Quality Assurance Project Plan Northeast Texas Municipal Water District

PO Box 955
Hughes Springs, TX 75656

Clean Rivers Program

Water Quality Planning Division

Texas Commission on Environmental Quality

P.O. Box 13087, MC 234

Austin, Texas 78711-3087

Effective Period: FY 2022 to FY 2023

Questions concerning this QAPP should be directed to:
Randy Rushin
Project Manager
Water Monitoring Solutions, Inc.
P.O. Box 1132
Sulphur Springs, Texas 75483
(903) 439-4741
randy@water-monitor.com

A1 Approval Page

Texas Commission on Environmental Quality

Water Quality Planning Division

8/31/2021

Kyle Girten, Manager — Date
Water Quality Monitoring and Assessment Section

Rebecca DuPont 08/31/2021

Rebecca DuPont, Work Leader — Date
Clean Rivers Program

Rebecca DuPont 08/31/2021

Rebecca DuPont, — Date
Acting Project Quality Assurance Specialist
Clean Rivers Program

8/30/2021

Jenna Wadman, Project Manager — Date
Clean Rivers Program

Cathy S. Anderson 08/31/2021

Cathy Anderson, Team Leader — Date
Data Management and Analysis

Monitoring Division

08/31/2021

Sharon Coleman — Date
TCEQ Quality Assurance Manager

Dana D. Squires 8/31/2021

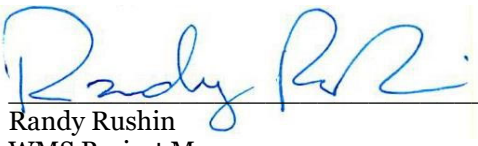
Dana Squires — Date
Lead CRP Quality Assurance Specialist

Northeast Texas Municipal Water District (NETMWD)

Walt Sears, Jr. 8-30-2021
NETMWD General Manager Date

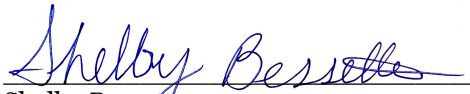
Robert Speight 8-30-2021
NETMWD Project Manager Date

Water Monitoring Solutions, Inc. (WMS)



8/30/2021

Randy Rushin — Date
WMS Project Manager



8/30/2021

Shelby Bessette — Date
WMS Data Manager

8/30/2021

Angela Kilpatrick — Date
WMS Quality Assurance Officer

8/30/2021

Dr. Roy Darville — Date
WMS Data Collection Supervisor

Lower Colorado River Authority Environmental Services Laboratory (LCRA ELS)

Dale Jurecka 8-30-21
Dale Jurecka Date
LCRA ELS Laboratory Manager

Angel Mata 08-30-21
Angel Mata Date
LCRA ELS Quality Manager

Jason Woods 8/30/21
Jason Woods Date
LCRA ELS Project Manager

A2 Table of Contents

List of Acronyms

AU	Assessment Unit
AWRL	Ambient Water Reporting Limit
BMP	Best Management Practices
BS	Biased to Season monitoring
CAP	Corrective Action Plan
CE	Collecting Entity
COC	Chain of Custody
CRP	Clean Rivers Program
DCS	Data Collection Supervisor
DMRG	Surface Water Quality Monitoring Data Management Reference Guide, July 2019, or most recent version
DM&A	Data Management and Analysis
EPA	United States Environmental Protection Agency
FY	Fiscal Year
GIS	Geographical Information System
GPS	Global Positioning System
IR	2020 Texas Integrated Report
LCRA ELS	Lower Colorado River Authority Environmental Laboratory Services
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
LOD	Limit of Detection
LOQ	Limit of Quantitation
MT	Monitoring Type
NELAP	National Environmental Laboratory Accreditation Program
NETMWD	Northeast Texas Municipal Water District
QA	Quality Assurance
QM	Quality Manual
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QAS	Quality Assurance Specialist
QC	Quality Control
QMP	Quality Management Plan
PM	Project Manager
RT	Routine Monitoring
SE	Submitting Entity
SLOC	Station Location
SOP	Standard Operating Procedure
SWQM	Surface Water Quality Monitoring
SWQMIS	Surface Water Quality Monitoring Information System
TMDL	Total Maximum Daily Load
TCEQ	Texas Commission on Environmental Quality
TNI	The NELAC Institute
TSWQS	Texas Surface Water Quality Standards
WMS	Water Monitoring Solutions, Inc.
VOA	Volatile Organic Analytes
WWTP	Wastewater Treatment Plant

A3 Distribution List

Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Jenna Wadman, Project Manager
Clean Rivers Program
MC-234
(512) 239-5626
jenna.wadman@tceq.texas.gov

Dana Squires
Lead CRP Quality Assurance Specialist
MC-165
(512) 239-0011
Dana.squires@tceq.texas.gov

Cathy Anderson
Team Leader, Data Management and Analysis
MC-234
(512) 239-1805
Cathy.anderson@tceq.texas.gov

Northeast Texas Municipal Water District
PO Box 955
Hughes Springs, Texas 75656
903-639-7538

Walt Sears, Jr., General Manager
netmwd@aol.com

Robert Speight, Project Manager
rspeightnetmwd@aol.com

Water Monitoring Solutions, Inc.
PO Box 1132
Sulphur Springs, Texas 75483
(903) 439-4741

Randy Rushin, WMS Project Manager
randy@water-monitor.com

Shelby Bessette, WMS Data Manager
srbessette92@gmail.com

Angela Kilpatrick, WMS QAO
kilpatricka@sbcglobal.net

Dr. Roy Darville, WMS Data Collection Supervisor
rdarville@etbu.edu

LCRA Environmental Services Laboratory
3505 Montopolis Drive
Austin, Texas 78744
(877) 362-5272

Jason Woods, LCRA ELS Project Manager
Jason.Woods@LCRA.ORG

Angel Mata, LCRA ELS Quality Manager
Angel.Mata@LCRA.ORG

Dale Jurecka, LCRA ELS Laboratory Manager
Dale.Jurecka@LCRA.ORG

The Northeast Texas Municipal Water District will provide copies of this project plan and any amendments or appendices of this plan to each person on this list and to each sub-tier project participant, e.g., subcontractors, subparticipants, or other units of government. The Northeast Texas Municipal Water District will document distribution of the plan and any amendments and appendices, maintain this documentation as part of the project's quality assurance records, and ensure the documentation is available for review.

A4 Project/Task Organization

Description of Responsibilities

TCEQ

Rebecca DuPont
CRP Work Leader

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

Dana Squires
CRP Lead Quality Assurance Specialist

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

Jenna Wadman
CRP Project Manager

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

Cathy Anderson
Team Leader, Data Management and Analysis (DM&A) Team

Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Ensures DM&A staff perform data management-related tasks.

Sarah Kirkland
CRP Data Manager, DM&A Team

Responsible for coordination and tracking of CRP data sets from initial submittal through CRP Project Manager review and approval. Ensures that data are reported following instructions in the Data Management Reference Guide, July 2019 or most current version (DMRG). Runs automated data validation checks in the Surface Water Quality Management Information System (SWQMIS) and coordinates data verification and error correction with CRP Project Managers. Generates SWQMIS summary reports to assist CRP Project Managers' data review. Identifies data anomalies and inconsistencies. Provides training and guidance to CRP and Planning Agencies on technical data issues to ensure that data are submitted according to documented procedures. Reviews QAPPs for valid stream monitoring stations. Checks validity of parameter codes, submitting entity code(s), collecting entity code(s), and monitoring type code(s). Develops and maintains data management-related SOPs for CRP data

management. Coordinates and processes data correction requests. Participates in the development, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP).

Rebecca DuPont
Acting CRP Project Quality Assurance Specialist
Serves as liaison between CRP management and TCEQ QA management. Participates in the development, approval, implementation, and maintenance of written QA standards (e.g., Program Guidance, SOPs, QAPPs, QMP). Serves on planning team for CRP special projects and reviews QAPPs in coordination with other CRP staff. Coordinates documentation and implementation of corrective action for the CRP.

Northeast Texas Municipal Water District

Walt Sears, Jr.
Northeast Texas Municipal Water District General Manager
Mr. Sears is the General Manager of NETMWD and is a member of the Steering Committee for the Cypress Creek Basin Clean Rivers Program. Mr. Sears will provide coordination and cooperation between the project partners, stakeholders, and WMS.

Robert Speight
Northeast Texas Municipal Water District Project Manager
Responsible for implementing and monitoring CRP requirements in contracts, QAPPs, and QAPP amendments and appendices. Coordinates basin planning activities and work of basin partners. Conducts monitoring systems audits of WMS to ensure QAPPs are followed by the Cypress Creek basin planning agency participants and that projects are producing data of known quality. Ensures that sub-participants are qualified to perform contracted work. Ensures CRP project managers and/or QA Specialists are notified of deficiencies and corrective actions, and that issues are resolved. Responsible for validating that data collected are acceptable for reporting to the TCEQ. Maintains quality-assured data on NETMWD internet sites.

Water Monitoring Solutions, Inc.

WMS contracts with the Northeast Texas Municipal Water District to administer the tasks and responsibilities outlined in this QAPP on behalf of the NETMWD.

Randy Rushin
WMS Project Manager
Responsible for contact and coordination with NETMWD, TCEQ and other entities participating in the Cypress Creek Basin Clean Rivers Program activities. Responsible for reviewing and maintaining the QAPP and monitoring its implementation. Responsible for implementing and monitoring CRP requirements in contracts, QAPPs and QAPP amendments and appendices and maintaining records of sub-tier commitment to requirements specified in this QAPP. Responsible for the supervision of all CRP field activities (water quality, biological sampling and monitoring), including equipment calibration, sampling, sample preservation, fieldwork, sample transport, and chain-of-custody maintenance in compliance with the approved QAPP. Designates WMS staff with subordinate responsibility, and oversees task progress and completion of project deliverables. Responsible for performing necessary data analysis and development of conclusions and recommendations in technical deliverables. Notifies the NETMWD Project Manager of circumstances which may adversely affect the quality of data. Responsible for maintaining records of QAPP distribution, including appendices and amendments. Ensures that field staff is properly trained and that training records are maintained.

Angela Kilpatrick
WMS Quality Assurance Officer
Responsible for coordinating the implementation of the QA program. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Responsible for receiving and reviewing project QA records. Responsible for coordinating with the TCEQ QAS to resolve QA-related issues. Coordinates and monitors deficiencies, non-conformances and corrective actions;

coordinates and reviews records of data verification and validation.

Shelby Bessette
WMS Data Manager
Responsible for the transfer of basin quality-assured water quality data in a format compatible with SWQMIS. Assists QAO with identifying, receiving, and reviewing project QA records. Responsible for coordinating with the TCEQ QAS to resolve QA-related issues. Notifies the WMS PM of particular circumstances which may adversely affect the quality of data. Assists QAO with deficiencies, non-conformances and corrective actions; coordinates and reviews records of data verification and validation. Review data from monitoring events and provide data quality comments to the WMS PM. Responsible for ensuring that field and lab data are properly reviewed and verified.

Dr. Roy Darville
Data Collection Supervisor
Ensures that all field sampling activities are conducted in accordance with this QAPP, reporting to the WMS PM and QAO any deviation from this QAPP, maintaining proper documentation of sampling events, sampling preservation, sampling shipment, and field procedures at designated stations. Responsible for the supervision of all field activities including water quality sampling and monitoring, and including equipment preparation, sampling, sample preservation, fieldwork, sample transport, and chain-of-custody maintenance in compliance with the approved QAPP. Participates in field data collection activities and training of new field personnel.

Lower Colorado River Authority Environmental Laboratory Services (LCRA ELS)

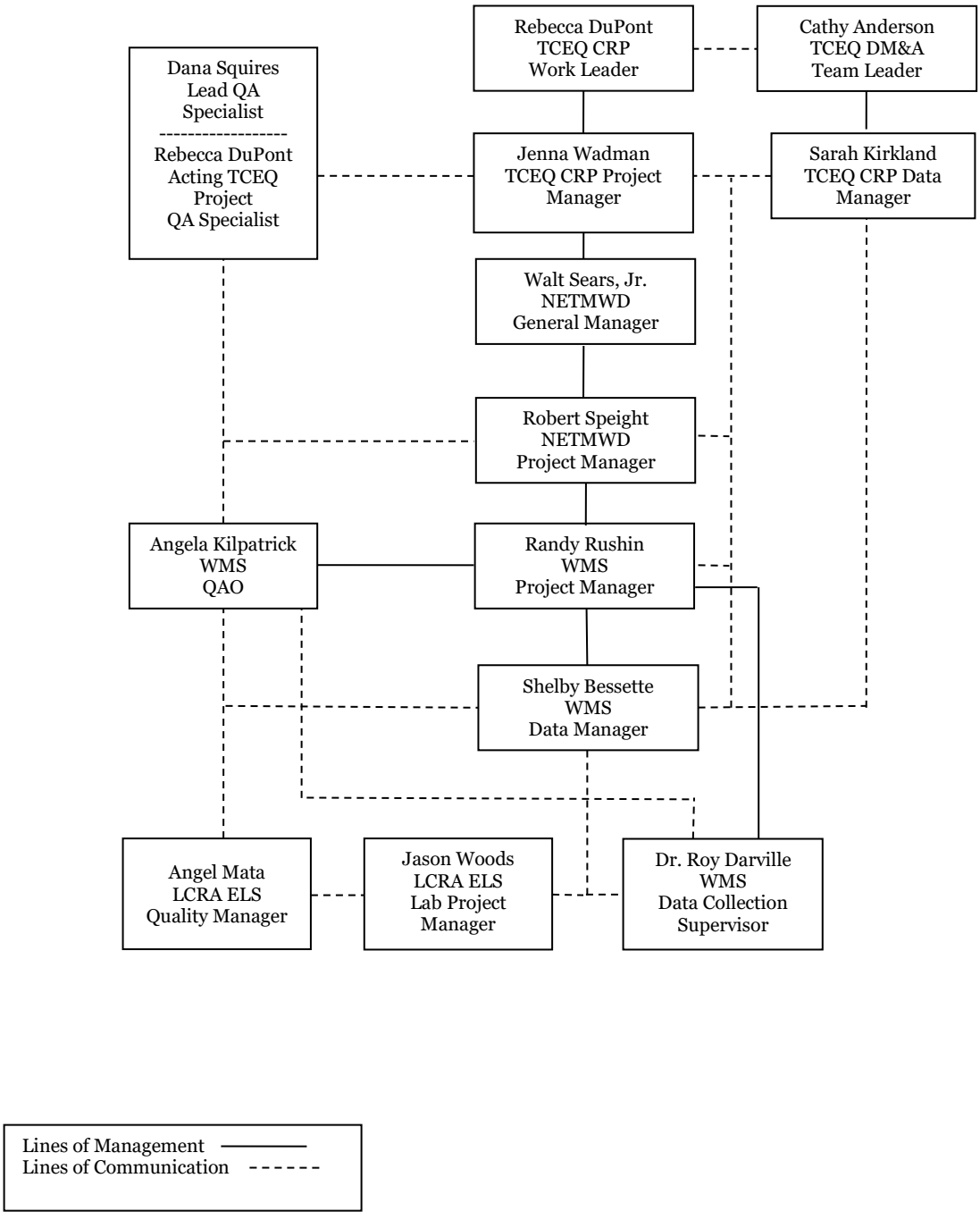
Jason Woods
Laboratory Project Manager
Responsible for analyses performed by LCRA ELS. Responsible for project set up in LIMS. Serves as the primary point of contact for all laboratory activity conducted by LCRA under this QAPP.

Dale Jurecka
Laboratory Manager
Responsible for the overall performance, administration, and reporting of analyses performed by LCRA ELS. Responsible for ensuring that laboratory personnel involved in generating analytical data have adequate training and a thorough knowledge of the QAPP and all SOPs specific to the analysis or task performed and or supervised. Responsible for oversight of all operations, ensuring that all QA/QC requirements are met, and documentation related to the analysis is completely and accurately reported.

Angel Mata
Quality Manager
Responsible for the overall quality control and quality assurance of analyses performed by LCRA's ELS. Monitors the implementation of the QM/QAPP within the laboratory to ensure complete compliance with QA data quality objectives, as defined by the contract and in the QAPP. Conducts in-house audits to ensure compliance with written SOPs and to identify potential problems. Responsible for supervising and verifying all aspects of the QA/QC in the laboratory.

Project Organization Chart

Figure A4.1. Organization Chart – Lines of Communication



A5 Problem Definition/Background

In 1991, the Texas Legislature passed the Texas Clean River Act (Senate Bill 818) in response to growing concerns that water resource issues were not being pursued in an integrated, systematic manner. The act requires that ongoing water quality assessments be conducted for each river basin in Texas, an approach that integrates water quality issues 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 comply with TCEQ rules for surface water quality monitoring (SWQM) 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 Northeast Texas Municipal Water District and the TCEQ to carry out the activities mandated by the legislation. The QAPP was developed and will be implemented in accordance with provisions of the TCEQ Quality Management Plan, January 8, 2019 or most recent version (QMP).

The purpose of this QAPP is to clearly delineate the NETMWD QA policy, management structure, and procedures which will be used to implement the QA requirements necessary to verify and validate the surface water quality data collected. The QAPP is reviewed by the TCEQ to help ensure that data generated for the purposes described above are of known and documented quality, deemed acceptable for their intended use. This process will ensure that data collected under this QAPP and submitted to SWQMIS have been collected and managed in a way that guarantees its reliability and therefore can be used in water quality assessments, total maximum daily load (TMDL) and water quality standards development, permit decisions, and other program activities deemed appropriate by the TCEQ. Project results will be used to support the achievement of CRP objectives, as contained in the *Clean Rivers Program Guidance and Reference Guide FY 2022-2023*.

The Cypress Creek Basin in Texas consists of three major watersheds converging at the lowermost segment of Big Cypress Creek (Segment 0402). The four largest reservoirs in the basin are Caddo Lake (Segment 0401), Lake O' the Pines (Segment 0403), Lake Bob Sandlin (Segment 0408), and Lake Cypress Springs (Segment 0405). These four reservoirs are impoundments of Big Cypress Creek and are designated for use as public water supplies. Four smaller reservoirs (Monticello, Welch, Ellison Creek, and Johnson Creek) have been constructed on tributary streams to be used primarily as cooling ponds for steam-electric power plants. While shoreline development has been permitted only around Lake Cypress Springs, recreational and retirement housing construction continues within the small watersheds draining directly into Lake Bob Sandlin, Lake O' the Pines and Caddo Lake.

The Cypress Creek Basin water quality monitoring program has been established to collect surface water samples within the basin and to provide longitudinal water quality data for continuing evaluation of water quality. Previous efforts of other monitoring agencies have established reliable and useful data for evaluation under the SWQM water quality screening procedures. Monitoring data has been collected at gage locations within each of the ten segments of the Cypress Creek Basin since 1981.

This Cypress Creek Basin water quality monitoring plan was developed to maintain consistent sampling through time and locations, provide data analyzed using consistent detection limits, and address water quality impairments and concerns throughout the basin. Low dissolved oxygen (DO) concentrations occur in stream and marginal reservoir habitats throughout the Cypress Creek Basin. All segments except 0408 (Lake Bob Sandlin) have reaches on the *2020 Texas 303(d) List*, or for which concerns about low DO concentrations are expressed in the *2020 Texas Integrated Report for Clean Water Act Sections 305(b) and 303(d)* (IR). In most locations, the low DO concentrations are associated with natural low flow conditions and high levels of photosynthesis and respiration.

Marginal and backwater habitats in Caddo Lake, as in Lake O' the Pines, occasionally exhibit DO concentrations below the segment criterion for support of aquatic life. However, these episodes are not generally accompanied by large daily changes in DO concentrations, and often reflect relatively constant, low concentrations throughout a 24-hour sample period. Caddo Lake has a lower nutrient load than Lake O' the Pines, and consequently does not support intense algal production during summer conditions. It is more likely in Caddo Lake that an intense oxygen demand is produced from the sediments during summer conditions, primarily from the decomposition of rooted plants mass-produced with the help of nutrients in the sediment. The 2020 Texas IR also includes a review of the DO levels in Caddo Lake which highlighted a pattern of lower DO in the upper end of the lake.

