOP	89933	NA
Benthic Sampler	1=Surber, 2=Ekman, 3=kicknet, 4=Petersen, 5=Hester-Dendy	Water	TNRCC RWA SOP	89950	NA
Area of snag surface sampled	m^2	Water	TNRCC RWA SOP	89975	NA
Undercut bank at sample point	%	Water	TNRCC RWA SOP	89921	NA
Overhanging brush at sample point	%	Water	TNRCC RWA SOP	89922	NA
Gravel substrate at sample point	%	Water	TNRCC RWA SOP	89923	NA
Sand substrate at sample point	%	Water	TNRCC RWA SOP	89924	NA
Soft bottom at sample point	%	Water	TNRCC RWA SOP	89925	NA
Macrophyte bed at sample point	%	Water	TNRCC RWA SOP	89926	NA
Snags and brush at sample point	%	Water	TNRCC RWA SOP	89927	NA
Bedrock at sample point	%	Water	TNRCC RWA SOP	89928	NA
Benthic Organisms, None Present	NA	Water	TNRCC RWA SOP	90005	NA
Mesh Size, any net or sieve, average bar (diagonal measurement) for benthic collection	cm	NA	TNRCC RWA SOP	89946	NA
Stream Order	#	NA	TNRCC SOP	84161	NA
Ecoregion (Texas Ecoregion Code)	#	NA	TNRCC SOP	89961	NA
PARAMETER	**UNITS**	**MATRIX**	**METHOD**	**STORET**	**LABORATORY PERFORMING ANALYSIS*** **

Total Taxa (Taxa Richness)	#	Water	TNRCC RWA SOP	90055	?? Genera
Diptera Taxa	#	Water	TNRCC RWA SOP		NA
Ephemeroptera Taxa	#	Water	TNRCC RWA SOP		NA
Intolerant Taxa	#	Water	TNRCC RWA SOP		NA
EPT Taxa	%	Water	TNRCC RWA SOP		NA
Chironomidae	%	Water	TNRCC RWA SOP		NA
Tolerant Taxa	%	Water	TNRCC RWA SOP		NA
Grazers	%	Water	TNRCC RWA SOP		NA
Gatherers	%	Water	TNRCC RWA SOP		NA
Filterers	%	Water	TNRCC RWA SOP		NA
Dominance (3 Taxa)	%	Water	TNRCC RWA SOP		NA
Benthics- Freshwater - RBA (Qualitative)					
PARAMETER	**UNITS**	**MATRIX**	**METHOD**	**STORET**	**LABORATORY PERFORMING ANALYSIS*** **
Biological Data Reporting Units	1= number of individuals from sub-sample; 2 = number of individuals/ft^2; 3 = number of individuals/m^2; 4 = total number in kicknet	Water	TNRCC RWA SOP	89899	NA
Kicknet Effort, area kicked	m^2	Water	TNRCC RWA SOP	89903	NA
Kicknet Effort, minutes kicked	minutes	Water	TNRCC RWA SOP	89904	NA
Snags and Shoreline Sampling Effort, minutes picked	minutes	Water	TNRCC RWA SOP	89905	NA
Number of individuals in benthic RBA sub-sample (∀ 100)	#	Water	TNRCC RWA SOP	89906	NA
Benthic Sampler	1=Surber, 2=Ekman, 3=kicknet, 4=Petersen, 5=Hester-Dendy	Water	TNRCC RWA SOP	89950	NA
Undercut bank at sample point	%	Water	TNRCC RWA SOP	89921	NA
Overhanging brush at sample point	%	Water	TNRCC RWA SOP	89922	NA
Gravel substrate at sample point	%	Water	TNRCC RWA SOP	89923	NA
Sand substrate at sample point	%	Water	TNRCC RWA SOP	89924	NA
PARAMETER	**UNITS**	**MATRIX**	**METHOD**	**STORET**	**LABORATORY PERFORMING ANALYSIS*** **