Assessment units in segments 0401, 0404, 0405, 0406, 0407, 0409 and 0410 have concerns for, or are listed as impaired for bacteria levels. In 2011, data collection was completed for a collaborative effort to assess sources for the listings in 0404 (Big Cypress Creek), 0404B (Tankersley Creek), and 0404C (Hart Creek). This approach to assessing bacteria loading is one option to consider in the other listed watersheds in the basin. A similar bacteria study was conducted in South Lilly Creek in 2016.

Except for nitrate, nutrient concentrations in streams rarely exceed TCEQ screening levels. However, total phosphorus and total nitrogen concentrations in streams throughout the Cypress Creek Basin are usually at levels that can result in excessive algal growth under low flow conditions or in impoundments. The heaviest loads have been observed originating from the Tankersley Creek watershed, and to a lesser extent, from other tributary watersheds in the upper part of the basin. Some phosphorus and a large proportion of the nitrogen load is lost during transport in Big Cypress Creek from the vicinity of Mount Pleasant and Pittsburg to the headwaters of Lake O' the Pines, presumably through biological activity and trapping in the floodplain.

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

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

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

To achieve this goal, a variety of sampling regimens have been implemented including routine water quality grab sampling, diel dissolved oxygen monitoring, and biological and habitat assessments. Routine water quality grab sampling has been an ongoing effort over the years; however, this type of sampling provides only a short-term view of water quality in an area; especially for streams and rivers-where flow conditions and water quality can change rapidly. Due to the dynamic nature of these systems, specific acute water quality issues may be missed due to sample timing. For example, stormwater runoff may not be captured by routinely scheduled quarterly grab sampling. Biological monitoring provides a more long-term view of water quality in these systems. Biological monitoring consists of fish and benthic macroinvertebrates which are identified and evaluated to determine if the assigned aquatic life use is being met. Since biological populations respond predictably to water quality issues, issues that may not be captured in a water quality grab sample may be identified. For example, in a system that frequently receives discharges of poor water quality, the species present will typically be more tolerant of poor water quality. However, in a system that does not receive such discharges, the biological community may contain higher number of intolerant species to poor water quality; and therefore, may indicate that the system generally maintains good water quality. As a result, biological monitoring can be used to determine the level of aquatic life use the system can sustain as well as the associated standards that are appropriate for the system.

A6 Project/Task Description

Assessment and management of water quality within the Cypress Creek Basin is dependent on quality-assured data. Water quality monitoring and data collection is a primary function of the Clean Rivers Program. Water quality monitoring in the Cypress Creek Basin is made possible through a cooperative program directed by NETMWD. WMS assists NETMWD in planning, data collection, analysis, and reporting of water quality data. The Clean Rivers Program Steering Committee members, basin partners and affiliates include Pilgrim's Pride Corporation, Franklin County Water District, Titus County Fresh Water District #1, US Steel Tubular Products, Luminant, and the U.S. Geological Survey.

The monitoring program for the Cypress Creek Basin Clean Rivers Program is divided into two major areas: (1) water quality monitoring via routine (RT) station monitoring and (2) monitoring that is biased to season (BS).

Routine (RT) monitoring of physical, chemical, and bacteriological parameters is used primarily to populate SWQMIS with data usable for the assessment of the water bodies in the Cypress Creek Basin. A major objective of this monitoring type is to improve the ability to identify trends and water quality changes in the major sub-basins. Reservoir monitoring usually occurs near the dam and in the major arms that receive contributory surface inflow from rivers and streams. Routine sampling is generally conducted on a quarterly basis to provide information on water quality conditions. For FY 2022, routine sampling will continue without the intentional examination of any particular target environmental condition or event at fourteen stations.

Biased-to-season (BS) monitoring is accomplished by collecting DO, pH, conductance, and temperature values over a period of twenty-four hours (diel). BS monitoring is conducted with no less than one-half and no more than two-thirds of the monitoring occurring in the index period, and no less than one fourth and no more than one-third will be collected in the critical period. Index and critical period is determined following the definition published in *Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, Chapter 2*. Diel monitoring will be performed at five stations in FY 2022. Three stations will be monitored four times per year, while diel sampling will be performed at two stations as part of biological monitoring studies.

Biased-to-season monitoring also includes performing biological collections and habitat assessment. Biological sampling provides a long-term view of stream health due to the extended life cycle of organisms. Biological monitoring and habitat assessment will be conducted by following the procedures published in *Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data*. Sampling for nekton and benthic macroinvertebrates, diel monitoring, and a habitat assessment will be conducted at two stations (one in Frazier Creek and one in Hart Creek) during the index and critical periods of FY 2022.

The project design and site selection was chosen by the Coordinated Monitoring Committee with the intention of focusing attention on specific watersheds and water bodies known or suspected to have water quality issues, based either upon local public concern or assessment unit information contained in the *2020 Texas IR*.

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

See Appendix B for sampling design and monitoring pertaining to this QAPP.

Amendments to the QAPP

Revisions to the QAPP may be necessary to address incorrectly documented information or to reflect changes in project organization, tasks, schedules, objectives, and methods. Requests for amendments will be directed from the WMS and NETMWD Project Managers to the CRP Project Manager electronically. The Basin Planning Agency will submit a completed QAPP Amendment document, including a justification of the amendment, a table of changes, and all pages, sections, and attachments affected by the amendment. Amendments are effective immediately upon approval by the WMS and NETMWD Project Managers, the WMS QAO, the CRP Project Manager, the CRP Lead QA Specialist, the CRP Project QA Specialist, and additional parties affected by the amendment. Amendments are not retroactive. No work shall be implemented without an approved QAPP or amendment prior to the start of work. Any activities under this contract that commence prior to the approval of the governing QA document constitute a deficiency and are subject to corrective action as described in section C1

of this QAPP. Any deviation or deficiency from this QAPP which occurs after the execution of this QAPP will be addressed through a Corrective Action Plan (CAP). An amendment may be a component of a CAP to prevent future recurrence of a deviation.

Amendments will be incorporated into the QAPP by way of attachment and distributed to personnel on the distribution list by the WMS and NETMWD Project Managers. If adherence letters are required, WMS will secure an adherence letter from each sub-tier project participant (e.g., subcontractors, sub-participant, or other units of government) affected by the amendment stating the organization's awareness of and commitment to requirements contained in each amendment to the QAPP. The Basin Planning Agency will maintain this documentation as part of the project's QA records, and ensure that the documentation is available for review.

Special Project Appendices

Projects requiring QAPP appendices will be planned in consultation with the NETMWD, WMS, and the TCEQ Project Manager and TCEQ technical staff. Appendices will be written in an abbreviated format and will reference the Basin QAPP where appropriate. Appendices will be approved by the WMS and NETMWD Project Managers, the WMS QAO, the Laboratory (as applicable), and the CRP Project Manager, the CRP Project QA Specialist, the CRP Lead QA Specialist and additional parties affected by the Appendix, as appropriate. Copies of approved QAPP appendices will be distributed by WMS to project participants before data collection activities commence. WMS will secure written documentation from each sub-tier project participant (e.g., subcontractors, subparticipants, other units of government) stating the organization's awareness of and commitment to requirements contained in each special project appendix to the QAPP. The NETMWD will maintain this documentation as part of the project's QA records, and ensure that the documentation is available for review.

A7 Quality Objectives and Criteria

The purpose of routine water quality monitoring is to collect surface water quality data that can be used to characterize water quality conditions, identify significant long-term water quality trends, support water quality standards development, support the permitting process, and conduct water quality assessments in accordance with TCEQ's Guidance for Assessing and Reporting Surface Water Quality in Texas, June 2015 or most recent version (https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/14txir/2014_guidance.pdf). These water quality data, and data collected by other organizations (e.g., United States Geological Survey (USGS), TCEQ, etc.), will be subsequently reconciled for use and assessed by the TCEQ.

Aquatic Life Monitoring and diel monitoring will be conducted at locations identified in Appendix B. These sampling regimes are considered biased to season. Additional parameters associated with Aquatic Life Monitoring will be included in the final data set but are not listed in Tables A7.7 to A7.9, specifically those for the reporting of taxa inventory.

The measurement performance specifications to support the project purpose for a minimum data set are specified in Appendix A.

Ambient Water Reporting Limits (AWRLs)

For surface water to be evaluated for compliance with Texas Surface Water Quality Standards ("TSWQS") and screening levels, data must be reported at or below specified reporting limits. To ensure data are collected at or below these reporting limits, required ambient water reporting limits ("AWRL") have been established. A full listing of AWRLs can be found at https://www.tceq.texas.gov/assets/public/waterquality/crp/QA/awrlmaster.pdf.

The limit of quantitation (LOQ) is the minimum reporting limit, concentration, or quantity of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence by the laboratory analyzing the sample. Analytical results shall be reported down to the laboratory's LOQ (i.e., the laboratory's LOQ for a given parameter is its reporting limit) as specified in Appendix A.

The following requirements must be met in order to report results to the CRP:

- The laboratory's LOQ for each analyte must be set at or below the AWRL.
- Once the LOQ is established in the QAPP, that is the reporting limit for that parameter until such time as the laboratory amends the QAPP and lists an updated LOQ.
- The laboratory must demonstrate its ability to quantitate at its LOQ for each analyte by running an LOQ check sample for each analytical batch of CRP samples analyzed.
- When reporting data, no results may be reported below the LOQ stated in this QAPP.
- Measurement performance specifications for LOQ check samples are found in Appendix A.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria are provided in Section B5.

Precision

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. It is a measure of agreement among replicate measurements of the same property, under prescribed similar conditions, and is an indication of random error.

Laboratory precision is assessed by comparing replicate analyses of Laboratory Control Samples (LCS) in the sample matrix (e.g. deionized water, sand, commercially available tissue), Matrix Spike/Matrix Spike Duplicate (MS/MSD), or sample/duplicate (DUP) pairs, as applicable. Precision results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for precision are defined in Appendix A.

Bias

Bias is the systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). Bias is a statistical measurement of correctness and includes multiple components of systematic error. Bias is determined through the analysis of LCS and LOQ check samples prepared with verified and known amounts of all target analytes in the sample matrix (e.g. deionized water, sand, commercially available tissue) and by calculating percent recovery. Results are compared against measurement performance specifications and used during evaluation of analytical performance. Program-defined measurement performance specifications for bias are specified in Appendix A.

Representativeness

Site selection, the appropriate sampling regime, comparable monitoring and collection methods, and use of only approved analytical methods will assure that the measurement data represents the conditions at the site. Routine data collected under CRP are considered to be spatially and temporally representative of ambient water quality conditions. Water quality data are collected on a routine frequency and are separated by approximately even time intervals. 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) and 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 maximum representation of the water body will be tempered by funding availability.

Biological monitoring sites will be selected that best represent conditions (both biological and water quality) of the entire water body. The chosen sites will be accessible and have a good variety of microhabitats to sample, including a mixture of riffles, runs, and pools. Sampling will be avoided in reaches where water quality conditions and hydrology change dramatically over the reach, such as areas with a major tributary or contaminant source.

Comparability

Confidence in the comparability of routine data sets for this project and for water quality assessments is based

on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements as described in this QAPP and in TCEQ guidance. 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 in Section B10.

Completeness

The completeness of the data describes how much of the data are 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

Before new field personnel independently conduct field work, the WMS PM and/or DCS will train the individual in proper instrument calibration, field sampling techniques, and field analysis procedures. The QA officer (or designee) will document the successful field demonstration. The QA Officer (or designee) will retain documentation of training and the successful field demonstration in the employee's personnel file and ensure that the documentation will be available during monitoring systems audits.

Contractors and subcontractors must ensure that laboratories analyzing samples under this QAPP meet the requirements contained in The NELAC Institute Standard (TNI) (2016) Volume 1, Module 2, Section 4.5.5 (concerning Subcontracting of Environmental Tests).

Collection of habitat, benthics, and fish will be in accordance with the *Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, Revised May 2014* (or most recent version). Individuals conducting identification of benthic macroinvertebrates and fish have adequate training and education to accurately identify species.

A9 Documents and Records

The documents and records that describe, specify, report, or certify activities are listed. The list below is limited to documents and records that may be requested for review during a monitoring systems audit.

Table A9.1 Project Documents and Records

Document/Record	Location	Retention (yrs)	Format
QAPPs, amendments and appendices	NETMWD/WMS**	5	Paper/Electronic
Field SOPs	NETMWD/WMS**	5	Paper/Electronic
Laboratory Quality Manuals	LCRA ELS*	5	Paper/Electronic
Laboratory SOPs	LCRA ELS*	5	Paper/Electronic
QAPP distribution documentation	NETMWD/WMS**	5	Paper/Electronic
Field staff training records	NETMWD/WMS**	5	Paper/Electronic
Field equipment calibration/maintenance logs	WMS**	5	Electronic/Paper
Field instrument printouts	WMS**	5	Electronic/Paper
Field notebooks, data sheets, or electronic field data collection tables	WMS**	5	Electronic/Paper
Chain of custody records	NETMWD/WMS**	5	Electronic
Laboratory calibration records	LCRA ELS*	5	Paper
Laboratory instrument printouts	LCRA ELS*	5	Paper
Laboratory data reports/results	NETMWD/WMS**/ LCRA ELS*	5	Paper/Electronic/Paper
Laboratory equipment maintenance logs	LCRA ELS*	5	Paper
Corrective Action Documentation	NETMWD/WMS**/ LCRA ELS*	5	Paper/Electronic/Paper

* Laboratory Records must be retained in accordance with the NELAC Standards

**WMS will transfer all paper documents to NETMWD annually and will retain electronic copies only.

Laboratory Test Reports

Test/data reports from the laboratory must document the test results clearly and accurately. Routine data reports should be consistent with the TNI Standard (2016), Volume 1, Module 2, Section 5.10 and include the information necessary for the interpretation and validation of data. The requirements for reporting data and the procedures are provided.

- Title of report
- Name and address of the laboratory
- Name and address of the client
- A clear identification of the sample(s) analyzed
- Station, date and time of sample collection/receipt
- Identification of method used

- Identification of samples that did not meet QA requirements and why (e.g., holding times exceeded)
- Sample results
- Units of measurement
- Sample matrix
- Dry weight or wet weight (as applicable)
- Sample depth
- Name and title of person authorizing the report
- Project-specific quality control results to include: equipment and field blank results (as applicable)
- Narrative information on QC failures or deviations from requirements that may affect the quality of results or is necessary for verification and validation of data.
- Holding time for *E. coli*.
- LOQ and LOD (formerly referred to as the reporting limit and the method detection limit, respectively), and qualification of results outside the working range (if applicable)
    - Additionally, laboratory control spikes/laboratory control spike duplicates may also be listed under other nomenclature such as laboratory fortified blanks and laboratory fortified blank duplicates depending on the standard report generated by the lab.
- Certification of NELAP compliance

The information in test reports will be consistent with the information that is needed to prepare data submittals to TCEQ. Otherwise, reports will be consistent with the TNI Standards and will include any additional information critical to the review, verification, validation, and interpretation of data.

Electronic Data

After field sampling is completed, data sheets and applicable QA documentation such as calibration logs are scanned into a portable document format (pdf) file and electronically transmitted to the WMS Project Manager. Laboratory reports, scanned Chain of Custody forms, and results are sent electronically by the LCRA ELS Project Manager to the NETMWD and WMS Project Managers.

The WMS Project Manager compiles and electronically distributes data files to the WMS QAO and WMS Data Manager as they are received. After the data have been verified, validated, and formatted, the WMS Data Manager electronically transfers the files to the WMS Project Manager and NETWMD Project Manager for review. Upon approval, the WMS Data Manager submits the data files to the TCEQ Project Manager.

Data are submitted electronically to the TCEQ in the Event/Result file format described in the most current version of the DMRG, which can be found at https://www.tceq.texas.gov/waterquality/data-management/dmrg_index.html. A completed Data Review Checklist and Data Summary (see Appendix F) will be submitted with each data submittal. Portions of the Biological Monitoring Reporting Packet (Appendix D) will be submitted by NETMWD to TCEQ in the required BLOB format as described in the DMRG.

B1 Sampling Process Design

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

B2 Sampling Methods

Field Sampling Procedures

Field sampling will be conducted in accordance with the latest versions of the TCEQ Surface Water Quality Monitoring Procedures Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue, 2012 (RG-415) and Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416), collectively referred to as "SWQM Procedures." Updates to SWQM Procedures are posted to the Surface Water Quality Monitoring Procedures website (https://www.tceq.texas.gov/waterquality/monitoring/swqm_guides.html), and shall be incorporated into the NETMWD's procedures, QAPP, SOPs, etc., within 60 days of any final published update. Additional aspects outlined in Section B below reflect specific requirements for sampling under CRP and/or provide additional clarification.

At stations where the depth is less than 0.5m deep, samples will be collected at 1/3 the total depth. For stations between 0.5 and 1.5 meters deep, samples will be collected at 0.3 m depth. For stations between 1.5 m and 3 meters deep, field parameters will be recorded at 0.3m, mid-depth, and 0.3 m above the bottom of the stream. Vertical profiles will not be recorded in rivers and streams that are too deep to wade. In cases where the total stream depth cannot be determined, samples will be collected at 0.3 m and water column depth will not be reported.

Table B2.1 Sample Storage, Preservation and Handling Requirements

Parameter	Sample Volume	Holding Time	Matrix	Container	Preservation
TSS	400 ml	7 days	Water	New Plastic or New Cubitainer	Cool to < 6 °C, dark
Alkalinity	100 ml	14 days	Water		
Sulfate	100 ml	28 days	Water		
Chloride	100 ml	28 days	Water		
Nitrate (N)	150 ml	48 hrs	Water		
Nitrite (N)	150 ml	48 hrs	Water		
Ammonia	150 ml	28 days	Water	New Plastic or New Cubitainer	1-2 ml conc. H_2SO_4 to pH <2 and cool to < 6 °C, dark
Total Phosphorus	150 ml	28 days	Water		
TKN	200 ml	28 days	Water		
TOC	100 ml	28 days	Water		
Chlorophyll *a*/ Pheophytin	1000 ml	≤ 48 hrs Unfiltered 24 days Filtered	Water	New Amber Plastic	Dark and ice before filtration; Dark and frozen after filtration
E. coli +	125 ml	8 hours	Water	Plastic (sterile)	Cool to < 6 °C, dark sample container with sodium thiosulfate powder
Fish Vouchers	As needed to submerge samples without crowding	7 days in Formalin, indefinite for isopropyl alcohol or ethanol	Fish	Plastic	10% Formalin in field, store in Formalin for at least one week, soak in fresh water each day for three days, transfer to 50% isopropyl alcohol or 75% ethanol for indefinite storage
Benthic macro-invertebrates	As needed to submerge samples without crowding (no more than ½ full)		Benthic macro-invertebrates	Plastic	If processing in the field, 70% ethanol or 40% isopropyl alcohol. If processing in the lab immediately after collection, 95% ethanol. If processing in the lab at least a week after collection, 10% Formalin. Transfer to 70% ethanol or 40% isopropyl alcohol for indefinite storage

+ *E. coli* samples should always be processed as soon as possible and incubated no later than 8 hours from time of collection. When transport conditions necessitate sample incubation after 8 hours from time of collection, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.

Sample Containers

Certificates from sample container manufacturers are maintained in a notebook by the LCRA ELS. All sample containers will be provided by the LCRA ELS and will be purchased pre-cleaned and disposable. All containers will have preservatives added prior to shipment from the LCRA ELS.

- The bacteriological sample containers are the 120 and 290 mL bottles from IDEXX.
- Brown polyethylene bottles are provided for chlorophyll-a sampling.

No bottles will be reused for water quality sampling.

Sample containers for biological monitoring will be plastic, leak-proof, high density polyethylene, wide-mouth bottles in various sizes. The appropriate size will be used to adequately store and preserve samples without crowding.

Processes to Prevent Contamination

SWQM Procedures outline the necessary steps to prevent contamination of samples, including: direct collection into sample containers, when possible; use of certified containers for organics; and clean sampling techniques for metals. 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 D. Flow worksheets, aquatic life use monitoring checklists, habitat assessment forms, field biological assessment forms, and records of bacteriological analyses (if applicable) are part of the field data record. The following will be recorded for all visits:

- Station ID
- Sampling Date
- Location
- Sampling Depth
- Water Column Depth
- Sampling Time
- Sample Collector's name and signature
- Values for all field parameters collected
- Notes containing detailed observational data not captured by field parameters, including;
- Water appearance
- Weather
- Biological activity
- Unusual odors
- Pertinent observations related to water quality or stream uses
- Watershed or instream activities
- Specific sample information
- Missing parameters

Examples of Field Data Sheets to be used during Aquatic Life Use monitoring are shown in Appendix D. Additional forms for biological monitoring data reporting as described in Appendix C of the *TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data*, 2014 (RG-416), are also located in Appendix D. Nekton samples will be identified and separated by collection type – seining and/or electroshocking – and will include associated metadata.

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:

- Write legibly, in indelible ink
- Make changes by crossing out original entries with a single line strike-out, entering the changes, and initialing and dating the corrections.
- Close-out incomplete pages with an initialed and dated diagonal line.

Sampling Method Requirements or Sampling Process Design Deficiencies, and Corrective Action

Examples of sampling method requirements or sample design deficiencies include but are not limited to such things as inadequate sample volume due to spillage or container leaks, failure to preserve samples appropriately, contamination of a sample bottle during collection, storage temperature and holding time exceedance, sampling at the wrong site, etc. Any deviations from the QAPP, SWQM Procedures, or appropriate sampling procedures may invalidate data, and require documented corrective action. Corrective action may include for samples to be discarded and re-collected. It is the responsibility of the WMS Project Manager, in consultation with the WMS QAO, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. In addition, these actions and resolutions will be conveyed to the CRP Project Manager both verbally and in writing in the project progress reports and by completion of a CAP.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

B3 Sample Handling and Custody

Sample Tracking

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 Chain of Custody (COC) form is a record that documents the possession of the samples from the time of collection to receipt in the laboratory. The following information concerning the sample is recorded on the COC form (See Appendix E). The following list of items matches the COC form in Appendix E.

Date and time of collection
Site identification
Sample matrix
Number of containers
Preservative used
Was the sample filtered
Analyses required
Name of collector
Custody transfer signatures and dates and time of transfer
Bill of lading, if applicable

Sample Labeling

Samples from the field are labeled on the container, or on a label, with an indelible marker. Label information includes:

Site identification
Date and time of collection
Preservative added, if applicable
Indication of field-filtration for metals, as applicable
Sample type (i.e., analyses) to be performed

Sample Handling

The WMS Data Manager or designee will notify LCRA ELS prior to each sampling event with information regarding the expected sampling date and number of sample containers required. The LCRA ELS will deliver all sample containers, ice chests, and appropriate chain-of-custody forms to a pre-determined location prior to each sampling event. The containers provided by LCRA ELS, will be certified new, supplied with correct preservatives, and labeled accordingly. Quality control for sample containers will be provided by LCRA ELS.

The WMS DCS will be responsible for ensuring that samples are collected using approved TCEQ methods. A Chain-of-Custody form will be completed for each sample collected during the sampling event. Samples will be shipped to LCRA ELS or arrangements will be made with LCRA ELS for sample pick up at a pre-determined location after each day's sampling event is completed in order to assure that the chain-of-custody forms are correctly filled out and signed. The LCRA ELS transfer custodian will also see that the samples arrive within holding time constraints. LCRA ELS will have a sample custodian who examines all arriving samples for proper documentation, and proper preservation. This custodian will accept delivery by signing the final portion of the chain-of-custody form. The sample custodian will log and monitor the progress of the samples through the analysis stage. Internal sample handling, custody, and storage procedures are described in LCRA ELS's Quality Manual(s).

Sample Tracking Procedure Deficiencies and Corrective Action

All deficiencies associated with COC procedures, as described in this QAPP, are immediately reported to the NETMWD and WMS Project Managers. 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 WMS Project Manager in consultation with the WMS QAO and NETMWD Project Manager will determine if the procedural violation may have compromised the validity of the resulting data. Any failures that have reasonable potential to compromise data validity will invalidate data and the sampling event should be repeated. The resolution of the situation will be reported to the TCEQ CRP Project Manager in the project progress report. CAPs will be prepared by the WMS QAO in coordination with the NETMWD and WMS Project Mangers, and submitted to TCEQ CRP Project Manager along with project progress report.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

B4 Analytical Methods

The analytical methods, associated matrices, and performing laboratories are listed in Appendix A. The authority for analysis methodologies under CRP is derived from the 30 Tex. Admin. Code Ch. 307, in that data generally are generated for comparison to those standards and/or criteria. The Texas Surface Water Quality Standards state "Procedures for laboratory analysis must be in accordance with the most recently published edition of the book entitled Standard Methods for the Examination of Water and Wastewater, the TCEQ Surface Water Quality Monitoring Procedures as amended, 40 CFR 136, or other reliable procedures acceptable to the TCEQ, and in accordance with chapter 25 of this title."

Laboratories collecting data under this QAPP must be NELAP accredited in accordance with 30 TAC Chapter 25. Copies of laboratory QMs and SOPs shall be made available for review by the TCEQ.

Standards Traceability

All standards used in the field and laboratory are traceable to certified reference materials. Standards preparation is fully documented and maintained. 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 Deficiencies and Corrective Actions

Deficiencies in field and laboratory measurement systems involve, but are not limited to such things as instrument malfunctions, failures in calibration, blank contamination, quality control samples outside QAPP-defined limits, etc. In many cases, the field technician or lab analyst will be able to correct the problem. 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 LCRA ELS Laboratory Project Manager, who will make the determination and notify the WMS QAO if the problem compromises sample results. If the analytical system failure may compromise the sample results, the

resulting data will not be reported to the TCEQ. The nature and disposition of the problem is reported on the data report which is sent to the NETMWD and WMS Project Managers. The WMS Project Manager will include this information in a CAP and submit with the Progress Report which is sent to the TCEQ CRP Project Manager.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

The TCEQ has determined that analyses associated with qualifier codes (e.g., "holding time exceedance," "sample received unpreserved," "estimated value") may have unacceptable measurement uncertainty associated with them. This will immediately disqualify analyses from submittal to SWQMIS. Therefore, data with these types of problems should not be reported to the TCEQ. Additionally, any data collected or analyzed by means other than those stated in the QAPP, or data suspect for any reason should not be submitted for loading and storage in SWQMIS. However, when data is lost, its absence will be described in the data summary report submitted with the corresponding data set, and a CAP (as described in section C1) may be necessary.

B5 Quality Control

Sampling Quality Control Requirements and Acceptability Criteria

The minimum field QC requirements, and program-specific laboratory QC requirements, are outlined in SWQM Procedures. None of the parameters covered in this QAPP require the collection of field QC samples.

Laboratory Measurement Quality Control Requirements and Acceptability Criteria

Batch

A batch is defined as environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same NELAP-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extract, digestates, or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Method Specific QC requirements

QC samples, other than those specified later this section (e.g., sample duplicates, surrogates, internal standards, continuing calibration samples, interference check samples, positive control, negative control, and media blank), are run as specified in the methods and in SWQM Procedures. The requirements for these samples, their acceptance criteria or instructions for establishing criteria, and corrective actions are method-specific.

Detailed laboratory QC requirements and corrective action procedures are contained within the individual laboratory quality manuals (QMs). The minimum requirements that all participants abide by are stated below.

Comparison Counting

For routine bacteriological samples, repeat counts on one or more positive samples are required, at least monthly. If possible, the analyst will compare counts with another analyst who also performs the analysis. Replicate counts by the same analyst should agree within 5 percent, and those between analysts should agree within 10 percent. The analyst(s) will record the results.

Limit of Quantitation (LOQ)

The laboratory will analyze a calibration standard (if applicable) at the LOQ published in Appendix A of this QAPP on each day calibrations are performed. In addition, an LOQ check sample will be analyzed with each analytical batch. Calibrations including the standard at the LOQ listed in Appendix A will meet the calibration requirements of the analytical method, or corrective action will be implemented.

LOQ Check Sample

An LOQ check sample consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system at the lower limits of analysis. The LOQ check sample is spiked into the sample matrix at a level less than or equal to the LOQ published in Appendix A of this QAPP, for each analyte for each analytical batch of CRP samples run. If it is determined that samples have exceeded the high range of the calibration curve, samples should be diluted or run on another curve. For diluted or high concentration samples run on batches with calibration curves that do not include the LOQ published in Appendix A of this QAPP, a check sample will be run at the low end of the calibration curve.

The LOQ check sample is carried through the complete preparation and analytical process and is performed at a rate of one per analytical batch.

The percent recovery of the LOQ check sample is calculated using the following equation in which %R is percent recovery, S_R is the sample result, and S_A is the reference concentration for the check sample:

$$\%R = {}^{S_R}/_{S_A} \times 100$$

Measurement performance specifications are used to determine the acceptability of LOQ Check Sample analyses as specified in Appendix A of this QAPP.

Laboratory Control Sample (LCS)

An LCS consists of a sample matrix (e.g., deionized water, sand, commercially available tissue) free from the analytes of interest spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is used to establish intra-laboratory bias to assess the performance of the measurement system. The LCS is spiked into the sample matrix at a level less than or near the midpoint of the calibration for each analyte. In cases of test methods with very long lists of analytes, LCSs are prepared with all the target analytes and not just a representative number, except in cases of organic analytes with multipeak responses.

The LCS is carried through the complete preparation and analytical process and is performed at a rate of one per preparation batch.

Results of LCSs are calculated by percent recovery (%R), which is defined as 100 times the measured concentration, divided by the true concentration of the spiked sample.

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

$$\%R = {}^{S_R}/_{S_A} \times 100$$

Measurement performance specifications are used to determine the acceptability of LCS analyses as specified in Appendix A.

Laboratory Duplicates

A laboratory duplicate is an aliquot taken from the same container as an original sample under laboratory conditions and processed and analyzed independently. A laboratory duplicate is achieved by preparing 2 separate aliquots of a sample, LCS, or matrix spike. Both samples are carried through the entire preparation and analytical process. Laboratory duplicates are used to assess precision and are performed at a rate of one per preparation batch.

For most parameters except bacteria, precision is evaluated using the relative percent difference (RPD) between 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:

$$RPD = \frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2}\right)} \times 100$$

If the precision criterion is exceeded, the data are not acceptable for use under this project and are not reported to TCEQ. Results from all samples associated with that failed duplicate (usually a maximum of 10 samples) are considered to have excessive analytical variability and are qualified as not meeting project QC requirements.

For bacteriological parameters, precision is evaluated using the results from laboratory duplicates. Bacteriological duplicates are analyzed at a 10% frequency (or once per preparation batch, whichever is more frequent). Sufficient volume should be collected to analyze laboratory duplicates from the same sample container.

The base-10 logarithms of the results from the original sample and its duplicate are calculated. The absolute value of the difference between the two base-10 logarithms is calculated and compared to the precision criterion in Appendix A.

The precision criterion in Appendix A for bacteriological duplicates applies only to samples with concentrations > 10 MPN.

Matrix spike (MS) – Matrix spikes are prepared by adding a known quantity of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available.

Matrix spikes indicate the effect of the sample on the precision and accuracy of the results generated using the selected method. Matrix-specific QC samples indicate the effect of the sample matrix on the precision and accuracy of the results generated using the selected method. The information from these controls is sample/matrix specific and would not normally be used to determine the validity of the entire batch. The frequency of matrix spikes is specified by the analytical method, or a minimum of one per preparation batch, whichever is greater. To the extent possible, matrix spikes prepared and analyzed over the course of the project should be performed on samples from different sites.

The components to be spiked shall be as specified by the mandated analytical method. The results from matrix spikes are primarily designed to assess the validity of analytical results in a given matrix and are expressed as percent recovery (%R).

The percent recovery of the matrix spike is calculated using the following equation, where %R is percent recovery, S_{SR} is the concentration measured in the matrix spike, S_R is the concentration in the parent sample, and S_A is the concentration of analyte that was added:

$$\%R = \frac{S_{SR} - S_R}{S_A} \times 100$$

Matrix spike recoveries are compared to the acceptance criteria published in the mandated test method. If the matrix spike results are outside established criteria, the data for the analyte that failed in the parent sample is not acceptable for use under this project and will not be reported to TCEQ. The result from the parent sample associated with that failed matrix spike will be considered to have excessive analytical variability and will be qualified by the laboratory as not meeting project QC requirements. Depending on the similarities in composition of the samples in the batch, the NETMWD may consider excluding all of the results in the batch related to the analyte that failed recovery.

Method blank

A method blank is a sample of matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as the samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. The method blank is used to document contamination from the analytical process. The analysis of method blanks should yield values less than the LOQ.

For very high-level analyses, the blank value should be less than 5% of the lowest value of the batch, or corrective action will be implemented. Samples associated with a contaminated blank shall be evaluated as to the best corrective action for the samples (e.g. reprocessing, data qualifying codes). In all cases the corrective action must be documented.

The method blank shall be analyzed at a minimum of one per preparation batch. In those instances for which no separate preparation method is used (e.g., VOA) the batch shall be defined as environmental samples that are analyzed together with the same method and personnel, using the same lots of reagents, not to exceed the analysis of 20 environmental samples.

Quality Control or Acceptability Requirements Deficiencies and Corrective Actions

Sampling QC excursions are evaluated by the NETMWD and WMS Project Managers, in consultation with the WMS QAO. In those differences in sample results are used to assess the entire sampling process, including environmental variability, the arbitrary rejection of results based on pre-determined limits is not practical. Therefore, the professional judgment of the NETMWD and WMS Project Managers and WMS QAO will be relied upon in evaluating results.

Laboratory measurement quality control failures are evaluated by the laboratory staff. The disposition of such failures and the nature and disposition of the failure is reported to the LCRA ELS Quality Manager. The LCRA ELS Quality Manager will discuss the failure with the NETMWD and WMS Project Managers. If applicable, the WMS Project Manager will include this information in a CAP and submit with the Progress Report which is sent to the TCEQ CRP Project Manager.

The definition of and process for handling deficiencies and corrective action are defined in Section C1.

Additionally, in accordance with CRP requirements and the TNI Standard (Volume 1, Module 2, Section 4.5, Subcontracting of Environmental Tests) when a laboratory that is a signatory of this QAPP finds it necessary and/or advantageous to subcontract analyses, the laboratory that is the signatory on this QAPP must ensure that the subcontracting laboratory is NELAP-accredited (when required) and understands and follows the QA/QC requirements included in this QAPP. This includes that the subcontracting laboratory utilize the same reporting limits as the signatory laboratory and performs all required quality control analysis outlined in this QAPP. The signatory laboratory is also responsible for quality assurance of the data prior to delivering it to the NETMWD and WMS, including review of all applicable QC samples related to CRP data. As stated in section 4.5.5 of the 2016 TNI Standard, the laboratory performing the subcontracted work shall be indicated in the final report and the signatory laboratory shall make a copy of the subcontractor's report available to the client (NETMWD) when requested.

B6 Instrument/Equipment Testing, Inspection, and Maintenance

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

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

B7 Instrument Calibration and Frequency

Field equipment calibration requirements are contained in the SWQM Procedures. Post-calibration check error limits and the disposition resulting from errors are adhered to. Data collected from field instruments that do not meet the post-calibration check error limits specified in the SWQM Procedures will not be submitted for inclusion into SWQMIS.

Detailed laboratory calibrations are contained within the QM(s).

B8 Inspection/Acceptance of Supplies and Consumables

Supplies and consumables which affect the quality of the sampling and analysis programs are specified and approved for use by the LCRA ELS Quality Manager. Those items include, but are not limited to: sample bottles, calibration gases, reagents, hoses, materials for decontamination of sampling equipment, deionized water, and potable water. Sample containers are either new and purchased precleaned to EPA specifications, or are cleaned to appropriate specifications by the laboratory. Calibration gases are purchased having known concentrations, and the documentation is maintained on file by the laboratory managers. Reagents are analytical grade or better. Hoses and sampling equipment are made of impervious materials that are suited for the materials being sampled. Deionized water used for rinsing sampling equipment between samples, is typically obtained from the laboratory, and is shown to be free of contamination through daily conductivity testing; monthly bacteria, pH, and residual Chlorine testing; and annual heavy metals testing. Refer to the laboratory QMs for all laboratory related items.

B9 Acquired Data

Non-directly measured data, secondary data, or acquired data involves the use of data collected under another project and collected with a different intended use than this project. The acquired data still meets the quality requirements of this project and is defined below. The following data source(s) will be used for this project:

USGS gage station data will be used throughout this project to aid in determining gage height and flow. Rigorous QA checks are completed on gage data by the USGS and the data are approved by the USGS and permanently stored at the USGS. This data will be submitted to the TCEQ under parameter code 00061 Flow, Instantaneous or parameter code 74069 Flow Estimate depending on the proximity of the monitoring station to the USGS gage station.

Reservoir stage data are collected every day from the USGS and the United States Army Corps of Engineers (USACE) websites. These data are preliminary and subject to revision. The Texas Water Development Board (TWDB) derives reservoir storage (in acre-feet) from these stage data (elevation in feet above mean sea level), by using the latest rating curve datasets available. These data are published at the TWDB website at http://waterdatafortexas.org/reservoirs/statewide. Information about measurement methodology can be found on the TWDB website. These data will be submitted to the TCEQ under parameter code 00052 Reservoir Stage and parameter code 00053 Reservoir Percent Full.

Precipitation data are obtained from USGS precipitation gauges located throughout the watershed. Data from the USGS gauge located nearest to the monitoring station will be used. These data will be submitted to the TCEQ under parameter code 72053 Days Since Precipitation Event.

B10 Data Management

Data Management Process

The NETMWD Cypress Creek Basin CRP Database will be maintained and updated with data obtained from the Cypress Creek Basin CRP monitoring programs (routine and systematic stations, special studies, and flow studies). All data results will be maintained electronically in accordance with procedures and guidelines described in the Cypress Creek Basin Clean Rivers Program Data Management Plan. The process described below summarizes these procedures and guidelines.

All data to be stored in the SWQMIS will be submitted in the format specified in the latest version of the SWQM Data Management Reference Guide.

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

This data management process will be used as guidance for the collection, quality assurance and archiving of all data collected pursuant to the CRP. This plan has been developed after a full assessment of the human, data, and computer resource needs of the CRP as appropriate for the Cypress Creek Basin. It is anticipated that the types of data to be collected and archived in the future may change, as future data retrieval, analysis and presentation needs may change.

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

1. Field Sampling
2. Sample Custodian
3. Lab Analyst
4. LCRA ELS Project Manager
5. WMS Project Manager
6. WMS Data Manager
7. WMS Quality Assurance Officer
8. Transfer of Data to TCEQ CRP Project Manager
9. TCEQ CRP Project Manager transfers data to TCEQ CRP Data Manager
10. TCEQ CRP Data Manager loads data into SWQMIS Production environment.

After the LCRA ELS Project Manager has received data from the lab analyst, the supervisor screens the data to ensure accuracy and that the data meets the quality criteria for that data type. The LCRA ELS Quality Manager validates the analytical data by comparing the various quality control measurements and by recalculating a random selection of the results produced by each analyst submitting data. The LCRA ELS Project Manager, using the lab's standard reporting format, will provide results to the NETMWD and WMS Project Managers. The analytical laboratory will retain files of all quality assurance verifications for five years in accordance with NELAP and make them available for inspection on request.

Field and flow data are submitted to the WMS PM, are validated by the WMS QAO, and are included in data deliverables to the TCEQ by the WMS Data Manager.

Scanned field forms and copies of Chain of Custody forms will be sent by the WMS Project Manager to the WMS Data Manager and WMS QAO for data screening and quality assurance and data formatting. This information will be quality checked by the WMS Data Manager by comparing it with the appropriate CRP monitoring schedule to verify that the correct stations have been sampled, that the correct sets of measurements and samples have been collected, and that calibration procedures have been correctly applied. The WMS Data Manager will be responsible for the review of all field and laboratory-generated data for consistency with QA criteria, for accuracy of data entry, and for timely transfer to TCEQ. The WMS Data Manager will also be responsible for ensuring that all field reports, calibration records, and general information is maintained and properly filed.