Soft bottom at sample point	%	Water	TNRCC RWA SOP	89925	NA
Macrophyte bed at sample point	%	Water	TNRCC RWA SOP	89926	NA
Snags and brush at sample point	%	Water	TNRCC RWA SOP	89927	NA
Bedrock at sample point	%	Water	TNRCC RWA SOP	89928	NA
Benthic Organisms, None Present	NA	Water	TNRCC RWA SOP	90005	NA
Mesh Size, any net or sieve, average bar (diagonal measurement) for benthic collection	cm	NA	TNRCC RWA SOP	89946	NA
Stream Order	#	NA	TNRCC SOP	84161	NA
Ecoregion (Texas Ecoregion Code)	#	NA	TNRCC SOP	89961	NA
Total Taxa (Taxa Richness)	#	Water	TNRCC RWA SOP	90055	?? Genera
EPT Taxa	#	Water	TNRCC RWA SOP	90008	NA
Biotic Index (HBI)	NA	Water	TNRCC RWA SOP	90007	
Chironomidae	%	Water	TNRCC RWA SOP	92491	
Dominant Taxon	%	Water	TNRCC RWA SOP	90042	
Dominant FFG	%	Water	TNRCC RWA SOP	90010	
Predators	%	Water	TNRCC RWA SOP	90036	
Ratio of Intolerant:Tolerant taxa	NA	Water	TNRCC RWA SOP	90050	
Total Trichoptera as Hydropsychidae	%	Water	TNRCC RWA SOP	92266	
Non-insect taxa	#	Water	TNRCC RWA SOP	90052	
Collector-gatherers	%	Water	TNRCC RWA SOP	90025	
Total number as Elmidae	%	Water	TNRCC RWA SOP	90054	

Nekton- Freshwater

PARAMETER	UNITS	MATRIX	METHOD	STORET	LABORATORY PERFORMING ANALYSIS***
Nekton, none captured	NA	Water	TNRCC RWA SOP	98005	NA
Electrofishing effort, duration of shocking	Seconds	Water	TNRCC RWA SOP	89944	NA
Seining effort	# of Hauls	Water	TNRCC RWA SOP	89947	NA
Combined length of seine hauls	meters	Water	TNRCC RWA SOP	89948	NA
Seining effort, duration	minutes	Water	TNRCC RWA SOP	89949	NA

PARAMETER	UNITS	MATRIX	METHOD	STORET	LABORATORY PERFORMING ANALYSIS***
Minimum Mesh Size, net average bar (diagonal measurements) for nekton collection	cm	Water	TNRCC RWA SOP		NA
MaximumMesh Size, net average bar (diagonal measurements) for nekton collection	cm	Water	TNRCC RWA SOP		NA
Net length	meters	Water	TNRCC RWA SOP	89941	NA
Electrofishing method	1 = boat 2 = backpack 3 = tote barge	Water	TNRCC RWA SOP	89943	NA
Area seined	m^2	Water	TNRCC RWA SOP	89976	NA
Stream Order	#	NA	TNRCC SOP	84161	
Ecoregion (Texas Ecoregion Code)	#	NA	TNRCC SOP	89961	
Total fish species (richness)	#	Water	TNRCC RWA SOP	98003	
Total darter species	#	Water	TNRCC RWA SOP	98004	
Total sunfish species (except bass)	#	Water	TNRCC RWA SOP	98008	
Total sucker species	#	Water	TNRCC RWA SOP	98009	
Total intolerant species	#	Water	TNRCC RWA SOP	98010	
Tolerant individuals	%	Water	TNRCC RWA SOP	98016	
Omnivore individuals	%	Water	TNRCC RWA SOP	98017	
Insectivore individuals	%	Water	TNRCC RWA SOP	98021	
Piscivore individuals	%	Water	TNRCC RWA SOP	98022	
Total individuals	#	Water	TNRCC RWA SOP	98023	
Hybrid individuals	%	Water	TNRCC RWA SOP	98024	
Individuals w/ disease/anomalies	%	Water	TNRCC RWA SOP	98030	

* Reporting to be consistent with SWQM guidance and based on measurement capability
**** Measurement performance criteria will vary according to range of results.
***** Based on range statistic as described in Standard Methods, 20th Edition, Section 9020-B, " Quality Assurance/Quality Control - Intralaboratory Quality Control Guidelines."
(1) The current field meter is the Hydrolab Surveyor 3, but other meters are available in the event of instrument failure. All back-up instruments are capable of producing similar results.
(2) The TNRCC SOP's referenced are found in the latest edition of the Surface Water Quality Monitoring Procedures Manual.

References for Table A7.1:

United States Environmental Protection Agency (USEPA) "Methods for Chemical Analysis of Water and Wastes," Manual #EPA-600/4-79-020
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), "Standard Methods for the Examination of Water and Wastewater," 20th Edition,1999.
TNRCC SOP - TNRCC Surface Water Quality Monitoring Procedures Manual, June, 1999 or subsequent editions.
American Society for Testing and Materials (ASTM) Annual Book of Standards, Vol 11.02

Ambient Water Reporting Limits

Ambient water reporting limits, or AWRLs, 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. (also see Accuracy.)

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 the 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.

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.

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-October 15). Although data may be collected during varying regimes of weather and flow, the data sets will not be biased toward unusual conditions of flow, runoff, or season. The goal for meeting total representation of the water body will be tempered by the potential funding for complete representativeness.

Comparability

Confidence in the comparability of 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).

Completeness

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

A8 SPECIAL TRAINING/CERTIFICATION

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 Planning Agencies as part of the Clean Rivers Program.

A9 DOCUMENTS AND RECORDS

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

Table A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	TNRCC/SRA	2 years	Paper
QAPP distribution documentation	SRA	2 years	Paper
Contract Laboratory Letter of certification of EPA Methodologies Compliance	SRA	Reviewed annually	Paper
Field notebooks or data sheets	SRA	Minimum 7 years	Paper
Field equipment calibration/maintenance logs	SRA	Minimum 7 years	Paper
Chain of custody records	SRA	Minimum 7 years	Paper
Field SOPs	SRA	Reviewed annually	Paper
Laboratory QA Manuals	SRA	Updated annually	Paper
Laboratory SOPs	SRA	Reviewed annually	Paper
Laboratory data reports/results	SRA	Minimum 7 years	Paper
Instrument printouts	SRA	Minimum 7 years	Paper
Laboratory equipment maintenance logs	SRA	Minimum 7 years	Paper
Laboratory calibration records	SRA	Minimum 7 years	Paper
Corrective Action Documentation	SRA	Minimum 7 years	Paper

B1 SAMPLING PROCESS DESIGN

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

B2 SAMPLING METHODS

Field Sampling Procedures

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

Sample volume, container types, minimum sample volume, preservation requirements, and holding time requirements.

Table B2.1 Sample Storage, Preservation and Handling Requirements

Parameter	Matrix	Container	Preservation	Sample Volume	Holding Time
Conventionals					
Total Suspended Solids	Water	cubitainer ®	Cool to 4°C	200 mL	7 days
Turbidity	Water	cubitainer ®	Cool to 4°C	100 mL	48 hours
Orthophosphate	Water	cubitainer ®	Filter ASAP/ Cool to 4°C	100 mL	48 hours
Nitrate/Nitrite	Water	cubitainer ®	Cool to 4°C	100 mL	48 hours
Sulfate	Water	cubitainer ®	Cool to 4°C	100 mL	28 days
Bromide	Water	cubitainer ®	Cool to 4°C	100 mL	28 days
Fluoride	Water	cubitainer ®	Cool to 4°C	100 mL	28 days
Chloride	Water	cubitainer ®	Cool to 4°C	100 mL	28 days
Total Organic Carbon	Water	cubitainer ®	H_2SO_4	100 mL	28 days
Alkalinity	Water	cubitainer ®	Cool to 4°C	200 mL	14 days
Hardness, total	Water	cubitainer ®	HNO_3	100 mL	6 months
Chlorophyll-a/ Pheophytin a	Water	dark bottle	Cool to 4°C	500 mL	48 hours[1]
Fecal coliform	Water	sterile bottle	Cool to 4°C	100 mL	6 hours
Fecal Streptococcus	Water	sterile bottle	Cool to 4°C	100 mL	6 hours
E. coli	Water	sterile bottle	Cool to 4°C	100 mL	6 hours
Metals					
Dissolved[2]	Water	Precleaned plastic bottle	HNO_3	1000 mL	6 months
Total	Water	Precleaned plastic bottle	HNO_3	1000 mL	6 months[3]
Sediment metals	Sediment	Poly-Con	Cool to 4°C	150 mL	6 months[3]
Ambient Toxicity	Water	cubitainer®	Cool to 4°C	2.5 gallons	36 hours
Rapid Bioassessment	NA	plastic or glass	formalin or alcohol	NA	NA