Upon completion of the review and entry into an electronic file, the WMS Data Manager sends the file to the WMS QAO for review. The WMS QAO reviews all data recorded on the field sheets, calibration logs, and from the laboratory against the electronic file. The WMS QAO notifies the WMS Data Manger of any discrepancies. The WMS PM will perform a secondary review at the request of the WMS QAO. Upon approval by the WMS QAO, the WMS Data Manager converts the quality-assured data into pipe-delimited text format which is submitted to the TCEQ Project Manager for review. The TCEQ Project Manager will submit the file to the TCEQ Data Manager for review and loading into the SWQMIS database. Once these procedures have been completed, copies of all data reports and QA records (both paper and electronic) will be transferred from WMS to NETMWD and retained for the periods described in Table A9.1.

Data will only be excluded from the NETWMD data set files if it is determined to be erroneous, or is found to have been collected in a manner that does not follow the TCEQ guidelines for data procurement. The WMS Data

Manager will alert the WMS Project Manager to any abnormalities or apparent outliers. The WMS Project Manager in consultation with the WMS QAO and NETMWD Project Manager will evaluate the data and determine if any statistical tests need to be performed to further evaluate the data. The suspect data will be recorded in the Data Manager's QC data log, noting the reason for its exclusion. A summary will be provided in the data summary report, as well as any appropriate corrective actions.

Paper copies of all field sheets and calibration logs are maintained at the WMS offices in Sulphur Springs, Texas and transferred annually to the NETMWD office in Hughes Springs, Texas where they are stored for the required duration defined in Table A9.1. Requests for data should be made to the NETMWD Project Manager.

Data Dictionary

Terminology and field descriptions are included in the 2019 DMRG, or most recent version. A table outlining the entities that will be used when submitting data under this QAPP is included below for the purpose of verifying which entity codes are included in this QAPP.

Monitoring Entity	Tag Prefix	Submitting Entity	Collecting Entity
Northeast Texas Municipal Water District	CY	NT	
Water Monitoring Solutions, Inc.	CY	NT	WM

Data Errors and Loss

The WMS Project Manager and NETMWD Project Manager will be responsible for determining what data, if any, will be excluded from the NETMWD Cypress Creek Basin CRP Database. The WMS Project Manager and LCRA ELS Quality Manager will initially review any questions concerning analytical data. If a modification of the data originally reported is deemed necessary, documentation of the original data, the question concerning that data and the modified data along with the copies of the data change will be saved electronically.

The WMS Data Manager produces data files in Microsoft Excel formats, and transfers to the pipe-delimited text file format before submitting the data to the TCEQ. The file format utilized involves the established event and result file formats. Presently, the WMS Data Manager manually reviews all data for the established minimum, maximum, AWRL limits set for each parameter by the TCEQ, and LOQ limits set for each parameter by the lab.

First, any values flagged during review will be checked against the laboratory report to see if there are transcription errors. If the values are correct, then an e-mail querying the validity of the value reported will be sent to the laboratory. Values that are verified as correct by the laboratory will be flagged as outliers within the data set. In addition to the review check, a minimum 10% check is done on all data sets by the WMS QAO prior to their conversion to text files. A data review checklist and data summary form (Appendix F) will be included with the submittal of the completed data set. This summary form includes data information and comments specific to the data set.

Care must be taken to ensure that all Excel files exported are in pipe-delimited text format (following the guidelines in the SWQM DMRG, most recent version) to ensure correct transfer of all information. After the conversion of any database files into another format, a ten-percent check of the transferred files occurs. File transfer and checking is initially a responsibility of the WMS QAO, and secondarily the WMS Data Manager.

Preparation of data files is dependent on the use of forms and checklists, some of which are available in the appendices of this QAPP. These documents include: 1) Field documentation which contains all instrument calibration/standards records, field measurements, and site characteristics (Appendix D), 2) Field notes, 3) Laboratory documentation including analyst's comments on the condition of the sample and progress of the analysis, raw data, instrument printouts, results of calibration, QA checks, external and internal standards records, and SOPs, and 4) Chain of Custody forms (Appendix E).

Examples of data deliverable forms and checklists can be found in Appendix F. Refer to QAPP Appendices as appropriate for Field and Laboratory Data Sheets, the Data Summary, etc.

Record Keeping and Data Storage

All data files and GIS data layers will be stored on the NETMWD server and WMS computers. A full backup of all WMS files is completed weekly and stored in a cloud-based server and on external drives. Electronic data and reports will be submitted to NETMWD after the end of each quarter. All paper documents are scanned upon receipt and the paper documents are transferred to the NETMWD annually. In addition, all data files and reports concerning the project are available to the Project Manager at TCEQ.

The disaster recovery procedure consists of reinstalling the operation system and software either from the original software media, or from a disaster recovery CD that has been created and stored on site. Electronic files will be replaced from the weekly backup files.

Data Handling, Hardware, and Software Requirements

All data are stored on Microsoft Windows© based computers and manipulated using the Microsoft Office suite of programs. Files may be saved to Adobe Acrobat Portable Document Format (PDF) for storage. Laboratory data will be housed in LCRA ELS's Chemware© Horizon LIMS. Once reports are generated, PDF and Microsoft Excel copies will be delivered to the WMS PM. Lab data will be forwarded by the WMS PM to the WMS QAO for QA checks and then to the WMS DM for transcription and formatting per the most current version of the SWQM Data Management Reference Guide.

All field data except flow are recorded on paper field sheets. After collection, the documents are scanned and converted to PDF format. These files are then transferred to the WMS PM for archiving and distribution to the WMS QAO and WMS DM as above.

When flow is measured using the FlowTracker2, the system-generated file provides the total flow for each event. This information is saved as an external document in PDF format.

Information Resource Management Requirements

The information management specifications include TCEQ as well as NETMWD and WMS internal information management controls. The TCEQ has the following data specification requirements: the Surface Water Quality Monitoring Data Management Reference Guide (DMRG), GIS Policy (TCEQ OPP 8.11) and GPS Policy (TCEQ OPP 8.12). Note that GPS certification is not required for positional data that will be used for photo interpolation in the Station Location (SLOC) request process.

Data will be managed in accordance with the TCEQ DMRG (most recent revision), and applicable NETMWD information resource management policies.

GPS equipment may be used as a component of the information required by the Station Location (SLOC) request process for creating the certified positional data that will ultimately be entered into SWQMIS database. Positional data obtained by CRP grantees using a GPS will follow the TCEQ's OPP 8.11 and 8.12 policy regarding the collection and management of positional data. Positional data may be acquired with a GPS and verified with photo interpolation using a certified source, such as Google Earth or Google Maps. The verified coordinates and map interface can then be used to develop a new SLOC.

C1 Assessments and Response Actions

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

Table C1.1 Assessments and Response Requirements

Assessment Activity	Approximate Schedule	Responsible Party	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	NETMWD	Monitoring of the project status and records to ensure requirements are being fulfilled	Report to TCEQ in Quarterly Report
Monitoring Systems Audit of Basin Planning Agency	Dates to be determined by TCEQ QA	TCEQ	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to the TCEQ to provide corrective actions
Monitoring Systems Audit of Program Sub-participants	One audit per sub-participant prior to the expiration of the QAPP	NETMWD	Field sampling, handling and measurement; facility review; and data management as they relate to CRP	30 days to respond in writing to NETMWD. The NETWMD will report problems to TCEQ in Progress Report.
Laboratory Assessment	Dates to be determined by TCEQ	TCEQ Laboratory Assessor	Analytical and quality control procedures employed at the laboratory and the contract laboratory	30 days to respond in writing to the TCEQ to provide corrective actions

Corrective Action Process for Deficiencies

Deficiencies are any deviation from the QAPP, SWQM Procedures, or other applicable guidance. Deficiencies may invalidate resulting data and require corrective action. Repeated deficiencies should initiate a CAP. Corrective action for deficiencies may include for samples to be discarded and re-collected. Deficiencies are documented in logbooks, field data sheets, etc. by field or laboratory staff, are communicated to the NETMWD and WMS Project Managers (or other appropriate staff) and should be subject to periodic review so their responses can be uniform, and their frequency tracked. It is the responsibility of the WMS Project Manager, in consultation with the WMS QAO, to ensure that the actions and resolutions to the problems are documented and that records are maintained in accordance with this QAPP. In addition, these actions and resolutions will be conveyed to the CRP Project Manager both verbally and in writing in quarterly progress reports and by completion of a CAP.

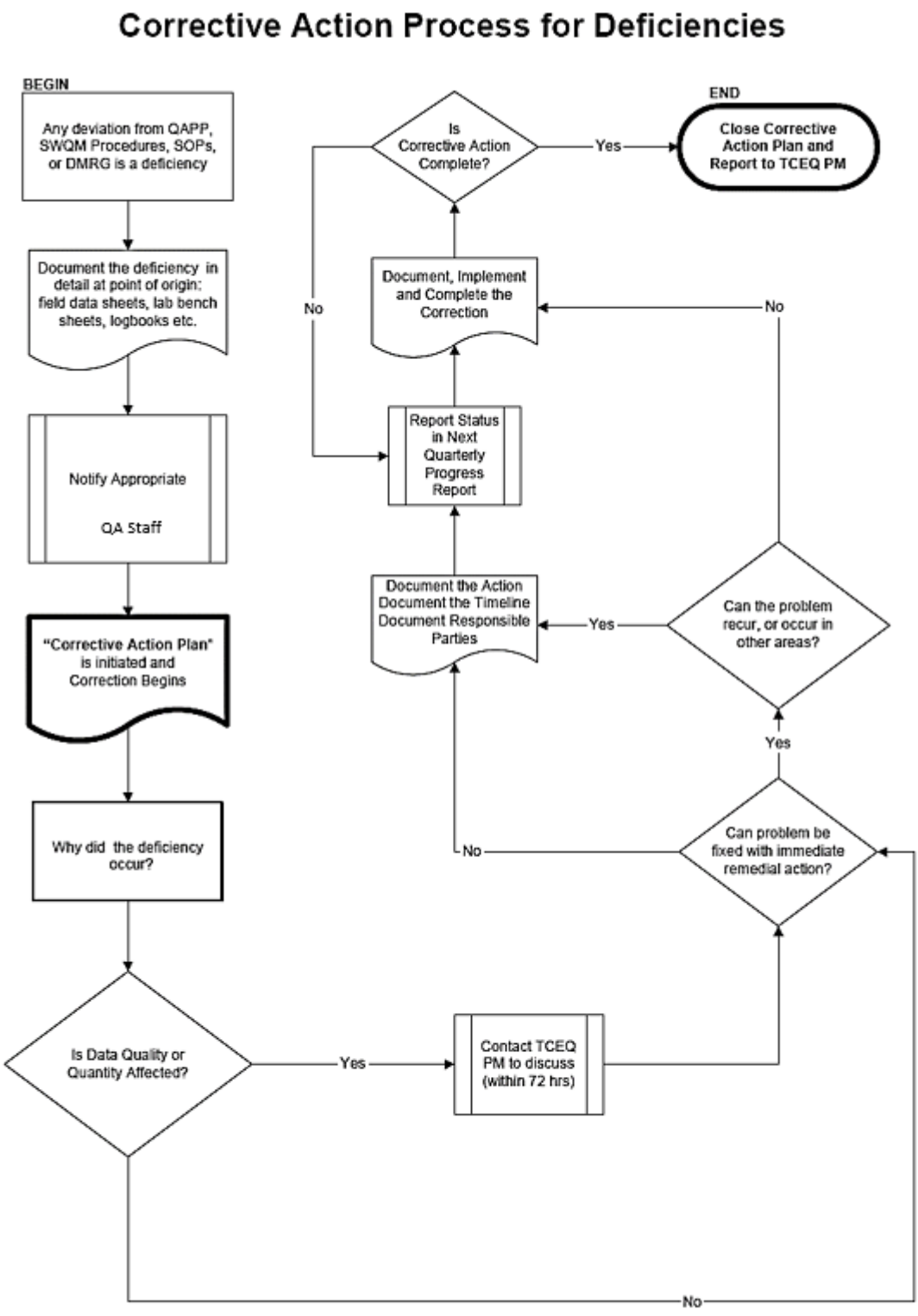
Corrective Action

CAPs should:

- Identify the problem, nonconformity, or undesirable situation
- Identify immediate remedial actions if possible
- Identify the underlying cause(s) of the problem
- Identify whether the problem is likely to recur, or occur in other areas
- Assist in determining the need for corrective action
- Employ problem-solving techniques to verify causes, determine solution, and develop an action plan
- Identify personnel responsible for action
- Establish timelines and provide a schedule
- Document the corrective action

A flow chart has been developed to facilitate the process (see figure C1.1: Corrective Action Process for Deficiencies).

Figure C1.1 Corrective Action Process for Deficiencies



The status of CAPs will be included with quarterly progress reports. In addition, significant conditions which, if uncorrected, could have a serious effect on safety or on the validity or integrity of data will be reported to the TCEQ immediately.

The WMS Project Manager is responsible for ensuring that corrective actions have been implemented and tracks deficiencies and corrective actions. Records of audit findings and corrective actions are maintained by WMS Project Manager. Audit reports and associated corrective action documentation will be submitted to the TCEQ with the quarterly progress reports.

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

C2 Reports to Management

Table C2.1 QA Management Reports

Type of Report	Frequency (daily, weekly, monthly, quarterly, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipients
Non-Conformance	As needed	As needed	WMS PM	NETMWD PM TCEQ CRP PM
Monitoring Summary	Quarterly	By the 15th day of the month following the end of the quarter	WMS PM	NETMWD PM TCEQ CRP PM
CRP Progress Report	Quarterly	December 15, 2021 March 15, 2022 June 15, 2022 September 15, 2022 December 15, 2022 March 15, 2023 June 15, 2023 August 31, 2023	WMS PM	NETMWD PM TCEQ CRP PM
Data Summary	Three times per year	By the contracted due date	WMS DM	NETMWD PM TCEQ CRP PM
Monitoring Systems Audit Report of WMS	Once per biennium	Within 30 days of Audit completion	NETMWD PM	TCEQ CRP PM
Contractor Evaluations	Annually	Within 30 days of Evaluation completion	TCEQ CRP PM	NETMWD PM

Reports to the NETMWD Project Management

Each quarter, the WMS QAO will review QA laboratory results and field sheets. Reports with any corrective actions that occurred will be sent quarterly to the NETMWD PM for review. The NETMWD PM will then review and transmit these reports to TCEQ for their review. The LCRA ELS Project Manager will submit data and QA/QC reports within 30 days of the receipt of samples for analysis to the NETMWD and WMS PM. For Aquatic Life Use monitoring, field forms will be transferred to the NETMWD by WMS. The Biological Monitoring Reporting Packet (Appendix D) will be completed and submitted to the NETMWD along with the event/result text and BLOB files.

Reports to TCEQ Project Management

All reports detailed in this section are contract deliverables and are transferred to the TCEQ in accordance with contract requirements. In addition, the completed Biological Monitoring Reporting Packet (Appendix D) will be submitted to the NETMWD in the formats required for event/result text and BLOB files for review. Upon the NETMWD PM approval, WMS will submit the data to TCEQ for acceptance into SWQMIS.

Progress Report

Summarizes the NETMWD's and WMS's activities for each task; reports monitoring status, problems, delays, deficiencies, status of open CAPs, and documentation for completed CAPs; and outlines the status of each task's deliverables.

Monitoring Systems Audit Report and Response

The NETMWD will audit sub-participants (i.e. WMS) once per biennium. Following any audit performed by the NETMWD, a report of findings, recommendations and response is sent to the TCEQ in the quarterly progress report.

Data Summary

Contains basic identifying information about the data set and comments regarding inconsistencies and errors identified during data verification and validation steps or problems with data collection efforts (e.g. deficiencies).

Reports by TCEQ Project Management

Contractor Evaluation

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

D1 Data Review, Verification, and Validation

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

D2 Verification and Validation Methods

All field and laboratory data will be reviewed, verified and validated to ensure they conform to project specifications.

Data review, verification, and validation will be performed using self-assessments as well as peer and management review as appropriate to the project task. The data review tasks to be performed by field and laboratory staff are listed in the first two columns of Table D2.1, respectively. Potential errors are identified by examination of documentation and by manual examination of corollary or unreasonable data; this analysis may be computer-assisted. If a question arises or an error is identified, the manager of the task responsible for generating the data is contacted to resolve the issue. Issues which can be corrected are corrected and documented. If an issue cannot be corrected, the task manager consults with the higher-level project management to establish the appropriate course of action, or the data associated with the issue are rejected and not reported to the TCEQ for storage in SWQMIS. Field and laboratory reviews, verifications, and validations are documented.

After the field and laboratory data are reviewed, another level of review is performed once the data are combined into a data set. This review step as specified in Table D2.1 is performed by the WMS Data Manager and QAO. Data review, verification, and validation tasks to be performed on the data set include, but are not limited to, the confirmation of laboratory and field data review, evaluation of field QC results, additional evaluation of anomalies and outliers, analysis of sampling and analytical gaps, and confirmation that all parameters and sampling sites are included in the QAPP.

The Data Review Checklist (see Appendix F) covers three main types of review: data format and structure, data quality review, and documentation review. The Data Review Checklist is transferred with the water quality data submitted to the TCEQ to ensure that the review process is being performed.

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

If any requirements or specifications of the CRP are not met, based on any part of the data review, the responsible party should document the nonconforming activities and submit the information to the WMS Data Manager with the data in the Data Summary (See Appendix F). All failed QC checks, missing samples, missing analytes, missing parameters, and suspect results should be discussed in the Data Summary.

Table D2.1: Data Review Tasks

Data to be Verified	Field Task	Laboratory Task	WMS Data Management Task
Sample documentation complete; samples labeled, sites identified	WMS DCS		WMS QAO
Standards and reagents traceable	WMS DCS	LCRA ELS QAO	WMS QAO
Chain of custody complete/acceptable	WMS DCS	LCRA ELS QAO	WMS QAO
NELAP Accreditation is current		LCRA ELS QAO	WMS QAO
Sample preservation and handling acceptable		LCRA ELS QAO	WMS QAO
Holding times not exceeded		LCRA ELS QAO	WMS QAO
Collection, preparation, and analysis consistent with SOPs and QAPP	WMS DCS	LCRA ELS QAO	WMS DM, WMS QAO
Field documentation (e.g., biological, stream habitat) complete	WMS DCS		WMS DM
Instrument calibration data complete	WMS DCS	LCRA ELS QAO	WMS DM
Bacteriological records complete		LCRA ELS QAO	
QC samples analyzed at required frequency		LCRA ELS QAO	WMS DM
QC results meet performance and program specifications		LCRA ELS QAO	WMS QAO
Analytical sensitivity (LOQ/AWRL) consistent with QAPP		LCRA ELS QAO	WMS QAO, WMS DM
Results, calculations, transcriptions checked		LCRA ELS QAO	WMS DM, WMS QAO
Laboratory bench-level review performed		LCRA ELS QAO	
All laboratory samples analyzed for all scheduled parameters		LCRA ELS QAO	WMS DM
Corollary data agree			WMS DM
Nonconforming activities documented		LCRA ELS QAO	WMS QAO, WMS DM
Outliers confirmed and documented; reasonableness check performed			WMS DM
Dates formatted correctly			WMS DM
Depth reported correctly and in correct units			WMS DM
TAG IDs correct			WMS DM, WMS QAO
TCEQ Station ID number assigned			WMS PM, WMS QAO
Valid parameter codes			WMS QAO
Codes for submitting entity(ies), collecting entity(ies), and monitoring type(s) used correctly			WMS DM
Time based on 24-hour clock			WMS DM
Absence of transcription errors confirmed			WMS QAO, WMS PM
Absence of electronic errors confirmed			WMS QAO, WMS PM
Sampling and analytical data gaps checked (e.g., all sites for which data are reported are on the coordinated monitoring schedule)			WMS QAO, WMS DM
Field instrument pre- and post-calibration check results within limits			WMS DM
Verified data log submitted			WMS QAO, WMS PM
10% of data manually reviewed			WMS QAO

D3 Reconciliation with User Requirements

Data produced in this project, and data collected by other organizations (e.g., USGS, TCEQ, etc.), will be analyzed and reconciled with project data quality requirements. Data which do not meet requirements will not be submitted to SWQMIS nor will be considered appropriate for any of the uses noted in Section A5.

Appendix A: Measurement Performance Specifications (Table A7.1-9)

Measurement performance specifications define the data quality needed to satisfy project objectives. To this end, measurement performance specifications are qualitative and quantitative statements that:

- clarify the intended use of the data
- define the type of data needed to support the end use
- identify the conditions under which the data should be collected

Appendix A of the QAPP addresses measurement performance specifications, including:

- analytical methodologies
- AWRLs
- limits of quantitation
- bias limits for LCSs
- precision limits for LCSDs
- completeness goals
- qualitative statements regarding representativeness and comparability

Procedures for laboratory analysis must be in accordance with the most recently published edition of Standard Methods for the Examination of Water and Wastewater, 40 CFR 136, or otherwise approved independently. Only data collected that have a valid TCEQ parameter code assigned in Tables A7 are stored in SWQMIS. Any parameters listed in Tables A7 that do not have a valid TCEQ parameter code assigned will not be stored in SWQMIS.

TABLE A7.1 Measurement Performance Specifications for NETMWD (data collected by WMS)					
Field Parameters					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
TEMPERATURE, WATER (DEGREES CENTIGRADE) *	DEG C	water	SM 2550 B and TCEQ SOP V1	00010	Field
TEMPERATURE, AIR (DEGREES CENTIGRADE)	DEG C	air	NA	00020	Field
RESERVOIR ACCESS NOT POSSIBLE LEVEL TOO LOW ENTER 1 IF REPORTING	NS	other	TCEQ Drought Guidance	00051	Field
RESERVOIR STAGE (FEET ABOVE MEAN SEA LEVEL) **	FT ABOVE MSL	water	TWDB	00052	Field
RESERVOIR PERCENT FULL**	% RESERVOIR CAPACITY	water	TWDB	00053	Field
TRANSPARENCY, SECCHI DISC (METERS)*	meters	water	TCEQ SOP V1	00078	Field
SPECIFIC CONDUCTANCE, FIELD (US/CM @ 25C) *	µs/cm	water	EPA 120.1 and TCEQ SOP, V1	00094	Field
OXYGEN, DISSOLVED (MG/L) *	mg/L	water	SM 4500-O G and TCEQ SOP V1	00300	Field
PH (STANDARD UNITS) *	s.u.	water	EPA 150.1and TCEQ SOP V1	00400	Field
DAYS SINCE PRECIPITATION EVENT (DAYS)	days	other	TCEQ SOP V1	72053	Field
DEPTH OF BOTTOM OF WATER BODY AT SAMPLE SITE	meters	water	TCEQ SOP V2	82903	Field
MAXIMUM POOL WIDTH AT TIME OF STUDY (METERS)***	meters	other	TCEQ SOP V2	89864	Field
MAXIMUM POOL DEPTH AT TIME OF STUDY(METERS)***	meters	other	TCEQ SOP V2	89865	Field
POOL LENGTH, METERS***	meters	other	TCEQ SOP V2	89869	Field
% POOL COVERAGE IN 500 METER REACH***	%	other	TCEQ SOP V2	89870	Field
WIND DIRECTION (1=N, 2=S, 3=E, 4=W, 5=NE, 6=SE, 7=NW, 8=SW)	NU	other	NA	89010	Field
WIND INTENSITY (1=CALM,2=SLIGHT,3=MOD.,4=STRONG)	NU	other	NA	89965	Field
PRESENT WEATHER (1=CLEAR,2=PTCLDY,3=CLDY,4=RAIN,5=OTHER)	NU	other	NA	89966	Field
WATER SURFACE (1=CALM,2=RIPPLE,3=WAVE,4=WHITECAP)	NU	water	NA	89968	Field
WATER COLOR 1=BRWN 2=RED 3=GRN 4=BLCK 5=CLR 6=OTHER	NU	water	NA	89969	Field
WATER ODOR (1=SEWAGE, 2=OILY/CHEMICAL, 3=ROTTEN EGGS, 4=MUSKY, 5=FISHY, 6=NONE, 7=OTHER (WRITE IN COMMENTS))	NU	water	NA	89971	Field

* Reporting to be consistent with SWQM guidance and based on measurement capability.
** As published by the Texas Water Development Board on their website https://www.waterdatafortexas.org/reservoirs/statewide
*** To be routinely reported when collecting data from perennial pools.
References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.2 Measurement Performance Specifications for NETMWD (data collected by WMS)					
Flow Parameters					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	water	TCEQ SOP V1	00061	Field
FLOW SEVERITY:1=No Flow,2=Low,3=Normal,4=Flood,5=H igh,6=Dry	NU	water	TCEQ SOP V1	01351	Field
STREAM FLOW ESTIMATE (CFS)	cfs	Water	TCEQ SOP V1	74069	Field
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	other	TCEQ SOP V1	89835	Field

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.3 Measurement Performance Specifications for NETMWD (data collected by WMS)										
Conventional Parameters in Water										
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**TCEQ AWRL**	**LOQ**	**LOQ Check Sample %Rec**	**Precision (RPD**	**Bias %Rec. of LCS**	**Lab**
ALKALINITY, TOTAL (MG/L AS CACO3)	mg/L	water	SM 2320 B	00410	20	20	NA	20	NA	LCRA ELS
RESIDUE, TOTAL NONFILTRABLE (MG/L)	mg/L	water	SM 2540 D	00530	5	1	NA	NA	NA	LCRA ELS
NITROGEN, AMMONIA, TOTAL (MG/L AS N)	mg/L	water	EPA 350.1 Rev. 2.0 (1993)	00610	0.1	0.02	70-130	20	80-120	LCRA ELS
NITRITE NITROGEN, TOTAL (MG/L AS N)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00615	0.05	0.02	70-130	20	80-120	LCRA ELS
NITRATE NITROGEN, TOTAL (MG/L AS N)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00620	0.05	0.02	70-130	20	80-120	LCRA ELS
NITROGEN, KJELDAHL, TOTAL (MG/L AS N)	mg/L	water	EPA 351.2 Rev. 2.0 (1993)	00625	0.2	0.2	70-130	20	80-120	LCRA ELS
PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)	mg/L	water	EPA 365.4	00665	0.06	0.02	70-130	20	80-120	LCRA ELS
CARBON, TOTAL ORGANIC, NPOC (TOC), MG/L	mg/L	water	SM 5310 C	00680	2	0.5	NA	NA	NA	LCRA ELS
CHLORIDE (MG/L AS CL)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00940	5	5	70-130	20	80-120	LCRA ELS
SULFATE (MG/L AS SO4)	mg/L	water	EPA 300.0 Rev. 2.1 (1993)	00945	5	5	70-130	20	80-120	LCRA ELS
PHEOPHYTIN-A UG/L FLUOROMETRIC METHOD	µg/L	water	EPA 445.0	32213	3	2	NA	NA	NA	LCRA ELS
CHLOROPHYLL-A, FLUOROMETRIC METHOD, UG/L	µg/L	water	EPA 445.0	70953	3	2	NA	20	80-120	LCRA ELS

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.4 Measurement Performance Specifications for NETMWD (data collected by WMS)										
Bacteriological Parameters in Water										
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**TCEQ AWRL**	**LOQ**	**LOQ Check**	**Log Difference of Duplicates**	**Bias %Rec. of**	**Lab**
E. COLI, COLILERT, IDEXX METHOD, MPN/100ML	MPN/100 mL	water	SM 9223-B**	31699	1	1	NA	0.5*	NA	LCRA ELS
E.COLI, COLILERT, IDEXX, HOLDING TIME	hours	water	NA	31704	NA	NA	NA	NA	NA	LCRA ELS

* This value is not expressed as a relative percent difference. It represents the maximum allowable difference between the logarithm of the result of a sample and the logarithm of the duplicate result. See Section B5.
** E.coli samples analyzed by these methods should always be processed as soon as possible and within 8 hours. When transport conditions necessitate delays in delivery longer than 6 hours, the holding time may be extended and samples must be processed as soon as possible and within 30 hours.

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.5 Measurement Performance Specifications for NETMWD (data collected by WMS)					
24 Hour Parameters in Water					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
TEMPERATURE, WATER (DEGREES CENTIGRADE), 24HR AVG	DEG C	Water	TCEQ SOP V1	00209	Field
WATER TEMPERATURE, DEGREES CENTIGRADE, 24HR MAX	DEG C	Water	TCEQ SOP V1	00210	Field
TEMPERATURE, WATER (DEGREES CENTIGRADE) 24HR MIN	DEG C	Water	TCEQ SOP V1	00211	Field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR AVG	µS/cm	Water	TCEQ SOP V1	00212	Field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR MAX	µS/cm	Water	TCEQ SOP V1	00213	Field
SPECIFIC CONDUCTANCE, US/CM, FIELD, 24HR MIN	µS/cm	Water	TCEQ SOP V1	00214	Field
PH, S.U., 24HR MAXIMUM VALUE	std. units	Water	TCEQ SOP V1	00215	Field
PH, S.U., 24HR, MINIMUM VALUE	std. units	Water	TCEQ SOP V1	00216	Field
WATER TEMPERATURE, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00221	Field
SPECIFIC CONDUCTANCE, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	00222	Field
pH, # OF MEASUREMENTS IN 24- HRS	NU	Water	TCEQ SOP V1	00223	Field
DISSOLVED OXYGEN, 24-HOUR MIN. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89855	Field
DISSOLVED OXYGEN, 24-HOUR MAX. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89856	Field
DISSOLVED OXYGEN, 24-HOUR AVG. (MG/L) MIN. 4 MEA	mg/l	Water	TCEQ SOP V1	89857	Field
DISSOLVED OXYGEN, # OF MEASUREMENTS IN 24-HRS	NU	Water	TCEQ SOP V1	89858	Field

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.6 Measurement Performance Specifications for NETMWD (data collected by WMS)					
Habitat Parameters for Aquatic Life Monitoring					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
FLOW STREAM, INSTANTANEOUS (CUBIC FEET PER SEC)	cfs	Water	TCEQ SOP V2	00061	Field
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field
STREAM TYPE; 1=PERENNIAL 2=INTERMITTENT S/PERENNIAL POOLS 3=INTERMITTENT 4=UNKNOWN	NU	Water	NA/Calculation	89821	Field
STREAMBED SLOPE (M/KM)	M/KM	Other	NA/Calculation	72051	Field
AVERAGE PERCENTAGE INSTREAM COVER	%	Other	TCEQ SOP V2	84159	Field
STREAM ORDER	NU	Water	TCEQ SOP V2	84161	Field
NUMBER OF LATERAL TRANSECTS MADE	NU	Other	TCEQ SOP V2	89832	Field
FLOW MTH 1=GAGE 2=ELEC 3=MECH 4=WEIR/FLU 5=DOPPLER	NU	Other	TCEQ SOP V2	89835	Field
TOTAL NUMBER OF STREAM BENDS	NU	Other	TCEQ SOP V2	89839	Field
NUMBER OF WELL DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89840	Field
NUMBER OF MODERATELY DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89841	Field
NUMBER OF POORLY DEFINED STREAM BENDS	NU	Other	TCEQ SOP V2	89842	Field
TOTAL NUMBER OF RIFFLES	NU	Other	TCEQ SOP V2	89843	Field
DOMINANT SUBSTRATE TYPE (1=CLAY, 2=SILT, 3=SAND, 4=GRAVEL, 5=COBBLE, 6=BOULDER, 7=BEDROCK, 8=OTHER)	NU	Sediment	TCEQ SOP V2	89844	Field
AVERAGE PERCENT OF SUBSTRATE GRAVEL SIZE OR LARGER	%	Other	TCEQ SOP V2	89845	Field
AVERAGE STREAM BANK EROSION (%)	%	Other	TCEQ SOP V2	89846	Field
AVERAGE STREAM BANK SLOPE (DEGREES)	deg	Other	TCEQ SOP V2	89847	Field
HABITAT FLOW STATUS, 1=NO FLOW, 2=LOW,3=MOD,4=HIGH	NU	Other	TCEQ SOP V2	89848	Field
AVERAGE PERCENT TREES AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89849	Field
AVERAGE PERCENT SHRUBS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89850	Field
AVERAGE PERCENT GRASS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89851	Field
AVERAGE PERCENT CULTIVATED FIELDS AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89852	Field
AVERAGE PERCENT OTHER AS RIPARIAN VEGETATION	%	Other	TCEQ SOP V2	89853	Field
AVERAGE PERCENTAGE OF TREE CANOPY COVERAGE	%	Other	TCEQ SOP V2	89854	Field
DRAINAGE AREA ABOVE MOST DOWNSTREAM TRANSECT*	km2	Other	TCEQ SOP V2	89859	Field
REACH LENGTH OF STREAM EVALUATED (M)	m	Other	NA/Calculation	89884	Field
AVERAGE STREAM WIDTH (METERS)	M	Other	TCEQ SOP V2	89861	Field
AVERAGE STREAM DEPTH (METERS)	M	Other	TCEQ SOP V2	89862	Field
MAXIMUM POOL WIDTH AT TIME OF STUDY (METERS)	M	Other	TCEQ SOP V2	89864	Field
MAXIMUM POOL DEPTH AT TIME OF STUDY(METERS)	M	Other	TCEQ SOP V2	89865	Field
AVERAGE WIDTH OF NATURAL RIPARIAN VEGETATION (M)	M	Other	TCEQ SOP V2	89866	Field
AVERAGE WIDTH OF NATURAL RIPARIAN BUFFER ON LEFT BANK (M)	M	Other	NA/Calculation	89872	Field
AVERAGE WIDTH OF NATURAL RIPARIAN BUFFER ON RIGHT BANK (M)	m	Other	NA/Calculation	89873	Field
AESTHETICS OF REACH (1=WILD 2=NAT. 3=COMM. 4=OFF.)	NU	Other	TCEQ SOP V2	89867	Field
NUMBER OF STREAM COVER TYPES	NU	Other	TCEQ SOP V2	89929	Field
LAND DEVELOP IMPACT (1=UNIMP,2=LOW,3=MOD,4=HIGH)	NU	Other	TCEQ SOP V2	89962	Field
RIPARIAN VEGETATION %; LEFT BANK - TREES	%	Other	NA/Calculation	89822	Field
RIPARIAN VEGETATION %; RIGHT BANK - TREES	%	Other	NA/Calculation	89823	Field
RIPARIAN VEGETATION %; LEFT BANK SHRUBS	%	Other	NA/Calculation	89824	Field
RIPARIAN VEGETATION %; RIGHT BANK - SHRUBS	%	Other	NA/Calculation	89825	Field
RIPARIAN VEGETATION %: LEFT BANK - GRASSES OR FORBS	%	Other	NA/Calculation	89826	Field
RIPARIAN VEGETATION %; RIGHT BANK - GRASSES OR FORBS	%	Other	NA/Calculation	89827	Field
RIPARIAN VEGETATION %: LEFT BANK - CULTIVATED FIELDS	%	Other	NA/Calculation	89828	Field
RIPARIAN VEGETATION %: RIGHT BANK - CULTIVATED FIELDS	%	Other	NA/Calculation	89829	Field
RIPARIAN VEGETATION %: LEFT BANK – OTHER	%	Other	NA/Calculation	89830	Field
RIPARIAN VEGETATION %: RIGHT BANK - OTHER	%	Other	NA/Calculation	89871	Field

TABLE A7.6 Measurement Performance Specifications for NETMWD (data collected by WMS) cont.					
Habitat Parameters for Aquatic Life Monitoring					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
AVAILABLE INSTREAM COVER HQI SCORE: 4=ABUNDANT 3=COMMON 2=RARE 1=ABSENT	NU	Other	NA/Calculation	89874	Field
BOTTOM SUBSTRATE STABILITY HQI SCORE: 4=STABLE 3=MODERATELY STABLE 2=MODERATELY UNSTABLE 1=UNSTABLE	NU	Other	NA/Calculation	89875	Field
NUMBER OF RIFFLES HQI SCORE: 4=ABUNDANT 3=COMMON 2=RARE 1=ABSENT	NS	Other	NA/Calculation	89876	Field
DIMENSIONS OF LARGEST POOL HQI SCORE: 4=LARGE 3=MODERATE 2=SMALL 1=ABSENT	NU	Other	NA/Calculation	89877	Field
CHANNEL FLOW STATUS HQI SCORE: 3=HIGH 2=MODERATE 1=LOW 0=NO FLOW	NU	Other	NA/Calculation	89878	Field
BANK STABILITY HQI SCORE: 3=STABLE 2=MODERATELY STABLE 1=MODERATELY UNSTABLE 0=UNSTABLE	NU	Other	NA/Calculation	89879	Field
CHANNEL SINUOSITY HQI SCORE: 3=HIGH 2=MODERATE 1=LOW 0=NONE	NU	Other	NA/Calculation	89880	Field
RIPARIAN BUFFER VEGETATION HQI SCORE: 3=EXTENSIVE 2=WIDE 1=MODERATE 0=NARROW	NU	Other	NA/Calculation	89881	Field
AESTHETICS OF REACH HQI SCORE: 3=WILDERNESS 2=NATURAL AREA 1=COMMON SETTING 0=OFFENSIVE	NU	Other	NA/Calculation	89882	Field
HQI TOTAL SCORE	NU	Other	NA/Calculation	89883	Field
LENGTH OF STREAM EVALUATED (KM)	KM	Other	NA/Calculation	89860	Field
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	Field
POOL LENGTH, METERS**	meters	other	TCEQ SOP V2	89869	Field
% POOL COVERAGE IN 500 METER REACH**	%	other	TCEQ SOP V2	89870	Field
NO FLOW ISOLATED POOL: LARGEST POOL MAX WIDTH (M)	M	Other	NA/Calculation	89908	Field
NO FLOW ISOLATED POOL: LARGEST POOL MAX LENGTH (M)	M	Other	NA/Calculation	89909	Field
NO FLOW ISOLATED POOL: LARGEST POOL MAX DEPTH (M)	M	Other	NA/Calculation	89910	Field
NO FLOW ISOLATED POOL: SMALLEST POOL MAX DEPTH (M)	M	Other	NA/Calculation	89911	Field
NO FLOW ISOLATED POOL: SMALLEST POOL MAX WIDTH (M)	M	Other	NA/Calculation	89912	Field
NO FLOW ISOLATED POOL: SMALLEST POOL MAX LENGTH (M)	M	Other	NA/Calculation	89913	Field
NO FLOW ISOLATED POOLS: NUMBER OF POOLS EVALUATED	NU	Other	NA/Calculation	89914	Field

* From USGS map.
** To be reported when collecting data from perennial pools.