[1]Chlorophyll *a* samples must be filtered within 48 hours and processed immediately after filtering.
[2]Dissolved metal samples must be filtered when collected using “clean techniques”.
[3]Mercury must be analyzed within 28 days.

Sample Containers

Sample containers (cubitainers) are purchased pre-cleaned for conventional parameters and metals and are disposable. Pre-sterilized plastic bottles containing 1% sodium thiosulfate tablets are used for bacteriological bottles. Bottles are purchased pre-cleaned and certified for organic constituents. Certificates are maintained in a notebook by the SRA. Amber glass bottles are used routinely for chlorophyll samples. These bottles are cleaned in an automatic steam washer with Dry-Contrad. One piece of glassware from each batch is checked with a 0.04% Bromothymol Blue solution to ensure proper rinsing. An equipment blank is ran for each batch of amber glass bottles to assure that there is no contamination resulting from the washing procedure.

Processes to Prevent Contamination

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

Documentation of Field Sampling Activities

Field sampling activities are documented on field data sheets as presented in Appendix C. 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 (*as applicable*), 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
   - specific sample information (number of sediment grabs, type/number of fish in a tissue sample, etc.)
   - missing parameters (i.e., when a scheduled parameter or group of parameters is not collected)

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;
3. Close-outs on incomplete pages with an initialed and dated diagonal line.

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 sample container problems, sample site considerations, etc. Failures or deviations from the QAPP are documented on the field data sheet *(or applicable record)* and reported to the SRA Project Manager. The SRA Project Manager will determine if the deviation from the QAPP compromises the validity of the resulting data. The SRA Project Manager, in consultation with the SRA QAO will decide to accept or reject data associated with the sampling event, based on best professional judgement. Any recurring or unresolved QA/QC problem will be brought to the immediate attention of the QA Officer and the Laboratory Supervisor. A Corrective Action Form (CAF) will be prepared and a copy will be forwarded to SRA management. The QA Officer, Laboratory Supervisor, and SRA management will develop an appropriate corrective action plan. The QA Officer will review the results of the corrective action and determine if further action is required. The resolution of the situation will be reported to the TNRCC in the quarterly report. Corrective action documentation is maintained by the SRA.

B3 SAMPLING HANDLING AND CUSTODY PROCEDURES

Chain-of -Custody The COC system described in this QAPP replaces the "tag" system as described in the SWQM Manual.

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. Site identification
3. Sample matrix
4. Number of containers
5. Preservative used or if the sample was filtered
6. Analyses required
7. Name of collector
8. Custody transfer signatures and dates and time of transfer
9. Bill of lading (*if applicable*)

Sample Labeling

Samples are labeled on the container with an indelible marker and with a computer generated label. Label information includes:

1. Site identification
2. Date and time of sampling
3. Preservative added, if applicable
4. Designation of "field-filtered" *(for metals)* as applicable
5. Sample type (e.g., conventional water parameters, organics, etc. as defined in the monitoring schedule in Appendix B*)*

Sample Handling

All samples submitted to the laboratory for analyses must have proper documentation as to its source, method of collection, and maintenance of integrity during transport and delivery.