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.7 Measurement Performance Specifications for NETMWD (data collected by WMS)					
Quantitative Benthic Parameters for Aquatic Life Monitoring					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
STREAM ORDER	NU	Water	TCEQ SOP, V1	84161	Field
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field
QUANTITATIVE PROTOCOLS REGIONAL BENTHIC MACROINVERTEBRATE IBI SCORE	NS	Other	NA/Calculation	90085	Field
BENTHIC DATA REPORTING UNITS (1=NUMBER OF INDIVIDUALS IN SUB-SAMPLE, 2=NUMBER OF INDIVIDUALS/FT2, 3=NUMBER OF INDIVIDUALS/M2, 4=TOTAL NUMBER OF INDIVIDUALS IN SAMPLE)	NU	Other	TCEQ SOP V2	89899	Field
UNDERCUT BANK AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89921	Field
OVERHANGING BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89922	Field
GRAVEL BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89923	Field
SAND BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89924	Field
SOFT BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89925	Field
MACROPHYTE BED AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89926	Field
SNAGS AND BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89927	Field
BEDROCK STREAMBED AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89928	Field
MESH SIZE, ANY NET OR SIEVE, AVERAGE BAR (CM)	cm	Other	TCEQ SOP V2	89946	Field
BENTHIC SAMPLE COLLECTION METHOD (1=SURBER, 2=EKMAN, 3=KICKNET, 4=PETERSON, 5=HESTER DENDY, 6=SNAG, 7=HESS)	NU	Other	TCEQ SOP V2	89950	Field
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	Field
BENTHOS ORGANISMS -NONE PRESENT (0=NONE PRESENT)	NS	Other	TCEQ SOP V2	90005	Field
BENTHIC GRAZERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90020	Field
BENTHIC GATHERERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90025	Field
BENTHIC FILTERERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90030	Field
TOTAL TAXA RICHNESS, BENTHOS	NU	Other	TCEQ SOP V2	90055	Field
NUMBER OF DIPTERA TAXA	NU	Other	TCEQ SOP V2	90056	Field
NUMBER OF EPHEMEROPTERA TAXA	NU	Other	TCEQ SOP V2	90057	Field
TOTAL NUMBER OF INTOLERANT TAXA, BENTHOS	NU	Other	TCEQ SOP V2	90058	Field
EPT, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90060	Field
CHIRONOMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90062	Field
BENTHIC SHREDDERS (% OF COMMUNITY)	%	Other	TCEQ SOP V2	90035	Field
TOTAL # OF FAMILIES IN BENTHIC SAMPLE	NU	Other	TCEQ SOP V2	90012	Field
TOLERANT BENTHOS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90066	Field
DOMINANT 3 TAXA, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90067	Field
TOTAL # OF BENTHIC GENERA IN SAMPLE	NU	Other	TCEQ SOP V3	90011	Field
Species Enumeration	#	Benthics	NA/Calculation	Various	WMS

References:

United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.8 Measurement Performance Specifications for NETMWD (data collected by WMS)					
Qualitative Benthic Parameters for Aquatic Life Monitoring					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
STREAM ORDER	NU	Water	TCEQ SOP, V1	84161	Field
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field
RAPID BIOASSESSMENT PROTOCOLS BENTHIC MACROINVERTEBRATE IBI SCORE	NS	Other	NA/Calculation	90081	Field
BENTHIC DATA REPORTING UNITS (1=NUMBER OF INDIVIDUALS IN SUB-SAMPLE, 2=NUMBER OF INDIVIDUALS/FT2, 3=NUMBER OF INDIVIDUALS/M2, 4=TOTAL NUMBER OF INDIVIDUALS IN SAMPLE)	NU	Other	TCEQ SOP V2	89899	Field
KICKNET EFFORT, MINUTES KICKED (MIN.)	min.	Other	TCEQ SOP V2	89904	Field
NUMBER OF INDIVIDUALS IN BENTHIC SAMPLE	NU	Other	TCEQ SOP V2	89906	Field
UNDERCUT BANK AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89921	Field
OVERHANGING BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89922	Field
GRAVEL BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89923	Field
SAND BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89924	Field
SOFT BOTTOM AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89925	Field
MACROPHYTE BED AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89926	Field
SNAGS AND BRUSH AT COLLECTION POINT (%)	%	Other	TCEQ SOP V2	89927	Field
BEDROCK STREAMBED AT COLLECTION POINT (%)	%	Sediment	TCEQ SOP V2	89928	Field
MESH SIZE, ANY NET OR SIEVE, AVERAGE BAR (CM)	cm	Other	TCEQ SOP V2	89946	Field
BENTHIC SAMPLE COLLECTION METHOD (1=SURBER, 2=EKMAN, 3=KICKNET, 4=PETERSON, 5=HESTER DENDY, 6=SNAG, 7=HESS)	NU	Other	TCEQ SOP V2	89950	Field
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	Field
BENTHOS ORGANISMS -NONE PRESENT (0=NONE PRESENT)	NS	Other	TCEQ SOP V2	90005	Field
HILSENHOFF BIOTIC INDEX (HBI)	NU	Other	TCEQ SOP V2	90007	Field
NUMBER OF EPT INDEX	NU	Other	TCEQ SOP V2	90008	Field
DOMINANT BENTHIC FUNCTIONAL FEEDING GRP, % OF INDIVIDUALS	%	Other	TCEQ SOP V2	90010	Field
BENTHIC GATHERERS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90025	Field
BENTHIC PREDATORS, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90036	Field
DOMINANT TAXON, BENTHOS PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90042	Field
RATIO OF INTOLERANT TO TOLERANT TAXA, BENTHOS	NU	Other	TCEQ SOP V2	90050	Field
NUMBER OF NON-INSECT TAXA	NU	Other	TCEQ SOP V2	90052	Field
ELMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90054	Field
TOTAL TAXA RICHNESS, BENTHOS	NU	Other	TCEQ SOP V2	90055	Field
CHIRONOMIDAE, PERCENT OF INDIVIDUALS	%	Other	TCEQ SOP V2	90062	Field
PERCENT OF TOTAL TRICHOPTERA INDIVIDUALS AS HYDROPSYCHIDAE	%	Other	TCEQ SOP V2	90069	Field
TOTAL # OF BENTHIC GENERA IN SAMPLE	NU	Other	TCEQ SOP V3	90011	Field
BENTHIC SHREDDERS (% OF COMMUNITY)	%	Other	TCEQ SOP V2	90035	Field
TOTAL # OF FAMILIES IN BENTHIC SAMPLE	NU	Other	TCEQ SOP V2	90012	Field
DIP NET EFFORT, AREA SWEPT (SQ. METER)	m2	Other	TCEQ SOP V2	89902	Field
KICKNET EFFORT, AREA KICKED (SQ. METER)	m2	Other	TCEQ SOP V2	89903	Field
Species Enumeration	#	Benthics	NA/Calculation	Various	WMS

References:

United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

TABLE A7.9 Measurement Performance Specifications for NETMWD (data collected by WMS)					
Nekton Parameters for Aquatic Life Monitoring					
Parameter	**Units**	**Matrix**	**Method**	**Parameter Code**	**Lab**
STREAM ORDER	NU	Water	TCEQ SOP V1	84161	Field
NEKTON TEXAS REGIONAL IBI SCORE	NS	Other	NA/Calculation	98123	Field
BIOLOGICAL DATA	NS	Other	NA/Calculation	89888	Field
SEINE, MINIMUM MESH SIZE, AVERAGE BAR, NEKTON, IN	IN	Other	TCEQ SOP V2	89930	Field
SEINE, MAXIMUM MESH SIZE, AVG BAR, NEKTON, INCH	IN	Other	TCEQ SOP V2	89931	Field
NET LENGTH (METERS)	M	Other	TCEQ SOP V2	89941	Field
ELECTROFISHING METHOD 1=BOAT 2=BACKPACK 3=TOTEBARGE	NU	Other	TCEQ SOP V2	89943	Field
ELECTROFISH EFFORT, DURATION OF SHOCKING (SEC)	SEC	Other	TCEQ SOP V2	89944	Field
SEINING EFFORT (# OF SEINE HAULS)	NU	Other	TCEQ SOP V2	89947	Field
COMBINED LENGTH OF SEINE HAULS (METERS)	M	Other	TCEQ SOP V2	89948	Field
SEINING EFFORT, DURATION (MINUTES)	MIN	Other	TCEQ SOP V2	89949	Field
ECOREGION LEVEL III (TEXAS ECOREGION CODE)	NU	Other	TCEQ SOP V1	89961	Field
AREA SEINED (SQ METERS)	M2	Other	TCEQ SOP V2	89976	Field
NUMBER OF SPECIES, FISH	NU	Other	TCEQ SOP V2	98003	Field
NEKTON ORGANISMS-NONE PRESENT (0=NONE PRESENT)	NS	Other	TCEQ SOP V2	98005	Field
TOTAL NUMBER OF SUNFISH SPECIES	NU	Other	TCEQ SOP V2	98008	Field
TOTAL NUMBER OF INTOLERANT SPECIES, FISH	NU	Other	TCEQ SOP V2	98010	Field
PERCENT OF INDIVIDUALS AS OMNIVORES, FISH	%	Other	TCEQ SOP V2	98017	Field
PERCENT OF INDIVIDUALS AS INVERTIVORES, FISH	%	Other	TCEQ SOP V2	98021	Field
PERCENT OF INDIVIDUALS AS PISCIVORES, FISH	%	Other	TCEQ SOP V2	98022	Field
PERCENT OF INDIVIDUALS WITH DISEASE OR ANOMALY	%	Other	TCEQ SOP V2	98030	Field
TOTAL NUMBER OF NATIVE CYPRINID SPECIES	NU	Other	TCEQ SOP V2	98032	Field
PERCENT INDIVIDUALS AS NON-NATIVE FISH SPECIES (% OF COMMUNITY)	%	Other	TCEQ SOP V2	98033	Field
TOTAL NUMBER OF INDIVIDUALS SEINING	NU	Other	TCEQ SOP V2	98039	Field
TOTAL NUMBER OF INDIVIDUALS ELECTROFISHING	NU	Other	TCEQ SOP V2	98040	Field
TOTAL NUMBER OF BENTHIC INVERTIVORE SPECIES	NU	Other	TCEQ SOP V2	98052	Field
TOTAL NUMBER OF BENTHIC FISH SPECIES	NU	Other	TCEQ SOP V2	98053	Field
NUMBER OF INDIVIDUALS PER SEINE HAUL	NU	Other	TCEQ SOP V2	98062	Field
NUMBER OF INDIVIDUALS PER MINUTE ELECTROFISHING	NU	Other	TCEQ SOP V2	98069	Field
PERCENT INDIVIDUALS AS TOLERANT FISH SPECIES (EXCLUDING WESTERN MOSQUITOFISH)	%	Other	TCEQ SOP V2	98070	Field
TOTAL NUMBER OF SUCKER SPECIES	NU	Other	TCEQ SOP V2	98009	Field
PERCENT OF INDIVIDUALS AS HYBRIDS	%	Other	TCEQ SOP V2	98024	Field
TOTAL NUMBER OF INDIVIDUALS IN SAMPLE, FISH	NU	Other	TCEQ SOP V2	98023	Field
PERCENT OF INDIVIDUALS AS TOLERANTS, FISH	%	Other	TCEQ SOP V2	98016	Field
TOTAL NUMBER OF DARTER SPECIES	NU	Other	TCEQ SOP V2	98004	Field
Species Enumeration	#	Nekton	NA/Calculation	Various	Field

References:
United States Environmental Protection Agency (USEPA) Methods for Chemical Analysis of Water and Wastes, Manual #EPA-600/4-79-020
U.S. Code of Federal Regulations (CFR). Title 40: Protection of Environment, Part 136
American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017.
TCEQ SOP, V1 - TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods, 2012 (RG-415).
TCEQ SOP, V2 - TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data, 2014 (RG-416).

Appendix B: Task 3 Work Plan & Sampling Process Design and Monitoring Schedule (Plan)

TASK 3: WATER QUALITY MONITORING

Objectives: Water quality monitoring will focus on the characterization of a variety of locations and conditions. This will include a combination of the following:

- planning and coordinating basin-wide monitoring;
- routine, regularly-scheduled monitoring to collect long-term information and support statewide assessment of water quality; and
- systematic, regularly-scheduled short-term monitoring to screen water bodies for issues.

Task Description: The Performing Party will make the basin-wide water quality monitoring plan its primary focus for the biennium.

The Performing Party will complete the following subtasks:

Monitoring Description - Based upon the input from the Cypress Creek Basin Steering Committee and through the coordinated monitoring process, the Performing Party will monitor a minimum of eight routine stations quarterly for field parameters, flow (where applicable), bacteria, and conventional water chemistry. Field parameters and flow (when possible) will be collected at a minimum of two other stations per quarter. Diel studies consisting of pH, dissolved oxygen, conductivity, and temperature, along with instantaneous flow measurements (when possible) and field observations will be conducted four times per year at a minimum of two stations. Biological monitoring will be conducted on at least one station in each year of the FY 2022-2023 biennium. Specific locations, parameters, and sampling frequencies for FY 2022 are provided in the Basin-wide CRP QAPP for FY 2022-2023.

In FY 2023, a similar monitoring effort is expected. Changes to the monitoring schedule will be made after considering input from the Cypress Creek Basin Steering Committee, and through the Coordinated Monitoring Process. The specific locations, parameters, and sampling frequencies for FY 2023 will be provided in the Cypress Creek Basin QAPP Appendix B monitoring schedule.

All monitoring will be completed in accordance with the Performing Party QAPP, the TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods (RG-415) and the TCEQ Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416).

Coordinated Monitoring Meeting - The Performing Party will hold an annual coordinated monitoring meeting as described in the FY 2022-2023 CRP Guidance. Qualified monitoring organizations will be invited to attend the working meeting in which monitoring needs and purposes will be discussed segment by segment and station by station. Information from participants and stakeholders will be used to select stations and parameters that will enhance overall water quality monitoring coverage, eliminate duplication of effort, and address basin priorities. A summary of the changes to the monitoring schedule will be provided to the participants within two weeks of the meeting. Changes to the monitoring schedule will be entered into the statewide Coordinated Monitoring Schedule (http://cms.lcra.org) and communicated to meeting attendees. Changes to monitoring schedules that occur during the year will be entered into the Coordinated Monitoring Schedule and communicated to meeting attendees. All requirements related to meetings will be followed and required meetings will be conducted in-person or via TCEQ approved virtual format.

Progress Report - Each Progress Report will include all types of monitoring and indicate the number of sampling events and the types of monitoring conducted in the quarter.

Deliverables and Dues Dates:

September 1, 2021 through August 31, 2022

A. Conduct water quality monitoring, summarize activities, and submit with Progress Report - December 15, 2021; March 15 and June 15, 2022
B. Coordinated Monitoring Meeting - between March 15 and April 30, 2022
C. Coordinated Monitoring Meeting Summary of Changes - within 2 weeks of the meeting
D. Email notification that Coordinated Monitoring Schedule updates are complete - May 31, 2022

September 1, 2022 through August 31, 2023

A. Conduct water quality monitoring, summarize activities, and submit with Progress Report - September 15 and December 15, 2022; March 15 and June 15 and August 31, 2023
B. Coordinated Monitoring Meeting - between March 15 and April 30, 2023
C. Coordinated Monitoring Meeting Summary of Changes – within 2 weeks of themeeting
D. Email notification that Coordinated Monitoring Schedule updates are complete - May 31, 2023

Appendix B Sampling Process Design and Monitoring Schedule (plan)

Sample Design Rationale FY 2022

The sample design is based on the legislative intent of CRP. Under the legislation, the Basin Planning Agencies have been tasked with providing data to characterize water quality conditions in support of the Texas Water Quality Integrated Report, and to identify significant long-term water quality trends. 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 accord with available resources. As part of the Steering Committee process, the NETMWD coordinates closely with the TCEQ and other participants to ensure a comprehensive water monitoring strategy within the watershed.

The goal of this portion of the Clean Rivers Program is to provide the appropriate, quality assured data to allow continuing assessment and management of water quality in the Cypress Basin. The Long-Term Goals of the Clean Rivers Program include the following:

- Establish a long-term monitoring program for the basin,
- Focus on and provide for local participation in monitoring,
- Provide reliable information to the public to enhance awareness and knowledge of water quality conditions in the basin,
- Monitor and evaluate water quality trends,
- Identify the nature and source of water quality problems that result in impairments,
- Evaluate the applicability of State Surface Water Quality Criteria to specific water bodies in the basin,
- Evaluate permit requirements with respect to water quality conditions and trends in the basins, and,
- Provide data to support the development of cost-effective water quality management programs.

During FY 2022, 14 routine stations will be monitored and 24-hour diel monitoring will be performed at three stations. Aquatic life monitoring will be conducted at two stations. The results from data collected at these monitoring stations will be submitted to the TCEQ for inclusion in the SWQMIS database.

Routine Monitoring

Routine monitoring stations are situated to provide long term water quality data at locations draining major sub-watershed and important river segment reaches within the Cypress Creek Basin. The primary objective of collecting comparable water quality data over a substantial period of time is to identify temporal trends and to differentiate water quality characteristics, impairments and possible causes over discrete sub-watershed areas.

Parameters to be measured or sampled are listed in Tables A7 in Appendix A. Field parameters and conventional water samples for laboratory analysis will be collected regardless of the conditions encountered. Field parameters include the measurements of water temperature, DO, specific conductance, pH, and transparency. Conventional water quality samples will be analyzed for total suspended solids, alkalinity, sulfate, chloride, total phosphorus, ammonia nitrogen, nitrate nitrogen, nitrite nitrogen, total Kjeldahl nitrogen, total organic carbon. Chlorophyll-*a* and pheophytin will be collected only at the three Caddo Lake stations and at station 10295 Big Cypress Creek at SH 43. These parameters will not be collected at the other stream stations due to budget constraints. With the exception of *E. coli*, no other laboratory parameters will be collected at stations 20153 (Lilly Creek at FM 556) and 17954 (South Lilly Creek at FM 2454). Bacteriological samples will be collected for laboratory analysis during all conditions encountered.

The following changes have been made to the FY 2022 monitoring schedule. These changes are a result of concerns or requests made by Cypress Creek Basin steering committee members and/or monitoring entities.

1. Station 14236 - CLINTON LAKE 165 METERS NORTH AT CHANNEL MARKER C111 NEAR CADDO LAKE: removed from the schedule due to budget constraints.
2. Station 10261 - TANKERSLEY CREEK AT FM3417: removed from the monitoring schedule for Aquatic Life Monitoring due to completion of two-year study.
3. Station 10331 - LITTLE CYPRESS BAYOU AT FM 134: removed from the monitoring schedule due to TCEQ Region 5 sampling in same Assessment Unit.

4. Station 10244 - BLACK CYPRESS BAYOU AT CC BRIDGE ROAD NORTHWEST OF BEREA: removed from the monitoring schedule due to access issues. There are enough data collected at this station for the assessment, and TCEQ Region 5 monitors at a station downstream.
5. Station 10266 – HART CREEK AT COUNTY ROAD 4550: removed from the monitoring schedule for routine quarterly sampling due to planned bridge construction at the station and concerns for access during all weather conditions.
6. Station 10266 – HART CREEK AT COUNTY ROAD 4550: added to the monitoring schedule for Aquatic Life Monitoring to be conducted in the Index and Critical periods of FY 2022 and 2023. Private landowner has granted access to property during dry weather conditions should the stream be inaccessible due to bridge construction. Samples for bacteria and conventional parameters will be collected within a few days of the ALM.
7. Station 10259 – FRAZIER CREEK AT US 59: added to the monitoring schedule for quarterly routine monitoring for field parameters, conventional parameters, bacteria and flow. Also added to the monitoring schedule for Aquatic Life Monitoring to be conducted in the Index and Critical periods of FY 2022 and 2023.
8. Station 20153 – LILLY CREEK AT FM 556 and Station 17954 – SOUTH LILLY CREEK AT FM 2454: removed quarterly sampling for conventional laboratory analysis due to budget constraints.
9. Removed chlorophyll analysis at stations 15508 – HARRISON BAYOU AT FM 134; 14976 – JAMES BAYOU AT SH 43; 16458 – BIG CYPRESS CREEK NEAR CONFLUENCE WITH GREASY CREEK; 10261 – TANKERSLEY CREEK AT FM 3417 due to budget constraints.
10. Moved sampling in Hughes Creek from Station 16936 – HUGHES CREEK AT SH 155 to Station 22321 – HUGHES CREEK AT CR 2985 due to the determination that Station 16936 was not representative of the stream. The Coordinated Monitoring Committee recommended moving sampling to another location.

WMS will perform all monitoring activities shown in this document and on the Coordinated Monitoring Schedule.

Biased to Season Monitoring

Diel monitoring will be conducted four times throughout the year. No less than one-half and no more than two-thirds of the samples will be collected in the Index period, and no less than one-fourth and no more than one-third will be collected in the Critical period. Diel monitoring includes quarterly sampling on Prairie Creek at FM 557 (Station 15836), Black Cypress Creek at SH 11 (Station 10247), and Big Cypress Creek at CR SW 3170 (Station 22151). Flow will be measure at all wadable stream stations or will be obtained from a nearby USGS gaging station.

Aquatic Life Monitoring will be conducted once during the Index period and once during the Critical period in FY 2022 and FY 2023. Monitoring will be conducted at Frazier Creek at US 59 (Station 10259) and at Hart Creek at CR 4550 (Station 10266). Habitat assessment, benthic macroinvertebrates, and nekton will be assessed. Field parameters, flow, and diel data will be obtained during the monitoring events.