The samples are received in the laboratory by the sample custodian or assigned alternate. After checking the COC form for completeness, the sample custodian records the date, time, and signs the form. The sample custodian maintains copies of the signed forms. The field personnel maintain the original signed field sheets in bound notebooks. Laboratory analyses conducted on the samples are referenced to the field sheets by the station name and date.

The sample custodian then affixes a computer-generated label to the sample. The label indicates the sample ID number, the place of storage, date received, date collected, tentative date of disposal, and the tests to be performed. The sample is then checked for proper preservation by the sample custodian and preserved as necessary. The sample custodian then performs any pretreatment procedures at this time when necessary.

The sample is stored in the appropriate refrigeration unit or issued to an analyst if immediate analysis is required. Only authorized laboratory personnel will handle samples received by the laboratory. Samples remain stored in the appropriate refrigeration unit until removed for analysis by an analyst. The Laboratory Supervisor or designate will assign testing to laboratory analysts within the specified holding times.

The analyst assigned to perform the test generates a work list of samples from the computer. The analyst removes the samples from storage and records the sample ID numbers in the appropriate bound benchsheet notebook. All other appropriate information is recorded in the book at this time. The information includes the date and time the analysis began, the analyst's initials, and any other information pertinent to the specific test such as standards, dilution volumes, all required quality assurance samples, etc.

The analyst is responsible for the integrity of the sample from the time it is removed from storage, during the time of the analysis, and until it is returned to storage. The analyst must be prepared to testify in a court of law that the integrity of the sample was maintained throughout the analysis.

Each sample is returned to its appropriate storage upon completion of the analysis. If the entire sample is used, the empty container will be stored in the designated storage place until the appointed disposal time. At the beginning of each month, samples are removed from refrigeration and stored on the storage shelf in the laboratory after all tests have been completed. The samples are properly disposed of 60 days after testing.

Failures in Chain-of-Custody and Corrective Action

All failures associated with chain-of-custody procedures are immediately reported to the SRA Project Manager. These include 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 SRA Project Manager, in consultation with the SRA QAO, will determine if the procedural violation may have compromised the validity of the resulting data. The SRA Project Manager in consultation with the SRA 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; redo 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 documentation is maintained by the SRA.

B4 ANALYTICAL METHODS

The analytical methods, associated matrices, and performing laboratories are listed in Table A7.1 of Section A7. The authority for analysis methodologies under the Clean Rivers Program is derived from the TSWQS (§§307.1 - 307.10) in that data generally are generated for comparison to those standards and/or criteria. The Standards state that “Procedures for laboratory analysis will be in accordance with the most recently published edition of *Standard Methods for the Examination of Water and Wastewater*, the latest version of the *TNRCC Surface Water Quality Monitoring Procedures Manual*, 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 SRA and are available for review by the TNRCC. Laboratory SOPs are consistent with EPA requirements as specified in the method.

Standards Traceability

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

Analytical Method Modification

Only data generated using 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.

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 documented on the data report which is sent to the SRA Project Manager. The SRA Project Manager will include this information on the Quarterly Report which is sent to the TNRCC.

Corrective action documentation is maintained by the SRA.

B5 QUALITY CONTROL

Sampling Quality Control Requirements and Acceptability Criteria

The minimum Field QC Requirements are outlined in the *TNRCC Surface Water Quality Monitoring Procedures Manual.* Specific requirements are outlined below. Field QC sample results are submitted with the data report (see Section C2.)

Field equipment blank - A field equipment blank is a sample of reagent water poured into or over a sampling device or pumped through a sampling device. It is collected in the same type of container as the environmental sample, preserved in the same manner and analyzed for the same parameter. The analysis of 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. Equipment blanks are prepared whenever a new batch of filters is used or every tenth sample filtered (or collected for total metal analysis).

Field duplicate - 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 for most parameters 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 using the following equation:

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

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

Field duplicates are collected on all samples on a 10% basis.

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. The frequency of field blanks is variable and may be inserted into the sampling regime to address specific requirements. They are not routinely collected or analyzed.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory quality assurance manuals (QAMs). The minimum requirements 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 metals sampling equipment are cleaned between uses. These blanks document that the materials provided by the laboratory are free of contamination. The QC check is performed before the metals sampling equipment is sent to the field. The analysis of laboratory equipment blanks should yield values less than the AWRL, otherwise the equipment should not be used.

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

For most parameters, 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:

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

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

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 pair. Precision limits for bacteriological analyses are defined in “A7- Quality Objectives and Criteria.”.

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:

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

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 or corrective action will be implemented. 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 spike (MS) - A matrix spike is an aliquot of sample spiked with a known concentration of the analyte of interest. Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Spiked samples are routinely prepared and analyzed at a rate of 10% of samples processed. 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:

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

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 Minimum Analytical Level. For very high level analyses, blank value should be less then 5% of the lowest value of the batch, or corrective action will be implemented.

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

Failures in Field and Laboratory Quality Control and Corrective Action

Sampling QC excursions are evaluated by the SRA Project Manager in consultation with the SRA 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. Incidences of 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 SRA.

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*. Sampling equipment is inspected and tested upon receipt and is assured appropriate for use. Equipment records are kept on all field equipment and a supply of critical spare parts is maintained.

All laboratory tools, gauges, instrument, and equipment testing and maintenance requirements are contained within laboratory QAM(s). 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*. 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

Requirements for acceptance of laboratory supplies and consumables are outlined in the SRA QAM.

B9 NON-DIRECT MEASUREMENTS

Other than historical data already furnished to the TNRCC, SRA will only provide data collected under this QAPP.

B10 DATA MANAGEMENT

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

C1 ASSESSMENTS AND RESPONSE ACTIONS

The following table presents the types of assessments and response action for data collection activities applicable to the QAPP.

Table C1.1 Assessments and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	SRA	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TNRCC in Quarterly Report
Monitoring Systems Audit	Dates to be determined 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
Monitoring Systems Audit of Sample Collection by Eastman Chemical and Monitoring By City of Longview	Biannually	SRA	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to the Planning Agency. PA will report problems to TNRCC in Progress Report.
Laboratory Inspection	Dates to be determined 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

Corrective Action

The SRA 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 Planning Agency Project Managers. Corrective action documentation will be submitted to the TNRCC with the Progress Report.

Corrective action is taken anytime errors, deficiencies, or out-of-control circumstances occur. Errors, deficiencies, and out-of control circumstances may involve, but are not limited to such things as, instrument malfunctions, failures in calibration, blank contamination, quality control samples outside QAPP defined limits, etc. Corrective action can be an immediate response to remedy a spontaneous or non-recurring problem such as equipment malfunction. Long-term corrective action is necessary to correct recurring problems.

All test results beyond control limits are recorded by the analyst in a bound logbook and the QA Officer is notified immediately. The QA Officer will then determine the proper course of action. The following routine is observed for out of control results. This routine is performed in sequence until the problem is resolved, at which point the process may be terminated.

1. The analyst records the out of control result in the logbook and notifies the QA Officer.
2. All raw data, equations, and calculations are verified.
3. The calibration of the instrument is checked with a known standard.
4. The QC samples are reanalyzed.

5. All samples that are suspect are reanalyzed.
6. The instrument is shut down for complete recalibration, cleaning, tuning, alignment, etc., as recommended by the manufacturer.
7. The client is notified of the problem and given an estimate of delay.
8. The frequency of QC samples is doubled until the correction is validated.

Recurring QA/QC problems will be addressed by the QA Officer, the Laboratory Supervisor and ESD management. Any recurring or unresolved QA/QC problem will be brought to the immediate attention of the QA Officer and the Laboratory Supervisor. A Corrective Action Form (CAF) will be prepared and a copy will be forwarded to ESD management (see Figure C1). The QA Officer, Laboratory Supervisor, and ESD management will develop an appropriate corrective action plan. The QA Officer will review the results of the corrective action and determine if further action is required.