Site Selection Criteria

This data collection effort involves monitoring routine water quality using procedures that are consistent with the TCEQ SWQM program. Some general guidelines are followed when selecting sampling sites, as outlined below, and discussed thoroughly in SWQM Procedures, Volumes I and II. Overall consideration is given to accessibility and safety. All monitoring activities have been developed in coordination with the CRP Steering Committee and with the TCEQ. The site selection criteria specified are those the TCEQ would like considered to produce data which is complementary to that collected by the state and which may be used in assessments, etc.

1. Locate stream sites so that samples can be safely collected from the centroid of flow. Centroid is defined as the midpoint of that portion of stream width which contains 50 percent of the total flow. If multiple potential sites on a stream segment are appropriate for monitoring, choose one that would best represent the water body, and not a site that displays unusual conditions or contaminant source(s). Avoid backwater areas or eddies when selecting a stream site.
2. At a minimum for reservoirs, locate sites near the dam (reservoirs) and in the major arms. Larger reservoirs might also include stations in the middle and upper (riverine) areas. Select sites that best represent the water body by avoiding coves and back water areas. A single monitoring site is considered representative of

25 percent of the total reservoir acres, but not more than 5,120 acres.

3. Monitoring sites are selected to maximize stream coverage or basin coverage. Very long segments may require more stations. As a rule of thumb, stream segments between 25 and 50 miles long require two stations, and longer than 50 miles require three or more depending on the existence of areas with significantly different sources of contamination or potential water quality concerns. Major hydrological features, such as the confluence of a major tributary or an instream dam, may also limit the spatial extent of an assessment based on one station.
4. Because historical water quality data can be very useful in assessing use attainment or impairment, it may be best to use sites that are on current or past monitoring schedules.
5. All classified segments (including reservoirs) should have at least one Monitoring site that adequately characterizes the water body, and monitoring should be coordinated with the TCEQ or other qualified monitoring entities reporting routine data to TCEQ.
6. Monitoring sites may be selected to bracket sources of pollution, influence of tributaries, changes in land uses, and hydrological modifications.
7. Sites should be accessible. When possible, stream sites should have a USGS stream flow gauge. If not, it should be possible to conduct flow measurement during routine visits.

Monitoring Sites for FY 2022

Table B1.1 Sample Design and Schedule, FY 2022

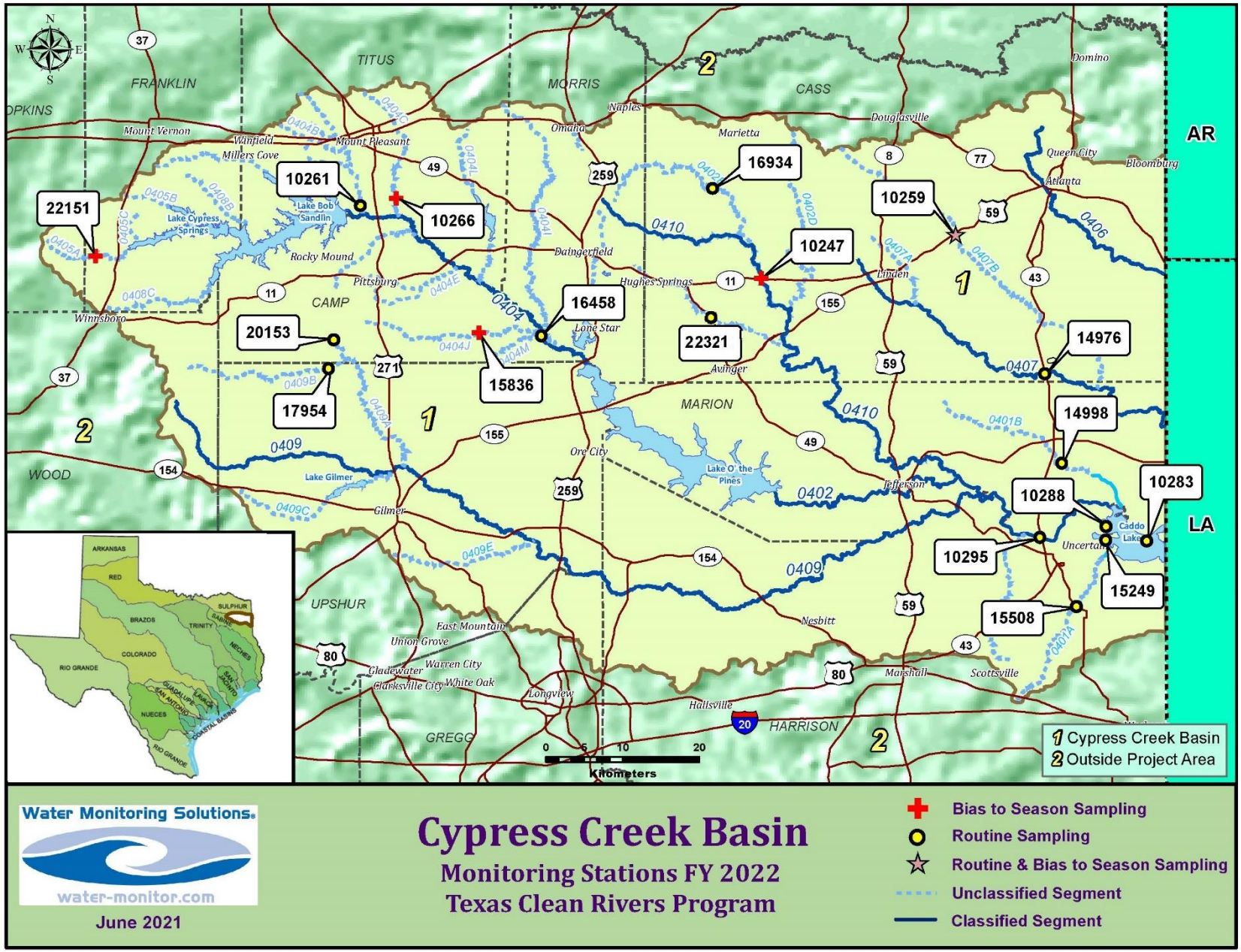
Site Description	Station ID	Waterbody ID	Basin	Region	SE	CE	MT	Field	Conv	Bacteria	Flow	24 HR DO	Aq. Habitat	Benthic	Nekton	Comments
Segment 0401 Caddo Lake																
CADDO LAKE IN GOOSE PRAIRIE	10288	0401	4	5	NT	WM	RT	4	4	4						
CADDO LAKE MID LAKE	10283	0401	4	5	NT	WM	RT	4	4	4						
CADDO LAKE NEAR SHORE AT END OF FM 2198	15249	0401	4	5	NT	WM	RT	4	4	4						
HARRISON BAYOU AT FM 134	15508	0401A	4	5	NT	WM	RT	4	4	4	4					Flow measured when wadable. No chlorophyll samples
KITCHEN CREEK AT MARION CR 3416	14998	0401B	4	5	NT	WM	RT	4								
Segment 0402 Big Cypress Creek below Lake O' the Pines																
BIG CYPRESS CREEK AT SH 43	10295	0402	4	5	NT	WM	RT	4	4	4	4					
HUGHES CREEK AT CR 2985	22321	0402B	4	5	NT	WM	RT	4								
KELLEY CREEK AT FM 250	16934	0402E	4	5	NT	WM	RT	4			4					
Segment 0404 Big Cypress Creek below Lake Bob Sandlin																
BIG CYPRESS CREEK DOWNSTREAM OF CONFL. WITH GREASY CREEK	16458	0404	4	5	NT	WM	RT	4	4	4						No chlorophyll samples
TANKERSLEY CREEK AT FM 3417	10261	0404B	4	5	NT	WM	RT	4	4	4	4					No chlorophyll samples
HART CREEK AT COUNTY ROAD 4550	10266	0404C	4	5	NT	WM	BS	2	2	2	2	2	2	2	2	ALM; Conventional samples collected around time of ALM; No chlorophyll samples
PRAIRIE CREEK AT FM 557	15836	0404J	4	5	NT	WM	BS	4			4	4				
Segment 0405 Lake Cypress Springs																
BIG CYPRESS CREEK AT CR SW 3170	22151	0405A	4	5	NT	WM	BS	4			4	4				
Segment 0407 James' Bayou																
JIMS BAYOU AT SH 43	14976	0407	4	5	NT	WM	RT	4	4	4	4					No chlorophyll samples
FRAZIER CREEK AT US 59	10259	0407B	4	5	NT	WM	BS	2			2	2	2	2	2	ALM
FRAZIER CREEK AT US 59	10259	0407B	4	5	NT	WM	RT	4	4	4	4					No chlorophyll samples

Site Description	Station ID	Waterbody ID	Basin	Region	SE	CE	MT	Field	Conv	Bacteria	Flow	24 hr DO	AqHab	Benthics	Nekton	Comments
Segment 0409 Little Cypress Creek																
LILLY CREEK AT FM 556	20153	0409A	4	5	NT	WM	RT	4		4						Flow measured when wadable
SOUTH LILLY CREEK AT FM 2454	17954	0409B	4	5	NT	WM	RT	4		4	4					Flow measured when wadable
Segment 0410 Black Cypress Creek																
BLACK CYPRESS BAYOU AT SH 11	10247	0410	4	5	NT	WM	BS	4			4	4				Flow measured when wadable

Appendix C: Station Location Maps

Station Location Maps

The map of stations monitored by the NETMWD is provided below. The map was generated by WMS. This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. For more information concerning this map, contact Water Monitoring Solutions, Inc. at 903-439-4741.


Water Monitoring Solutions
water-monitor.com
June 2021
Cypress Creek Basin
Monitoring Stations FY 2022
Texas Clean Rivers Program
Bias to Season Sampling
Routine Sampling
Routine & Bias to Season Sampling
Unclassified Segment
Classified Segment
1 Cypress Creek Basin
2 Outside Project Area
22151
10261
10266
16934
10259
10247
16458
20153
22321
14976
17954
15836
14998
10283
10288
10295
15249
15508
FRANKLIN
TITUS
MORRIS
CASS
CAMP
MARION
WOOD
UPSHUR
GREGG
HARRISON
AR
LA
Lake Bob Sandlin
Lake Cypress Springs
Lake Gilmer
Lake O' the Pines
Caddo Lake
Mount Vernon
Winfield
Millers Cove
Mount Pleasant
Naples
Omaha
Marietta
Douglasville
Domino
Queen City
Bloomburg
Atlanta
Rocky Mound
Daingerfield
Pittsburg
Hughes Springs
Linden
Winnsboro
Lone Star
Avinger
Ore City
Jefferson
Uncertain
Gilmer
Nesbitt
Marshall
Scottsville
Hallsville
Longview
Union Grove
East Mountain
Gladewater
Warren City
White Oak
Clarksville City
0 5 10 20
Kilometers

Appendix D: Field Data Sheets

Water Monitoring Solutions

water-monitor.com

Basin:
FY:
QTR:

Stream Field Form

Station ID:		**Date:**	**Time:**
Station Location:			
Sample(s) Collected By:			
Days Since Last Rain:	**Total Rainfall** - 7 Days Inclusive Prior to Sampling (Inches):		

Stream Type:	**Present Weather:**	**Wind Intensity**	**Wind Direction**		**Aesthetics:**
perennial	Clear	Calm	N	S	Wilderness
intermittent w/ perennial pools	Partly Cloudy	Slight	E	W	Natural
	Cloudy	Moderate	NE	SE	Common
intermittent	Rain	Strong	NW	SW	Offensive

Flow (cfs):	**Flow Severity:**		**Water Odor:**		**Water Color:**		**Water Clarity:**	
	No Flow	Flood	Sewage	Oily/ Chemical	Brown	Red	Poor	Good
Flow Method:	Low Flow	High	Rotten Eggs	Musky	Green	Black	Fair	Excellent
	Normal	Dry	Fishy	None Other	Clear	Other		

Flow Est. cfs	**Water Temp °C**	**DO % sat**	**DO mg/L**	**Sp. Cond µS/cm**	**pH s.u.**	**Secchi m**	**Air Temp °C**	**Sample Depth m**	**Water Column Depth m**

Evidence of Flow Fluctuations:
Observed Stream Uses:
Adjacent Land Use:
Channel Obstructions/Modifications:
Observations: (stream flow [if any], debris in water, canopy coverage, obvious signs of eutrophication, etc.):

Parameters:	**Field**		**Conventionals**		***E. coli***		

P.O. Box 1132 Sulphur Springs, TX 75483 903-439-4741 www.water-monitor.com

Water Monitoring Solutions

water-monitor.com

Basin:
FY:
QTR:

Reservoir Field Form

Station ID:	**Date:**	**Time:**
Station Location:		
Sample(s) Collected By:		
Days Since Last Rain:	**Total Rainfall** - 7 Days Inclusive Prior to Sampling (Inches):	

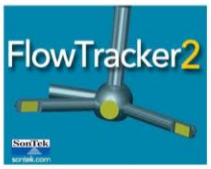
Water Level:	**Present Weather:**	**Wind Intensity**	**Wind Direction**	**Water Surface**
Below Normal	Clear	Calm	N S	Calm
Normal	Partly Cloudy	Slight	E W	Ripple
Above Normal	Cloudy	Moderate	NE SE	Waves
	Rain	Strong	NW SW	Whitecap

Reservoir Stage (ft.)	**Reservoir % Full**	**Sediment Odor:**	**Water Odor:**	**Water Color:**	**Water Clarity:**
		None Sewage Musky Other: Fishy	Sewage Oily / Chemical Rotten Eggs Musky Fishy None / Other	Brown Red Green Black Clear Other	Poor Good Fair Excellent

Sample Depth m	**Water Temp °C**	**DO % sat**	**DO mg/L**	**Sp. Cond µS/cm**	**pH**	**Total Depth (m):**	**Secchi (m)**	**Air Temp °C**	**Photos Taken**
0.3									
1.0									
2.0									
3.0						**% Cloud Coverage**		**% Aquatic Plant Coverage**	
4.0									
5.0									
6.0									

Observed Uses:
Adjacent Land Use:
Observations:

Parameters:	**Field**		**Conventionals**		***E. coli***		



Discharge Measurement Summary

File Information

File name	Slc_20210329-085644.ft
Start date and time	3/29/2021 8:37 AM
Calculations engine	FlowTracker2
Data collection mode	Discharge

Discharge Summary

Start time	3/29/2021 8:38:59 AM	End time	3/29/2021 8:56:03 AM
# Stations	22	Avg interval	20
Mean depth	1.176 ft		
Mean velocity	0.3680 ft/s	Total width	26.100 ft
Mean SNR	45 dB	Total area	30.7000 ft²
Mean temp	57.993 °F	Total discharge	11.2976 ft³/s

System Information

Sensor type	Top Setting
Handheld serial number	FT2H1915001
Probe serial number	FT2P1817003
Probe firmware	1.30
Handheld software	1.6

Site Details

Site name	Slc
Site number	54
Operator(s)	Rushin
Comment	

Discharge Uncertainty

Category	ISO	IVE
Accuracy	1.0%	1.0%
Depth	0.1%	1.7%
Velocity	0.3%	1.8%
Width	0.1%	0.1%
Method	1.8%	
# Stations	2.3%	
Overall	3.1%	2.7%

Discharge Settings

Discharge equation	Mid Section
Discharge uncertainty	IVE
Discharge reference	Measured

Station Warning Settings

Station discharge caution		%
Station discharge warning	10.00	%
Maximum depth change	50.00	%
Maximum spacing change	100.00	%

Summary overview

No changes were made to this file
Quality control warnings

Data Collection Settings

Salinity	0.000	PSS-78
Temperature		°F
Sound speed		ft/s
Mounting correction	0.00	%

Quality Control Settings

SNR threshold	10	dB
Standard error threshold	0.0328	ft/s
Spike threshold	10.00	%
Maximum velocity angle	20.0	deg
Maximum tilt angle	5.0	deg


Discharge chart
Station discharge (ft³/s)
0
0.2
0.4
0.6
0.8
26 24 22 20 18 16 14 12 10 8 6 4 2
ft
Velocity chart
Velocity (ft/s)
0
0.1
0.2
0.3
0.4
26 24 22 20 18 16 14 12 10 8 6 4 2
ft
Depth chart
Depth (ft)
0
0.5
1.0
1.5
2.0
26 24 22 20 18 16 14 12 10 8 6 4 2
ft

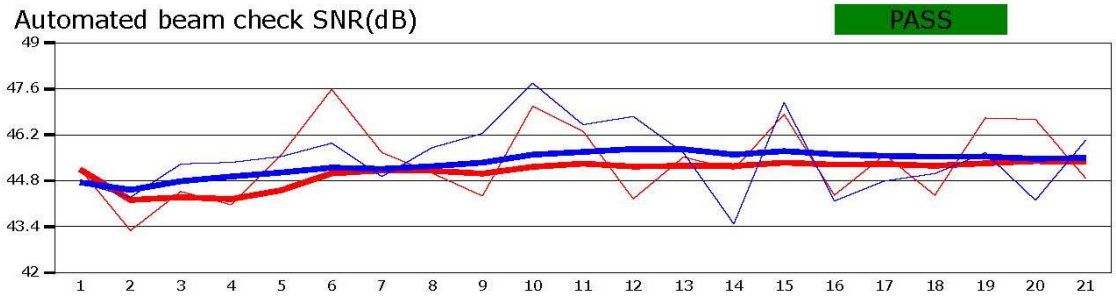
Measurement results

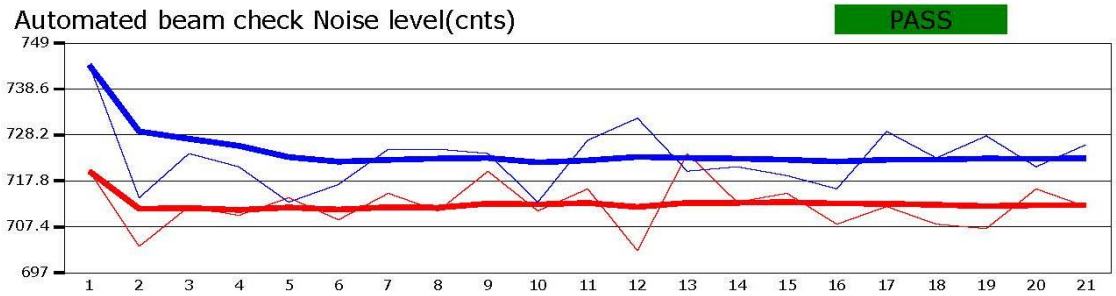
St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Samples	Velocity (ft/s)	Correction	Mean Velocity (ft/s)	Area (ft^2)	Flow (ft^3/s)	%Q	
0	8:38 AM	1.000	None	0.000	0.0000	0.000	0	0.0000	1.0000	0.1215	0.0000	0.0000	0.00	✓
1	8:39 AM	3.000	0.6	0.400	0.6000	0.240	40	0.1215	1.0000	0.1215	0.8000	0.0972	0.86	✓
2	8:40 AM	5.000	0.6	1.100	0.6000	0.660	40	0.2070	1.0000	0.2070	2.2000	0.4554	4.03	✓
3	8:41 AM	7.000	0.6	1.200	0.6000	0.720	40	0.3640	1.0000	0.3640	2.4000	0.8735	7.73	✓
4	8:42 AM	9.000	0.6	1.100	0.6000	0.660	40	0.3934	1.0000	0.3934	1.6500	0.6491	5.75	✓
5	8:42 AM	10.000	0.6	1.000	0.6000	0.600	40	0.4695	1.0000	0.4695	1.0000	0.4695	4.16	✓
6	8:43 AM	11.000	0.6	1.100	0.6000	0.660	40	0.4740	1.0000	0.4740	1.1000	0.5214	4.61	✓
7	8:44 AM	12.000	0.6	1.100	0.6000	0.660	40	0.4117	1.0000	0.4117	1.1000	0.4529	4.01	✓
8	8:45 AM	13.000	0.6	1.100	0.6000	0.660	40	0.3921	1.0000	0.3921	1.1000	0.4313	3.82	✓
9	8:46 AM	14.000	0.6	1.300	0.6000	0.780	40	0.4434	1.0000	0.4434	1.3000	0.5764	5.10	✓
10	8:47 AM	15.000	0.6	1.300	0.6000	0.780	40	0.3653	1.0000	0.3653	1.3000	0.4749	4.20	✓
11	8:47 AM	16.000	0.6	1.500	0.6000	0.900	40	0.3748	1.0000	0.3748	1.5000	0.5621	4.98	✓
12	8:48 AM	17.000	0.6	1.650	0.6000	0.990	40	0.3731	1.0000	0.3731	1.6500	0.6156	5.45	✓
13	8:49 AM	18.000	0.6	1.700	0.6000	1.020	40	0.4061	1.0000	0.4061	1.7000	0.6904	6.11	✓
14	8:50 AM	19.000	0.6	1.700	0.6000	1.020	40	0.4120	1.0000	0.4120	1.7000	0.7003	6.20	✓
15	8:50 AM	20.000	0.6	1.850	0.6000	1.110	40	0.4268	1.0000	0.4268	1.8500	0.7895	6.99	✓
16	8:51 AM	21.000	0.6	1.900	0.6000	1.140	40	0.4207	1.0000	0.4207	1.9000	0.7994	7.08	✓
17	8:52 AM	22.000	0.6	1.800	0.6000	1.080	40	0.4395	1.0000	0.4395	1.8000	0.7911	7.00	✓
18	8:53 AM	23.000	0.6	1.700	0.6000	1.020	40	0.3415	1.0000	0.3415	1.7000	0.5806	5.14	✓
19	8:54 AM	24.000	0.6	1.400	0.6000	0.840	40	0.2919	1.0000	0.2919	1.4000	0.4086	3.62	✓
20	8:55 AM	25.000	0.6	1.000	0.6000	0.600	40	0.2312	1.0000	0.2312	1.5500	0.3584	3.17	✓
21	8:56 AM	27.100	None	0.000	0.0000	0.000	0	0.0000	1.0000	0.2312	0.0000	0.0000	0.00	✓