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

Figure C1. CORRECTIVE ACTION FORM

Date:	
Problem:	
Person(s) Involved:	
Cause of Problem:	
Corrective Action:	

Date:	
Follow Up Action:	
Quality Assurance Review:	

Reviewed By: ______________________________ Date: ______________
Laboratory Supervisor

Approved By: ______________________________ Date: ______________
Quality Assurance Officer

C2 REPORTS TO MANAGEMENT

Reports to Planning Agency Project Management

Laboratory Data Reports

Laboratory data reports contain QC information so that this information can be reviewed by the Planning Agency Project Manager.

Reports to Planning Agency Project Management

The QA Officer reports the status of implementation of the procedures discussed in this project plan to the SRA Project Manager. The QA Officer must be informed of any quality assurance problems encountered and solutions adopted.

The QA Officer will submit an annual quality assurance (QA) report to the SRA Project Manager. This report will address the accuracy, precision and completeness of measurement data used in the project. It will also discuss any problems encountered and solutions made.

The annual QA report from the QA Officer will also be transmitted to the Development Coordinator and the Development Manager. This will allow the highest levels of management to be kept informed as to the quality of data obtained by the ESD in conducting this project

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 SRA's activities for each task; reports monitoring status, problems, delays, and corrective actions; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response - Following any audit performed by the SRA a report of findings, recommendations and response is sent to the TNRCC in the quarterly progress report.

Reports by TNRCC Project Management

Contractor Evaluation - The SRA 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 SRA Field Office Coordinators are responsible for ensuring that field data are properly reviewed, verified, and submitted in the required format to the project database. Likewise, the Laboratory Supervisor is responsible for ensuring that laboratory data (from the SRA laboratory and any contract laboratory) are reviewed, verified, and submitted in the required format to the project database. The SRA Data Resource Manager is responsible for verifying that field and laboratory data have been entered correctly into the project database. Finally, the SRA QAO is responsible for validating that all data collected meet the data quality objectives of the project and are suitable for reporting to TNRCC.

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 conform 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 chain-of-custody forms and hard copy output from instruments. The data management task deals primarily with 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 D.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 the data review checklist (*see sample form in Task 4 of CRP Program Guidance and Reference Guide*).

The SRA QAO is responsible for validating that the verified data meet the measurement performance criteria and are reportable to TNRCC. One element of the validation process involves the SRA QAO evaluating the data again for anomalies. The SRA Project Manager may designate other experienced water quality experts familiar with the project to perform this evaluation. Any, suspected errors or anomalous data must be addressed by the manager of the task associated with the data, before data validation can be completed. 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 will be assessed. Finally, the SRA QAO validates that the 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	Field Task	Laboratory Task	Database (or Data Manager) Task
Sample documentation complete	Y	Y	
Standards and reagents traceable	Y	Y	
Holding times not exceeded	Y	Y	
Collection, preparation, and analysis consistent with SOPs and QAPP	Y	Y	
Analytical sensitivity (AWRLs) consistent with QAPP	Y	Y	
QC analyzed at required frequency	Y	Y	
QC results meet performance and program specifications	Y	Y	Y
Results, calculations, transcriptions checked	Y	Y	
Laboratory bench-level review performed		Y	
All laboratory samples analyzed for all parameters		Y	
Corollary data agree	Y	Y	Y
Nonconforming activities documented	Y	Y	Y
TAG IDs correct			Y
TNRCC ID number assigned			Y
Dates formatted correctly			Y
Depth reported correctly			Y
Source codes 1, 2, and program code used correctly			Y
STORET codes valid and in QAPP			Y
Time based on 24-hour clock	Y	Y	Y
Outliers confirmed and documented			Y
Verified data log submitted			Y
10% of data manually reviewed			Y
Sampling and analytical data gaps checked (e.g., all sites for which data are reported are on the coordinated monitoring schedule)	Y	Y	Y

D3 RECONCILIATION WITH USER REQUIREMENTS

Data produced, in this project will not be used by the project team. These data, and data collected by other organizations (e.g., USGS, TNRCC, etc.), 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*.