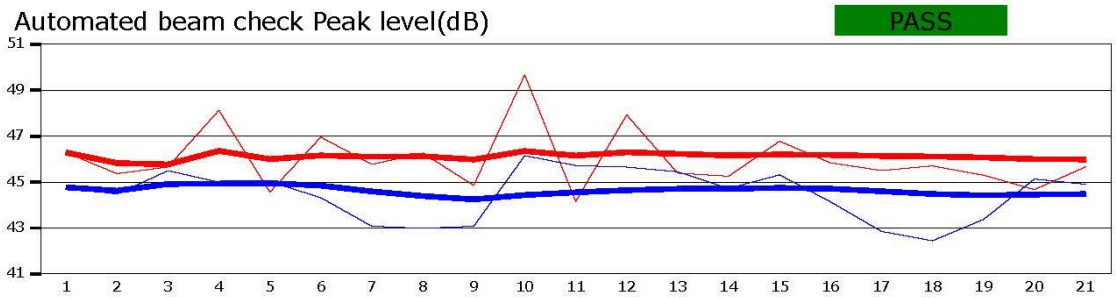
Quality control warnings

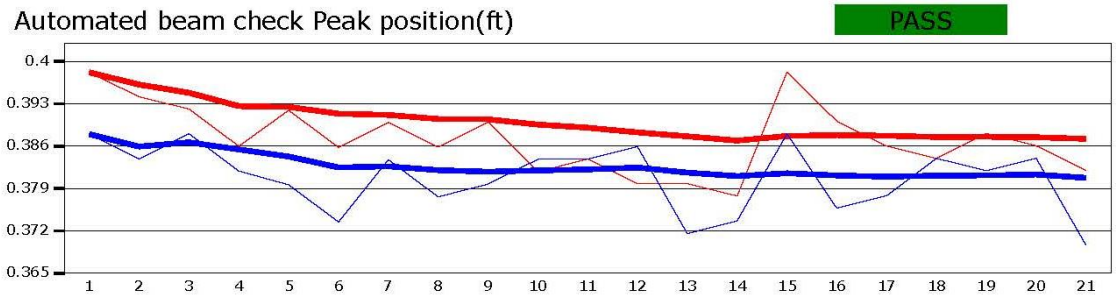
St#	Time	Location (ft)	Method	Depth (ft)	%Depth	Measured Depth (ft)	Warnings
21	8:56 AM	27.100	None	0.000	0.0000	0.000	Stn Spacing > QC,Water Depth > QC

Automated beam check Start time 3/29/2021 8:38:24 AM









Automated beam check Quality control warnings

No quality control warnings

Water Monitoring Solutions
water-monitor.com

Fish Collection Data Sheet

Date		Time		Segment #	
Station ID		Station Description			
County		Lat/Long			
Flow (cfs)	Water Temp ºC	DO % sat	DO mg/L	pH s.u.	Sp. Cond µS/cm
Flow Method	Secchi m	Air Temp ºC	Avg Depth m	Min depth m	Max depth m
Permittee Name			Permit #		
Collectors					
Backpack Electrofisher					
Start Time		End Time		Voltage (v)	
Pulse width (msec)		Duration (sec)		Frequency (pps)	
Comments					
Seine					
Start Time		End Time		No. hauls	
Seine Length		Mesh Size		Duration of hauls	
Comments					
Weather					
Habitat Type(s) sampled					
Observations					

P.O. Box 1132 Sulphur Springs, TX 75483 903-439-4741 www.water-monitor.com

Water Monitoring Solutions
water-monitor.com

ELECTROSHOCK / SEINE

County	Station #	Location		Start Time	End Time
Common Name *or* Scientific Name	Length in mm; up to 20 inviduals (circle vouchers)	Total # Collected	# Released	# Live Take / Vouchers	# Incidental Mortalities / Anomalies
Permittee Name(s)	Signature of Permittee	Permit #			Date

Water Monitoring Solutions
water-monitor.com

Benthic Collection Data Sheet

Date		**Start Time**		**End Time**	
Station ID		**Station Description**			
County		**Segment #**			
Collectors					
Sample Tracking Log Number					
Benthic Sampler Type (circle)	**Surber**	**Ekman**	**Kicknet**	**Petersen**	**Hester-Dendy**
Kicknet - area kicked (m^2)			**Mesh size (cm)**		
Dip-net - area swept (m^2)			**Kicknet - minutes kicked**		
Shallowest Depth (m)				**Deepest Depth (m)**	
Habitat Type(s) sampled					
Undercut bank (%)			**Overhanging brush (%)**		
Gravel substrate (%)			**Sand substrate (%)**		
Soft bottom (%)			**Bedrock (%)**		
Macrophyte bed (%)			**Snags and brush (%)**		
Observations					

P.O. Box 1132 Sulphur Springs, TX 75483 903-439-4741 www.water-monitor.com

Part I - Stream Physical Characteristics Worksheet

Observers:		Date:		Time:	
Weather conditions:					
Stream:				Segment ID:	
Site Location:				Reach length:	
Observed stream uses:					
Stream type (circle one):	perennial	or	intermittent with perennial pools		
Stream bends:	No. well defined		No. moderately defined		No . poorly defined
Aesthetics (circle one):	(1) wilderness	(2) natural	(3) common	(4) offensive	
Channel obstructions or modifications:				No. riffles	
Channel flow status (circle one):	high	moderate	low	no flow	

Riparian vegetation (%	Left bank	Right bank	Maximum pool depth:		Maximum pool width:
Trees			Notes:		
Shrubs					
Grasses or forbs					
Cultivated fields					
Other					

Site map:

TCEQ 20156-A (Rev. 07/18/2014)

Part I - Stream Physical Characteristics Worksheet (continued)

Date:		Stream name:																			
Location of transect		Stream width (m)	Left bank slope (°)	LB erosion potential (%)	Thalweg depth:												RB erosion potential (%)	Right Bank Slope (°)			
					Stream Depths (m) at Points Across Transect																
																		Tree canopy (%)			
		Habitat type (circle one)		Dominant substrate type				Dominant types riparian vegetation:									% Gravel or larger	Total			
		Riffle	Run					Left bank:										CL			
		Glide	Pool					Right bank:													
Macrophytes (circle one)		Algae (circle one)		Width of natural buffer (m)		Instream cover types											% Instream cover	CR			
Abundant	Commmon	Abundant	Commmon	LB	RB													LB			
Rare	Absent	Rare	Absent															RB			

Location of transect		Stream width (m)	Left bank slope (°)	LB erosion potential (%)	Thalweg depth:												RB erosion potential (%)	Right Bank Slope (°)			
					Stream Depths (m) at Points Across Transect																
																		Tree canopy (%)			
		Habitat type (circle one)		Dominant substrate type				Dominant types riparian vegetation:									% Gravel or larger	Total			
		Riffle	Run					Left bank:										CL			
		Glide	Pool					Right bank:													
Macrophytes (circle one)		Algae (circle one)		Width of natural buffer (m)		Instream cover types											% Instream cover	CR			
Abundant	Commmon	Abundant	Commmon	LB	RB													LB			
Rare	Absent	Rare	Absent															RB			

Location of transect		Stream width (m)	Left bank slope (°)	LB erosion potential (%)	Thalweg depth:												RB erosion potential (%)	Right Bank Slope (°)			
					Stream Depths (m) at Points Across Transect																
																		Tree canopy (%)			
		Habitat type (circle one)		Dominant substrate type				Dominant types riparian vegetation:									% Gravel or larger	Total			
		Riffle	Run					Left bank:										CL			
		Glide	Pool					Right bank:													
Macrophytes (circle one)		Algae (circle one)		Width of natural buffer (m)		Instream cover types											% Instream cover	CR			
Abundant	Commmon	Abundant	Commmon	LB	RB													LB			
Rare	Absent	Rare	Absent															RB			

TCEQ 20156-A (Rev. 4-13-2005)

Part I - Stream Physical Characteristics Worksheet (continued)

Date:		Stream name:																			
Location of transect		Stream width (m)	Left bank slope (°)	LB erosion potential (%)	Thalweg depth:		Stream Depths (m) at Points Across Transect											RB erosion potential (%)	Right Bank Slope (°)		
		Habitat type (circle one)		Dominant substrate type			Dominant types riparian vegetation:											% Gravel or larger	Tree canopy (%)		
		Riffle	Run				Left bank:												Total		
		Glide	Pool				Right bank:												CL		
Macrophytes (circle one)		Algae (circle one)		Width of natural buffer (m)		Instream cover types												% Instream cover	CR		
Abundant	Commmon	Abundant	Commmon	LB	RB														LB		
Rare	Absent	Rare	Absent																RB		

Location of transect		Stream width (m)	Left bank slope (°)	LB erosion potential (%)	Thalweg depth:		Stream Depths (m) at Points Across Transect											RB erosion potential (%)	Right Bank Slope (°)		
		Habitat type (circle one)		Dominant substrate type			Dominant types riparian vegetation:											% Gravel or larger	Tree canopy (%)		
		Riffle	Run				Left bank:												Total		
		Glide	Pool				Right bank:												CL		
Macrophytes (circle one)		Algae (circle one)		Width of natural buffer (m)		Instream cover types												% Instream cover	CR		
Abundant	Commmon	Abundant	Commmon	LB	RB														LB		
Rare	Absent	Rare	Absent																RB		

Location of transect		Stream width (m)	Left bank slope (°)	LB erosion potential (%)	Thalweg depth:		Stream Depths (m) at Points Across Transect											RB erosion potential (%)	Right Bank Slope (°)		
		Habitat type (circle one)		Dominant substrate type			Dominant types riparian vegetation:											% Gravel or larger	Tree canopy (%)		
		Riffle	Run				Left bank:												Total		
		Glide	Pool				Right bank:												CL		
Macrophytes (circle one)		Algae (circle one)		Width of natural buffer (m)		Instream cover types												% Instream cover	CR		
Abundant	Commmon	Abundant	Commmon	LB	RB														LB		
Rare	Absent	Rare	Absent																RB		

TCEQ 20168-A (Rev. 07/18/2014)

TCEQ Fish Sample Tracking Log

Sample tracking log #:		TCEQ Station ID:		
Location description:				
Collector(s):				
Identifier(s):				
Dates				
Collected	Entered into Log	Transferred to EtOH	Identified	
Methods				
Seine hauls	Electrofish (secs.)	Gill net duration	Other	

Sample tracking log #:		TCEQ Station ID:		
Location description:				
Collector(s):				
Identifier(s):				
Dates				
Collected	Entered into Log	Transferred to EtOH	Identified	
Methods				
Seine hauls	Electrofish (secs.)	Gill net duration	Other	

Sample tracking log #:		TCEQ Station ID:		
Location description:				
Collector(s):				
Identifier(s):				
Dates				
Collected	Entered into Log	Transferred to EtOH	Identified	
Methods				
Seine hauls	Electrofish (secs.)	Gill net duration	Other	

Sample tracking log #:		TCEQ Station ID:		
Location description:				
Collector(s):				
Identifier(s):				
Dates				
Collected	Entered into Log	Transferred to EtOH	Identified	
Methods				
Seine hauls	Electrofish (secs.)	Gill net duration	Other	

TCEQ-20235 (rev. 07/18/2014)

TCEQ Benthic Macroinvertebrate Sample Tracking Log

Sample tracking log number:
Name of collector:
TCEQ Station ID:
Location description:
Date of collection:
Date entered in sample tracking log:
Date identification started:
Date identification completed:
Method of collection:

Sample tracking log number:
Name of collector:
TCEQ Station ID:
Location description:
Date of collection:
Date entered in sample tracking log:
Date identification started:
Date identification completed:
Method of collection:

Sample tracking log number:
Name of collector:
TCEQ Station ID:
Location description:
Date of collection:
Date entered in sample tracking log:
Date identification started:
Date identification completed:
Method of collection:

TCEQ-20231 (rev 7/18/2014)

TCEQ Fish Laboratory Bench Sheet	
Sample tracking log number:	
Name of identifier:	
Location of collection:	Method of collection:
Date of collection:	
Date entered in sample tracking log:	
Date identification/enumeration started:	
Date identification/enumeration completed:	

Scientific Name	Number of Individuals

TCEQ-20232 (rev. 07/18/2014)

TCEQ Benthic Macroinvertebrate Laboratory Bench Sheet	
Sample tracking log number:	
Name of identifier:	
Location of collection:	Method of collection:
Date of collection:	
Date entered in sample tracking log:	
Date identification/enumeration started:	
Date identification/enumeration completed:	

Scientific Name	Number of Individuals

TCEQ-20232 (rev. 7/18/2014)

Appendix E: Chain of Custody Forms

Environmental Laboratory Services
The Solution Lab

LCRA Environmental Laboratory Services
Request for Analysis Chain-of-Custody Record

LCRA - Environmental Lab
3505 Montopolis Dr.
Austin, TX 78744

Phone: (512) 356-6022 or 1-800-776-5272
Fax: (512) 356-6021
https://els.lcra.org

Project:	NETMWD East	**Client:**	Northeast Texas Municipal Water District
Collector:		**Contact:**	
Event#:		**Phone:**	

Report To: Roy Darville
East Texas Baptist University
1 Tiger Drive
Biology Bldg.
Marshall, TX 75670

Lab ID#:

Client PO:

Invoice To: Robert Speight
Northeast Texas Municipal Water
P.O. Box 955
Hughes Springs, TX 75656

LAB USE ONLY	Sample ID *	Collected *		Matrix*	Container(s) Type/Preservative/Number *										Requested Analysis *											
		Date*	Time * HH:MM	AQ = Aqueous S = Solid T = Tissue DW =Drinking Water	COMPOSITE Y/N	FILTERED Y/N	250STERL	500APU	1LPU	125STERL	250PHSO4	250APU	250PHNO3	250PU	5310-ATOC	365.4AM	9223-A-30	445.0AM	350.1AM	2320-AM	200.7AM	2540-AMTSS	300.0AM-48	2340-AM	351.2AM		
1	15249			AQ			1	1	1		1		1	1	X	X	X	X	X	X	X	X	X	X	X	
2	15508			AQ					1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	
3	10321			AQ					1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	
4	14976			AQ					1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	
5	10283			AQ					1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	
6	10244			AQ					1	1	1	1	1	1	X	X	X	X	X	X	X	X	X	X	X	
7																										

Transfers	Relinquished By	Date/Time	Received By	Date/Time	Cooler Temp:			
					#	T#	Obs.	Corr.
1								
2					1			
3					2			

Client Special Instructions:

Lab Use Only:

Note: Relinquishing sample(s) and signing the COC, client agrees to accept and is bound by the ELS Standard Terms and Conditions. All fields with an asterisk (*) are required to be completed.

Appendix F: Data Review Checklist and Summary Shells

Data Review Checklist

This checklist is to be used by the NETMWD and other entities handling the monitoring data in order to review data before submitting to the TCEQ. This table may not contain all of the data review tasks being conducted.

Data Format and Structure	Y, N, or N/A
Are there any duplicate Tag Id numbers in the Events file?	
Do the Tag prefixes correctly represent the entity providing the data?	
Have any Tag Id numbers been used in previous data submissions?	
Are Tag IDs associated with a valid SLOC?	
Are sampling Dates in the correct format, MM/DD/YYYY with leading zeros?	
Are sampling Times based on the 24 hr clock (e.g. 09:04) with leading zeros?	
Is the Comments field filled in where appropriate (e.g. unusual occurrence, sampling problems, unrepresentative of ambient water quality)?	
Are Submitting Entity, Collecting Entity, and Monitoring Type codes used correctly?	
Do sampling dates in the Results file match those in the Events file for each Tag Id?	
Are values represented by a valid parameter code with the correct units?	
Are there any duplicate parameter codes for the same Tag Id?	
Are there any invalid symbols in the Greater Than/Less Than (GT/LT) field?	
Are there any Tag Ids in the Results file that are not in the Events file or vice versa?	
Data Quality Review	Y, N, or N/A
Are “less-than” values reported at the LOQ? If no, explain in Data Summary.	
Have the outliers been verified and a "1" placed in the Verify_flg field?	
Have checks on correctness of analysis or data reasonableness been performed? e.g., Is ortho-phosphorus less than total phosphorus? Are dissolved metal concentrations less than or equal to total metals? Is the minimum 24 hour DO less than the maximum 24 hour DO? Do the values appear to be consistent with what is expected for site?	
Have at least 10% of the data in the data set been reviewed against the field and laboratory data sheets?	
Are all parameter codes in the data set listed in the QAPP?	
Are all stations in the data set listed in the QAPP?	
Documentation Review	Y, N, or N/A
Are blank results acceptable as specified in the QAPP?	
Were control charts used to determine the acceptability of lab duplicates (if applicable)?	
Was documentation of any unusual occurrences that may affect water quality included in the Event file’s Comments field?	
Were there any failures in sampling methods and/or deviations from sample design requirements that resulted in unreportable data? If yes, explain in Data Summary.	
Were there any failures in field and/or laboratory measurement systems that were not resolvable and resulted in unreportable data? If yes, explain in Data Summary.	
Was the laboratory’s NELAP Accreditation current for analysis conducted?	
Did participants follow the requirements of this QAPP in the collection, analysis, and reporting of data?	

Data Summary

Data Set Information

Data Source: _____

Date Submitted: _____

Tag ID Range: _____

Date Range: _____

□ I certify that all data in this data set meets the requirements specified in Texas Water Code Chapter 5, Subchapter R (TWC §5.801 et seq) and Title 30 Texas Administrative Code Chapter 25, Subchapters A & B.
□ This data set has been reviewed using the criteria in the Data Review Checklist.

WMS Data Manager: _____ Date: _____

Please explain in the table below any data discrepancies discovered during data review including:

- Inconsistencies with LOQs
- Failures in sampling methods and/or laboratory procedures that resulted in data that could not be reported to the TCEQ (indicate items for which the Corrective Action Process has been initiated and send *Corrective Action Status Report* with the applicable Progress Report).

Dataset ____ contains data from FY__ QAPP Submitting Entity code NT and collecting entity WM. This is field and lab data that was collected by the (collecting entity). Analyses were performed by the LCRA ELS. The following tables explain discrepancies or missing data as well as calculated data loss.

Discrepancies or missing data for the listed tag ID:

Tag ID	Station ID	Date	Parameters	Type of Problem	Comment/PreCAPs/CAPs

Data Loss

Parameter	Missing Data points out of Total	Percent Data Loss for this Dataset	Parameter	Missing Data points out of Total	Percent Data Loss for this Dataset